



UNIVERSITY OF AMSTERDAM

UvA-DARE (Digital Academic Repository)

Education and social capital: empirical evidence from microeconomic analyses

Huang, J.

Publication date

2010

Document Version

Final published version

[Link to publication](#)

Citation for published version (APA):

Huang, J. (2010). *Education and social capital: empirical evidence from microeconomic analyses*. Thela Thesis.

General rights

It is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), other than for strictly personal, individual use, unless the work is under an open content license (like Creative Commons).

Disclaimer/Complaints regulations

If you believe that digital publication of certain material infringes any of your rights or (privacy) interests, please let the Library know, stating your reasons. In case of a legitimate complaint, the Library will make the material inaccessible and/or remove it from the website. Please Ask the Library: <https://uba.uva.nl/en/contact>, or a letter to: Library of the University of Amsterdam, Secretariat, Singel 425, 1012 WP Amsterdam, The Netherlands. You will be contacted as soon as possible.

tinbergen *institute*

Education And Social Capital Empirical Evidence From Microeconomic Analyses

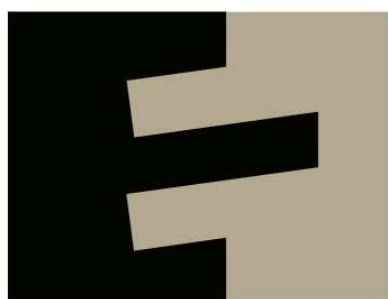
Jian Huang

Social capital is considered an important asset for individuals, groups, communities and society because it is related to individual health and socio-economic status, and it affects the crime rate, social cohesion, and social welfare. The purpose of this dissertation is to provide a detail description of the formation of individual social capital and the role of education, with an emphasis on education endogeneity and gender differences. Meta-analysis is performed to evaluate the possible sources of the variations in the effect of education on social capital in the relevant literature. The one-factor model and the single treatment model are applied to the data of the National Child Development study in order to quantify the exact impact of education. The empirical findings in this dissertation reveal that schooling variance is a key source of variation in individual social capital outcomes, directly or indirectly. Education posts much higher returns for men than for women on both dimensions of individual social capital: social trust and social participation. The education effect is even negative for women in the study of membership of voluntary groups, whilst there is a strongly positive estimate for men in the studies of social trust and voluntary participation. The study shows that increased pressure from the workplace decreases satisfaction with the job, lowers perception of personal happiness, and diverts available time or energy away from voluntary participation.

Jian Huang Enrolled in the M.Phil program of the Tinbergen Institute in 2003 and received his M.Phil degree in 2005. He then started his Ph.D research in the economics of education at the University of Amsterdam and he spent 5 years working on the nonmonetary return to education. In September 2009, he has joined the Top Institute for Evidence Based Education Research (TIER) at the University of Amsterdam as a post-doc researcher.

EDUCATION AND SOCIAL CAPITAL

EMPIRICAL EVIDENCE FROM MICROECONOMIC
ANALYSES



TIER

ISBN 978 90 361 0156 1

Cover design: Crasborn Graphic Designers bno, Valkenburg a.d. Geul

This book is no. **472** of the Tinbergen Institute Research Series, established through cooperation between Thela Thesis and the Tinbergen Institute. A list of books which already appeared in the series can be found in the back.

EDUCATION AND SOCIAL CAPITAL
EMPIRICAL EVIDENCE FROM MICROECONOMIC ANALYSES

ACADEMISCH PROEFSCHRIFT

ter verkrijging van de graad van doctor
aan de Universiteit van Amsterdam
op gezag van de Rector Magnificus
prof. dr. D.C. van den Boom
ten overstaan van een door het college voor promoties
ingestelde commissie,
in het openbaar te verdedigen in de Agnietenkapel
op dinsdag 25 mei 2010, te 16:00 uur

door

Jian Huang

geboren te Huazhou, China

Promotoren: Prof. dr. H. Maassen van den Brink

Prof. dr. W.J.N. Groot

Faculteit Economie & Bedrijfskunde

Acknowledgement

This doctoral dissertation represents five years of research work on the relationship between education and social capital. In these five years, I have been fortunate to know many nice people and to work with them. It is a pleasure to thank all these people who gave me the possibility to complete this dissertation.

First of all, I would like to express sincere gratitude to my promoters, Professor Henriëtte Maassen van den Brink and Professor Wim Groot, for their continuous support and guidance of my Ph.D study and research over the years. They have read innumerable times of the drafts and provided many inspiring comments. They have contributed substantial efforts to make this thesis possible.

I would like to thank my committee members – Professor Bernard van Praag, Professor Henk Flap, Professor Herman G. van de Werfhorst, Professor Joop Hartog, Professor Jules Theeuwes – for taking their time to read and provide useful comments to this dissertation.

Special thanks are extended to my colleagues, Adam Booij, Chris Van Klaveren, Monique de Haan and Sandra Maximiano, in the Department of Economics at the University of Amsterdam (UvA) and at the Top Institute for Evidence Based Education Research (TIER). Although I did not have fixed working hours and I did not appear in the Department of Economics very often, I benefited from the interactions with these colleagues. I am grateful to Professor Erik Plug and Professor Hessel Oosterbeek for their useful suggestions for and valuable guidance of my Ph.D study and research. I also wish to thank Carla Lessen, Sebastiene Postma, and other staff in TIER and SCHOLAR for running these departments so smoothly, and for assisting me to tackle many administrative problems.

Sincere gratitude goes to my colleagues and friends in the Tinbergen Institute and in other universities of the Netherlands for making my academic career full of fun and bringing pleasures into my life: Wei Chen, Jia-Jia Cui, Linda Midgley, Michel van der Wel, Lei Pan, Razvan Vlahu, Rocco Huang, Ronald Wolthoff, Sumedha Gupta, Tse-Chun Lin, Jian-Bin Xiao, Nan Yang, and Yang Yang.

Special appreciation is due to my family for their understanding and love. I owe many thanks to my father Long-Gui Huang, my mother Yan-Ming Li, and my brother Yi Huang. I am indebted to my aunt Xiao-Bing Huang, my cousin Guo Chen, and my partner's mother

Chin-Yin Lin for their support in so many ways.

Finally, I would like to convey my special thanks to my partner Yin-Yen Tseng, although there is no word, English or Chinese, to express my appreciation for her dedication, love and confidence in me. It would have been impossible for me to finish this work without her backing me and her caring of our beautiful daughter – Si-Yuan Huang. This dissertation is dedicated to Yin-Yen Tseng and Si-Yuan Huang.

TABLE OF CONTENTS

CHAPTER 1

INTRODUCTION TO SOCIAL CAPITAL THEORY1

1.1 SOCIAL CAPITAL	1
1.2 ATTRIBUTES, IMPORTANCE AND MEASUREMENT OF INDIVIDUAL SOCIAL TRUST	2
1.3 ATTRIBUTES, IMPORTANCE AND MEASUREMENT OF SOCIAL PARTICIPATION	5

CHAPTER 2

A META-ANALYSIS OF THE EFFECT OF EDUCATION ON SOCIAL CAPITAL.....9

2.1 INTRODUCTION.....	9
2.2 DESCRIPTIVE STATISTICS AND SIMPLE ANALYSIS OF POOLED EFFECT SIZES	13
2.3 ANALYSIS OF THE EXTENDED MODEL.....	16
2.4 PUBLICATION BIAS, TEST AND CORRECTION	19
2.5 DISCUSSION AND CONCLUSION	23
APPENDIX 2 CODING OF VARIABLES AND HEDGE'S TEST FOR PUBLICATION BIAS	27
APPENDIX 2A CODING OF THE EFFECT SIZE	27
APPENDIX 2B TREATMENTS OF MISSING VALUES FOR SPECIFIC GROUPS	28
APPENDIX 2C HEDGES' TEST FOR PUBLICATION BIAS	28

CHAPTER 3

EARLY CHILDHOOD INFLUENCE, EDUCATION, AND SOCIAL CAPITAL29

3.1 INTRODUCTION.....	29
3.2 HYPOTHESES AND REVIEWS.....	30
3.3 INTRODUCTION TO THE NATIONAL CHILD DEVELOPMENT STUDY	34
3.4 RESULTS	37
3.5 EDUCATION ENDOGENEITY AND CAUSAL EDUCATIONAL EFFECTS	45
3.6 CONCLUSION	49
APPENDIX 3 DETAILS OF THE ASSUMPTIONS AND DERIVATION OF THE NON-PARAMETRIC BOUNDS	51

CHAPTER 4

ENDOGENEITY MODELS FOR SINGLE TREATMENT EVALUATION WITH A BINARY OUTCOME.....55

4.1 INTRODUCTION OF THE SINGLE TREATMENT MODEL.....	55
4.2 SIMULATION DESIGN.....	59
4.3 SIMULATION RESULTS.....	61
4.4 CONCLUSION	65

CHAPTER 5

COLLEGE EDUCATION AND SOCIAL TRUST FORMATION: EVIDENCE FROM A BRITISH COHORT STUDY67

5.1 INTRODUCTION.....	67
5.2 DATA.....	68
5.3 EVALUATION OF THE <i>ATE</i>	70
5.4 SENSITIVITY TEST AND POST-EDUCATION RE-EVALUATION.....	75
5.5 CONCLUSION	82
APPENDIX 5 CODING OF VARIABLES AND REGRESSION DETAILS ON SOCIAL TRUST OUTCOME.....	85
APPENDIX 5A CODING OF VARIABLES	85
APPENDIX 5B ESTIMATION RESULTS FOR ALL SIGNIFICANT VARIABLES IN SOCIAL TRUST OUTCOME.....	87

CHAPTER 6

HIGHER EDUCATION AND MEMBERSHIP OF VOLUNTARY GROUPS89

6.1 INTRODUCTION.....	89
6.2 EVALUATION METHOD.....	91
6.3INTRODUCTION OF NCDS DATA SET AND EVALUATION OF EDUCATION EFFECTS	94
6.4 FURTHER ANALYSIS.....	101
6.5 CONCLUSION	109
APPENDIX 6 CODING OF VARIABLES AND ADDITIONAL FINDINGS IN EMPIRICAL STUDIES	111
APPENDIX 6A CODING OF VARIABLES	111
APPENDIX 6B ADDITIONAL FINDINGS IN EMPIRICAL STUDIES.....	113

CHAPTER 7

CONCLUSIONS..... 115

REFERENCE..... 119

Chapter 1

Introduction to Social Capital Theory

1.1 Social capital

Social capital is considered an important asset for individuals, groups, communities and society because it is related to individual health and socio-economic status, and it affects the crime rate, social cohesion, and social welfare (Portes, 1998; Lin, 2001; Flap and Boxman, 2001; Flap, 2004; Helliwell, 2001). The interest in social capital has led to an explosion of studies on its economic and social effects, as well as on its sources of origin and accumulation mechanisms. Social capital is a heuristic concept with diverse and multidimensional definitions and operationalizations, and research has expanded into numerous arenas and applications. Coleman defines social capital as social-structural resources that “facilitate certain actions of individuals who are within the structure” (Coleman, 1990a, p. 302). Putnam et al. (1993) and Putnam (1995a, 1995b) extends the term ‘social capital’ to describe elements of social life such as networks, norms, and trust that “facilitate coordination and cooperation for mutual benefit”. The World Bank and the Organisation for Economic Co-operation and Development (OECD) have also considered the definition of social capital. The OECD defines social capital as “networks together with shared norms, values and understandings that facilitate co-operation within or among groups” (Cote and Healy, 2001, p. 41). The World Bank suggests that social capital refers to the institutions, relationships, and norms that shape the quality and quantity of a society’s social interactions.

The scope of social capital ranges from the micro- and meso- levels to the macro-level, as reviewed by Grootaert (1998), Grootaert and Van Bastelaer (2001). These scopes are characterized by social norms and reciprocity at varying social scales, from individual to the level of communities and nation states.

The micro-level of social capital, or social capital at the individual level, is generally classified as an aggregation of personal involvement in voluntary associations and trust in people: those we know and those we do not know. The meso-level refers to the number and density of groups in a given community with the assumption that social capital is inherently good, that more is better, and that its presence always has a positive effect on a community’s welfare. The meso-perspective equates social capital with such local organizations as clubs,

associations, and civic groups in the community or region. Macro-level social capital includes the social and political environment that shapes social structure and enables norms to develop. At the macro-level, researchers, such as Collier (1998) and Baumann (2000), define the political or institutional level on the basis of the argument that the vitality of community networks and civil society is largely the product of the political, legal, and institutional environment. Researchers, such as Putnam et al. (1993) and Fukuyama (1995), define the ethnic level or cultural level according to the ethnic and cultural heterogeneity in the level of generalized trust, norms of reciprocity, and conventional habit in participating in civic activities across nations and races.

So far, the most compelling empirical evidence in support of the social capital theory comes from studies on the individual level, where it is possible to employ microeconomic analysis, and it lends itself to easier application and generalization in empirical models of research. At the meso- and macro-level, researchers do not have a uniform definition, and there is no standard and convincing quantitative economic measure of collective social capital available. Overall, *“decisions to invest in social capital are made by individuals, not communities. Without a definition of social capital that begins at the individual level I cannot begin to understand its formation”* (Glaeser, 2001).

This dissertation will focus on two commonly discussed dimensions of social capital at the micro-level – individual social trust, and individual social participation. The presence of social capital is indicated by a high degree of trust in most people and participation in collective action, and these elements reinforce one another in a virtuous circle (Putnam, 2000).

1.2 Attributes, importance and measurement of individual social trust

Social trust is the amount of trust individuals have in most people, those they know and do not know. Social trust reflects the bond that people share across economic and ethnic groups. It is the foundation of a cooperative spirit that brings people together for common and mutually advantageous purposes (Rothstein and Uslaner, 2005). On the basis of a review of the literature on social trust, two dimensions of social trust are distinguished at the micro-level:

- A. Individual perception of the social environment;
- B. Individual moral values.

Firstly, social trust is an indicator of the individual perception of the social environment. It reflects the individual assessment about how people in general are behaving, and how society is developing. From this perspective, the degree of social trust depends on social circumstances, as well as on individual knowledge and rationality in assessing social risks and uncertainties. Community safety (in terms of crime rates), community homogeneity (in terms of ethnicity or socio-economic class), and fairness of social welfare (in terms of wealth distribution, racial and gender equality) are critical determinants of social trust at both the individual and societal levels. Recent studies suggest that uncertainty arising from social heterogeneity is a key impediment for social trust formation. Alesina and La Ferrara (2002) propose that most individuals are less inclined to trust people who are different from themselves. Social trust also embodies the individual sense of fairness or justice in society. Rothstein and Uslaner (2005) argue that social trust originates from an equitable distribution of resources and opportunities in a society. It has been shown in many surveys that the countries with the highest scores on social trust, like the Nordic countries, the Netherlands, and Canada, also rank highest in terms of economic, gender and racial equality.

Secondly, social trust has its roots in the individual morality that people follow in social and daily life (Uslaner, 1999). People who believe in racial and gender equality, for instance, are more tolerant towards minorities and towards others who are not like themselves, and these people have a higher level of trust in others. Trustworthiness is a crucial morality that is associated with social trust. People who consider themselves to be untrustworthy are less trusting of others (Putnam, 2000, p. 138). Glaeser et al. (2000) also propose that trustworthiness can be correlated with giving positive answers to the question about trusting others, according to their study based on a trust experiment. A typical reason for such correlation is, as one man put it, "I feel if I can be trusted, I can trust other people. Throughout my lifetime I've found that to be true, that if you are up and above and honest with people, they will return that respect" (Wuthnow, 1998). Therefore, one's willingness to trust others can be a reflection of one's self-knowledge of whether one can trust oneself and one's feeling of whether one needs to be trustworthy for reciprocity.

While the individual perception of social environment and individual morality are the basic aspects of social trust at the individual level, these notions do not share the same features. Social trust as a perception of social risks and fairness is a knowledge cumulative function, which is strongly correlated with social environment, individual standing or bearing in society, and individual self-image of one's ability in handling the uncertainties in society. Social trust as a moral value stems from family and school influence and is possibly exposed

to individual life experiences, in particular, traumatic experiences (Alesina and La Ferrara, 2000b).

The importance of social trust has been widely recognized. Social trust reflects a bond that people share across society, across economic and ethnic groups, religions and races. It is the foundation of a cooperative spirit that brings people together for common and mutually advantageous purposes (Rothstein and Uslaner, 2005). Social trust correlates with many variables that are normatively desirable for most people. Those who believe that most other people in their society in general can be trusted are also more inclined to have a positive view of their democratic institutions and participate more in civic organizations. Individuals with a higher level of trust in people also have a more optimistic view of being able to control their own life-chances, and, not less important, are happier with how their life is going (Uslaner, 2005).

Social trust also contributes to economic growth and market efficiency. Knack and Keefer (1997) find that a one standard deviation increase of the national-level of social trust increases economic growth by more than one-half of a standard deviation. High levels of social trust lead people to expect that others are cooperative and not opportunistic in social and economic exchanges, which reduces transaction cost and helps solve the free-rider problem in providing public goods. La Porta et al. (1997) show that social trust promotes the performance and character of political institutions. It is positively correlated with judicial efficiency, and negatively correlated with government corruption.

Social trust is usually measured by the response to the following question: “Generally speaking, would you say that most people can be trusted or that you can’t be too careful in dealing with people?” This operationalization of social trust has been widely used for more than four decades in empirical studies and surveys around the world, including the National Child Development Study (NCDS) in the UK, the General Social Survey (GSS) in the US, and the World Values Survey (WVS).

While the survey question is controversial among some researchers for its abstract definition with respect to which “people” respondents have in mind, it has been proved informative in many studies. Uslaner (2002) points out that this measurement of social trust provides useful information on respondents’ faith in other people, and it is far beyond being simply an indicator of respondents’ interactions with their intimates. Many empirical studies on the benefits of social trust employ this measurement as the main indicator, and they provide plenty of evidence for the positive effects of social trust at the individual and societal level (see, e.g., Knack and Keefer, 1997; La Porta et al., 1997; Whiteley, 2000).

1.3 Attributes, importance and measurement of social participation

Social participation refers to people's social involvement and interaction with others. It is defined in this thesis as the organized collective activities associated with voluntary groups and organizations relating to community living and welfare. These social groups and organizations are outside the political arena and the workplace (i.e. unions, parties, voting and lobbying groups). Based on Max Weber's typology ([1914]1978) of social action, activities in unions, parties, voting and lobbying groups are instrumentally rational action, serving the purpose of certain interest groups. These group activities do not share the same contexts with social participation as defined in this thesis. Social participation occurs in neighborhood associations, environment groups, charity groups and other community or voluntary organizations. Social participation is a form of affective or value rational behavior; it constitutes its own reward and is regarded as a type of expressive action. Lin views *instrumental action* as directed at obtaining new resources, while *expressive action* is directed at preserving or maintaining resources (Lin, 2001; Lin and Erickson, 2008). There are differences between instrumental action and expressive action in terms of gender involvement. Women are much less likely to join in political groups, labor unions and staff associations. They tend to participate in smaller, more peripheral organizations and activities with a focus on domestic or community affairs, while men tend to participate in large, core organizations that are related to economic institutions and political activities.

The local and community aspects that social groups focus on can be private interest-oriented, such as parent-teacher associations (PTAs), tenant associations, as well as altruistic interest-oriented, such as charity, environmental and community volunteering. These social groups are established to facilitate people's effective involvement in community life, to improve the living environment or teaching quality, and to increase social well-being.

Social participation can act as a resource for the people involved by increasing access to information (Knoke, 1990). Group members acquire organizational skills and expand their social ties in ways that may have a positive impact on their physical and mental health. (House et al., 1988). Researchers believe that social participation helps to promote a sense of community and norms of reciprocity and facilitate the transmission of knowledge. In addition, a high level of social participation is supposed to raise civic norms among people and strengthen the foundations of a democratic society.

To measure an individual's social participation level, two sub-categories are distinguished to capture the complexity and diversity of social participation: membership of voluntary

social groups and participation frequency in voluntary activities. Researchers conventionally rely on membership of social groups: namely, group membership as a main indicator of the level of social participation. Participation frequency in activities related to social groups is also an indicator used to study an individual's involvement in social activities. Voluntary participation is a self-imposed obligation in social groups, which is not dictated by others; the individual may choose to participate, to a greater or less extent, or not at all. Thus, participation frequency in group activity is an important subject in social participation studies. The participation outcome variables in this dissertation are measured as either the probability of joining voluntary groups/participating in voluntary activities or the degree of social involvement.

1.4 Education and social capital

Education, according to Putnam (1995a, 1995b, 2000), Brehm and Rahn (1997), Glaeser et al. (1999), and Alesina and La Ferrara (2000a), is one of the most important determinants of individual social capital. It reflects an orientation toward the future by strengthening human capital and social capital for economic and social development. Schooling spreads knowledge – the basic component of human capital, and cultivates social norms – the core of social capital. It is the first non-familial context in an individual's life where moral and cognitive capacities are trained (Offe and Fuchs, 2002). Through civil education from schooling, students learn the basic norms and responsibilities in society, as well as the functioning of democracy.

Glaeser et al. (1999) assert that the most robust correlate of social capital variables is years of schooling. Using the World Values Survey, they find a positive relationship between schooling and membership of organizations in almost every country. Denny (2003) claims that acquiring a 4-year university degree is associated with a 10 percent higher probability of an individual engaging in voluntary work. Putnam (1995a, 1995b, 2000), Uslaner (1997, 1998), and Alesina and La Ferrara (2000a, 2000b) also show that more educated people are more likely to trust other people, and that they tend to join more social organizations and participate in group activities more frequently.

In studies on private returns to education, the endogeneity of schooling is always a difficult topic to tackle. It is confirmed that income and educational attainment can be simultaneously influenced by a wide range of unobservable terms, and that the omitted-variable problem could lead to an upward bias in the estimate of the education effect.

Similar problems can emerge in the investigation of the relation between educational attainment and social capital.

The divergence in the transitions of education and social participation in Western countries casts another shadow on the positive role of education. Over the second half of the twentieth century, most Western countries have experienced an evolution from an elitist higher education system to a mass higher education system, and the average education level of people increased dramatically. Figures from the OECD Education at a Glance 2007 show that more than one in five adults in OECD countries have received tertiary education. If education is a major source of social engagement, there should also have been a substantial rise in the social participation rate for these countries. However, it appears in many social reports that nowadays more people are disengaging from civic life and social ties as they belong to fewer voluntary groups, they volunteer less, and they give a smaller share of their income to charity (Knack, 1992; Putnam, 1995a, 1995b). With the exception of the Scandinavian countries and Japan where levels have remained relatively stable, there seems to be a common pattern of declining organizational activity across industrialized democracies during the 1980s and 1990s (Leigh, 2003). There is thus reason to be skeptical about the role that higher education plays in the formation of social participation behavior. Its hypothetical impact on social participation needs to be further verified.

This dissertation provides a systematic evaluation of the role of education in the formation of social capital from different perspectives. A research synthesis is conducted on the estimates of the education effects on individual social capital, and in Chapter 2 a meta-analysis is performed to evaluate the possible sources of the variations in the effect of education on social capital in the relevant literature.

Several aspects in the meta-analysis will be investigated further in the later sections of this thesis. Analyses are presented on whether different education measurements have an impact on the size of the schooling effect, with an emphasis on schooling endogeneity. Efforts are taken to develop an assessment of an explicit causal pathway from higher education to the formation of social capital from a mid-life perspective. Potential gender difference in the association between education and social capital is another key subject of this thesis. The traditional gap in the participation in higher education between men and women has been narrowed or has even disappeared over the last half century, and highly-educated women are keener to move out of their home into paid employment. The increasing number of women who are both breadwinners and caregivers may directly result in their higher work pressure, greater time constraints, and consequently less involvement in social activities.

Chapter 3 explores the relations between social capital in early childhood, education achievement, and social capital in adulthood with a multiple-stage analysis. Education is aggregated into a single measure – years of schooling – in this study. In the later sections of the dissertation, a binary treatment model is applied to evaluate the impact of college/higher education on social trust and social participation. The control functions probit (CFP) and the bivariate probit (BVP) methods are applied to correct for omitted-variable bias in a single-treatment framework with a binary outcome. Model development and simulation performance for the CFP and the BVP methods are presented in Chapter 4. In Chapters 5 and 6 these two methods are employed to study the causal impact of college/higher education on, respectively, social trust and social participation. Some light will be shed on the gender-specific effect of education and the potential causal pathway from educational achievement to the development of social capital from a mid-life perspective. Chapters 5 and 6 offer some empirical findings that can be seen as clues to the puzzle that arises from the decline of social capital and the development of education. Chapter 7 is a concluding chapter that discusses and compares the evaluation results from the previous studies in this dissertation.

Chapter 2

A Meta-analysis of the Effect of Education on Social Capital

2.1 Introduction

There are many empirical studies to corroborate the perception that education is a central factor in the formation of social trust and social participation. However, results sometimes vary across studies because of heterogeneous survey sources, research methods and model specifications. It is therefore of academic interest, as well as of policy value to evaluate the possible sources of the variations in the effect of education on social capital in the literature. Hitherto, there has been no systematic synthesis of this topic in spite of the extensive literature. For this reason in this thesis a meta-analysis, a statistical procedure that integrates the findings from independent studies, and that addresses a set of related hypotheses, will be applied to shed some light on the effect of education on social capital.

As discussed above, individual social capital has two dimensions which share different attributes and measurements. Thus a standard comparison, effect size, is necessary in order to find out the variation between dimensions and within each dimension. Effect size can be conceptualized as a **standardized difference** – which, in its simplest form, is the mean difference between groups in standard score form, i.e. the ratio of the difference between the means to the standard deviation (Glass, 1976). In this meta-analysis, an estimate of the return to education is obtained as the effect of one year of schooling on the probability or level change of social capital. So effect size is calculated as the proportion of the standard deviation in the dependent variable (each dimension of individual social capital) that is accounted for by one year of schooling, by standardizing the estimate with the corresponding standard deviation.

Two criteria were used for the inclusion of the available literature in the meta-analysis: (a) studies should focus on the determinants of at least one dimension of social capital at the individual level with formal education as a covariate in the model; (b) studies should have reported statistical data (t-statistics, p-value or standard error) that allow for estimation by the fixed effects and random effects models. A data set was created for this analysis that includes estimates from 65 studies. 28 studies provide estimates of the return to education on social trust, and 37 studies provide estimates on social participation. Table 2.1 presents information

on the authors, year of publication, and survey period, classified by social trust and social participation.

The number of estimates varies markedly from 1 to 88 because some studies provide the estimates of educational return for each nation in the surveys (for instance, Denny (2003) evaluates the effect of schooling on social participation for 20 countries, using the International Adult Literacy Survey; and Glaeser et al. (1999) evaluates the effect of schooling on social trust for 20 countries, using the World Value Survey). The evaluation methodology may differ in the same study as authors may compare the estimates from a simple linear model with those from a model that accounts for endogeneity of education on social capital (see, e.g., Denny, 2003; Dee, 2003; Milligan et al., 2003). Contextual variations in the same study are also a key factor for the large number of effect sizes, as authors may compare estimates from different specifications of the model. They may investigate the difference in the effects of schooling in the model with and without control for average education (such as Glaeser et al., 1999; Helliwell and Putnam, 1999; and Marshall and Stolle, 2004), or they may compare the return to education for men and for women, for the elderly and for young people, for college education and for high school education.

Table 2.1 Sources for meta-analysis

<i>Social Trust Study</i>	<i>No of effect sizes in study</i>	<i>Survey Period</i>	<i>Social Participation Study</i>	<i>No of effect sizes in study</i>	<i>Survey Period</i>
Alesina & La Ferrara (2000a)	8	1990	Alesina & Ferrara (2000b)	2	1990
Alesina & La Ferrara (2002)	8	1974-1994	Brehm & Rahn (1997)	1	1972-1994
Brehm & Rahn (1997)	1	1972-1994	Choi (2003)	1	1993
Claibourn & Martin (2000)	4	1982	Claibourn & Martin (2000)	4	1982
Glaeser & Sacerdote (2001)	1	1972-1998	Cutler & Hendricks (2000)	2	1974-1994
Glaeser et al. (1999)	46	1972-1994	Dee (2003)	14	1972-2000
Helliwell & Putnam (1999)	6	1972-1996	Denny (2003)	88	1990-1999
Huang et al. (2009)	9	1991	DiPasquale & Glaeser(1999)	4	1986-1994
Ibáñez et al. (2002)	4	2000	Funk (1998)	1	1991
Johansson-Stenman et al. (2005)	1	2003	Glaeser & Sacerdote (2000)	6	1973-1998
Lederman (2005)	4	2000	Glaeser & Sacerdote (2001)	22	1972-1998
Lee et al. (2003)	3	1996	Glaeser et al. (1999)	9	1972-1994
Leigh (2006)	6	1997	Hauser (2000)	6	1974-1990
Levinsen (2004)	3	2002	Helliwell & Putnam (1999)	7	1972-1996
Marshall & Stolle (2004)	3	1975	Hooghe (2003)	1	1998
Milligan et al. (2003)	2	1948-2000	Huang et al. (2009)	6	2000
Newton (2001a)	7	1990	Kang & Kwak (2003)	2	1997
Rahn et al. (2003)	6	2002	La Ferrara (2002)	4	1994
Rothstein & Uslander (2005)	2	1992	Lederman (2005)	4	2000
Rothstein (2001)	3	1998	Letki (2008)	1	2001
Scheufele & Shah (2000)	1	1997	Levinsen (2004)	9	2002
Shah et al. (2001)	4	1999	Li et al. (2003)	8	1988-1989
Uslander (1997)	5	1992	Liu & Besser (2003)	7	1994
Uslander (1998)	6	1972-1994	Milligan et al. (2003)	2	1948-2000
Uslander (2003)	2	1990-1995	Norris (1996)	1	1990
Uslander (2004)	4	1972-1998	Patricia et al. (1999)	1	1997
Wilson & Musick (1997)	3	1992	Pattie et al. (2003)	3	2000
Wollebæk & Selle (2003)	2	1998	Scheufele & Shah (2000)	2	1997
			Shah (1998)	3	1995
			Shah et al. (2001)	4	1999
			Stoneman & Anderson (2006)	10	2006
			Tang (2006)	12	1986-1994
			Taniguchi (2006)	3	1995-1996
			Tiehen (2000)	24	1979-1980
			Uslander (1997)	4	1990-1993
			Uslander (1998)	6	1972-1994
			Wellman et al. (2001)	2	1998

The majority of studies in this data set do not consider the possibility that the choice of educational attainment and social capital are simultaneously influenced by unobserved heterogeneity specific to the individuals. This ignorance of the endogeneity problem can cause biased estimates of the educational influence. For example, it is plausible that people with good relations with parents and friends in their childhood may obtain a better education and have a higher level of social capital in adulthood. However, these interactions in childhood usually turn out to be unobservable to researchers.

Some studies in the data set have taken account of the endogeneity problem. Using policy reform dummies as instruments, i.e. the increase in the minimum schooling age and abolition of tuition fees for secondary school, Denny (2003) applies a two-step procedure in the evaluation for Britain, Italy, Northern Ireland and the Republic of Ireland. The results of his study are mixed, although he observes a positive relation between education and altruistic (charity) activities in most West European countries. Dee (2003) employs 2SLS and bivariate probit, by relying on changes in teen exposure to child labor laws, in order to estimate the educational impact on the probability of joining social groups and volunteering in social services, and the impact on the number of affiliated groups. He confirms the substantial causal effect of schooling on most measurements of social participation, except for the frequency of voluntary work. Changes in compulsory schooling law are also applied in the studies of education and social trust. Milligan et al. (2003), for example, apply this strategy in their study of the influence of education on trust and other civic outcomes. They do not observe any substantial difference between the estimates from OLS and 2SLS regressions. Does the estimation method which accounts for the endogeneity problem produce considerably different estimates of educational return? The meta-analysis will shed some light on this question.

It is also noteworthy that one's social capital can be affected not only by one's own education, but also by that of others in one's social environment. The impact of education on social capital can be divided into a relative effect and an absolute effect, according to Nie et al. (1996). The *relative effect* indicates that education is a proxy for relative status, a sorting mechanism for people with a higher capacity to acquire social capital. The *absolute effect* refers to the accumulation of civic values and knowledge. One's own education level is not directly linked to the level of individual social capital, given that education merely serves to sort out people who have different capabilities in social capital (Nie et al., 1996; Helliwell and Putnam, 1999). Therefore, as Nie et al. argue, if more people have a college degree, then this means that perhaps the sociological significance of the high school leaving certificate has

been devalued as a credential. This issue is covered in this meta-analysis. Both effects of education will be assessed by evaluating the effects of individual schooling years and average schooling years in the region concerned. I further test whether the impact of one more year of schooling on individual social trust and individual social participation varies across different levels of education, or whether it rises with educational attainments.

Coleman (1990a), Putnam et al. (1993) and Putnam (1995a) suggest a reciprocal effect between trust in general people and participation in social activities: “Social trust, norms of reciprocity, networks of a civic engagement and successful cooperation are mutually reinforcing” (Putnam et al., 1993, p.180). Brehm and Rahn (1997) posit an asymmetric causal chain in which trust is the direct outcome of civic engagement. But this asymmetric association is disputed by Uslaner (1997), who argues that trust shapes civic participation. These hypotheses will be tested by including controls for reciprocity between trusting and participating in the meta-analysis. Many studies, such as Brehm and Rahn (1997), Claibourn and Martin (2000), Newton (2001b), Ibáñez et al. (2002), Li et al. (2003), Liu and Besser (2003), Rahn et al. (2003), and Uslaner (1997, 1998, 2003, 2004b), and some others in the data set provide information on the role of schooling in this reciprocity mechanism.

Several other questions will be assessed on the relation between education and individual social capital. For instance, are gender differences a critical factor in explaining the variation in the effects of education? Does education play a role in what is referred to as the “erosion” of social capital during the past few decades? Americans are believed to have more social capital than people in other nations (Putnam 1995a, 2000). In this connection, by means of a meta-analysis of the estimates taken from the surveys across nations, it is possible to examine whether education systems in the US and other nations are related to the social capital inequality.

2.2 Descriptive statistics and simple analysis of pooled effect sizes

An effect size (ES) measure is a common currency in the meta-analysis to evaluate the estimates across studies. In this study the effect size is obtained as the proportion of the standard deviation in the dependent variable that is accounted for by one year of schooling, by standardizing the study estimate with the corresponding standard deviation.

Part A of Table 2.2 presents the summary means of the pooled effect sizes. They are 0.046 for social trust and 0.048 for social participation. That is, one additional year of schooling increases one’s social trust by 4.6 percent of its standard deviation and increases social

participation by 4.8 percent of its standard deviation. Therefore, one standard deviation of schooling years, which is 2.5-3.3 years for most countries, accounts for the variation in social trust and social participation by 12-16 percent of their standard deviation. The summary statistics present a simple and gross description of the magnitude of the effect sizes. The fixed effects and random effects models are general methodologies for meta-analysis. The fixed effects model in the simplest form assumes a global and homogeneous population effect size across the studies, such that:

$$\begin{aligned} t_i &= t^* + \mu_i \\ t_i &\sim N(t^*, v_i), \end{aligned}$$

where t_i is the estimated effect size and t^* is the “true” population effect size; and v_i is the variance of the measurement error μ_i due to estimation on a sample smaller than the entire target population. The random effects model, in its simplest form, allows for heterogeneity in the global population effect sizes, usually by assuming that the “true” effects follow a normal distribution with a mean \bar{t}^* and a variance τ^2 :

$$\begin{aligned} t_i &= t_i^* + \mu_i \\ t_i &\sim N(t_i^*, v_i) \\ t_i^* &\sim N(\bar{t}^*, \tau^2). \end{aligned}$$

In meta-analysis τ^2 is commonly called ‘between studies variance’. Clearly, the fixed effects model, where $\tau^2 = 0$, is a special case of the random effects model.

The fixed and random effects models with a global population effect size do not allow the “true” effect size to be subject to the characteristics of studies, whereas a central topic in research synthesis is to find out whether methodological, contextual, or substantive variations in research studies are related to variations in effect size parameters (Cooper and Hedges, 1994). A linear model is generally applied to capture the effect of study heterogeneities:

$$t_i = x_i \Delta + \varepsilon_i + \mu_i,$$

where x are observed characteristics of the studies that cause variations in the “true” effect, and Δ is the vector of the coefficients of the variables. There is no residual heterogeneity in

the fixed effects model, thus residuals $\varepsilon_i = 0$. In the random effects model, residuals ε_i follow a normal distribution with a mean zero and a variance τ^2 .

Part B of Table 2.2 presents the estimates of the pooled effect of education under the assumption that there is a global effect size across studies. The estimates of the global effect size vary between the fixed effects and random effects models (inverse variance weighting used for pooling). The random effects model gives similar estimates as the summary statistics. The test statistics (p-value < 0.0001) indicate a strongly significant, positive return to education for both fixed effects and random effects models. The Q-statistics in Part C test the null hypothesis that the “true” effect sizes are homogeneous across studies, and thus there is no residual heterogeneity in the global effect size (between studies variance $\tau^2 = 0$). The Q-statistics follow a Chi-squared distribution with $N - 1$ degrees of freedom, with N being the number of observations in the meta-analysis. Solid evidence is found (p-value < 0.0001) for between-studies variance in both dimensions of social capital, which rejects the null hypothesis that the “true” effect size is homogeneous across studies, and therefore the fixed-effects model is not an appropriate hypothesis.

Table 2.2 Summary statistics, estimates of pooled effect size and test statistics for fixed effect

	<i>Social Trust</i>		<i>Social Participation</i>	
<u><i>A. Summary statistics</i></u>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>
Effect size	0.046	0.035	0.048	0.032
Measure error (s.e. of effect size)	0.015	0.017	0.021	0.046
<u><i>B. Estimate of pooled effect size</i></u>	<i>Estimate</i>	<i>z-value</i>	<i>Estimate</i>	<i>z-value</i>
Fixed effects	0.031	83.54	0.059	152.99
Random effects	0.045	18.44	0.050	21.67
<u><i>C. Test for fixed effects</i></u>				
Q-statistics	4557.98		8675.51	
p-value	<0.0001		<0.0001	
Between studies variance τ^2	0.001		0.001	
N	154		286	

2.3 Analysis of the extended model

Given that study feature has no influence on the effect sizes, the estimates from Table 2.2 indicate that the pooled estimates of education are 0.046 for social trust and 0.048 for social participation. In the meta-analysis, the assumption of a global effect does not seem realistic and tenable. The statistics classified by groups in Table 2.3 show that the mean effect sizes are markedly lower for the female group, for Non-US nations, and for surveys conducted after 1990. Note that, in studies of social participation, controlling for the average education level in the region raises the effect size substantially, while accounting for schooling endogeneity reduces the effect size dramatically.

Table 2.3 Mean effect size by characteristics of the study and the population

<u>Specific group</u>	<i>Social trust</i>				<i>Social activity</i>			
	Obs	Mean	Dif*	Sig of dif**	Obs	Mean	Dif*	Sig of dif**
Female	4	0.020	0.027	0.01	22	0.017	-0.033	0.00
Older age group (over 60=1)	3	0.117	0.072	0.36	13	0.051	0.003	0.69
College graduate	52	0.048	0.002	0.70	24	0.043	-0.006	0.46
Survey after 1990	66	0.040	0.011	0.03	158	0.042	-0.014	0.00
Non-US survey	74	0.031	-0.032	0.00	150	0.038	-0.020	0.00
Average education control	11	0.045	-0.002	0.84	10	0.116	0.071	0.00
Education endogeneity control	7	0.048	0.001	0.95	11	0.009	-0.041	0.00
Reciprocity control	47	0.044	-0.003	0.46	33	0.045	-0.004	0.55

Notes: “Dif” refers to the mean difference between the effect sizes from the target group and the rest of the effect sizes; “Sig of dif” refers to the statistical significance of the group difference.

To capture the impact of study characteristics, a linear model which allows for residual heterogeneity (random effect hypothesis) is introduced into the explanation of the effect sizes: $t_i = x_i\Delta + \varepsilon_i + \mu_i$. Few studies provide estimates of the return to schooling for particular groups (for men or women, for elderly or non-elderly, for college graduates or for high school dropouts). Indicators are therefore created for the presence of specific groups in the studies – whether the effect size is obtained for each specific target group. The coefficients of the

specific group variables represent the variations in the study estimates caused by group differences, conditional on these groups being observed. Important information will be included in this linear model on whether individual studies have considered education endogeneity, the relative effect of education, and reciprocity mechanisms within dimensions of social capital. Here also added to the extended model are indicators on whether the individual study has controlled for economic status (income and employment status), environment (population density, residency length, and development index), religion, media influence (television or Internet).

Table 2.4 presents the results of the extended model obtained from the STATA meta-analysis package¹. There is a statistically significant impact of controls for environment and controls for reciprocity for both social trust and social participation. Controls for religion, family (family size or marital status), media influence (radio, TV and Internet) appear to have an effect on the variation in study estimates of individual social trust, but no significant influence on individual social participation. Controls for economic status, education endogeneity, and average education level in the target region only have an influence on the variation in study estimates of social participation. Some study features, such as gender and age controls, have no statistically significant influence on the estimated return to schooling. The influence of literacy controls cannot be neglected. The literacy controls reduce the effect of schooling on social participation by a considerable degree.

¹ I use “metareg” from STATA to perform random effects meta-analysis.

Table 2.4 Extended model for random effects meta-analysis

	<i>Social Trust</i>		<i>Social</i>	<i>Participation</i>
<u><i>Variable control in study</i></u>	<i>Coef.</i>	<i>z-value</i>	<i>Coef.</i>	<i>z-value</i>
Gender control	0.007	1.30	0.010	1.08
Family control	0.015**	2.24	0.004	0.91
Reciprocity mechanism control	- 0.015**	- 2.53	- 0.013**	- 2.19
Environment control	- 0.010**	- 1.86	0.021***	4.76
Religion control	0.017***	2.95	- 0.001	0.11
Age/cohort control	- 0.006	- 0.53	0.006	0.85
Media control	- 0.013**	- 2.14	- 0.002	0.28
Education endogeneity control	- 0.008	0.54	- 0.042***	- 3.11
Average education control	- 0.004	0.32	0.037***	3.46
Literacy control	-	-	- 0.022***	- 5.68
<hr/>				
<u><i>Specific groups in study</i></u>	<i>Coef.</i>	<i>z-value</i>	<i>Coef.</i>	<i>z-value</i>
Female	- 0.019	- 0.99	- 0.059***	- 4.62
Survey after 1990	- 0.025	- 0.49	- 0.022***	- 2.77
College graduate	0.010**	1.97	0.026***	3.94
Older age group (over 60=1)	- 0.010	- 0.36	0.020**	1.97
Non-US survey	- 0.020***	- 3.47	- 0.036***	- 8.03
Participation in voluntary activity	-	-	0.008	0.57
Constant	0.051***	3.65	0.071***	6.06
τ^2	0.0003		0.0002	
N	154		286	

Notes: **Significant at the 5 percent level. ***Significant at the 1 percent level.

When it comes to specific target groups, there is a decline in the estimates from social participation studies for women and for the period after 1990. The effect sizes do not seem to vary for these groups in social trust studies. Educational attainment is an important factor for the variation in the effect sizes of the return to an additional year of schooling. People with at least a college degree receive a notably higher return to a marginal year of education. No systematic variation is found for the stages across the life cycle, and nor is any substantial difference observed between membership of social groups and participation level in voluntary activities, the two sub-categories of individual social participation. There is a significant distinction in the effects of education between the United States and other countries. The findings suggest that the higher return to education is one reason why American people tend to have more social capital.

2.4 Publication bias, test and correction

Publication bias is an important aspect related to the quality of the research synthesis. It arises in a meta-analysis when the probability that an estimate is observed is related to the statistical size of the estimate. Such selection effects can produce a substantial bias in the effect sizes. Egger's test is a common approach to test for the presence of publication bias. Egger et al. (1997) suggest performing a regression of the standardized effect size against its precision (i.e. the inverse of effect size's standard error), weighted by the reciprocal of the variance of the estimate. If the intercept differs significantly from zero, this may indicate that publication bias is present. The Egger's test statistics presented in Table 2.5 indicate that there is a severe bias in the meta-analysis of both social trust and social participation. The Egger's bias coefficients, 2.605 (p -value<0.001) in social trust studies and -1.598 (p -value=0.005) in social participation studies, strongly indicate the presence of asymmetry and publication bias.

Table 2.5 Egger's test statistics for publication bias

	<i>Social Trust</i>				<i>Social Participation</i>			
<u>Std. Effect size</u>	<i>Coef</i>	<i>s.e</i>	<i>t-value</i>	<i>p> t </i>	<i>Coef</i>	<i>s.e</i>	<i>t-value</i>	<i>p> t </i>
Slope	0.024	0.003	9.59	0	0.070	0.004	17.79	0
Bias (intercept)	2.605	0.564	4.62	0	- 1.598	0.570	- 2.81	0.005
N	154				286			

Note: The slope and bias in the Egger's test is not the slope and intercept of the fitted value line.

Begg's adjusted rank correlation test (Begg and Mazumdar, 1994) is an alternative approach to check for publication bias, by determining if there is a significant correlation between the effect sizes and their variances. In order to construct a valid rank correlation test, it is necessary to stabilize the variances by standardizing the effect sizes prior to performing the test. Plots are also presented with a predicted value line of the effect sizes against their standard error as a straightforward interpretation of publication bias. In the absence of any selective reporting, the line of fitted values in the scatter plot should be horizontal, as the estimates of the return to schooling should not vary in proportion to their standard error.

The statistics of Begg's adjusted rank correlation test are presented in Table 2.6, followed

by the scatter plots with the line of fitted value in Figure 2.1. The z-statistics and p-value of Begg's adjusted rank test in social trust and social participation studies provide the same conclusion as the Egger's test on the presence of publication bias. The scatter plots in Figure 2.1 show that the line of fitted values is upward-sloped for social trust, while it is downward-sloped for social participation, indicating that publication bias is a serious issue for both dimensions of individual social capital. Hence the findings from Egger's test, Begg's test, and the scatter plots corroborate the existence of publication bias.

Table 2.6 Begg's test statistics

Social Trust	Social Participation
adj. Kendall's Score (P-Q) = -2000	adj. Kendall's Score (P-Q) = 7428
Std. Dev. of Score = 566.84(corrected for ties)	Std. Dev. of Score = 1466.38(corrected for ties)
Number of Studies = 142	Number of Studies = 268
Z = -3.53	z = 5.07
Pr > z = 0.000	Pr > z = 0.000
Z = -3.53 (continuity corrected)	z = 5.06 (continuity corrected)
Pr > z = 0.000 (continuity corrected)	Pr > z = 0.000 (continuity corrected)

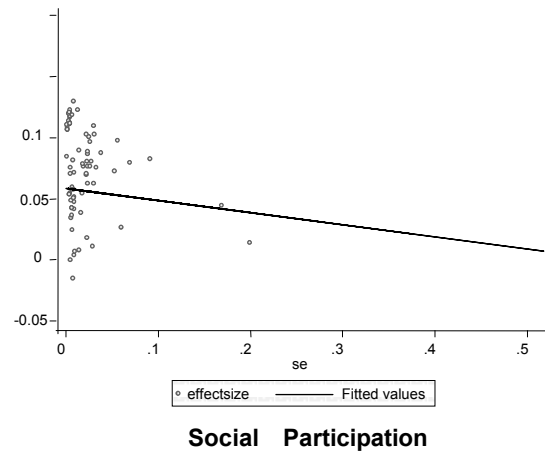
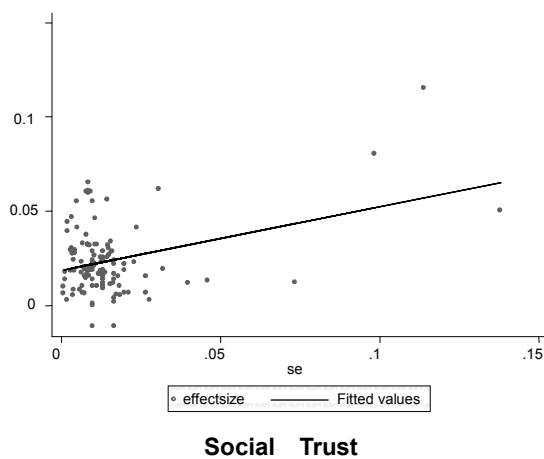


Figure 2.1 Scatter plot and predicted value line of effect sizes against their measurement error

Hedges' correction method (Hedges, 1992) is based on the assumption that there is a weight function of p-values that determines the probability of a study being observed. The weight function should be introduced into the likelihood in order to isolate the effect of p-values (details of this weight and the likelihood functions are outlined in Appendix 2C). In this analysis, the probability of observing a study is specified according to whether the p-value for that study is $0.01 < p < 0.05$ (denoted by ω_2) or $p > 0.05$ (denoted by ω_3), relative to a default category of $0 < p < 0.01$ (denoted by ω_1). The latter is normalized to unity. In the absence of reporting bias ω_2 and ω_3 should be equal to 1 as well.

Table 2.7 provides the results from Hedges' correction method under the global effect size hypothesis. Part A in the table gives the results of the restricted model, where $\omega_2 = \omega_3 = 1$. The effect sizes for social trust and social participation are 0.046 and 0.051, respectively. Part B presents the results after correcting for publication bias, as ω_2 and ω_3 are allowed to vary. The global effect size is moderately smaller for social participation studies, but remains identical for social trust studies. The likelihood ratio test, which follows the Chi-squared statistics with two degrees of freedom, indicates that publication bias is a problem for the effect sizes of social participation, but not for social trust. This is not totally consistent with Egger's test.

Table 2.7 Hedges' model with global effect size hypothesis

<i>A. Restricted</i>	<i>Social Trust</i>		<i>Social Participation</i>	
	<i>Coef.</i>	<i>z-value</i>	<i>Coef.</i>	<i>z-value</i>
ω_2	1		1	
ω_3	1		1	
Constant	0.045***	18.44	0.051***	26.23
τ^2	0.001		0.001	
Log Likelihood	458.59		829.76	
<i>B. Unrestricted</i>	<i>Social Trust</i>		<i>Social Participation</i>	
	<i>Coef.</i>	<i>z-value</i>	<i>Coef.</i>	<i>z-value</i>
ω_2	1.324***	3.24	1.506***	4.53
ω_3	0.979***	3.33	0.605***	4.25
Constant	0.045***	12.62	0.048***	18.64
τ^2	0.001		0.001	
Log Likelihood	459.13		837.06	
Chi-squared statistics	1.073		14.60	
p-value	0.585		<0.001	
N	154		286	

Notes: ***Significant at the 1 percent level.

Hedges' model is extended by introducing the study characteristics into the likelihood, and the key estimation results are presented in Table 2.8. Study cluster and data set dummies are also introduced into the likelihood.² Clear evidence is found concerning publication bias for both social trust and social participation. The Chi-squared test for the global effect also indicates a significant influence of study heterogeneities (p-value <0.0001). This result offers a clue why the global effect model does not provide consistent test statistics for social trust. The coefficients for study characteristics are very similar to those in the extended model (see Table 2.4), where there was no correction for publication bias, except that the coefficient of gender control becomes significant for the social trust equation at the 10 percent statistical level.

Table 2.8 Key statistics from the extended Hedges' model

<u>A. Statistics for unrestricted model</u>				
	Social	Trust	Social Participation	
Likelihood value(Restricted)	512.01		987.81	
Likelihood value(Unrestricted)	515.69		996.85	
Chi-squared statistics for publication bias	7.18 (p=0.027)		18.08 (p<0.001)	
Chi-squared statistics for Global effect	113.12 (p<0.001)		319.58 (p<0.001)	
<u>B. Estimate of unrestricted model</u>				
	Social	Trust	Social Participation	
	Coef.	z-value	Coef.	z-value
ω_2	0.795***	3.10	1.285***	4.11
ω_3	0.413***	2.94	0.435***	3.45
Education Endogeneity control	- 0.006	- 0.61	- 0.042***	- 3.39
Reciprocity mechanism control	- 0.017***	- 2.85	- 0.015***	- 2.70
Average education control	- 0.001	- 0.11	0.031***	3.22
Survey after 1990s	0.009	0.54	- 0.017**	- 2.23
College graduate	0.010**	2.10	0.020***	3.26
Older age group (over 60=1)	0.001	0.05	0.007	0.57
Non-US survey	- 0.016***	- 2.65	- 0.037***	- 8.11
Female	- 0.022*	- 1.77	- 0.052***	- 4.33
Constant	0.041***	2.70	0.040***	3.76
τ^2	0.0003	p=0.00	0.0002	p=0.00
N	154		286	

Notes: * Significant at the 10 percent level; **Significant at the 5 percent level; ***Significant at the 1 percent level.

² Study cluster is introduced into the likelihood to adjust for the correlation across estimates within the same paper. In addition, a great number of study estimates are obtained from the General Social Survey (GSS), the World Value Survey (WVS) and the International Adult Literacy Survey (IALS). Data dummies are created for these surveys to adjust for the correlation across estimate from the same survey, as two clusters cannot be introduced simultaneously into the maximum likelihood estimation.

2.5 Discussion and conclusion

It is found in this meta-analysis that one standard deviation of years of schooling accounts for the change in individual social capital by 12-16 percent of the standard deviation in each dimension. These findings confirm that education is a strong and robust correlate of individual social capital. The hypothesis that the fixed effects model is an appropriate synthesis method is rejected by the Q-statistics. There is strong evidence to suggest the presence of publication bias in the meta-analysis of social trust and social participation studies, and Hedges' model is employed to correct for publication bias in the analysis.

The coefficients for study characteristics in Hedges' correction model do not differ from those in the model where there was no correction for publication bias. Study heterogeneities have a substantial influence on the variation of the effect sizes. Gender differences play a role in the mechanism by which education affects social capital, as women exhibit a statistically negative influence on the effect sizes of both dimensions of individual social capital.

The endogeneity problem in schooling achievement and social capital outcome is a critical source of variation of study estimates of social participation, but it does not have any impact in study estimates of social trust. In social participation studies, almost every estimate which accounts for endogeneity turns out to be smaller than the corresponding one which does not account for endogeneity in the same study. The endogeneity problem poses the question whether there is a positive effect of schooling on social participation, as the coefficient of endogeneity control offsets the benchmark estimate (the constant term) in the meta-analysis (see Tables 2.4 and 2.7), and the mean effect size of study estimates which accounts for endogeneity is merely 0.01. The possibility that education is not an exogenous determinant of social capital should be taken into account in the study of the sources of social capital, especially when it comes to social participation outcomes.

Comparing the effect sizes obtained from surveys conducted before the 1990s with those from later surveys, one can observe a decline in the return to education on social participation. The decline in the education effect provides an explanation for the erosion of civic engagement in the United States (Putnam 1995a, 2000), despite a dramatic increase in educational attainment during the last half century. This finding is at odds with an upward trend in the wage effect of schooling, as found in a meta-analysis of private (wage) returns to education by Ashenfelter et al. (1999). One possible explanation for this discrepancy is that there is a trade-off between the returns to education on wages and that on social capital. Increased economic competition and increased demand for individuals with a high level

human capital in modern society may be seen as the cause. The emphasis on the role of schooling as a source of human capital could be detrimental to the contribution of schooling on cultivating social capital for collective welfare, as the role of civic education, which does not directly increase competence or income potential in the future, may be reduced in school programs or may appear less attractive to students who are anxious for an education that provides opportunities for a good job. However, there is no significant decline in the education effect on social trust. Social trust has its roots in individual morality that people follow in social and daily life (Fukuyama, 1995, p.153; Uslaner, 1999). People who believe in racial and gender equality, for instance, are more tolerant towards minorities and to others who are not like themselves, and these people have a higher level of trust in others. For schools, one of their essential functions is setting moral standards and equipping students with a basic sense of morality. It is possible that this function of education is not impacted by the social transition.

This analysis provides proof for the view that schooling has a higher effect on social capital in the United States than in the rest of the world. American schools are considered to be more active than schools in other countries in encouraging students to run student offices, participate in civic engagement and join various associations. The melting pot theory can also help explain why Americans tend to receive a higher educational return on social capital. Encouraging tolerance of ethnic diversity and creating core values of a common American heritage are the main subjects of the social education programs in American public schools. By exposing students to knowledge about ethnic diversity and the contributions of various groups to the development of American civilization, educators may change negative ethnic group stereotypes, reduce intolerance, and enhance cooperation for the common good.

The strongly significant influence of controlling for average education in social participation confirms the existence of a relative effect. For social trust, no evidence is found in support of a relative effect. The statistics classified by study characteristics in Table 2.3 show that the mean effect size for social participation is 0.045 in studies that do not control for average education, and 0.116 in those which do control for average education (both are statistically significant at the 0.0001 level). This provides evidence for both an absolute effect and a relative effect. The relative effect does not dominate the absolute effect of education, so the total effect on social participation is still positive and substantial.

It may be difficult to interpret why the effect size is positively associated with the inclusion of average education level control. A simple linear model is chosen to elucidate this insight, assuming education to be the only determinant of social participation (SP):

$$SP = a * edu_1 + b * (edu_1 - avedu),$$

where a represents the marginal absolute effect of years of individual schooling on social participation; and b represents the marginal signaling effect or relative effect (years of schooling compared with the average years of schooling in the region). If education has a signaling effect as well as an absolute effect on individual social capital, both a and b would be expected to be positive. In addition, years of schooling are positively associated with the average level of education in the region where the individual lives. Mathematically, the individual education level is included into the calculation of the average education level. Furthermore, higher educated people are more inclined to live in regions with a higher average education level, since people have a preference for a homogeneous region with similar socioeconomic status. More details can be found in Alesina and La Ferrara (2000b), who show that socioeconomic heterogeneity reduces trust and feelings towards other people. In the restricted model, the covariate of the average education level of the region is dropped:

$$SP = c * edu_1$$

Then the negative effect of average education level will be absorbed by individual schooling years. Thus the estimate of the effect of individual education, coefficient c in the restricted model, will be smaller than that in the full model, which equals $a + b$. This explains why there is a positive impact of the control variable for the average level of education on the magnitude of the effect of individual schooling years.

The size of the schooling effect varies with the level of education. Effect sizes are significantly higher for people with a college degree or above. The popular one-factor model, where it is assumed that education can always be aggregated into a single measure, say years of schooling, may not therefore be an adequate model to capture the effects of education on social capital. One may ask why the effect of education demonstrates a substantial leap for people with a college degree. It is possible that college education is a more efficient and critical stage for individuals to learn to trust other people and cultivate active civic behavior. Alternatively, a college degree may signal the existence of unobserved ability – individual personality, or other inherent psychological attributes – that positively affect both educational achievement and the level of individual social capital.

There is evidence to suggest that controlling for a reciprocity mechanism between the two dimensions of individual social capital influences the estimates of educational returns. This

confirms a “virtuous circle” (Putnam, 1995a) in the accumulation of social capital. If social trust is included as an explanatory variable in the social participation equation, the estimate of the marginal effect of schooling years will be lower. The reverse is also true. The intuition behind this is straightforward: since education has a significantly positive effect on both dimensions, and there is a mutual, positive effect between these dimensions, the direct effect of education on a dimension (after controlling for reciprocal effects) will be lower than the total effect (without controlling for reciprocal effects). The significant impact of controlling for reciprocal effects also provides support for the central role of schooling in the generation of social capital.

No substantial difference is found in the effect sizes across life stages. It is plausible that there are constant educational returns on individual social capital over time. Controlling for media influence has hardly any impact on the estimates of educational returns. It is surprising to observe a negative influence of the inclusion of environmental concern (urban or rural differences, population density, average income in the region, etc.) in study estimates of social trust but a positive influence in study estimates of social participation. Do urban schools have better access to resources, facilities and financing, and provide better quality social education than rural schools? Do life experiences in urban areas, which are more heterogeneous and complicated, spill over into people’s social values, and reduce the influence of education on social trust? Unfortunately, there is no explicit answer due to the lack of information in the literature on these issues.

The outcomes from the meta-analysis suggest several interesting topics for further investigation in the next chapters of this thesis, where analyses will be presented of the return to education using a one-factor measurement and using a single treatment measurement, with emphasis on the schooling endogeneity. Potential gender difference in the relation between education and social capital is another interesting subject in thesis. It will shed some light on the puzzle concerning the mysterious decline of the level of social participation, given the development in all aspects of education and learning.

Appendix 2 Coding of variables and Hedges' test for publication bias

Appendix 2A Coding of the effect size

Most effect sizes were obtained from regression as the unstandardized estimate of the education effect. For example, the marginal effect of a year of schooling from OLS and probit models, where the dependent variable is 0/1, was standardized by the standard deviation of the dependent variable to obtain the effect size. Some studies have provided standardized coefficients for education. Those estimates are not the effect size, but the proportion of the standard deviation in the dependent variable that is accounted for by one year of schooling. In this case the standardized coefficient was divided by the standard deviation of schooling years to obtain the effect size of marginal schooling year.

A small proportion of studies (less than 5 percent) merely indicated whether the estimate of the educational effect exceeded the 1 percent, 5 percent, or 10 percent levels of statistical significance. In these studies, I imputed the p-value of the effect estimate on the basis of the reported statistical significance level. If the level of statistical significance was reported to exceed the 5 percent level but not the 1 percent level, the p-value equaled .03, the midpoint between .01 and .05. If the level of statistical significance exceeded 1 percent, it was assumed that the p-value equaled .005. If the level of statistical significance exceeded the 10 percent but not the 5 percent level, it was assumed that the p-value equaled .075.

Many studies included the education variable into the regression as a dummy variable (as an indicator for high school certificate or an indicator for college degree). A simple calculation was performed to translate these estimates into the effect of marginal years: I divided the coefficient for the high school dummy variable by 4, for some college education by 5, and for college graduates by 6, in order to obtain the equivalent effect size for a year of schooling. Because these dummy variables provide further information on the education level of the respondents, a variable "college graduate or above" was created to evaluate whether people with higher education receive a higher marginal return to education. "College graduate or above =1" means that the effect sizes are obtained from studies using a binary variable which indicates whether the respondents had a college degree or not (so the effect sizes of education were obtained from those with at least college degree compared with those without).

Appendix 2B Treatments of missing values for specific groups

There is not much information available on specific groups because few studies have evaluated the educational return for specific groups. Rather than dropping studies without information on specific target groups, the following procedures were used to retain them: **a.** a full set of indicators, including education level, gender and life cycles were included. For each of these group variables mentioned, the category “missing” was included as a separate indicator variable, showing whether that study focuses on a specific group; **b.** each of the group variables mentioned in **a.**, were interacted with the category indicators that the variable is not missing. The coefficient reported in the tables for each of these group variables is the coefficient on the interaction of the group variable (e.g. female) with the indicator that the group variable has non-missing value. These coefficients therefore represent the effect of the group variable conditional on its value being observed; and **c.** The indicators for missing values were included in the Chi-squared test for the global effect; but this inclusion does not have any impact on the rejection of the global effect in the extended model, as the p-value is smaller than 0.0001 for both dimensions, when the category indicators are excluded.

Appendix 2C Hedges’s test for publication bias

The weight function outlined in here is identical to the one in the paper of Ashenfelter et al. (1999). More detail can be found in Hedges’ paper (1992).

$$L = c + \sum_{i=1}^n \log w_i(t_i, \omega) - \frac{1}{2} \sum_{i=1}^n \left(\frac{t_i - x_i \Delta}{\eta_i^2} \right)^2 - \sum_{i=1}^n \log(\eta_i^2) - \sum_{i=1}^n \log \left[\sum_{j=1}^n \omega_j \beta_{ij}(x_i \Delta, \tau) \right],$$

where $w_i(t_i, \omega)$ is a weight function which determines the probability of being observed, with the relationship with the effect size t_i coming via the p-value. $\beta_{ij}(x_i \Delta, \tau)$ denotes the probability of a normally-distributed random variable with mean $\mu = x_i \Delta$ and variance $\eta_i^2 = v_i + \tau^2$. In the restricted model of global effect, all variables of study characteristics (x_i) drop out except the constant term, which denotes the true effects.

Chapter 3

Early Childhood Influence, Education, and Social Capital

3.1 Introduction

This chapter investigates the relations between early childhood factors, education, and social capital. The social capital outcomes include two commonly discussed dimensions of social capital at the individual level – social trust and social participation in terms of membership of voluntary associations.

Social trust is the amount of trust individuals have in most people, those they know and do not know. Social trust reflects a bond that people share across society, across economic and ethnic groups, religions and races. It is a belief that other people share your fundamental social norms, and it is the foundation of a cooperative spirit that brings people together for common and mutually advantageous purposes (Rothstein and Uslaner, 2005). Social trust correlates with many variables that are normatively desirable for most people. Those who believe that most other people in society in general can be trusted are also more inclined to have a positive view of their democratic institutions and participate more in civic organizations. They also have a more optimistic view about controlling their own life-chances.

Social participation refers to people's social involvement and interaction with others. It is defined in this dissertation as the organized collective activities associated with all types of groups and organizations relating to community living and welfare. These social groups and organizations are outside the political arena and the workplace (i.e. unions, parties, voting and lobbying groups)³.

The local and community aspects that social groups focus on can be private interest-oriented, such as parent-teacher associations (PTA), tenant associations, as well as purely altruistic interest-oriented – charity, environmental and community volunteering. These social groups are established to facilitate people's effective involvement in community life, to

³ Based on Max Weber's typology of social action (1978), activities in unions, parties, voting, and lobbying groups are instrumentally rational action, serving the purpose of certain interest groups. These group activities are defined as instrumental action. Social participation, as defined in this dissertation, is a form of affective or value rational behavior and it constitutes its own reward. Hence, social participation is a form of expressive action. Lin views instrumental action as directed at obtaining new resources, while expressive action is directed at preserving or maintaining resources (Lin, 2001; Lin and Erickson, 2008).

improve the living environment, and to increase social well-being.

This chapter contributes to the debate on social capital research by presenting empirical evidence on the influences of early childhood factors on education outcome and social capital outcomes, and empirical evidence on the effect of an additional year of schooling in the building of social capital in mid-life, using the rich information from a British multi-wave survey of a cohort born in 1958. Education endogeneity in the social capital equations will be given emphasis: a non-systematic health component is separated from the length of school absence due to illness as an instrumental variable. This instrumental variable will be used in Chapter 3, 5, and 6 to handle the endogeneity of schooling.

This remainder of this chapter is divided into four sections. Section 3.2 puts forward hypotheses on the relations between education and social capital that will be tested. Section 3.3 introduces the National Child Development Study. Section 3.4 presents empirical findings on the hypothetical relations. Section 3.5 emphasizes the omitted variable bias of the educational effect on social capital. Section 3.6 summarizes the findings.

3.2 Hypotheses and reviews

Parental social life, family life and peer interactions are important sources of individual social capital in adulthood (Bourdieu, 1993; Putnam, 1995a; Fukuyama, 1999). Some scholars (e.g. Coleman, 1988) consider these social relations to be important indicators of social capital. However, children at a young age do not have an active command of the use or accumulation of their social resources. They have not established mature and independent social values or social norms as the governing principles of their social interactions. From this perspective, children at early age are not subject of human capital and social capital at the individual level. A term “social capital in early childhood”, based on Coleman’s defining and illustrating, is introduced to denote family social relations or social resources in early childhood that impact the development of children. Social capital in early childhood and social capital are two different concepts. Unless otherwise specified, social capital refers to social trust and social participation in adulthood.

Social capital in early childhood consists of two main forms: social capital inside the family, and social capital outside the family. Social capital inside the family refer to the relations between children and parents (and, when families include other members, relations with them as well), Coleman (1988, 1990a, p.595) suggests several indicators of social capital in the home: (1) the presence of both parents in the household; (2) number of siblings; (3)

talking about personal matters with the child; (4) the mother working outside the home before the child is in school; and (5) parents' interest in the child attending college⁴. Social capital outside the family refers to parental interactions with others, parental affiliation in social groups, family/school mobility, and children's interactions with peers.

Researchers generally agree that children's developmental trajectories can be enhanced by socio-ecologically-based interventions in early life. Parental practices and resources can benefit or hinder children's educational and life chances (see Coleman, 1988; Wright et al., 2001; Ermisch and Francesconi, 2001a, 2001b; Gesthuizen et al., 2005). While schooling is deemed to be a direct beneficiary of high levels of social capital in early childhood, it is also assumed to exert a key role in generating and accumulating social capital in later life. Putnam (2000) and Brehm and Rahn (1997) consider education as a determinant in the creation of social capital. Schooling is the first non-familial context in an individual's life where moral and cognitive capacities are trained. People with more cognitive skills probably know how to use a given stock of social resources more effectively.

This chapter will provide empirical evidence on the correlation between social capital and education by testing two main hypotheses based on a multiple-life-stage analysis.

Hypothesis 1: Social capital inside the family, social capital outside the family, and parental social-economic status have a lasting effect on offspring's education achievement and social capital in adulthood.

Hypothesis 2: Individual educational achievement has significantly positive effects on both social trust and social participation.

Figure 3.1 provides a simple illustration of the hypothetical causal inference on social capital and educational achievement. It presents a plain description of the hypothesized relations between social capital in early adulthood, education, and social capital in adulthood. Sieben and de Graaf (2004) also present a similar figure on the causal structure between family background, education achievement and social orientations (e.g. religious beliefs. Church attendance, political party preference, etc.).

⁴ The number of times a child has changed schools because the family has moved is also regarded as an indicator of family social capital in some studies. Here we consider it as an indicator of social capital outside the family.

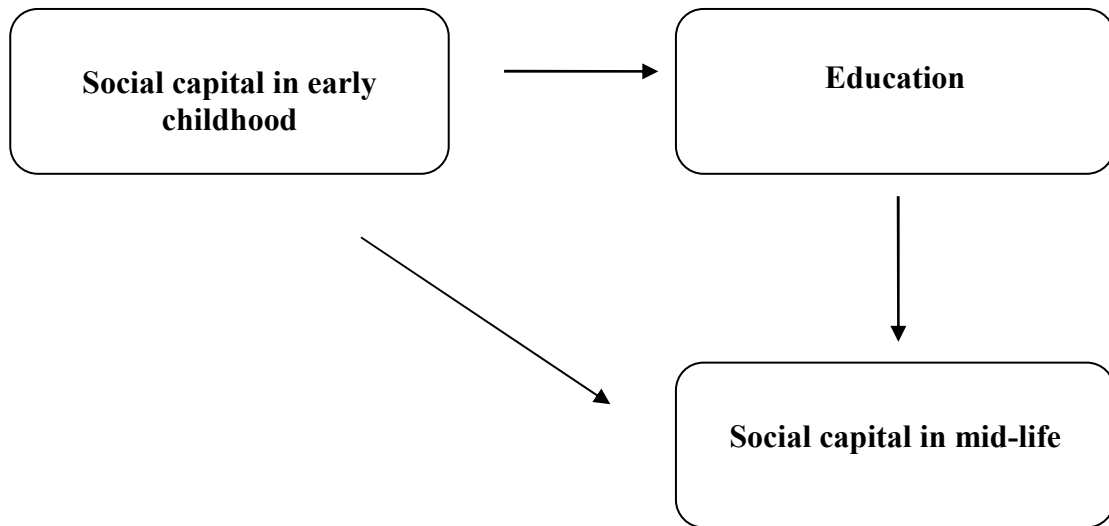


Figure 3.1 Potential causality for the development of education and social capital

Firstly, social capital inside the family, social capital outside the family, and parental social-economic status have a lasting effect on the offspring's social capital and education achievement in adulthood. Parents invest in their children by being physically present, giving them attention, and developing an intense relationship with them that involves talking about personal matters and expectations of their educational achievement. If the human capital possessed by parents is not complemented by social capital embodied in family relations, however, it is irrelevant to the child's educational growth whether the parent has a great deal or a small amount of human capital (Coleman, 1988).

Family life is perceived as the bedrock of individual social capital. Putnam (1995a) and Bourdieu (1993, p.33) sees the family as the main site of accumulation and transmission of social capital. Fukuyama (1999, p.17) also asserts that "families are obviously important sources of social capital everywhere". Social capital is transmitted to children through time and effort invested by parents, through affective ties between parents and their children, and through clearly articulated guidelines on behavior and moral value (Coleman, 1988, 1994).

The structural change in modern families, i.e. the increase of single-parent families and two-career families, is considered a prominent element which has been undermining social capital in recent decades (Coleman, 1988, 1990a; Putnam 1996). Robinson (1993) suggests that, other factors being equal, single mothers spent about 30 percent less time with their

children, on average, than married mothers. Some researchers claim that a two-career family or maternal employment negatively affects the cognitive development of children (Han et al, 2001; Waldfogel et al., 2002) and student achievement (Ermisch and Francesconi, 2001; Ruhm, 2005). However, there are different opinions. Dawson's research (1991) has found maternal employment to be unrelated to child outcomes or related only to outcomes for select subgroups. Using time-diary data collected on various samples of rural and urban women in the 1920s through to the late 1970s, Bryant and Zick (1996) concluded that the reduced time for children concomitant with the rise in married mothers' participation in the labor force may be overstated. According to Gregg et al. (2005), estimated coefficients in studies on maternal employment and child development may be biased because of the omission of confounding variables correlated with both child outcomes and maternal employment, such as maternal capability.

The social capital that facilitates a child's development does not reside solely within the family. It can be found outside in the community consisting of the social relations that exist among parents (Coleman, 1988). Putnam (2000, p.301) asserts that where mothers are supported by locally based social networks, their offspring will benefit "over and above how rich or poor they are materially".

Coleman (1988) points out that residential mobility disrupts the intergenerational closure of social capital links between family members and the community. For families that have moved often, the social relations that constitute social capital are broken at each move. Whatever the degree of intergenerational closure available to others in the community, it is not available to parents in mobile families.

Coleman (1990b) suggests that strengthening the social relationships between parents, teachers, and students would improve academic achievement in students. Increasing parental participation in extracurricular activities results in higher social capital, and thus plays a role not only in enhancing existing relationships but also in fostering new ones.

Secondly, individual educational achievement has significantly positive effects on both social trust and social participation. Education plays a key role for setting moral standards and equipping students with an essential sense of morality. Schooling experiences expand the horizon of individuals on economic and social change. Higher educated individuals are more open-minded to accept otherness from heterogeneous groups, and they will have a higher level of trust in people in general, those they know and those they do not know (Putnam, 1995a, 2000; Uslaner, 1998; Brehm and Rahm, 1997; Leigh, 2006; and Alesina and Ferrara, 2000b). Through civil education from schooling, students learn the basic norms and responsibilities in

society, the value of civic and social engagement, and the importance to be an active society member.

Glaeser et al. (1999) assert that the most robust correlate of social participation, measured by the probability of being group member, is years of schooling. Using the world values survey, they observe a positive relation between schooling and membership of social organizations in almost every country. Putnam (1995a, 2000) and Uslaner (1998) claim that high-educated people are more likely to join social organizations and participate in social engagements more frequently. Wilson and Musick (1997) also find similar results.

The positive role of education in promoting social capital is questioned, however, by the divergence in the transitions of education and social participation behavior in Western countries (Knack, 1992; Putnam, 1995a, 1995b). Moreover, few empirical studies have attempted to isolate the real effect of education from the influence of confounding variables. In studies on private returns to education, it is confirmed that income and educational attainment can be simultaneously influenced by a wide range of unobservable terms and that the omitted-variable problem could lead to a bias in the estimate of the return to education. Similar problems can emerge in the investigation of the relation between educational attainment and individual social capital.

Gibson (2001) claims that education is associated with a lower probability of volunteering and a lower supply of hours volunteered, after applying the difference in difference approach in a sample of twins to eliminate the unobserved heterogeneity. Sieben and de Graaf (2004) show that conventional regression models do not necessarily produce unbiased estimates of the education effects on social orientations (e.g. religious beliefs, church attendance, political party preference, etc.). Huang et al. (2009) also find that less than one quarter of the studies addressed the problem of education endogeneity, and that it could cause an upward bias in the estimate of the educational impact.

The endogeneity in educational attainment is a major concern of this dissertation. Econometric techniques are essential to eliminate the potential omitted variable bias. In this chapter, an instrument variable is constructed and applied in the evaluation of the education effects on individual social trust and individual social participation.

3.3 Introduction to the National Child Development Study

To investigate the development of social capital and education from childhood to adulthood, an appropriate data set is indispensable in order to follow the respondents through different

relevant life stages. The rich data of a British cohort born in 1958 from the National Child Development Study (NCDS) offers an opportunity to perform such an analysis. The NCDS is a multi-disciplinary longitudinal study of all those living in the UK who were born in the week 3 to 9 March, 1958. The first three sweeps were carried out by the National Children's Bureau in 1965, 1969 and 1974. The following three sweeps were carried out by the Centre for Longitudinal Studies (CLS) in 1985, 1991 and 1999-2000.

The NCDS is widely used in economics, social and health sciences research to examine the patterns of human development that follow the lifespan (McCulloch and Joshi, 2002; Case et al., 2005). The NCDS has gathered data from respondents on child development from birth to early adolescence that include information on child care, medical care, health, physical statistics, school readiness, home environment, educational progress, parental involvement, cognitive and social growth, family relationships, economic activity, income, training and housing. This data set allows the analysis to account for three categories of confounding variables in early childhood: parental socioeconomic status (especially maternal choice of employment); children's capacity (health, cognitive ability and language ability); and children's personality traits. The unavailability of any category of these variables in other data sets may lead to omitted variable bias on other variables⁵. Lack of information on children's health, cognitive capacity (nature variables), for example, may result in a biased estimate of maternal choice of employment or parental outings with children (nurture variables) in the accumulation of human and social capital.

Both social trust and social participation are measured by a binary indicator according to the survey question:

Social trust: Do you agree that most people can be trusted or that you can't be too careful in dealing with people?

Social participation: Are you currently a member of one or more community-based social groups that include environmental groups, charity groups, PTAs, residents' groups, and other volunteering groups? Researchers conventionally rely on this membership of social groups as a measurement of an individual's social participation level.

Since each wave of the NCDS did not necessarily have identical questions, the social trust variable is extracted from the 1991 survey, and the membership outcome is extracted from the 2000 survey, when the cohorts were 33 and 41 years old, respectively. The sample studied in

⁵ This study does not explore adolescent influences in the accumulation of human and social capital. Because there can be a simultaneous relation between schooling experience and social capital accumulation in adolescence. It is hard to identify the real causal directions between schooling experience and social behavior development at this stage.

this paper contains 9046 observations⁶. 68.1 percent of the cohort indicate that most people can be trusted and 16.8 percent of them reported that they are members of at least one social group. Table 3.1 provides a statistical description of the major variables in this study.

Most of the early childhood life variables come from the first and second wave survey (1958 and 1965). Information on social capital inside the family includes the presence of both natural parents, parental interest in their children's education, parental outings with, and reading to, the child, the mother's employment status, and choice of private daycare⁷. The 1969 survey provided information on social capital outside the family that include indicators of parental membership of library/reading groups, children's interest in club activities (in/out of school), and meeting other friends. Residential mobility is also included as an indicator of social capital outside the family. It is posited here that residential mobility is an exogenous variable for education and social capital in adulthood, conditional on family background, parental relations, and parental interest in education.

For the information on personality traits and cognitive abilities in developing social capital, several test scores are adopted on adverse personality traits at the age of 7. The personality traits comprise: withdrawal score, anxiety score for acceptance, and hostility score against adults. Whether children often fight with others and parent-reported emotional problems are also included as personality traits variables. Cognitive ability factors include rating in Math, reading and language ability, as well as motivation in school study at the age of 7.

The measures of parental socio-economic status and family background contain indicators for parental education level and social class, as well as the number of siblings in the family. The measures of natal and infantile health consist of information on whether the cohort member had a low birth weight, the mother's smoking habit during pregnancy, breastfeeding habit during the infant's first 3 months, and parent-reported chronic health problem at the age of 7.

All explanatory variables are obtained from the early stage of childhood (the 1958 survey and the 1965 survey), except for the number of residence changes up till the age of 11,

⁶ The sample size in birth survey is 17,409, but there is attrition among each survey, only 11,000-12,000 observations remain since the 1974 survey when the cohorts were at the age of 16. Attrition does not appear to be systematically associated with family background, such as parental socioeconomic status (a detailed discussion can be found in the paper of Case et al. (2005) or Huang et al. (2010a)).

⁷ Parental interest in their children's education and parent reading to the child are considered family social capital in early childhood. According to Coleman (1988), "social capital within the family depends on the physical presence of adults in the family and on the attention given by the adults to the kid". These factors are considered as elements of cultural capital in the studies of Bourdieu and Passeron (1977), DiMaggio (1982), Gesthuizen et al. (2005).

parental membership of reading groups or library, and children's involvement in clubs inside/outside school. Adolescent influence is not included in the evaluation because the design aims to offer a simple and clear explanation of the possible causality from early life factors to education and social capital, and the possible education effects on the development of social capital in adulthood.

Table 3.1 Descriptive statistics of the main variables

Variable	N	Mean	SD	Variable	N	Mean	SD
<u>Outcome variable</u>				<u>Treatment variable</u>			
Social trust	8616	0.682	0.466	Age on leaving school	9046	17.16	2.026
Social group membership	9046	0.168	0.374	Higher education	9046	0.204	0.403
<u>Basic Demographics</u>				<u>Father's social economic status</u>			
Male	9046	0.480	0.500	Professional	6286	0.057	0.233
Minority-Non White	9046	0.021	0.144	Managerial	6286	0.146	0.353
				Non-manual-skilled	6286	0.433	0.496
<u>Reading ability</u>				Manual-skilled	6286	0.014	0.116
Excellent	7005	0.168	0.374	Non-manual-semi	6286	0.127	0.333
Above average	7005	0.298	0.458	Manual-semi	6286	0.046	0.209
Average	7005	0.339	0.473				
Below average	7005	0.121	0.328	<u>Mother's social economic status</u>			
<u>Math ability</u>				Professional	6730	0.005	0.054
Excellent	6961	0.118	0.323	Managerial	6730	0.106	0.308
Above average	6961	0.223	0.416	Non-manual-skilled	6730	0.220	0.414
Average	6961	0.361	0.480	Manual-skilled	6730	0.048	0.214
Below average	6961	0.164	0.370	Non-manual-semi	6730	0.119	0.324
				Manual-semi	6730	0.100	0.301

3.4 Results

3.4.1 Early childhood influences on schooling

An OLS regression is first applied to examine the early-childhood influences on educational achievement in terms of years of schooling. The empirical results are presented in Table 3.2. The baseline estimate is 15.9, which corresponds to the minimum school leaving age of 16 in the UK. A statistically significant difference is found in schooling years between men and

women. The coefficient of the gender variable (Male=1) is 0.138, indicating that the male cohort received roughly two more months of schooling than the female cohort, other conditions being equal. There is no substantial ethnic difference in schooling, after taking into account individual abilities, parental ability in English, and family background. Health status at birth and early childhood is correlated with schooling. The age of the mother in 1958 has a non-linear effect. Breastfeeding and smoking habits also have a direct influence on schooling.

It is apparent that social capital factors in early life have a systematic impact on years of schooling. Above all, family social capital factors play a key role in human capital accumulation. The physical presence of both natural parents is a statistically significant and positive determinant of individual education. A mother reading to her child at least once a week appears to be an effective approach for the development of her child's education. The interaction of the father reading to the child and his education has a similar effect. Maternal employment is negatively correlated with her child's educational level. These empirical findings support Coleman's claim that children profit from strong family social capital in terms of educational achievement.

When it comes to social capital factors outside the family, parents' membership of reading groups/library – the only information on parental group participation – is a major predictor of educational achievement. Surprisingly, meeting other children every day outside school turns out to have a negative effect with a p-value of 0.003. Residential mobility does not seem to hinder the development of education. The positive estimate of change of residence, conditional on family background, parental relations, and parental interest in education, reveals that geographic mobility does not necessarily impede children's academic achievement.

Cognitive abilities, as expected in the hypothesis, are crucial for future educational achievement. The math, reading and oral abilities rated by teachers are the most important determinant for years of schooling. Personality traits are also statistically significant predictors of education level. Anxiety score and emotional problems cause adverse academic outcomes. The hostility score, withdrawal score and aggression score are not significant in the regression. They are strongly correlated with the anxiety score. Any of these variables would become a significantly negative determinant if other personality score variables are excluded from the regression equation.

Parental socioeconomic status, which includes parental age of leaving school and parental social class, is a major source in the explanation of schooling variance. Certainly, the estimates may not necessarily reflect a true causality from parental socioeconomic status to

children's schooling outcome, as both depend on parental genetic endowment or related characteristics. Given the information from family social capital factors, social capital outside the family, individual personality traits and cognitive abilities in early life, ethnicity background, as well as parental education and social class, however, there is a much smaller likelihood in the OLS regression that severe omitted variable bias leads to wrong conclusions about early childhood influences on schooling. The significant interaction between parent's education and their habit of reading to children also supports, directly and indirectly, socio-economic class as a strong determinant of offspring's schooling outcome. Family interaction is an effective approach, which is not determined by genetic endowment, to transfer parental human capital to offspring's human capital. It takes the combination of parental human capital and family social capital to effectively build up the social capital of the next generation. The absence of either factor may lead to an adverse outcome in child's educational achievement.

To obtain more evidence on the causal influence of early life factors, a nonparametric bound analysis was applied based on studies by Manski and Pepper (2000) and Haan (2009). With relatively weak assumptions, nonparametric bounds are obtained on the effects of family social capital factors, social capital outside the family, and parental education and social class (details of the assumptions and derivation of the nonparametric bounds are presented in Appendix 3). In this nonparametric bound analysis (see Table 3A.1 in the Appendix), all estimates from the OLS are well within the nonparametric upper bounds and most of these estimates are half the value of the nonparametric upper bounds. These results provide additional support to my claim that there is no severe omitted variable bias in the OLS regression, given the rich information of early childhood variables.

Table 3.2 Early life factors and schooling

OLS on years of schooling	coef..	S.E.	t-value	p-value
Male	0.138	0.039	3.50	0.000
Ethnic-white	-0.154	0.141	-1.09	0.275
Mother's age 1958	0.100	0.034	2.96	0.003
Mother's age 1958 square	-0.002	0.001	-2.71	0.007
Non-breastfeeding	-0.080	0.044	-1.83	0.067
Non-smoker	0.130	0.042	3.12	0.002
Presence of both natural parents	0.176	0.077	2.29	0.022
Mother reading to child every week	0.104	0.046	2.26	0.024
Father reading to child * father's education	0.009	0.005	1.69	0.090
Father's over concern for edu. of child aged 7	0.563	0.210	2.68	0.007
Mother not working before child went school	0.071	0.044	1.63	0.104
Mother no paid work since 1965	0.123	0.045	2.72	0.006
Father's social class 1965 (from low to high)	0.118	0.015	7.68	0.000
Father's age on leaving school	0.135	0.016	8.31	0.000
Mother left school after minimal age	-0.590	0.048	-12.42	0.000
Parents belong to reading groups/library	0.291	0.043	6.78	0.000
Private daycare	0.801	0.063	12.65	0.000
Math ability rating 1965 by teacher	0.239	0.031	7.80	0.000
Reading ability rating 1965 by teacher	0.233	0.032	7.35	0.000
Oral ability rating 1965 by teacher	0.128	0.029	4.46	0.000
Anxiety score for acceptance	-0.068	0.033	-2.06	0.039
Emotional problems	-0.403	0.144	-2.80	0.005
Meet other children outside school everyday	-0.149	0.049	-3.02	0.003
Child often fights in school	- 0.106	0.042	-2.52	0.012
Child reluctant to go to school at age 7	-0.155	0.065	-2.37	0.018
Const	15.822	0.436	36.31	0.000

3.4.2 Social trust

The results of the social trust analysis in Table 3.3 highlight the importance of schooling and social capital factors in early childhood. Education turns out to be one of the most significant variables in the social trust equation. There are positive effects for a number of family social capital factors, i.e. parental influence on children, maternal interest in children's education, and good parental interaction with children. Children who grew up in families without either natural parent tend to have less trust in people in general. Parent's education and language (English) level are statistically significant predictors of the offspring's social trust level. In this analysis, the number of siblings has a non-linear relationship with social trust, as shown by a positive first-order term and a negative square term at the 5 percent statistical level.

Positive estimates are found for the presence of natural parents and daytime maternal care (indicated by the mother not working before the child turns 7). These results reveal that two-career families and family divorce can be seen as a cause of declining social trust for the next generation. They are consistent with the notion (i.e. Coleman, 1988, 1990b) that the increase in single parents and in maternal employment undermines the social capital available to children.

Social capital outside the family is not as decisive in building social trust as social capital inside the family. Nevertheless, residential mobility proves to be a negative element that significantly hampers the accumulation of social trust.

There is no convincing evidence to suggest that cognitive abilities displayed in early childhood are relevant for the building of social trust. Personality characteristics in early childhood, on the other hand, are found to be a major predictor of trusting behavior. Those who showed a higher level of hostility or aggressiveness when they were young tend to have a lower level of social trust. Those who were actively involved in meeting others have a higher probability to trust other people.

Table 3.3 Education, early life factors and social trust

Probit on social trust	Probability change	S. E.	Z-score	p-value
Years of schooling	0.022	0.003	7.36	0.000
Male	-0.045	0.011	-4.11	0.000
Ethnic-white	0.160	0.043	3.86	0.000
Presence of both natural parents	0.037	0.021	1.76	0.079
Number of siblings	0.055	0.022	2.46	0.014
Number of siblings squared	-0.008	0.004	-2.26	0.024
Mother reading to child aged 7 every week	0.023	0.013	1.84	0.066
Father outing with child aged 7 every week	0.025	0.015	1.72	0.086
Mother interested in edu. of child aged 7	0.042	0.022	1.89	0.059
Mother very interested in edu. of child aged 7	0.054	0.026	2.06	0.039
Father unemployed	-0.073	0.045	-1.65	0.099
Mother not working before child went school	0.020	0.012	1.65	0.099
Father's age on leaving school	0.009	0.005	1.89	0.059
Mother's language (English) level – poor	-0.106	0.060	-1.85	0.064
Number of residence changes	-0.013	0.006	-2.15	0.031
Child reluctant to go to school at age 7	-0.042	0.018	-2.35	0.019
Hostility score of children/anxiety for acceptance	-0.016	0.010	-1.71	0.088
Meet other children outside school every day	0.035	0.014	2.54	0.011
Often fight with other children outside school	-0.061	0.027	-2.29	0.022

Note: * S. E. refers to the standard error of the reported marginal probability.

3.4.3 Membership of social groups

The OLS analysis of social participation outcome also confirms the importance of schooling, and the estimate of the marginal probability is the same as that from the social trust regression. In this analysis, no substantial evidence is found to support the perception that early life background or experience has a critical influence on social participation habits in adulthood. Few variables in the equation of group membership, compared with those in the equation of education and the equation of social trust, show statistical significance (see Table 3.4). The mother reading to her offspring at least once every week turns out to be the only significant variable from the category of social capital inside the family.

Parental social capital outside the family, as measured by membership of reading groups or library, has a large impact of their children's participation habit. The estimate implies that parental social interactions can create resources that will enhance the children's realization of their involvement in social activities.

People who often participated in club activities inside or outside school at the age of 11 (the 1969 survey) have a significantly higher probability to join social groups than those who did not. There are considerable demographic differences in social participation habits. Men are much less enthusiastic to join social groups. White respondents have a markedly lower affiliation rate.

Both individual language (English) ability and the mother's language (English) ability have significant effects on social participation level in adulthood. This analysis also reveals that language ability is more relevant to social participation development. Therefore, if we regard social capital as the glue that holds society together, then language must be a critical ingredient of that glue by enabling social relations to be developed through conversations.

Similar to the social participation analysis, men are much more reluctant to be members of social groups. However, white respondents have a significantly lower probability to be a group member. Social participation and participation in political organizations (unions, staff associations, etc.) appear to have different features in the gender aspect. Women are much less likely to join in political groups, labor unions and staff associations. They tend to participate in smaller, more peripheral organizations and activities with a focus on domestic or community affairs, while men tend to participate in large, core organizations that are related to economic institutions and political activities.

Table 3.4 Education, early life factors and group membership

Probit on membership	Prob. change	S. E.	Z	P-value
Years of schooling	0.021	0.002	10.49	0.000
Male	-0.064	0.008	-7.84	0.000
Ethnic-white	-0.076	0.035	-2.46	0.014
Mother reads to child 7 every week	0.018	0.010	1.88	0.060
Oral ability	0.022	0.006	3.78	0.000
Parents belong to reading group/library	0.023	0.009	2.58	0.009
Mother did not stay at school after minimal leaving age	-0.024	0.010	-2.52	0.012
Club often attended	0.033	0.009	3.59	0.000
Studying in London 1969	0.031	0.017	1.90	0.057
Mother's language (English level) – poor	-0.082	0.031	-1.91	0.057

Note: * S. E. refers to the standard error of the reported marginal probability.

Considerable empirical evidence is found on the causality from early childhood to schooling accomplishment. Less evidence is found on the causality from early life to social capital in adulthood. There are fewer covariates with statistical significance in the membership equation than in the social trust equation. Note that the social participation variable is extracted from the 2000 survey; the social trust variable is extracted from the 1991 survey; and the schooling variable has, in general, not changed much after the 1982 survey for most people. This could be one of the reasons why early childhood background does not have much effect on social participation habits compared with its impact on schooling and social trust.

The parent's education level, the mother frequently reading to children, and the mother's language (English) ability appear, all to have a direct and systematic effect on both schooling and the two dimensions of individual social capital. Family factors – parental interests, presence of both natural parents, and maternal presence in the family – have positive and significant impacts on both schooling and social trust equations. The empirical evidence lends strong support to the view that social capital inside the family in early childhood plays a crucial role in the creation of human capital and accumulation of social trust.

Personality traits, as reflected by anxiety score for acceptance, hostility score, or emotional problems, have a substantial influence on schooling and trusting. Children who are reluctant to go to school will receive significantly less schooling and have less trust in others. The father's social class also seems to be a possible predictor of education and social trust.

The only indicator of parental social involvement – membership of reading groups or a library – is a positive predictor of both schooling and social participation levels, suggesting that higher levels of parental social practices and resources benefit children's educational and life chances (Schneider and Coleman, 1993). Schooling and social participating levels are also affected by poor language ability. It is plausible that linguistic barriers impede people's ability to acquire sufficient knowledge to integrate into society and to interact with the mainstream community.

Some early childhood factors only affect social trust. Number of siblings, for instance, has a positive effect on social trust, while its square term has a negative influence. Geographical stability has no substantial influence on schooling and social participation, as discussed or anticipated in the previous sections, yet a significantly negative influence is observed on social trust, which indicates that geographical mobility does indeed impede the accumulation of trust by disrupting the intergenerational closure of social capital links between family members and the community.

The difference in survey year could be an explanation for why we observe more statistically significant variables in the social trust equation than in the social participation equation. It is also possible that social trust is much more subject to psychological characteristics demonstrated in early childhood, since social trust is seen to represent one's personality traits that remain quite consistent over the course of one's life.

The probit analyses show that education is the most influential factor in determining both dimensions of individual social capital. The schooling endogeneity, however, has not been accounted for in previous regressions. A two-stage least square (2SLS) approach is applied in the next section to correct for the possible omitted-variable bias in the estimate of yearly return to education.

3.5 Education endogeneity and causal educational effects

The education endogeneity problem has raised a substantial literature on the private returns to schooling which shows that income and educational achievement can be simultaneously influenced by a wide range of factors specific to the individual (i.e. Angrist and Krueger, 1991; Harmon and Walker, 1995; Angrist, 1998; Card, 1999). A similar problem is likely to emerge in the study of the causal relations between educational attainment and social capital. This section tackles the schooling endogeneity problem by using an instrumental variable extracted from the individual length of schooling absence due to illness at age 15-16.

The basic construction of the instrumental variable goes as follows. The length of schooling absence can be decomposed into a systematic component and a non-systematic component. The *systematic component* arises from inherited health status and family factors (living conditions, nutrition intake, parental role in family), which may have a lasting influence across the lifespan and affect both education choice and social trust in adulthood; the *non-systematic component* arises from haphazard events, such as accidents, illness (colds or sore throat) due to some random incidences such as unexpected weather changes. This non-systematic component is not supposed to have a lasting health effect over the life span, and it should not have any direct impact on social trust in adulthood.

Due to the timing of its occurrence, the absence length from school is strongly correlated with the grades awarded in the O-level and A-level exams, and subsequently the age of leaving full-time schooling (the minimum school leaving age is 16). Both the systematic and non-systematic components have a direct impact on future education choice and years of schooling. Provided one can separate the non-systematic component from the systematic

component, a valid excluded variable is plausible for educational achievement. A regression on the length of schooling absence turns out to be a feasible approach to achieve this design. With an ordered probit on the length of schooling absence, which is a qualitative variable with four length categories (from less than one week to over three months), it is possible to obtain its predicted value: ideally the systematic component, and its predicted residual: ideally the non-systematic component.

All major adverse health factors in adolescence are used to decompose the length of schooling absence. In addition, dummy variables are created for each type of illness reported for schooling absence due to illness, except for sore throat, colds, periods, and accident injury, and interacted with all other adverse health factors in the regression of length of schooling absence. The intuition is that, if an individual has certain health problems, and misses classes because of non-accident or chronic illness, it is highly plausible that this interaction captures some systematic health problems.

Table 3.5 presents statistical proof of the validity of the instrumental variable. Correlation tests are performed in Part A for the instrumental variable, the predicted residual of schooling absence due to illness, and health status. The health status variables include: report of general health status, report of health status last year (1990-1991), number of chronic conditions ever suffered, and number of chronic conditions suffered at age 32-33⁸. For comparison, similar correlation tests are also applied for both the length of schooling absence and its predicted value from the regression. It is straightforward that the length of schooling absence and its predicted value are strongly correlated with the general health status, chronic conditions, and emotional problems in later life, while the instrumental variable has no significant correlation with these health indicators. These statistics lend substantial support to the design principle adopted in this analysis that the predicted residual does not systematically correlate with general health in adulthood.

Part B of Table 3.5 provides the test statistics for the correlation between the instrumental variable and the residual of social capital outcomes not explained by years of schooling. Similar correlation tests are applied for the length of schooling absence and the predicted absence length. Once again, it can be seen that the instrumental variable has a trivial correlation with the component of social capital outcomes not explained by the respondent's schooling. Correlation tests in Part B provide statistical proof for the argument that the

⁸ Chronic conditions include 12 illnesses: arthritis, bronchitis, diabetes, epilepsy, heart trouble, hernia, kidney/bladder trouble, gall bladder trouble, stomach trouble, high blood pressure, dizziness/unsteadiness, cancer. A correlation test was also performed on each symptom, and similar test statistics were observed as those for the total number of chronic conditions.

non-systematic component of the length of schooling absence has an impact on social capital outcomes but only via educational achievement. Part C provides the partial F-statistics for whether coefficients are zero in the regression of the endogenous education choice on the instrumental variable. There is no weak instrumental variable problem, with the partial F-statistics being up to 12.64 and 15.21 for the social trust equation and the social participation equation, respectively.

Table 3.5 Test statistics on the validity of the instrumental variable

Variable	Absence length		Systematic term		Non-systematic term	
	coef.	p-value	coef.	p-value	coef.	p-value
A. Pearson correlation with later life health						
General health status	- 0.12	0.00	- 0.16	0.00	- 0.01	0.29
Health status at age 32-33	- 0.11	0.00	- 0.17	0.00	- 0.00	0.76
Number of chronic illness ever suffered	0.13	0.00	0.17	0.00	0.01	0.21
Number of chronic illness suffered at age 32-33	0.11	0.00	0.15	0.00	0.01	0.30
B. Pearson correlation with residual of trust						
Social trust not explained by schooling	-0.02	0.05	- 0.02	0.06	- 0.01	0.35
Social participation not explained by schooling	-0.01	0.59	- 0.02	0.13	0.01	0.42
C. Partial F-test						
Social trust						12.46
Social participation						15.21

By replacing schooling years in the outcome equations with the predicted value, contrasting educational effects are obtained for social trust and social participation. The marginal probability change of an additional schooling year is 0.030 ($p = 0.66$) in the social trust equation. Although this instrumental variable (IV) estimate is relatively larger than the OLS estimate of 0.022, the conclusion on the role of schooling remains the same in the building of social trust. The marginal probability of schooling years is -0.014 in the membership equation, which is completely different from the significantly positive estimate obtained in the OLS, indicating the existence of a severe endogeneity problem.

To further verify the *raison d'être* of the different conclusions for schooling in the social

trust and social participation equations in the previous probit model, information is now introduced from the 1974 survey, when the cohorts were 15-16 years old. It might be supposed that the endogeneity problem in the normal regression without IV would be alleviated in the social participation equation because the newly introduced variable set from adolescence provides further information on the unobservables. Since there is no endogeneity problem in the trust equation, the same education results would be expected. The information from the 1974 survey includes:

- Motivation for schooling/age expected to leave school;
- Truancy behavior reported by parents/school/children;
- Ability reported by parents/school for educational achievement (higher education, A-level, or O-level);
- Interactions with parents/children at age 16;
- Personality traits report from teacher/parents: laziness, emotional problems;
- School/education quality: expulsion ratio, teacher/student ratio.

Once these categories of variables are introduced, the educational effect drops dramatically in the membership equation. The marginal probability decreases from 0.021 to 0.010, a 51 percent decline. In the trust equation, the marginal probability decreases slightly from 0.022 to 0.021. Although the information from adolescence cannot completely eliminate the omitted-variable bias in the equation of social participation, it offers insights into the main cause for the substantial decrease of the educational effect and bias in the membership equation. The information also reinforces the conclusions from the IV methods described above: that education facilitates the building of social trust, while it is not as decisive as people generally believe in cultivating social participation behavior.

Women's increasing participation in the labor force is a potential cause of the negative educational effect and the dichotomy in the transitions of education and social participation level in Western countries. The traditional gap in education participation between men and women has narrowed or even disappeared over the last half century. Highly-educated women are keener to move out of their home into paid employment. However, despite the changing gender attitudes and the rapid entry of women into the labor force over the past few decades, women continue to play a major role in running the household and giving care to family members. This may directly result in their greater time constraints and, consequently, less involvement in social activities. Further analysis in Chapter 6 will provide evidence on the intuition for the negative educational effect on social participation and the dichotomy in the transitions of education and social participation level in Western countries.

3.6 Conclusion

This chapter has explored the potential relations between early-life social capital, education, and social capital in adulthood. Two major hypotheses have been tested. The empirical findings provide substantial evidence to support the hypothesis that early-life social capital factors and parental socioeconomic status affect the development of both education and social capital.

Firstly, family social capital factors, i.e. the physical presence of natural parents, and parental interaction with children, are critical for the development of both education and social capital in later life. Maternal employment has a negative effect on the offspring's education and social trust.

Secondly, parental social capital, measured by parental membership of reading groups/library, has a lasting influence on education and social participation, while residential mobility is negatively correlated with social trust.

Thirdly, personality traits, such as hostility or anxiety about social acceptance, affect education and social trust. Cognitive abilities in early childhood, in terms of English and Math rating, are crucial determinants of education achievement in adulthood. However, these cognitive abilities do not have any significant influence on the development of social trust and social participation. Language capacity shown in early childhood is strongly correlated with social participation levels in later life. Demographic factors play different roles in the development of education and social capital. Men seem to receive more schooling, but their social trust level and social participation level are significantly lower compared with women's level. Although there is no racial difference in schooling, whites have a higher level of social trust, and non-white cohorts are more likely to join in voluntary groups. It is plausible that participation in community based voluntary groups is a reliable approach for females and the non-white individuals to share the resources from society and exert their influence on society.

Parental education and social class are strongly and positively related to the offspring's education and social capital. Parents with poor English ability may be negative for accumulating social capital and acquiring more education.

This chapter offers substantial evidence for Coleman's (1988) claim that social capital in early childhood is crucial for the creation of human capital. It is also found that education is more than just a beneficiary of early childhood social capital. It has significant and positive effects in building social trust. However, the role of education in stimulating social participation involvement is mixed. There is no proof from the endogeneity model to support

the claim that causality runs from schooling to social participating habits, and the existence of a substantial omitted-variable problem is observed in the correlation test. Further analysis with adolescent information confirms that unobserved personality traits or abilities will simultaneously affect both education and social participation outcomes.

This study reveals that social trust and social participation have different attributes; they do not share an identical formation mechanism. Social trust has more psychological features. It is closely associated with family relations and family stability; while social participation has more behavioral features and is closely associated with ability factors, especially in language/expression capacity. Social trust has stable attributes across one's life course, while social participation is more subject to economic and household pressure.

To sum up, the empirical results in this chapter are consistent with several findings from the meta-analysis in Chapter 2. Above all, the OLS analysis suggests that an additional year of schooling accounts for the change of social trust and social participation by, respectively, 0.047 and 0.056 standard deviation of each outcome variable. These estimates are very similar to the mean effect sizes and baseline estimates of the effect sizes in the meta-regression. The significance of schooling endogeneity in the social participation equation rather than in the social trust equation also corresponds to the indication from the meta-analysis that controlling for education endogeneity only has a statistically significant impact on the effect size of social participation. There is no difference in the OLS estimator and IV estimator in the social trust equation. The estimate of the educational effect on social participation is negative in the IV approach, which seems at odds with the positive baseline estimate across the meta-analysis models. However, adding up the baseline estimate and the coefficient of controlling for schooling endogeneity from the meta-analysis on social participation outcome, one finds that the sum of these two coefficients is negative and trivial.

Appendix 3 Details of the assumptions and derivation of the non-parametric bounds

Nonparametric bounds analysis is conducted here in search for additional evidence to reinforce the conclusion that early-life factors have a systematic impact on years of schooling. Manski (1997) and Manski and Pepper (2000) introduced and derived the monotone treatment response (MTR) assumption, the monotone treatment selection (MTS) assumption, and the monotone instrumental variable (MIV) assumption. They obtain nonparametric bounds based on these assumptions. Haan (2009) presents a simple and clear illustration and application of these assumptions. This Appendix presents a very brief introduction to these assumptions and the derived nonparametric bounds based on the MTR-MTS-MIV assumption.

For a response function $y_i(\cdot): T \rightarrow Y$ which maps treatments $t \in T$ into outcome $y_i \in Y$, the monotone treatment response assumption states that:

$$t_2 \geq t_1 \Rightarrow Y(T = t_2) \geq Y(T = t_1)$$

The monotone treatment selection assumption states:

$$\begin{aligned} E[y(t) | z = u] &\in [E[y | z = u], \bar{y}] \text{ if } u < t \\ E[y(t) | z = u] &\in [\underline{y}, E[y | z = u],] \text{ if } u > t \end{aligned}$$

The combined MTR-MTS assumptions hold if, for $u_2 > u_1$:

$$E[y | z = u_2) = E[y(u_2) | z = u_2] \geq E[y(u_2) | z = u_1] \geq E[y | z = u_1) = E[y(u_1) | z = u_1]$$

Under the combined MTR-MTS assumptions, one can obtain the MTR-MTS bounds:

$$\begin{aligned} E[y | z < t].P(z < t) + E[y | z = t].P(z = t) + E[y | z > t].P(z > t) \\ \leq E[y(t)] \leq \\ E[y | z = t].P(z < t) + E[y | z = t].P(z = t) + E[y | z > t].P(z > t) \end{aligned}$$

With an instrumental variable z_{iv} satisfying the mean independence assumption, such that $E[y | z_{iv}] = E[y]$, one can obtain the MTR-MTS-IV bounds:

$$\begin{aligned} \max_{m \in M} (E[y | z < t | z_{it} = m].P(z < t | z_{it} = m) + \\ E[y | z = t | z_{it} = m].P(z = t | z_{it} = m) + \\ E[y | z > t | z_{it} = m].P(z > t | z_{it} = m)) \\ \leq E[y(t)] \leq \end{aligned}$$

$$\begin{aligned} & \min_{m \in M} (E[y | z = t | z_{it} = m].P(z < t | z_{it} = m) + \\ & E[y | z = t | z_{it} = m].P(z = t | z_{it} = m) + \\ & E[y | z > t | z_{it} = m].P(z > t | z_{it} = m)) \end{aligned}$$

In many cases, an instrumental variable that satisfies the mean independence assumption is hard to find. A weaker assumption is introduced to allow for a weakly monotone relation between the instrumental variable and the mean outcome function (Manski and Pepper, 2000), such that:

$$m_1 \leq m \leq m_2 \Rightarrow E[y(t) | z_{ov} = m_1] \leq E[y(t) | z_{ov} = m] \leq E[y(t) | z_{ov} = m_2]$$

With this monotone instrumental variable (MIV), one can obtain the MTR-MTS-MIV bounds:

$$\begin{aligned} & \sum_{m \in M} P(z_{iv} = m) [\max_{m_1 \leq m} (E[y | z < t | z_{it} = m].P(z < t | z_{it} = m) + \\ & E[y | z = t | z_{it} = m].P(z = t | z_{it} = m) + \\ & E[y | z > t | z_{it} = m].P(z > t | z_{it} = m))] \\ & \leq E[y(t)] \leq \\ & \sum_{m \in M} P(z_{iv} = m) [\min_{m_2 \geq m} (E[y | z = t | z_{it} = m].P(z < t | z_{it} = m) + \\ & E[y | z = t | z_{it} = m].P(z = t | z_{it} = m) + \\ & E[y | z > t | z_{it} = m].P(z > t | z_{it} = m))] \end{aligned}$$

Two variables are used as monotone instrumental variables for the examination of the effects of the early-life factors that are possibly exposed to the omitted-variable problem. The frequency with which parents read books to their children is used as the monotone instrumental variable for parent's reading to their child. The social class of the paternal grandfather (or maternal grandfather) is used as the monotone instrumental variable for other early childhood variables. It is not realistic to assume that the schooling function is mean-independent of these variables, but one can assume a weakly monotone relation and obtain the nonparametric upper bounds based on the combined assumptions of the monotone treatment response, the monotone treatment selection and the monotone instrumental variable (MTR-MTS-MIV).

The nonparametric upper bounds are presented in Table 3A.1 below. Comparing that Table with Table 3.2 on early life factors and schooling from Chapter 3, one can see that all estimates from the OLS approach are well within the nonparametric upper bound based on the percentile bootstrap. These results provide additional support for the claim that there is no

severe omitted variable bias if one has controlled for the five categories of early childhood factors.

Table 3A.1 Nonparametric upper bound based on percentile bootstrap

Variable	Monotone instrumental variable	upper limit of 95% confidence interval
Father reads to child every week	Frequency father reads book	0.335
Mother reads to child every week	Frequency mother reads book	0.396
Private daycare	Social class of paternal grandfather	1.384
Parent belongs to social group	Social class of paternal grandfather	0.849
Mother has no paid work	Social class of paternal grandfather	0.193
Father stayed at school after min. age	Social class of paternal grandfather	1.373
Mother stayed at school after min. age	Social class of paternal grandfather	1.219

Chapter 4

Endogeneity Models for Single Treatment Evaluation with a Binary Outcome

4.1 Introduction of the single treatment model

The one-factor model, where a linear relationship between years of schooling and level of individual social capital is assumed to be rational, was applied in the previous chapter to examine the effect of schooling on the development of social trust and social participation. Later in Chapters 5 and 6, a single treatment model will be applied to assess the average treatment effect (*ATE*) of college education or higher education on social trust and social participation at the individual level. Before presenting the empirical results, a description of the model is essential for the average treatment effect and the application of the single treatment evaluation with a binary outcome.

The average treatment effect is an econometric measure used to compare treatments in medical trials and policy evaluation. The average treatment effect measures the average causal difference in outcomes under the treatment and the control. The expression “treatment effect” refers to the causal effect of a given medical treatment or policy (for example, the administering of a drug or training program for disadvantaged workers) on an outcome variable of scientific or policy interest (for example, the health of the patient, income of disadvantaged workers, or unemployment spell of unemployed workers). The average treatment effect is the average of the individual treatment effects across the whole population of interest. In this dissertation, it denotes the average expected effect of college education or higher education relative to lower education on individual social trust and individual social participation.

The current approaches to causal inference in treatment evaluation stem from the statistical analysis of randomized experiments and potential outcomes. In the simplest binary framework, there are two outcomes (Y_1, Y_0), which correspond to the treatment dummy T ($T = 1$ if an individual chooses the treatment, and $T = 0$ otherwise). The outcome observed for the individual is hence defined as:

$$Y = TY_1 + (1 - T)Y_0$$

This is the famous Roy (1951)-Rubin (1974) model, or switching model, and the gain of participating in the treatment is $\Delta = Y_1 - Y_0$. This chapter aims to assess the treatment effect of higher education or college education relative to lower levels of education ($T_i = 1$ if individual i undertakes higher/college education, and $T_i = 0$ otherwise) on the social participation or social trust outcome (i.e. $y_i = 1$ if individual i is a member of at least one social group, and $y_i = 0$ otherwise). In a binary treatment framework where both the outcome and the treatment are a binary response variable:

$$T_i = 1(T_i^*(Z_i, \nu_i) > 0) \quad (1)$$

$$y_i = 1(y_i^*(T_i, X_i, \eta_i) > 0) \quad (2)$$

where T_i^* and y_i^* are the latent variables. T_i^* depends on observed covariates Z_i ($Z_i = (X_i, z_i)$)⁹, and an unobserved factor ν_i ; y_i^* depends on education choice T_i , observed covariates X_i , and an unobserved factor η_i . Assuming additive separability between observables and unobservables for both latent variables, and a cumulative standard normal distribution for the conditional probability in each equation, a standard bivariate specification is obtained as follows:

$$\Pr(T_i = 1) = \Phi(f(X_i, z_i) + \nu_i) \quad (3)$$

$$\Pr(y_i = 1) = \Phi(m(X_i, T_i) + \eta_i) \quad (4)$$

$$(\nu_i, \eta_i) \sim N(0, 0, 1, 1, \rho_{\nu\eta}) \quad (5)$$

where $\rho_{\nu\eta}$ is a constant correlation matrix between the unobservable components in treatment and outcome equations¹⁰. Define $m(X_i, T_i) = b_0 + m_0(X_i) + \beta(X_i)T_i$, and the population *ATE*, given characteristics x , is directly obtainable:

⁹ Observed covariates Z_i ($Z_i = (X_i, z_i)$) include exogenous variable set X_i and excluded variable z_i .

¹⁰ In a general framework of treatment evaluation, the unobservable component in the outcome equation comprises the random coefficients representing the heterogeneous relationship between treatment choice and outcome. It is difficult, however, to introduce the individual specific random coefficients into a binary response model. Therefore, this analysis focuses on omitted-variable bias instead of selection bias (which contains biases arising from omitted-variable and individual specific marginal returns), and only constant $\rho_{\nu\eta}$ is considered.

$$\begin{aligned}
ATE &= E[Y_1 | x] - E[Y_0 | x] \\
&= E[\Phi(b_0 + m_0(X_i) + \beta(X_i))] - E[\Phi(b_0 + m_0(X_i))] \\
&= E(\beta(X_i))
\end{aligned} \tag{6}$$

When $\rho_{v\eta}$ is non-zero, there would be endogeneity bias in the estimate of $\beta(X_i)$. The general two-step procedure methods, such as two-stage probit or 2SLS, are not sufficient to provide a consistent estimate for $\beta(X_i)$, and, consequently, ATE in the binary response model. The bivariate probit (BVP) method is considered to be more appropriate to handle the endogeneity problem (Wooldridge, 2002; Bhattacharya et al., 2006).

The BVP model has been widely used in medical evaluation to reduce the bias due to the endogeneity in the treatment choice. It is a simultaneous equation model that controls for the endogeneity in the likelihood of four joint sets of the treatment and outcome distribution. Take a joint set $(y_i = 1, T_i = 1)$, for example. The likelihood of this joint set, $P[y_i = 1, T_i = 1 | Z_i, X_i]$, can be written as $P[y_i = 1 | T_i = 1, Z_i, X_i] \cdot P[T_i = 1 | Z_i, X_i]$, where the first term $P[y_i = 1 | T_i = 1, Z_i, X_i]$ is expressed as:

$$P[y_i = 1 | T_i = 1, Z_i, X_i] = \int_{-f(X_i, z_i)}^{\infty} \Phi\left(\frac{a_0 + m_0(X_i) + \beta(X_i)T_i + \rho_{v\eta}v_i}{\sqrt{1 - \rho_{v\eta}^2}}\right) \frac{\phi(v_i)}{\Phi(Z_i, X_i)} dv_i \tag{7}$$

The likelihood of the second term is simply a probit likelihood. Combining the first term likelihoods (for all four joint sets of (y_i, T_i)), along with the probit model for the treatment T_i , and taking the log, gives the log-likelihood function for maximum likelihood analysis (Wooldridge, 2002). The bivariate probit imposes a constant $\rho_{v\eta}$ in its implementation, and thus there are no individual specific marginal returns, although it allows for observable heterogeneities of the independent variables X . Under this assumption, the model provides consistent estimates for coefficient $\beta(X_i)$ and an endogeneity test for the existence of non-zero correlation $\rho_{v\eta}$. On the subject of the endogeneity problem, Bhattacharya et al. (2006) present an inclusive comparison of the performances of the probit, two-stage probit, and bivariate probit models. The results from their Monte Carlo simulations suggest that the bivariate probit model is the only method to produce a consistent estimator when there is an endogenous treatment.

The control functions probit (CFP) method also provides comparable estimates to the

bivariate probit method in a binary response setup. The CFP is an application of the control functions (CF) method in a probit specification. The CF method is generally applied to correct for selection problems in the study of a treatment effect on a continuous outcome variable. Since the probit specification can be derived from a model involving the latent variable y_i^* with a linear expression, the application of the CF method in a probit specification will produce a good approximation of the true ATE in a binary response setup.

The principle inspiring the CF method is to evaluate the treatment effects by controlling directly for the correlation between the treatment choice and the unobservable heterogeneity in the outcome equation (see, e.g., Heckman, 1978; Jimenez and Kugler, 1987; Heckman et al., 2004; Blundell et al., 2005). The CF method allows for outcome unobservables η_i to depend on the treatment T_i , and it models this dependence. The control functions probit (CFP) applies the same idea to identify the treatment effect on the binary outcome variable. Under joint normality of ν_i and η_i in the treatment and outcome equations and a constant $\rho_{\nu\eta}$ between the unobservable components in the treatment and outcome choices:

$$y_i^* = b_0 + m_0(X_i) + \beta(X_i)T_i + \rho_{\eta\nu}(1-T_i)\lambda_{0i} + \rho_{\eta\nu}T_i\lambda_{1i} + \delta_i \quad (8)$$

A consistent estimator of $\beta(X_i)$ is achievable in equation (8) with a continuous dependent variable, where λ_{0i} and λ_{1i} are the standard inverse Mills ratios such that:

$$\lambda_{0i} = -\frac{\phi(\nu_i)}{1 - \Phi(Z_i, X_i)} \quad (9)$$

$$\lambda_{1i} = \frac{\phi(\nu_i)}{\Phi(Z_i, X_i)} \quad (10)$$

In the binary response model, the transformed error term δ_i in equation (8) does not generally follow a standard normal distribution. Moreover, the introduction of the corrected functions $(\rho_{\eta\nu}(1-T_i)\lambda_{0i} + \rho_{\eta\nu}T_i\lambda_{1i})$ would lead to a change of the mean and index functions, so that the estimate obtained from the CFP approach is merely an approximation of the true treatment effect. Nevertheless, our simulation practice in the following sections demonstrates that the CFP approach provides a rather precise ATE estimate, which can be comparable to the estimate obtained from the BVP approach, under the assumption of standard bivariate

normality¹¹. Compared with the BVP approach, which has a messy and time consuming, though doable, maximum likelihood, the CFP approach has a considerably lower calculation cost, especially when it comes to the estimation of the confidence interval for the treatment effect that involves Monte Carlo simulation. Meanwhile, the CFP method produces a more accurate estimate relative to that from the two-stage probit. The CFP allows the *ATE* to be identified when individuals select on the basis of the unobservables, and it is possible to test for the presence of treatment endogeneity by a test of the null hypothesis that $\rho_{v\eta}$ equals zero. In general, an exclusion restriction is required in the CFP and the BVP approaches. The identification of the estimates will be troublesome if $X_i = Z_i$, especially when there is not much variation in the observable characteristics X_i .

4.2 Simulation design

The previous section gives a simple review of the key assumptions and procedures of the single treatment framework with a binary outcome. The BVP method produces a consistent estimator in this framework, while the CFP method produces an approximation of the BVP estimator at a considerably lower computational cost. These two methods are major approaches in this evaluation to reduce omitted-variable bias in the assessment of the education effect on individual social capital in adulthood.

To support the arguments that the CFP method does considerably better than the 2SLS and the probit in estimating the *ATE*, and that it provides an approximate estimate of the *ATE* that can be comparable to the estimate from the BVP method, the Monte Carlo simulations will be performed here as they were applied by Bhattacharya et al. (2006). Their analysis demonstrates the limitations of the two-step procedure, such as 2SLS and the two-step probit, and they argue in favor of using the bivariate probit rather than the two-step or linear probability model estimators.

In the simulation exercise, a large random data set (5000 observations) is drawn according to a simple data generating process, and then the four different estimators, 2SLS, TSP, BVP

¹¹ In the application of the CFP method in the binary response model, the correlation matrix between the unobservable components is also restricted to be constant. In the continuous outcome model, however, a general CF method allows selection on unobserved or omitted ‘ability’ and selection on unobserved marginal returns to treatment. The CFP approach provides comparable estimates to the BVP approach under the assumption of constant correlation and standard bivariate normality, according to the results from Monte Carlo simulations, which follows the same design applied by Bhattacharya et al. (2006). The simulation exercises in this dissertation show that the CFP approach does considerably better than the probit and two-stage probit approaches in the identification of *ATE*, and it produces an approximate estimate of the true *ATE*, while the BVP approach produces a consistent estimator.

and CFP estimators, are applied to the same random data set. For the simulation, this step is repeated 1000 times, and the average bias for the four estimators is reported. The simple probit is not considered in the simulation exercise because its inadequacy in handling endogenous treatment has been heavily exploited, and the bias of its estimate obscures the scale in the comparison figures.

Model specification and detailed steps

$$\begin{aligned} T_i^* &= \gamma_0 + x_i\gamma_x + \nu_i \\ T_i &= 1(T_i^* > 0) \\ y_i^* &= m_0 + \beta T_i + b_x x_i + \eta_i \\ y_i &= 1(y_i^* > 0) \\ (\nu_i, \eta_i) &\sim N(0,0,1,1, \rho_{\nu\eta}) \end{aligned}$$

where T_i^* represents the index function generating the treatment T_i ; x_i represents the other regressor; z_i represents the instrument; ν_i and η_i represent the error term in the treatment equation and the outcome equation, respectively; and $\rho_{\nu\eta}$ is the correlation coefficient between ν_i and η_i .

Data-generating process

There are five parameters in this data-generating process that are varied in the experiment. These parameters alter the character of the random data set. Coefficient γ_x determines the association between constant T_i and x_i ; m_0 is the constant term in the outcome equation that determines the average probability of y_i being equal to 1; the treatment coefficient β reflects the influence of the treatment; the correlation coefficient $\rho_{\nu\eta}$ determines the correlation between the error terms in the treatment and the outcome equation; and the correlation coefficient $\rho_{z\eta}$ determines the power of the instrument. In the simulation exercises, γ_0 is first set at zero without loss of generality.

From the simulation exercises it is examined how each evaluation method performs in the case when the treatment T_i depends on x_i , and in the case when the treatment T_i does not

depend on x_i , with γ_x being 0 ($T_i^* = \nu_i$) and 0.5 ($T_i^* = 0.5x + \nu_i$), respectively¹². Correlation coefficient $\rho_{z\eta}$ is set at 0.5 so that there is a valid and strong instrumental variable (for comparison, values 0.3 and 0.4 were also tried, which led to a similar qualitative conclusion). $\rho_{v\eta}$ is arbitrarily specified to be 0.2 (for comparison, values 0.1 and 0.3 were also tried, which led to a similar qualitative conclusion). In the main experiment, β is varied between 0 and 2, while holding m_o arbitrarily fixed at -1. In an alternative, m_o is varied while holding the true *ATE* arbitrarily fixed at 0.2 (for more details, see Bhattacharya et al., 2006). 5000 independent observations (ν_i, x_i, z_i, η_i) are drawn from a multivariate normal distribution:

$$\begin{pmatrix} \nu_i \\ x_i \\ z_i \\ \eta_i \end{pmatrix} \sim \text{MVN} \begin{pmatrix} \nu_i \\ x_i \\ z_i \\ \eta_i \end{pmatrix} \begin{bmatrix} 1 & 0 & \rho_{xz} & \rho_{v\eta} \\ 0 & 1 & 0 & 0 \\ \rho_{vz} & 0 & 1 & 0 \\ \rho_{v\eta} & 0 & 0 & 1 \end{bmatrix}$$

In brief:

- Both the dependent variable and the treatment are binary variables;
- The treatment is correlated with the error term in the dependent variable (several values have been assigned: 0.1, 0.2, 0.3. I arbitrarily specify $\rho_{v\eta}$ to be 0.2) ;
- The instrumental variable is powerful (correlated strongly with the treatment, but not with the error term in the dependent variable. Correlation coefficient $\rho_{z\eta}$ is imposed to be 0.5 so that I have a valid and strong instrument.).

4.3 Simulation results

This section first compares the performance of the four methods when $T_i^* = \nu_i$ (the index function generating the treatment is also assumed to be independent of x_i in the study of

¹² Several non-zero numbers (0.25, 0.5, 0.75, 1) have been introduced for γ_x . The change of γ_x does not alter the simulation comparison results.

Bhattacharya et al. (2006)). Figure 4.1 shows the bias in the ATE estimate and the bias in its corresponding coefficient estimate – β when the value of β is varied (the bias from β in the OLS is not presented as it is enormously large compared with the biases in other methods). Figure 4.2 shows the bias in the ATE estimate and the bias in its corresponding coefficient estimate when the value of m_o is varied.

The two-step probit (TSP) performs much worse than the other methods. The TSP estimator is noticeably biased for the estimate of ATE and β , as the true ATE approaches 0.5 (or β approaches 2). Its bias in the ATE or β is also substantially different from zero as it tends to underestimate the ATE or β when the value of m_o is varied. The BVP estimator produces unbiased estimates of the ATE and β for all the values tried for β and m_o . This is not surprising for the large sample simulation exercise, since it is considered a consistent estimator. The 2SLS and the CFP approaches appear to have a good performance in the identification of the true ATE . Yet they are not unbiased and consistent estimators. The increasing of β or m_o (m_o ranges from -3 to 0) tends to lead to a larger bias for both the 2SLS and the CFP approaches in the simulation exercises.

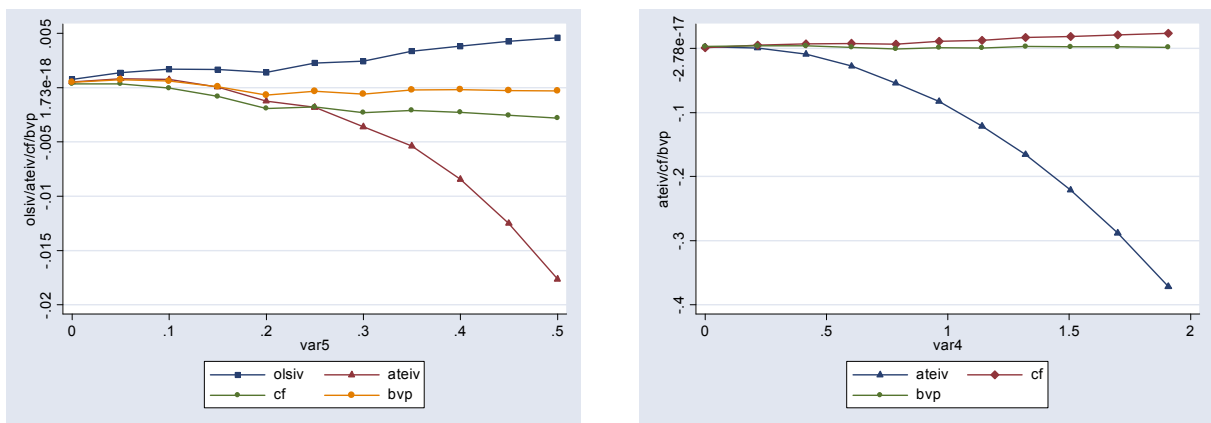


Figure 4.1 Bias in the treatment estimate and bias in the coefficient of the treatment estimate

Notes: 1. The coefficient from the 2SLS is not comparable to the coefficient from other models.

2. The X-axis refers to the value of β ; the Y-axis refers to the value of bias.

3. “olsiv” refers to 2SLS; “ateiv” refers to two-stage probit; “cf” refers to control functions probit; “bvp” refers to bivariate probit.

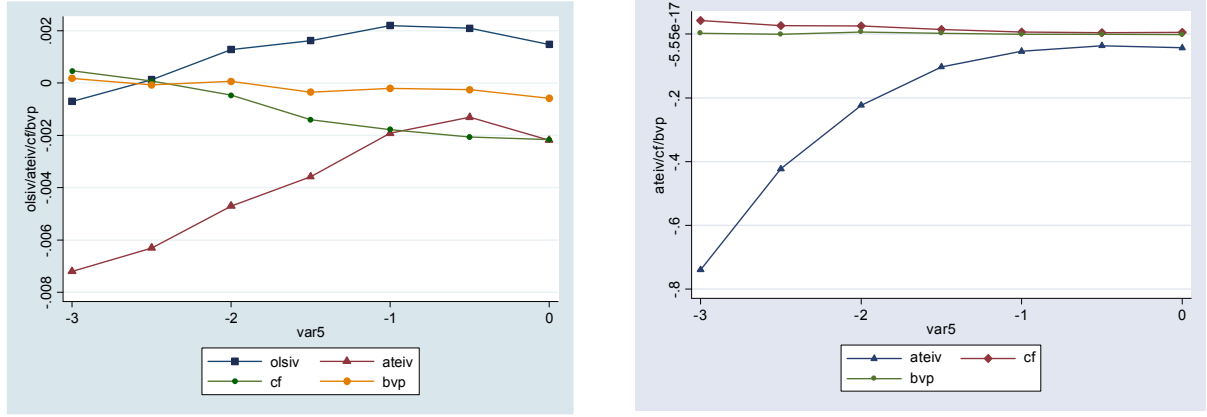


Figure 4.2 The constant term and bias in the treatment estimate and bias in the coefficient of the treatment estimate

Notes: 1. The coefficient from the 2SLS is not comparable to the coefficient from other models.

2. The X-axis refers to the value of β ; the Y-axis refers to the value of bias.

3. “olsiv” refers to 2SLS; “ateiv” refers to two-stage probit; “cf” refers to control functions probit; “bvp” refers to bivariate probit.

In the previous setup, it was assumed that $T_i^* = \nu_i$, such that the choice of the treatment T_i is independent of other observable covariates. This is an extreme case, and it is rare to see independent associations between the treatment T_i and other observable covariates. To give a comprehensive illustration of the performance of the four estimators, a second Monte Carlo simulation is now conducted similar to the one just described, except that $T_i^* = 0.5x_2 + \nu_i$.

Figure 4.3 shows the bias in the *ATE* estimate and the bias in its corresponding coefficient estimate when the value of β is varied. Figure 4.4 shows the bias in the *ATE* estimate and the bias in its corresponding coefficient estimate when the value of m_o is varied. The performance of the BVP is not affected by the change of model setup. The BVP produces unbiased estimates of the *ATE* and its corresponding β for all values of β and m_o assigned in the simulation. The performance of the CFP estimator is significantly superior to that of the 2SLS estimator and the TSP estimator. Similar to the setup where $T_i^* = \nu_i$, the CFP provides an approximate estimate of the *ATE* that is comparable to the estimate from the BVP method.

Specifically, as shown in Figure 4.3, the TSP and the 2SLS estimators overestimate the *ATE* and its corresponding coefficient β for all non-zero values of β . The bias increases

dramatically and becomes noticeably large (up to 0.05) as the true ATE approaches 0.5 or coefficient β approaches 2. Their performance in estimating the treatment changes substantially as m_o changes. The TSP and the 2SLS estimator overestimate the ATE for m_o between 0 and -2 and then rapidly decline with large negative bias as m_o decreases.

It is clearly shown that the performance of the BVP is not affected by the change in the generation of the random data sets. The BVP produces unbiased and consistent estimates of the ATE for all values of β and m_o assigned. The CFP produces an approximate estimate of the ATE , which is very close to that obtained from the BVP. Similarly, it cannot produce an unbiased and consistent estimator. The absolute value of bias in the ATE or β increases moderately as the absolute value of β or m_o increases.

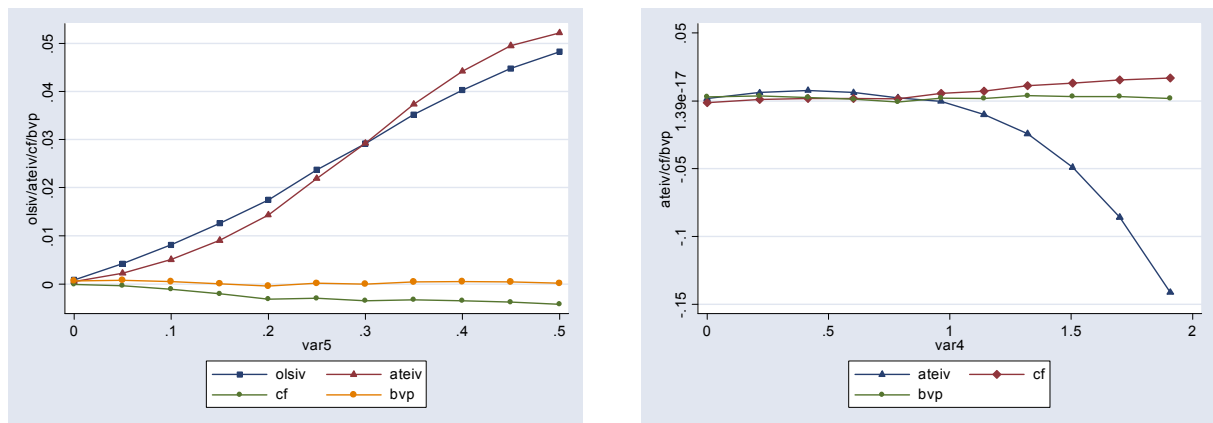


Figure 4.3 Bias in the treatment estimate and bias in the coefficient of the treatment estimate

Notes: 1. The coefficient from the 2SLS is not comparable to the coefficient from other models.

2. The X-axis refers to the value of β ; the Y-axis refers to the value of bias.

3. “olsiv” refers to 2SLS; “ateiv” refers to two-stage probit; “cf” refers to control functions probit; “bvp” refers to bivariate probit.

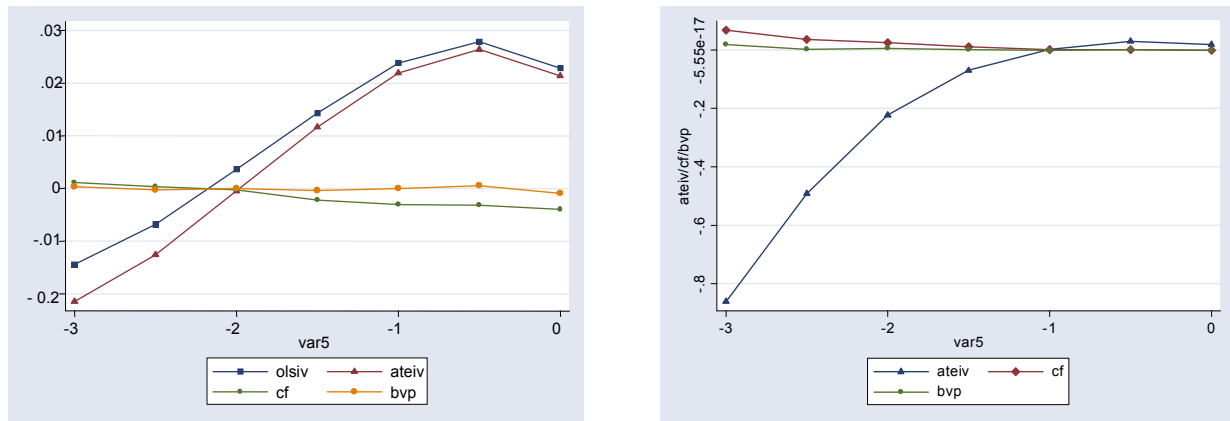


Figure 4.4 The constant term and bias in the treatment estimate and bias in the coefficient of the treatment estimate

Notes: 1. The coefficient from the 2SLS is not comparable to the coefficient from other models.

2. The X-axis refers to the value of β ; the Y-axis refers to the value of bias.

3. “olsiv” refers to 2SLS; “ateiv” refers to two-stage probit; “cf” refers to control functions probit; “bvp” refers to bivariate probit.

4.4 Conclusion

This chapter has presented a simple review of the key assumptions and procedures of the single treatment framework with a binary outcome. The bivariate probit (BVP) and control functions probit (CFP) approaches are proposed to be valid in the tackling of treatment endogeneity. To support the argument, the Monte Carlo simulations are presented to compare the performance of the two-stage least square (2SLS), the two-stage probit (TSP), the BVP, and the CFP, which are similar to the simulation procedures applied by Bhattacharya et al. (2006).

The simulation exercises in this chapter provide identical findings to those of Bhattacharya et al. (2006) – the BVP estimator produces consistent estimates, while the 2SLS and TSP do not. Furthermore, the simulation exercises also confirm that the CFP approach produces a close estimate of the true *ATE* that can be seen as a good approximation to that from the BVP. These two methods are major approaches in the studies in the later chapters to reduce endogeneity bias in the assessment of the education effect on the two dimensions of individual social capital.

Chapter 5

College Education and Social Trust Formation: Evidence from a British Cohort Study

5.1 Introduction

In Chapter 2 where a meta-analysis was performed to obtain a research synthesis of the educational effect on social capital, the effect sizes of the educational return vary with the level of education. Effect sizes are significantly higher for people with a college degree or above. The popular one-factor model, where it is assumed that education can always be aggregated into a single measure, was applied in Chapter 3 to study the effect of a marginal year of schooling. In Chapters 5 and 6, a single treatment evaluation is introduced to assess whether college or higher education is a critical stage for the formation of social capital. The focus will be on the causal inference between college/higher education and the two dimensions of social capital outcomes.

Educational experience increases individual social knowledge with the cognitive and perceptual experiences gained within and outside academic programs; expands the horizon of individuals in terms of economic and social possibilities; and makes individuals more open-minded to accept otherness from heterogeneous groups. Putnam (1995a, 2000), Uslaner (1997, 1998), Brehm and Rahm (1997), Leigh (2006), Alesina and La Ferrara (2000b) and other researchers find that individual social trust is strongly correlated with individual education level. The meta-analysis in Chapter 2 indicated that the returns to a marginal year of schooling on social trust vary with the level of education. In this chapter, a single treatment evaluation is applied to assess the influence of college education on social trust outcome, using the data from the National Child Development Study (NCDS).

There are two aspects in the identification of how much of the variation in social trust is attributable to educational achievement. Firstly, the correlation coefficients from many studies do not necessarily reflect the true causal effect of schooling. Studies may be exposed to omitted-variable bias if they ignore the possibility that the choices of educational attainment and social trust in adulthood are simultaneously affected by some unobservable early-life factors.

Secondly, the potential causality from schooling to social trust may not be a direct paradigm, but an indirect one via the variation in later life experiences that are led by the difference of education level. For example, college graduates are more likely to do well economically and generally live in a community where there is less heterogeneity in terms of socioeconomic status, and lower crime rates. They have less chance to be exposed to the “dark side” of society that could be a key factor in shaping the individual perception of social risks and uncertainties. The economic advantages may bring highly-educated people more confidence about their futures and more reasons to be optimistic, and thus they have a higher possibility to give affirmative responses in trust surveys. The possibility that economic class is on the casual pathway from educational attainment to social capital (social trust is generally believed to be a basic dimension of social capital) poses difficulties for the identification of a real and direct effect of college education experience.

Given the complexity of drawing causal inferences, the evaluation proceeds in two stages. In the first stage, the total causal effect of college education is disentangled from other early-life (adolescent) factors. The omitted variable problem will be given emphasis. In the second stage, sensitivity tests are performed on the robustness of the estimates of the college effect, concerning the measurement of educational achievement and attrition within samples. Then some insights are provided into the college effect from a mid-life perspective. By introducing into the social trust equation specific sets of post-education information when the cohorts are 33 years old, it is possible to assess the variation of the college effect on the unexplained component by those sets of control variables.

5.2 Data

A brief introduction to the secondary education system in the UK is presented for a better understanding of the evaluation. The General Certificate of Education or GCE is a secondary-level academic qualification that Examination Boards in the United Kingdom confer on students. The GCE traditionally comprised two levels: the Ordinary level (O-level) and the Advanced level (A-Level). The examinations were graded into O-level for 16-year-olds, and A-level for 18-year-olds¹³. The A-level qualification is used as a kind of entrance exam for UK universities. O-level was introduced as part of British educational reform in the 1950s alongside the more in-depth and academically rigorous A-level. In 1988,

¹³ *A-levels* are taken by students during the optional final two years of secondary school (years 12 and 13, usually of ages 16-18).

GCE O-levels were replaced by the General Certificate of Secondary Education (GCSE), while GCE A-levels were retained. The cohorts in the NCDS were born in 1958, and they were faced with the O/A levels when they were 16-18. The National Child Development Study (NCDS) provides information on both the years of schooling and educational attainment that the cohorts received, which enables the application of the single treatment model.

Table 5.1 presents summary statistics for the main variables in this chapter. The NCDS sample contains 10,441 observations¹⁴. 67.3 percent of the cohorts indicate that most people can be trusted, and 14.8 percent of them have received a college education. Since choice of college education is the main focus, adolescent information is critical for the evaluation before school leaving age or taking O/A-level exams. The measures of parental socioeconomic status include indicators of parental education level and parental social class. Information on the cohorts' family status contains an indicator of whether a parent has changed as a result of divorce or death, and an indicator of the number of siblings in the family in 1974.

The measures of adolescent health consist of information about adverse health conditions, such as parent-reported chronic health problems and physician-reported chronic health problems. Natal health variables include indicators of whether the cohort member had a low birth weight, the mother's smoking habit during pregnancy, and breastfeeding habit during the infant's first 3 months.

Academic ability and motivation in adolescence are crucial predictors for academic achievement in adulthood. These variables include indicators for teacher-rated ability in Math and English, and whether the respondent was absent from school for trivial reasons. The quality of the secondary school can be associated with both the college education choice and the formation of social trust. In this chapter, school quality/resource factors are accounted for by including school attendance rate (in terms of school capacity), teacher/student ratio, and facility resources (whether the school lacks facilities).

¹⁴ The sample size in the birth survey is 17,409, but there is attrition within/between each survey, only 11,000-12,000 observations remain since the 1974 survey. Attrition does not appear to be systematically associated with family background, such as parental socioeconomic status. A detailed discussion can be found in the Appendix to the working paper of Case et al. (2005). There are 10,901 observations in the WDYT sample of the 1991 survey and 10,404 observations (95.5 percent of the total observations) remain useful for this research: 240 observations were dropped because the question about social trust was not answered; and roughly 260 observations were dropped concerning, for example, cohorts registering as disabled people and cohorts attending special education for disabled people. Sensitivity tests are performed on the missing data due to attrition of parent and school reports in the 1974 survey.

Table 5.1 Descriptive statistics of the main variables

Variable	N	Mean	SD	Variable	N	Mean	SD
<u>Outcome variable</u>				<u>Basic Demographics</u>			
Social trust	10441	0.672	0.470	Male	10441	0.483	0.500
				Ethnicity Non-White	10392	0.025	0.156
<u>Treatment variable</u>				<u>Longstanding health problem in adolescence</u>			
College education	10441	0.148	0.355	Low birthweight	9617	0.054	0.226
				Handicapped	7268	0.058	0.233
<u>Father's social status</u>				Chronic illnesses since age 11	7584	0.129	0.335
Professional	7165	0.059	0.236	<u>Reading ability</u>			
Managerial	7165	0.212	0.409	Above average	8039	0.291	0.454
Non-manual-skilled	7165	0.101	0.302	Average	8039	0.338	0.473
Manual-skilled	7165	0.431	0.495	Below average	8039	0.123	0.328
Non-manual-semiskilled	7165	0.014	0.116	Little ability	8039	0.071	0.257
Manual-semi-skilled	7165	0.125	0.331	<u>Math ability</u>			
<u>Mother's social status</u>				Above average	7999	0.224	0.417
Professional	7658	0.003	0.056	Average	7999	0.351	0.477
Managerial	7658	0.110	0.313	Below average	7999	0.167	0.373
Non-manual-skilled	7658	0.219	0.414	Little ability	7999	0.130	0.337
Manual-skilled	7658	0.047	0.212				
Non-manual-semiskilled	7658	0.117	0.322				
Manual-semi-skilled	7658	0.101	0.302				

5.3 Evaluation of the *ATE*

This section offers a brief illustration on the bivariate probit and the control functions probit. These regression methods are applied to handle the potentially endogenous relation between a binary education variable ($T_i = 1$ if individual i undertakes college education, $T_i = 0$ otherwise) and a binary trust variable ($y_i = 1$ if individual i believes most people can be trusted, $y_i = 0$ otherwise). In a basic framework:

$$T_i = 1(T_i^*(Z_i, \nu_i) > 0) \quad (1)$$

$$y_i = 1(y_i^*(T_i, X_i, \eta_i) > 0) \quad (2)$$

where T_i^* and y_i^* are the latent variables. T_i^* depends on the observed covariates set Z_i (Z_i includes the exogenous variable set X_i and excluded variable z_i , such that

$Z_i = (X_i, z_i)$ and the unobserved factor v_i ; y_i^* depends on education choice T_i , exogenous variables X_i , and unobserved factor η_i . Assuming additive separability between observables and unobservables for both latent variables, and a cumulative standard normal distribution for the conditional probability in each equation, a standard bivariate specification is obtained as follows:

$$\Pr(T_i = 1) = \Phi(f(X_i, z_i) + v_i) \quad (3)$$

$$\Pr(y_i = 1) = \Phi(m(X_i, T_i) + \eta_i) \quad (4)$$

$$(v_i, \eta_i) \sim N(0, 0, 1, 1, \rho_{v\eta}) \quad (5)$$

where $\rho_{v\eta}$ is a correlation matrix between the unobservable components in the treatment and the outcome equations. Define $m(X_i, T_i) = b_0 + m_0(X_i) + \beta(X_i)T_i$, and the average treatment effect (*ATE*) is specified as:

$$\begin{aligned} ATE &= E[Y_1 | x] - E[Y_0 | x] \\ &= E[\Phi(b_0 + m_0(X_i) + \beta(X_i))] - E[\Phi(b_0 + m_0(X_i))] \\ &= E(\beta(X_i)) \end{aligned} \quad (6)$$

In a homogeneous return specification, where $\beta(x_i)$ and correlation matrix $\rho_{v\eta}$ are constrained to be constant across individuals undertaking a college education, the average treatment effect is specified as:

$$ATE = E[\Phi(b_0 + m_0(X_i) + \beta)] - E[\Phi(b_0 + m_0(X_i))] \quad (7)$$

When $\rho_{v\eta}$ is non-zero, which indicates the existence of an endogenous regressor, there would be endogeneity bias in the estimate of β if one performs an OLS or probit estimation based on equation (4). Econometric techniques are needed to eliminate the potential endogeneity bias.

The bivariate probit (BVP) model produces a consistent estimator of β in a homogeneous return specification (Wooldridge, 2002; Bhattacharya et al., 2006). The BVP model has been widely used in medical evaluation to reduce the bias due to self-selectivity in the treatment choice. It is a simultaneous equation model that controls for endogeneity in

the likelihood of the joint sets of the treatment and outcome distribution. Bhattacharya et al. (2006) have an inclusive comparison on the performances of the probit, two-stage probit (or two-stage least squares) and BVP models. They show that the BVP is the only method to produce a consistent estimator when there is an endogenous treatment.

The control functions probit (CFP) is a special case of the control functions (CF). The CF method is generally applied to correct an omitted-variable bias in the study of treatment effect on continuous outcome. Because the probit specification can be derived from a model involving a latent variable y_i^* with a linear expression, the CFP produces a good approximate of the true ATE in a binary response model.

The principle inspiring the CFP method is to evaluate the treatment effects by controlling directly for the correlation between the treatment choice and the unobservable heterogeneity in the outcome equation. In the binary response model, the CFP method allows for outcome unobservables η_i to depend on the treatment T_i , and it models this dependence. Under joint normality of v_i and η_i in the treatment and outcome equations:

$$y_i^* = b_0 + m_0(X_i) + \beta(X_i)T_i + \rho_{\eta v}(1-T_i)\lambda_{0i} + \rho_{\eta v}T_i\lambda_{1i} + \delta_i \quad (8)$$

A consistent estimator of $\beta(X_i)$ is achievable in equation (8) with a continuous dependent variable, where λ_{0i} and λ_{1i} are the standard inverse Mills ratios such that:

$$\lambda_{0i} = -\frac{\phi(v_i)}{1 - \Phi(Z_i, X_i)} \quad (9)$$

$$\lambda_{1i} = \frac{\phi(v_i)}{\Phi(Z_i, X_i)} \quad (10)$$

In the binary response model, the transformed error term δ_i in equation (8) does not generally follow a standard normal distribution. Moreover, the introduction of the corrected functions $(\rho_{\eta v}(1-T_i)\lambda_{0i} + \rho_{\eta v}T_i\lambda_{1i})$ would lead to a change of the mean and index functions, so that the estimate obtained from the CFP is merely an approximation of the true treatment effect. Nevertheless, the CFP approach provides a rather precise ATE estimate, which is comparable to the BVP approach, under the assumption of standard bivariate normality¹⁵.

¹⁵ When applying the CFP method in a binary response model, the correlation matrix between the unobservable components is also restricted to be constant. The CFP provides comparable estimates to the

The probit, CFP and BVP approaches are applied in the identification of the college effect. The implementation of the CFP and BVP approaches requires an exclusion restriction to achieve parametric (or semi-parametric) identification. The identification of the estimates will be troublesome if $X_i = Z_i$, and there is no functional-form assumptions. Following the same procedure as in Chapter 3, the non-systematic component of the length of schooling absence is separated from the systematic component and is used as the instrumental variable for college educational achievement. The homogeneous return specification, where the treatment coefficient $\beta(x_i)$ is constrained to be a constant B_0 across individuals undertaking a college education, is first introduced to assess the *ATE*. Observable demographic heterogeneities in gender and ethnicity will be introduced into the treatment coefficient, such that $\beta(x_i) = \beta_0 + \beta_{male}x_{male} + \beta_{non-white}x_{non-white}$. The linear interactions in the treatment coefficient, $\beta_{male}x_{male}$ and $\beta_{non-white}x_{non-white}$, denote observable heterogeneity in, respectively, gender and ethnic differences in the college effect.

Let us begin with a simple probit model in the first column of Table 5.2. The effect of college education is highly significant (the estimated *ATE* = 0.075 in terms of probability change and p-value = 0.00). The un-scaled coefficient from which the estimated *ATE* is derived is also reported. Since the binary response model has a non-linear (probit) expression, scaling of \hat{B}_{ATE} is necessary, and one can obtain the estimate of the *ATE* by taking the average of the scaled coefficient.

In the treatment endogeneity models: namely, the BVP and CFP approaches, where a homogeneous return on college education is imposed, all estimates of the *ATE* increase slightly from 0.075 to around 0.09, albeit no statistically significant signs of endogeneity bias (a non-zero $\rho_{v\eta}$) are observed in these models. The BVP and CFP approaches provide, as expected, similar and comparable estimates of the college effect.

For an inclusive illustration of the sources of social trust in individual early life, Table 5.2 presents the regression statistics of the key covariates that appear systematically significant¹⁶. The (unscaled-) coefficients of these covariates are consistent across all specifications, including the standard probit model. Above all, there are differences in the demographic characteristics in trusting other people. Men are much more reluctant to give a positive response, and white respondents are more likely to be trustful. Reading ability is a crucial

BVP under the assumption of constant correlation and standard bivariate normality, according to the Monte Carlo simulations in Chapter 4.

¹⁶ The regression statistics of all significant variables are presented in Table 5A.1 of Appendix 5B. Comprehensive regression results are available upon request.

determinant of trusting behavior. It turns out that those who were absent from school for trivial reasons and those who displayed withdrawn (not sociable) behavior according to the teacher would have a significantly lower probability to trust other people in their adulthood. Traumatic experiences in early life, such as parent change due to divorce or death, etc., are substantial factors that inhibit the development of social trust.

Table 5.2 Estimation results for the probit, BVP, and CFP models in the homogeneous specification

Variable	Probit		BVP		CFP	
<u>College effect estimates</u>	coef.	s.e	coef.	s.e	coef.	s.e
<i>ATE</i> (probability change)	0.075***	0.015	0.092	0.074	0.089	0.070
Unscaled coefficient	0.221***	0.047	0.265	0.224	0.274	0.220
<u>Key covariates: un-scaled coefficients</u>	coef	s.e	coef	s.e	Coef	s.e
Male	- 0.148***	0.028	- 0.149***	0.028	- 0.149***	0.028
Non-White	- 0.373***	0.089	- 0.374***	0.089	- 0.374***	0.089
Reading ability poor	- 0.196**	0.088	- 0.214**	0.105	- 0.213**	0.105
School absence for trivial reason	- 0.135**	0.067	- 0.134**	0.067	- 0.135**	0.067
Withdrawn – Unsociable	- 0.278**	0.124	- 0.277**	0.124	- 0.279**	0.124
Parent change since birth	- 0.160***	0.060	- 0.159***	0.060	- 0.159***	0.060
Correlation term			- 0.030	0.118	- 0.033	0.125
N	10441		10441		10441	

Notes: **Significant at the 5 percent level. ***Significant at the 1 percent level.

The homogeneous return specification, where the treatment coefficient $\beta(x_i)$ is constrained to be a constant B_0 across individuals undertaking a college education, is a special case from the general framework. In the following analysis, observable demographic heterogeneities in gender and ethnicity are introduced into the treatment coefficient, such that $\beta(x_i) = \beta_0 + \beta_{male}x_{male} + \beta_{non-white}x_{non-white}$. The linear interactions in the treatment coefficient, $\beta_{male}x_{male}$ and $\beta_{non-white}x_{non-white}$, denote, respectively, observable heterogeneity in gender and ethnic differences in the college effect.

The regression results for demographic heterogeneities in the college effect are shown in Table 5.3. Male and college interaction turns out to be a statistically significant variable,

indicating that college education has a much higher impact on male cohorts. A large difference is observed in the estimated *ATE* for whites and non-whites. However, there is no statistical sign for this ethnic difference because of the small proportion of non-white people in the population of the NCDS.

Table 5.3 Estimation results for the probit, BVP, and CFP with demographic specific returns

Variable	Probit		BVP		CFP	
<u>Interactions</u>	<u>coef</u>	<u>s.e</u>	<u>Coef</u>	<u>s.e</u>	<u>coef</u>	<u>s.e</u>
College \times Male	0.218***	0.078	0.218***	0.079	0.218***	0.079
College \times White	- 0.234	0.218	- 0.234	0.219	- 0.234	0.218
<u>ATE for sub-group</u>	<u>coef</u>	<u>s.e</u>	<u>Coef</u>	<u>s.e</u>	<u>coef</u>	<u>s.e</u>
ATE for male	0.112***	0.019	0.115*	0.069	0.115*	0.069
ATE for female	0.036*	0.020	0.039	0.071	0.039	0.071
ATE for white	0.074	0.015	0.078	0.069	0.077	0.069
ATE for non-white	- 0.003	0.085	0.001	0.116	0.000	0.116

Notes: * Significant at the 5 percent level; **Significant at the 5 percent level; ***Significant at the 1 percent level.

5.4 Sensitivity test and post-education re-evaluation

5.4.1 Sensitivity test on college measurement and attrition problems

The precision of education measurement is a critical issue in the evaluation of the college effect. A severe measurement error of college achievement, or a systematic education reporting bias from the respondents, will have a detrimental impact on the credibility of the estimates. The measurement problem is an important subject in the evaluation. The NCDS is a multi-wave survey, so that it is possible to check whether there is inconsistent reporting of college education by comparing relevant information from the 1981 survey, the 1991 survey and the 2000 survey.

Those who obtain a polytechnic diploma, an undergraduate diploma, an undergraduate degree and/or a higher degree are classified as college graduates. 1549 out of 10,441 respondents in the NCDS sample are defined as having received a college education or higher. The “age on leaving full-time continuous education” from the 2000 survey is used as a first

check for college measurement. In the 2000 survey there are 9150 respondents reporting their age on leaving full-time continuous education, and age on leaving full-time education. Among these 9150 observations, 158 respondents out of 1382 who are classified as college graduates reported that they had finished full-time continuous education before the age of 20. Furthermore, these 158 individuals do not seem to have attended any full-time education after the age of 20. According to information from the 1981 survey, 137 out of these 158 respondents have not received any college education according to the definition used here, and 102 of them did not even have an A-level certificate. Therefore, these 137 respondents, in particular those without an A-level certificate, are susceptible to severe measurement problems.

For a second check of respondents between the age of 23 and 33, it is found that 88 percent of the college graduates in the 1991 survey reported that they had finished college education by the age of 23, and another 7 percent of the college graduates were still having college education at the age of 23. 43 observations appear to be problematic as these respondents reported that they had a college education in the 1981 survey but a lower education level in the 1991 survey.

In the sensitivity test, these 102, 137, 180 observations are dropped in turn from the full sample¹⁷ where the CFP approach with homogeneous return will be applied to check whether there is a systematic change in the college effects. No significant deviation of the estimated *ATE* is observed, as shown in Table 5.4.

Table 5.4 Sensitivity test on education measurement

Sample	<i>ATE</i>	s.e	BC 95% confidence interval		N
Restricted sample for A-level error	0.096	0.063	- 0.034	0.219	10339
Restricted sample for College error	0.095	0.063	- 0.045	0.198	10304
Restricted sample for both errors	0.093	0.064	- 0.043	0.198	10261

¹⁷ There is an alternative way to perform the sensitivity test of the measurement errors: the observations with possible reporting bias are re-coded, such that those inclined to over-report in college education in the survey of 1991 are coded as non-college graduates. The re-coding does not produce any change in the estimated *ATE*.

There have been attritions within and between each survey used in the evaluation. The attritions emerge from school and parent questionnaires in the 1974 survey. Each questionnaire has roughly 20 percent of the total observations coded as missing data due to the attrition, and these missing observations from each questionnaire do not necessarily overlap. As a robustness test on attrition bias, the missing observations in these two questionnaires are dropped in turn, and the CFP approach with homogeneous return is applied on each restricted sample. For the estimated *ATE*, there is a slight downward deviation (roughly 10 percent smaller than the estimate in the full sample) in the sample where missing observations are dropped because of school-report attrition; there is a 30 percent upward deviation in the sample where missing observations are dropped because of parent-report attrition. In the more restricted sample where the missing observations from both parent and school questionnaires are dropped, a 20 percent upward deviation is observed.

The sensitivity tests reveal that the measurement error or the reporting problem of college education does not impose any change in the estimates. The attrition within the parent questionnaire somehow causes an attrition bias, which, however, does not change the qualitative conclusion.

Table 5.5 Sensitivity test on sample attrition

Sample	<i>ATE</i>	s.e	BC 95% confidence interval		N
Restricted sample for school attrition	0.080	0.072	-0.071	0.192	8308
Restricted sample for parent attrition	0.115	0.071	-0.036	0.246	7790
Restricted sample for both attritions	0.106	0.068	-0.025	0.218	6817

5.4.2 Further analysis from a post-education perspective

The regression statistics in the previous section indicate that a college education experience is one of the most powerful determinants of social trust among all early-life factors. However, it is not clear how college education contributes to the development of individual social trust in later life. The causality from schooling to social trust may not be a direct paradigm, but an indirect one via the variation in later-life experiences, as a result of the difference in individual educational attainment. It is possible that socioeconomic status is an intermediate

outcome on the causal pathway between education and social capital. In this subsection an analysis is presented on this causal pathway from a post-education perspective.

The design for this further analysis is based on a regression analysis of social trust on different sets of control variables of later life from a post-education perspective, and the assessment of the variation of the college effect on the unexplained component from the regression. These control variables are also drawn from the 1991 survey, the same survey from which information of individual social trust is collected. They are classified into four groups: (i) Individual social class (e.g. manager, professional, non-manual, manual, see Appendix 5A for more coding information) of the first job after schooling; (ii) Perception of social environment, sense of social fairness and expectation of future life and work skills; (iii) Individual moral standards over gender and race equality and law; and (iv) Other factors, including health status and family status.

Individual economic class of the first job after schooling depends critically on education levels¹⁸, while some non-cognitive attributes, such as reliability, consistency, and openness, which embody, at least partially, individual social trust, should not have a direct and immediate effect on the economic class of the first job since these non-cognitive attributes take time and experience to become recognized. Information from category (ii) reflects one's view on how society is developing (i.e. view on: whether the young are losing respect for traditional values; whether the environment is deteriorating; whether stiffer laws are necessary to uphold morality); perception of social fairness in terms of wealth distribution (whether ordinary people get a fair share of the nation's wealth); confidence in the role of government in wealth distribution; and individual optimism about future life and the workplace. Variables from category (iii) convey information on the individual's attitude toward: gender equality in housework and in the workplace; ethnic equality in the neighborhood, in school and in the workplace; individual respect for the law (the law should be obeyed even if it is wrong) and for employment (whether one must have a job to consider oneself a full member of society). Category (iv) contains information on self-reported health status, current marriage status and marriage history (widowed, remarried, divorced, etc.), and number of children in the family.

¹⁸ With the same instrumental variable, a substantial college effect is found on socioeconomic class (i.e. non-manual vs manual) at the age of 23, in spite of a significant upward bias of the college effect due to the selectivity problem.

Table 5.6 Control variables classified in groups for the analysis from a post-education perspective

i. Economic class	Information on economic class of first job; Unemployed before the first job
ii. Perception of social environment and sense of social fairness	Ideas on need for more strict laws and penalties; Perception of youth behavior; Perception of wealth distribution and role of government in the distribution; Perception on individual having a say in government; Perception of environmental deterioration Individual expectation for the future; Confidence in individual control in the workplace
iii. Individual moral standards	Individual attitude toward ethnic equality in the workplace, community, school, and in marriage; Individual attitude toward gender equality at home and in the workplace; Individual respect toward the law; Individual attitude toward job for fulfilling social responsibility
iv. Other variables	Self-reported general health; Marital status; Children in the family

First, a hierarchical model is adopted by introducing these categories of control variables to explain individual social trust, with these groups entering in sequence from category (i) to category (iv), with previous group(s) remaining in the regression. Each residual which cannot be explained by the introduced group(s) of post-education information will be used as a (continuous) dependent variable as the CF approach¹⁹ is performed to re-evaluate the college effect. The beta coefficients for college effect are reported instead of the *ATE* coefficients. They are the coefficients obtained from the regressions where all variables are standardized to have a mean of 0 and a standard deviation of 1. In Part A of Table 5.7, the beta coefficient of the college effect is reported in the reference regression, which includes only early-life factors²⁰. The beta estimate of the total college effect is 0.058, indicating that 1 standard deviation of college education increases social trust by 0.058 of its standard deviation.

¹⁹ Identical results were obtained using the OLS approach.

²⁰ It is identical to the setup of the homogeneous CFP model in Table 5.3, except that the outcome variable is the residual of social trust, rather than the binary indicator of social trust.

The beta coefficients from the hierarchical analysis are reported in Part B of Table 5.7. Column 2 reports the beta estimate corresponding to each group of post-education variables, and Column 3 reports the related p-value. Since these groups are added to explain for social trust in a stepwise increasing sequence, the residual of social trust is driven down, and so are the beta coefficients. The beta coefficients from these residual analyses cannot be directly compared, because the standard deviations of these residuals become smaller with the increase of later-life information. To facilitate a direct comparison, the beta coefficients are re-scaled by multiplying the ratio of the standard deviation of each residual relative to the standard deviation of the social trust outcome²¹, so that they can be conceived as the adjusted beta coefficients in the social trust equation. These adjusted beta coefficients are reported in Column 4. Column 5 “Dif-Adj-Beta” reports the decrement of the adjusted beta coefficient attributed to each category of later-life factors. Column 6 “% total Beta” reports the proportion of decrement of the adjusted beta coefficient compared with the overall beta coefficient.

The economic class of the first job is the first category group to enter the trust equation. It leads to a huge decline of the college effect on the social trust residual. The adjusted beta coefficient drops from 0.058 to 0.035, a 40 percent decline compared with the total beta. The introduction of perception of social environment and moral values reduces the adjusted beta coefficient by over 20 percent of the total beta in each case. The final group of later-life variables, such as health and marital status, reduces the college effect by roughly 12 percent of the total beta. All together, these later-life groups have explained all the college effect, seeing that the beta coefficient is 0.001 when all categories of later factors are applied to explain for social trust.

Another setup is devised where each set of later-life information is withdrawn separately from the full social trust equation while other sets remain, and similarly a CF approach is performed on the residuals that have not been explained by the specific sets of control variables. The regression statistics are presented in Part C of Table 5.7. All category groups continue to have the same explanatory power in terms of the proportion of the overall beta except for socioeconomic status. Its proportion declines dramatically from 40 percent to 12 percent.

For a more perceptual understanding, a bar graph is presented in figure 5.1 for the

²¹ This ratio is an approximation of the square root of the difference between unity and R-squared in each residual, or the square root of the variance can not be explained by the introduced sets of later-life information.

adjusted beta coefficients of post-education variables groups (ii), (iii), and (iv). The dark-shaded bar depicts the explanatory power of each group in terms of the proportion of the total beta which enters the social trust equation exclusively, while the light-shaded bar depicts the corresponding explanatory power with socioeconomic status in the equation as a reference group. The bar graph provides a straightforward illustration that the perception of social environment and optimism for the future turns out to be exposed to the influence of socioeconomic status induced by education variation.

Table 5.7 Estimation results from post-education re-evaluation

	Beta	p-value	Adj-Beta	Dif Adj-Beta	% total Beta
<u>A. Inference analysis</u>					
Total effect	0.058	0.29	0.058	0.000	0.00
<u>B. Hierarchical analysis – Stepwise increasing</u>					
Socio-economic status	0.035	0.53	0.035	- 0.024	- 40.56
Perception of social environment	0.023	0.68	0.022	- 0.013	- 22.12
Moral value	0.008	0.88	0.008	- 0.014	- 23.41
Other factors	0.001	0.98	0.001	- 0.007	- 12.03
<u>C. Separating analysis</u>					
Socio-economic status	0.009	0.88	0.008	0.007	12.30
Perception of social environment	0.014	0.80	0.014	0.013	21.89
Moral value	0.014	0.79	0.014	0.013	21.90
Other factors	0.008	0.88	0.008	0.007	12.03

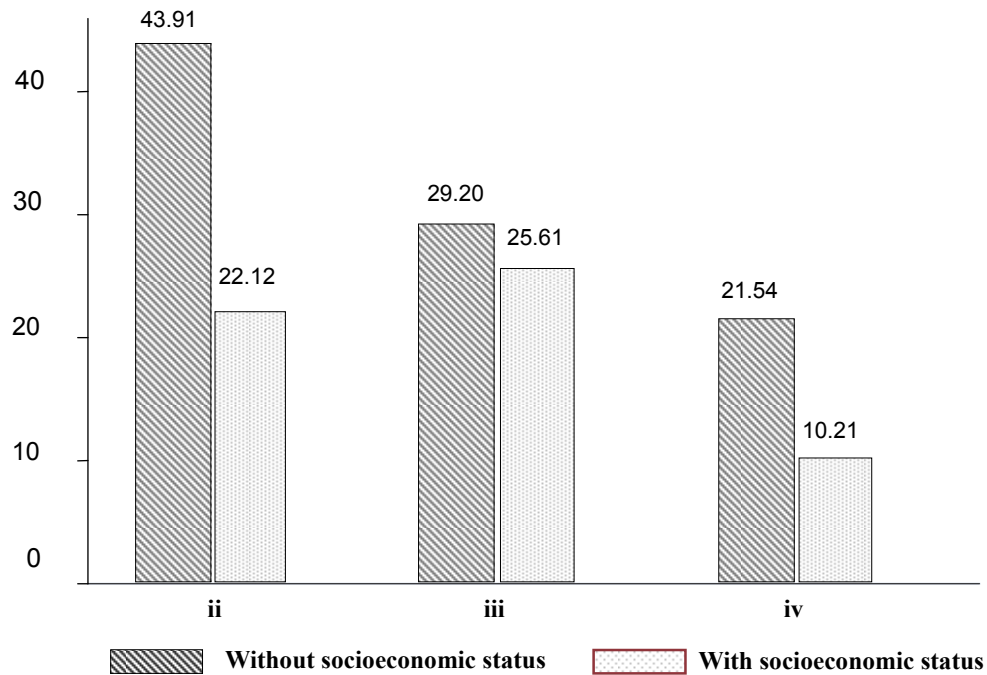


Figure 5.1 Bar graph for the adjusted beta

Given that variation in educational achievement is the main source of differences in the economic class of the first job after schooling, the substantial decline of the college effect (due to the introduction of socioeconomic class) provides support for the view that economic advantage is an intermediate outcome on the causal pathway from college education to the formation of social trust. In particular, social trust as a perception of social uncertainty and fairness is strongly correlated with social development, and individual standing in a social environment. Social trust as a moral value stems from family and school influence, which is less likely to be affected by the social environment.

This study also confirms a direct and lasting college effect on the two basic dimensions of individual social trust – individual perception of the social environment and individual moral values, although accurate estimates of the proportion of direct college effect and the proportion and indirect college effect cannot be provided.

5.5 Conclusion

This chapter has evaluated the role of college education in the formation of individual social trust. The evaluation proceeded in two stages. In the first stage the causal effect of college education was disentangled from ‘other’ early life factors. College education has a substantial

effect on individual social trust. The estimate of the average treatment effect is up to 0.09 in terms of probability change, and the beta coefficient is around 0.06. The estimates of the *ATE* are slightly larger in the endogeneity models than in the simple probit model, although there is no sign of endogeneity on college choice. The single treatment evaluation of college education results in a similar qualitative conclusion as the one-factor model evaluation: that education is a key factor in the increase of individual social trust. However, no sign is found from these models to support the view that college education is more efficient or more important than lower education in cultivating social trust (in terms of the effect of a marginal year of schooling), which is not consistent with the finding from the meta-analysis in Chapter 2²².

In the second stage, sensitivity tests were first performed on education measurement and attrition problems. Then, the analysis went further into the assessment of an explicit causal pathway from college education to the formation of social trust in a later-life perspective. By introducing specific sets of control variables from post-education surveys, some empirical evidence is found for the view that socioeconomic class is an intermediate outcome between education and social trust. The present study also confirms that college education is a key factor in the building of individual social trust; at least 40 percent of the college effect has a direct and lasting effect on individual perception, optimism, and moral standards, which are the basic dimensions of social trust.

Two topics remain for further discussion. Firstly, women do not appear to benefit as much as men from college education in terms of the social trust outcome. What causes such a difference? The patterns of gender roles in society may provide a useful insight. Traditionally, men of working age are expected to devote themselves to their professional life. Although this “male breadwinner” role has weakened since the 20th century, discontinuous economic activity is a still typical pattern for many women, as they have to give up their paid work or switch to part-time work, and take primary responsibility for domestic labor. This applies to both low-educated and highly-educated women. According to the OECD Employment Outlook 2001, a considerable gender wage gap remains. Census Bureau data from the US also show that the gender pay gap was quite real in the 1980s, and persists today, even among men and women with comparable education levels.

That highly-educated women are still facing a relatively marginalized position in the labor

²² The effect size of the returns to a marginal year of schooling from the single treatment evaluation of college education is similar to the effect size obtained from the meta-analysis in Chapter 2 and the one-factor model evaluation in Chapter 3. That is to say, a marginal year of college or higher education is not more efficient or more important in cultivating social trust than that of a lower education.

market, the inferiority of their salaries, and difficulties in getting promotion in their professional careers can provide a main interpretation for the insignificant college effect in the social trust equation, which leads to a negative view on social fairness and equal chance, and a pessimistic perception about individual development in the future²³. The analysis from a post-education perspective lends support to this opinion. By introducing socioeconomic status and individual perspective of gender role and equality in the workplace and housework in the analysis of social trust, it is found that the male and college interaction is no longer significant at the 10 percent statistical level in the unexplained component of social trust²⁴.

Secondly, social trust at an aggregate level, for instance, national level, has displayed a declining trend in many developed countries over the last four decades, despite a dramatic development in higher education in the same period. This paradox has been a popular subject in social studies. Many studies have long proposed that college education appears to be a measure of relative standing in society. People who have obtained a college degree, for instance, are more likely to gain advantages in life in terms of working skills, social class, income and living environment. These people are more confident about their future and have more reasons to be optimistic, and thus they have a higher probability to give affirmative responses in surveys on trust. Furthermore, as the proportion of people with higher degrees expands, those with only high school certificates become relatively disadvantaged. Their declining sense of opportunities appears to be reflected in a lower likelihood of giving optimistic responses to questions about trust.

Obviously, much can be said about the gender difference in the college effect on social trust and the paradox of social trust decline and college education development at an aggregate level. Further research on these topics is necessary and will certainly facilitate a clearer and comprehensive understanding of the role of college education in the formation of social trust, at the individual level and at the societal level.

²³ Northern European nations, for instance, have the highest rank in the surveys of social trust and gender parity.

²⁴ Regression results are not shown, but are available upon request from the author.

Appendix 5 Coding of variables and regression details on social trust outcome

Appendix 5A Coding of variables

i. Outcome variable - dummy indicator for individual social trust 1- Most people can be trusted or you can not be too careful with other people, and 0-others.

ii. Qualifications for college education - polytechnic qualification; university certificate or diploma; first degree; postgraduate diploma; higher degree.

iii. Pre-treatment (adolescent) control variables

1. Dummy indicator for gender (1-male, 0-female)
2. Dummy indicator for ethnicity (1- non-white, 0-white)
3. Dummy indicators for number of siblings at age 16 (one sibling, two siblings, three siblings, four siblings, five and more siblings; reference group – no sibling)
4. Dummy indicator for father's social class in 1974 (managerial, non-manual skilled, manual skilled, semi-skilled, unskilled; reference group – professional)
5. Dummy indicator for mother being employed in 1974 (reference group – not employed)
6. Dummy indicators for mother's social class if employed (managerial, non-manual skilled, manual skilled, semi-skilled, unskilled, unemployment; reference group - professional)
7. Dummy indicators for parental age on leaving full-time school (under age 14, age 15-16, age 17-18, age 18-21; reference group – above age 21)
8. Dummy indicators for teacher-rated ability in math and reading at the age of 16 (little ability, below average, O-level; reference group – A-level and higher)
9. Dummy indicators for teacher-reported whether individual was absent from school for trivial reasons (somehow applies, certainly applies; reference group – does not apply)
11. Dummy indicator of whether individual ever suffered non-accident hospitalization
12. Dummy indicator for parent-reported chronic health conditions since age 11
13. Dummy indicator for self-reported longstanding health conditions during age 0-16
14. Dummy indicator for teacher-reported emotional problems (always worry about things, somehow worry about things; reference group – does not apply)
15. Dummy indicators of mother's breastfeeding habit (whether she was breastfeeding for 3 months and whether she was breastfeeding for less than one month; reference group – never breastfeeding)
16. Discrete variable of number of cigarettes mother smoked during the pregnancy and dummy indicator for variable smoking
17. Discrete variable of number of cigarettes that cohorts smoked at adolescence
18. Dummy indicators for birth region (Scotland, Wales, East and Wriding, North Midlands, Eastern, Southern, Southwestern, Midlands, Northern, Northwest; reference group – London and east)
19. Dummy indicator for whether parent(s) has (have) changed (due to divorce, death, etc.) – (0-no, 1-yes)
20. Dummy indicators for school enrollment scale (less than 100, 100-500, 500-1000, 1000-1500, 1500-2000; reference group – over 2000)
21. Dummy indicators for school student-teacher ratio scale (10-15, 15-20, 20-25, 25-30, over 30; reference group – less than 10)
22. Dummy indicators for school attendance in terms of capacity (less than 50%, 50-60%, 60-70%, 70-80%, 80-90%, 90-95%; reference group – over 95%)

iv). Post-treatment (later-life) control variables

Economic class category

1. Dummy indicators for social class of the first job after full-time schooling (managerial, non-manual skilled, manual skilled, semi-skilled, unskilled, no job since school; reference group – professional)
2. Dummy indicators for job type of the first job after full-time schooling (part-time; reference group – full time)
3. Dummy indicator for employment type of the first job after full-time schooling (self-employed; reference group – employee)

Perception of social environment and sense of social fairness

4. Dummy indicators for perception of environmental deterioration (strongly agree serious deterioration, agree serious deterioration, uncertain about serious deterioration, disagree serious deterioration; reference group – strongly disagree)
5. Dummy indicators for view on the necessity for censorship in upholding moral values (strongly agree, agree, uncertain, disagree; reference group – strongly disagree)
6. Dummy indicators for view on the necessity for stiffer sentences for lawbreaker (strongly agree, agree, uncertain, disagree, reference group – strongly disagree), and the necessity of death penalty for some crimes (strongly agree, agree, uncertain, disagree; reference group – strongly disagree)
7. Dummy indicators for ever signing a petition (1- yes, 0- no), joining strike (1- yes, 0- no), joining demonstration (1- yes, 0- no)
8. Dummy indicators for view on fair wealth distribution in the nation ((strongly agree, agree, uncertain, disagree; reference group – strongly disagree)
9. Dummy indicators for view on the necessity for government improvement on a fair distribution of wealth in the nation (strongly agree, agree, uncertain, disagree; reference group – strongly disagree)
10. Dummy indicators for perception of the influence of ordinary people in government administration – ordinary people like me have no say in what the government does (strongly agree, agree, uncertain, disagree; reference group – strongly disagree)
11. Dummy indicators for perception of the young – the young do not have enough respect for traditional value (strongly agree, agree, uncertain, disagree; reference group – strongly disagree)
12. Dummy indicators for individual expectation of life in 10 years (10 categories range from completely dissatisfied to completely satisfied)
13. Dummy indicators for individual optimism of current work skills – current work skills will be useful/valuable in five years (strongly agree, agree, uncertain, disagree; reference group – strongly disagree)

Individual moral standards on racial and gender equality

14. Dummy indicators for perception of inter-racial marriage – alright for different races to marry (strongly agree, agree, uncertain, disagree; reference group – strongly disagree)
15. Dummy indicators for perception of racial equality in the workplace – Would not mind working with other races (strongly agree, agree, uncertain, disagree; reference group – strongly disagree)
16. Dummy indicators for perception of racial equality in school – Would not mind if 50 percent of pupils in child's school from other races (strongly agree, agree, uncertain, disagree; reference group – strongly disagree)
17. Dummy indicators for tolerance of race in community – Would not mind if family from other races moved next door (strongly agree, agree, uncertain, disagree; reference group – strongly disagree)
18. Dummy indicators for acceptance of people from other races, to be my boss (strongly agree, agree, uncertain, disagree; reference group – strongly disagree)
19. Dummy indicator for gender equality of having chance to do the same kind of work – Men and women should have the chance to do the same kind of work (strongly agree, agree, uncertain, disagree; reference group – strongly disagree)
20. Dummy indicators for acceptance of female boss – would not want a woman to be my boss (strongly agree, agree, uncertain, disagree; reference group – strongly disagree)
21. Dummy indicators for acceptance of more women getting important jobs – Should be more women bosses in important jobs (strongly agree, agree, uncertain, disagree; reference group – strongly disagree)
22. Dummy indicator for perception of job – must have job to feel a full member of society (strongly agree, agree, uncertain, disagree; reference group – strongly disagree)

Other variables

23. Dummy indicators for marriage status (married, re-married, widow, divorced, separated; reference group – married)

24. Dummy indicators for number of children (one, two, three, four, five; reference group – more than five)
 25. Dummy indicators for general health conditions (fair, good, excellent; reference group – poor)

Appendix 5B Estimation results for all significant variables in the social trust outcome

The regression results of all statistically significant (at the 10 percent level) control variables in the social trust equation (the control functions approach with homogeneous specification). Comprehensive regression results are available on request from the author.

Table 5B.1 Estimation results for all significant variables in the social trust equation

Control function in homogeneous specification			
<u>Variable</u>	<u>coef.</u>	<u>s.e.</u>	<u>p-value</u>
Male	-0.149	0.028	0.00
Non-white	-0.374	0.089	0.00
Reading ability- little	-0.214	0.105	0.04
Reading ability - below average	-0.174	0.089	0.05
Reading ability- average	-0.176	0.075	0.02
Overworry in general life	-0.132	0.076	0.08
Withdrawn – level 2	-0.093	0.040	0.02
Withdrawn – level 3	-0.075	0.043	0.08
Withdrawn – level 4	-0.109	0.052	0.04
Withdrawn – level 5	-0.280	0.124	0.02
Mother somewhat interested in children's education	0.258	0.119	0.03
Mother very interested in children's education	0.241	0.117	0.04
Certainly absent from school	-0.134	0.067	0.04
One sibling	0.106	0.064	0.10
Scotland	0.099	0.057	0.08
Wales	0.115	0.067	0.08
Parent change	-0.159	0.060	0.01
Constant	0.369	0.083	0.00

Chapter 6

Higher Education and Membership of Voluntary Groups: A Perspective on Gender Difference

6.1 Introduction

This chapter examines the effect of higher education on individual membership of voluntary groups and organizations relating to community living and welfare²⁵. Membership of voluntary groups is a general indicator of social participation and an important indicator of social capital (Glaeser et al., 1999; Paxton, 1999; Putnam, 2000). Voluntary groups facilitate people's effective involvement in community life and promote a sense of community. Voluntary groups serve as a resource for the people involved by increasing access to information and facilitating the transmission of knowledge (Gamson, 1992; Hughey et al., 1999; Dekker and Uslaner, 2001). Group members acquire organizational skills and expand their social ties in ways that positively impact their physical and mental health, as well as many other normatively desirable outcomes (House et al., 1988; Thoits and Hewitt, 2001). A high level of voluntary participation raises civic norms among people and strengthens the foundations of a democratic society.

Education is regarded as a major factor in increasing individual social capital and promoting social participation; it is widely believed that people with a higher level of education are more likely to join voluntary groups. Glaeser et al. (1999) assert that the most robust predictor of social participation, measured by the probability of being a group member, is years of schooling. Putnam (1995a, 1995b, 2000) and Uslaner (1998) also claim that high-educated people are more likely to join social organizations and participate in social engagements more frequently. The extent of the effect of education is, however, an under-studied topic. Few empirical studies have attempted to isolate the real effect of education from the influence of confounding variables.

The divergence of higher education enrollment and social participation behavior in Western countries also produces a puzzle about the exact relationship between education and

²⁵ These voluntary groups and organizations are outside the political arena and the workplace (i.e. unions, parties, voting and lobbying groups). Religious groups are not considered to be voluntary organizations, although they are often related to community living and welfare.

membership of voluntary groups. Over the second half of the 20th century, most Western countries have experienced an evolution from an elitist higher education system to a mass higher education system and the average education level of people has increased dramatically. More than one in five adults in OECD countries have received tertiary education. If education promotes social engagement, we should also have seen a substantial rise in the social participation level in Western countries. However, it appears from many social reports that more and more people are becoming disengaged from civic life and social ties nowadays, as they belong to fewer voluntary groups and do less voluntary work (Knack, 1992; Putnam, 1995a, 1995b). With the exception of the Scandinavian countries and Japan where levels have remained relatively stable, there seems to be a common pattern of declining organizational activity across the industrialized democracies during the 1980s and 1990s (Leigh, 2003).

The change in gender attitudes and the rapid entry of women into the labor force are considered as a cause for the decline of social participation levels (Putnam, 1995a, 1995b; Taniguchi, 2006). Women are traditionally the main force in the voluntary sector related to community affairs (McPherson and Smith-Lovin, 1982; Taniguchi, 2006; Enns et al., 2008). Over the past few decades, high-educated women have entered the labor market in large numbers as the gap in access to higher education between men and women has narrowed or even disappeared. Most of them have, however, to facilitate the reconciliation of work and family life as they are still responsible for most of the domestic work. This could divert their time, interest and energy away from joining voluntary or community organizations. In this perspective, the gendered patterns of workforce participation and social participation are important factors in the association between education attainment and voluntary participation level.

This section aims to quantify the effects of higher education on individual membership of voluntary groups for a British cohort born in 1958, using the rich data from the National Child Development Study (NCDS). The membership outcome is a binary indicator denoting an individual's current affiliation with one or more community-based voluntary groups. These voluntary groups include environmental groups, charity groups, PTAs, residents' groups, and other volunteering groups²⁶. This section also attempts to shed some light on the divergence in the transitions of higher education and social participation behavior in Western countries.

²⁶ These groups are established to facilitate people's effective involvement in community life, to improve the living environment or teaching quality, and to increase social well-being. PTAs and residents' groups have specific membership requirements, i.e. having children or being a tenant and there may be effective auto-enrollment in these groups. We offer additional analysis on the membership outcome in which PTAs and residents' groups are excluded, and we find identical effects for higher education.

To address these two topics in detail, this chapter proceeds in three stages in the empirical studies. Gender differences in the education effects are given emphasis as analyses performed separately for men and for women in each stage. In the first stage, the bivariate probit (BVP) and control functions probit (CFP) are applied to isolate the influences of education endogeneity, and identify the average treatment effect (*ATE*) of higher education. In the second stage, robustness tests are presented on: the distributional and functional form assumptions; missing data in key covariates; and education measurement. The third stage provides further investigations of the education effects and examines whether status of employment and attitudes towards workforce participation are important factors in the association between education attainment and group membership of voluntary organizations.

Section 6.2 gives a brief illustration of the BVP and CFP, which tackles the endogenous relation between a binary treatment variable and a binary outcome variable. Section 6.3 presents summary descriptions of the NCDS data set and quantifies the education effect on the membership outcome. Section 6.4 provides robustness tests on the education effects and provides further investigations into the roles of employment status and occupation attitudes. Section 6.5 draws conclusions and indicates policy implications.

6.2 Evaluation methods

This section provides a brief illustration of the BVP and the CFP. These regression methods are applied to handle the potentially endogenous relation between a binary variable for education attainment ($T_i = 1$ if individual i undertakes higher education, and $T_i = 0$, otherwise) and a binary variable for membership outcome ($y_i = 1$ if individual i has joined at least one voluntary group, and $y_i = 0$, otherwise). In a basic framework:

$$T_i = 1(T_i^*(Z_i, \nu_i) > 0) \quad (1)$$

$$y_i = 1(y_i^*(T_i, X_i, \eta_i) > 0) \quad (2)$$

where T_i^* and y_i^* are the latent variables. T_i^* depends on the observed covariates set Z_i (Z_i includes the exogenous variable set X_i and excluded variable z_i , such that $Z_i = (X_i, z_i)$), and the unobserved factor ν_i ; y_i^* depends on education choice T_i , exogenous variables X_i , and unobserved factor η_i . Assuming additive separability between observables and unobservables for both latent variables, and a cumulative standard normal

distribution for the conditional probability in each equation, a standard bivariate specification is obtained:

$$\Pr(T_i = 1) = \Phi(f(X_i, z_i) + v_i) \quad (3)$$

$$\Pr(y_i = 1) = \Phi(m(X_i, T_i) + \eta_i) \quad (4)$$

$$(v_i, \eta_i) \sim N(0, 0, 1, 1, \rho_{v\eta}) \quad (5)$$

where $\rho_{v\eta}$ is a correlation matrix between the unobservable components in treatment and outcome equations. Define $m(X_i, T_i) = b_0 + m_0(X_i) + \beta(X_i)T_i$, and the average treatment effect (*ATE*) is specified as:

$$\begin{aligned} ATE &= E[Y_1 | x] - E[Y_0 | x] \\ &= E[\Phi(b_0 + m_0(X_i) + \beta(X_i))] - E[\Phi(b_0 + m_0(X_i))] \\ &= E(\beta(X_i)) \end{aligned} \quad (6)$$

In a homogeneous return specification, where $\beta(x_i)$ and correlation matrix $\rho_{v\eta}$ are constrained to be constant across individuals undertaking higher education, the average treatment effect is specified as:

$$ATE = E[\Phi(b_0 + m_0(X_i) + \beta)] - E[\Phi(b_0 + m_0(X_i))] \quad (7)$$

When $\rho_{v\eta}$ is non-zero, which indicates the existence of an endogenous regressor, there would be endogeneity bias in the estimate of β if one performs an OLS or probit estimation based on equation (4). Econometric techniques are needed to eliminate the potential endogeneity bias.

The BVP produces a consistent estimator of β in a homogeneous return specification (Wooldridge, 2002; Bhattacharya et al., 2006). The BVP approach has been widely used in medical evaluation to reduce the bias due to self-selectivity in the treatment choice. It is a simultaneous equation model that controls for endogeneity in the likelihood of the joint sets of the treatment and outcome distribution. Bhattacharya et al. (2006) have made an inclusive comparison of the performances of the probit, two-stage probit (or two-stage least squares) and BVP models. They show that the BVP is the only method to produce a consistent estimator when there is an endogenous treatment.

The control functions probit (CFP) is a special case of the control functions (CF). The CF

method is generally applied to correct omitted-variable bias in the study of the treatment effect on continuous outcome. Because the probit specification can be derived from a model involving a latent variable y_i^* with a linear expression, the CFP produces a good approximate of the true *ATE* in a binary response model.

The principle inspiring the CF method is to evaluate the treatment effects by controlling directly for the correlation between the treatment choice and the unobservable heterogeneity in the outcome equation (see, e.g., Heckman et al., 2004; Blundell et al., 2005). The CF method allows for outcome unobservables η_i to depend on the treatment T_i , and it models this dependence. The CFP applies the same principle to identify the treatment effect on the binary outcome variable. Under joint normality of ν_i and η_i in the treatment and outcome equations and a homogeneous return specification, the latent variable y_i^* is specified as:

$$y_i^* = b_0 + m_0(X_i) + \beta(X_i)T_i + \rho_{\eta\nu}(1-T_i)\lambda_{0i} + \rho_{\eta\nu}T_i\lambda_{1i} + \delta_i \quad (8)$$

A consistent estimator of β is achievable in equation (8) with a continuous dependent variable y_i^* , where λ_{0i} and λ_{1i} are the standard inverse Mills ratios. In the binary response model, the estimate obtained from the CFP is merely an approximate of the true treatment effect because of the changes in the latent equation. Nevertheless, the CFP method provides a rather precise *ATE* estimate under the assumption of standard bivariate normality²⁷. Compared with the BVP, which has a messy and time consuming, though doable, maximum likelihood calculation, the CFP has a considerably lower calculation cost, especially when it comes to the estimation of the standard error or confidence interval for the treatment effect that involves Monte Carlo simulation. The maximum likelihood calculation may not always converge in bootstrapping estimation.

The CFP, like the BVP, allows one to identify the *ATE* even when individuals select on the basis of unobservables, and one can examine the presence of treatment endogeneity by a test of the null hypothesis that $\rho_{\nu\eta}$ equals zero. These two methods are major approaches in this evaluation to tackle endogeneity bias. Since the BVP and the CFP methods rely on certain distributional assumptions or functional form restrictions to identify average treatment effect, a nonparametric local average treatment effect (or LATE) analysis will be provided in the

²⁷ Our simulation exercises, which follow the same design applied by Bhattacharya et al. (2006), show that the CFP does considerably better than the probit and two-stage probit (or two-stage least squares) in the identification of *ATE*, and it produces an approximate estimate of the true *ATE*, while the BVP produces a consistent estimator.

robustness tests on the relaxation of distributional assumptions and functional form restrictions.

6.3 Introduction of the NCDS data set and evaluation of education effects

6.3.1 The NCDS data set

Table 6.1 provides summary statistics of the main variables in this study. Information on group membership is extracted from the 2000 survey, when the respondents were 42 years old. Information on higher education achievement is extracted from the 1991 NCDS survey based on their formal education experience and qualifications. There are noticeable differences between men and women in group membership and higher education attainment. 13 percent of men indicated that they were members of at least one voluntary group in the 2000 survey and around 24 percent of male respondents had received higher education by age 33. Women had a substantially higher participation rate in voluntary groups and a considerably lower rate in receiving higher education. 20 percent of women indicated in the 2000 survey that they had joined at least on voluntary group, and less than 18 percent of them had received higher education by age 33.

All covariates are extracted from the 1973-1974 survey except for the basic demographic information and prenatal/natal health information, which are extracted from the 1958 birth survey. The respondents were 15-16 years old during the 1973-1974 survey. They were approaching the end of compulsory education (secondary education was compulsory for all pupils between the ages of 11 and 16 in the UK). They would be faced with O/A-level examination(s), as well as with the choice of further education. Parental socioeconomic covariates include indicators of parental education level and parental social class from the 1973-1974 survey. Other covariates of family background contain information on whether parent(s) changed (as a result of divorce, death, etc.) and the number of siblings.

Academic ability and motivation in adolescence are crucial predictors for the highest education achievement in adulthood. The teacher's report in the 1973-1974 survey provides rich information of individual ability in Math and English, and whether the individual was absent from school for trivial reasons. The teacher's report also provides information on parental interest in the education of their children, as well as certain school characteristics consisting of school enrolment, teacher/student ratio, expelled student ratio and availability of facility resources.

This research includes as adolescent health indicators, information on chronic conditions

and physical height from the physician's examination and parent-reported adverse illness. It also includes as natal health indicator, information from the 1958 survey on the smoking habit of the mother during pregnancy, birth weight, and level of breastfeeding. To maintain a large and representative sample with respect to missing data in the key covariates, this research follows the treatment of missing value adopted by Case et al. (2003, 2005) in their health study of the same British cohort²⁸. Case et al. (2003, 2005) and Feinstein et al. (2003) have shown that the initial sampling bias and sample attrition do not appear to be a problem for the 1958 cohort targeted by the NCDS. It will be shown in the robustness tests that the estimates of education effects are not sensitive to missing data in the covariates.

Table 6.1 Descriptive statistics of the main variables

Variable	N	Mean	S.D.	Variable	N	Mean	S.D.
<u>Outcome variable (age 42)</u>				<u>Treatment variable (age 33)</u>			
Male membership	4326	0.133	0.340	Male higher education	4326	0.236	0.424
Female membership	4720	0.200	0.400	Female higher education	4720	0.175	0.380
<u>Basic Demographics (birth)</u>				<u>Father economic status (age 15-16)</u>			
Male	9046	0.480	0.500	Professional	6286	0.057	0.233
Minority-Non White	9046	0.021	0.144	Managerial	6286	0.146	0.353
<u>Reading ability (age 15-16)</u>				Non-manual-skilled	6286	0.433	0.496
Excellent	7005	0.168	0.374	Manual-skilled	6286	0.014	0.116
Above average	7005	0.298	0.458	Non-manual-semi	6286	0.127	0.333
Average	7005	0.339	0.473	Manual-semi	6286	0.046	0.209
Below average	7005	0.121	0.328	<u>Mother economic status (age 15-16)</u>			
<u>Math ability (age 15-16)</u>				Professional	6730	0.005	0.054
Excellent	6961	0.118	0.323	Managerial	6730	0.106	0.308
Above average	6961	0.223	0.416	Non-manual-skilled	6730	0.220	0.414
Average	6961	0.361	0.480	Manual-skilled	6730	0.048	0.214
Below average	6961	0.164	0.370	Non-manual-semi	6730	0.119	0.324
				Manual-semi	6730	0.100	0.301

²⁸ For each of these covariates, an observation with missing data is coded as 0. A new dummy indicator is created for the existence of missing value in the covariate (1 for observation with non-missing value, and 0 otherwise). We interacted each of the covariates with its missing-value indicator, and retain them in our analysis. The estimated coefficients therefore represent the estimated effect of the variable, conditional on its value being observed.

6.3.2 Validity of instrumental variables

Following the same procedure as in Chapter 3 and Chapter 5, the non-systematic component of the length of absence from school is separated from the systematic component, and the non-systematic component is used as the instrumental variable for education choice. As relevant covariates are included in the regression of the absence length, one can obtain its predicted value – ideally the systematic components, and its predicted residual – ideally the non-systematic components. Statistical proofs of the validity of the instrumental variable in this research are presented in Table 6.2. Part A of Table 6.2 provides the test statistics for the correlation between the respondent's mid-life health status and the instrument: namely, the predicted residual variable of the absence length. For comparison, similar correlation tests are also performed for the absence length and for the predicted value of the absence length. It is straightforward that the absence length and its predicted value are strongly correlated with the health conditions at age 33 and age 42, while the instrument has no significant correlation with the health conditions in adulthood. These statistics provide strong support for the design principle adopted in this research that the non-systematic components are not supposed to have a lasting health influence over the life span.

Part B of Table 6.2 provides evidence for the argument that the predicted non-systematic components of the absence length have an impact on group membership only via the respondent's exam passes. The membership outcome is broken down by the number of A-levels that the respondent had passed (as qualifications for university entrance) by age 20. Then a correlation test is performed for the instrument and the residual value of the membership outcome unrelated to the number of A-levels passed. Similar correlation tests are applied for the absence length and for the predicted systematic components of the absence length. Once again the absence length and its predicted value are strongly correlated with the residual value of the membership outcome unrelated to the number of A-levels passed, while the instrument has a trivial correlation with the residual value of the membership outcome.

Figure 6.1 and Figure 6.2 offer additional proof of the validity of the instrumental variable. Figure 6.1 depicts the kernel density (with bandwidth of 0.1) of the residual value of the absence length for voluntary group participants and non-participants in the control group: namely, the low-educated group. Figure 6.2 depicts the kernel density (with bandwidth of 0.1) of the residual value of the absence length for voluntary group participants and non-participants in the treatment group: namely, the high-educated group. Provided that the instrument only impacts membership outcome via education choice, the kernel densities of the residual value of the absence length should not be diverting for voluntary group participants

and non-participants in the same education group. It is straightforward in Figure 6.1 and Figure 6.2 that the kernel densities are almost completely overlapping for the same education group. Therefore the distribution of the residual value of the absence length does not vary between voluntary group participants and non-participants, and can be regarded as an applicable exclusion restriction in the membership equation.

Table 6.2 Test statistics on the validity of the instrumental variable

	Absence length		Systematic term		Non-systematic term	
	coef.	p-value	coef.	p-value	coef.	p-value
A. Correlation with mid-life health						
General health status at 32-33	- 0.09	0.00	- 0.11	0.00	0.01	0.30
General health status at 41-42	- 0.10	0.00	- 0.11	0.00	0.01	0.40
No. Chronic illnesses suffered at 32-33	0.07	0.00	0.11	0.00	- 0.00	0.84
No. longstanding illnesses suffered at 41-42	0.07	0.00	0.10	0.00	0.01	0.42
B. Correlation with residuals of membership						
Membership residuals unrelated to exams	- 0.03	0.03	- 0.04	0.00	- 0.00	0.90

Note: The indicator of general health status is a discrete variable with 4 categories: 0-poor, 1-fair, 2-good, 3-excellent.

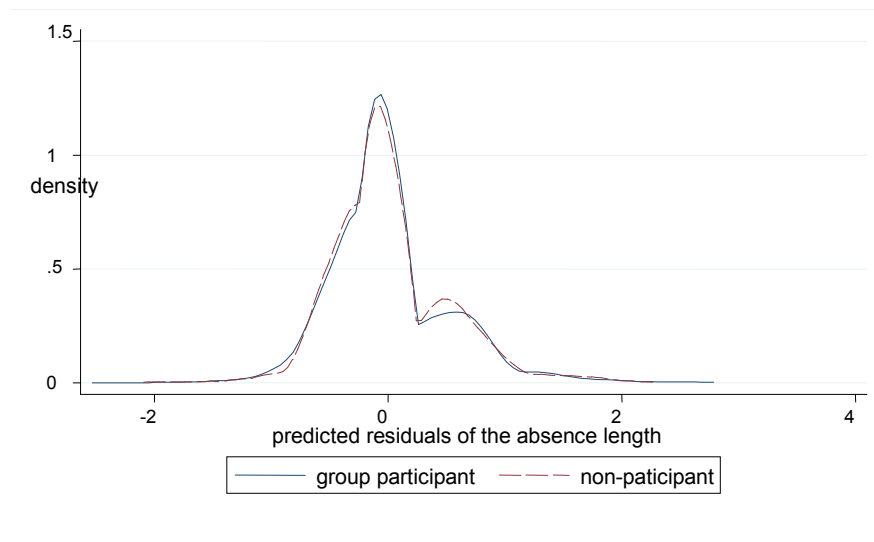


Figure 6.1 Kernel densities of the predicted residuals of the absence length - control group

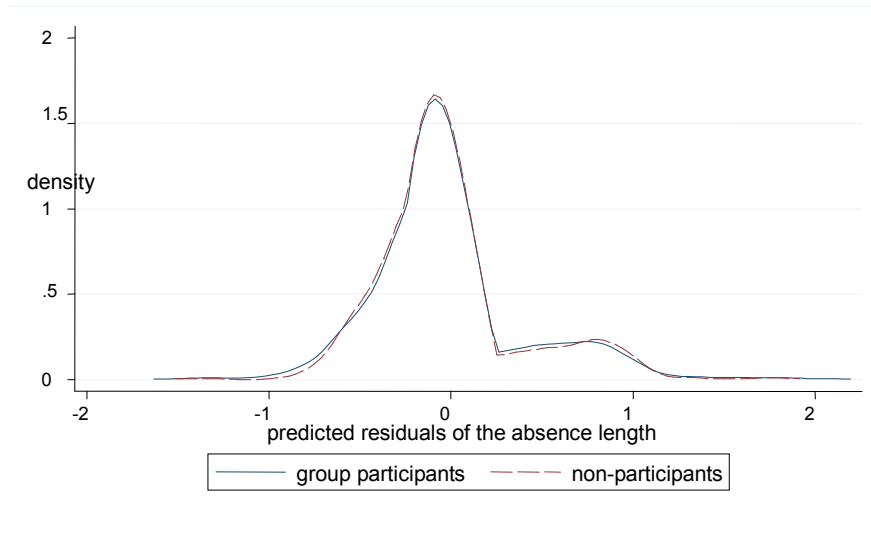


Figure 6.2 Kernel densities of the predicted residuals of the absence length - treatment group

6.3.3 Evaluation of the education effects

The probit, bivariate probit and control functions probit are applied to assess the average treatment effect (*ATE*) of higher education attainment on the membership of voluntary groups. The gender difference in the education effects is given emphasis as each estimation is performed separately for men and women.

The results are presented in Table 6.3. A statistically significant estimate of the average education effect, in terms of probability change, is found for both men and women in the probit model. The estimated *ATE* is 0.104 for men and 0.145 for women. In the BVP and CFP methods, however, the *ATE* estimates show a sizeable divergence between men and women. The estimated *ATE* turns negative in the female sample. It is -0.070 in the BVP analysis, and -0.063 in the CFP analysis. The estimated *ATE* is significantly positive across all specifications in the male sample. The estimates obtained from the endogeneity models are relatively larger than those from the probit model.

The CFP method provides as good an approximate estimate as the BVP method at a much lower computational cost. Both the BVP method and the CFP method allow endogeneity tests, and these tests strongly reject the hypothesis of a zero correlation term $\rho_{v\eta}$ in the female sample. There is no statistical evidence for education endogeneity in the male sample.

Table 6.3 Analysis of higher education and group membership

	<i>ATE (probability change)</i>		<i>Endogeneity test</i>
	coef.	s.e.	p-value
Male			
Probit	0.102	0.015***	-
Bivariate probit	0.167	0.082**	0.331
Control functions probit	0.171	0.084**	0.401
N	4326		
Female			
Probit	0.145	0.021***	-
Bivariate probit	- 0.070	0.061	0.006
Control functions probit	- 0.063	0.060	0.002
N	4720		

Note: *significant at the 10% level; **significant at the 5% level; ***significant at the 1% level. The coefficients and standard errors are reported from bootstrapping (500 repetitions).

The membership outcome under examination in Table 6.3 is a binary indicator denoting an individual's current membership of at least one of the community-based voluntary groups. PTAs and residents' groups are also included as outcome groups. These groups, however, have specific membership requirements, i.e. having children or being a tenant, and there may be effective auto-enrollment in these groups. The analysis is replicated to examine the education effects on a modified membership outcome, in which PTAs and residents groups are excluded from the outcome groups. The regression results are presented in Table 6.4. It turns out that the estimates are relatively smaller in the male sample. Nevertheless, the findings from the replicated analysis are similar to those in the previous analysis.

Table 6.4 Analysis of higher education and modified group

	<i>ATE (probability change)</i>		<i>Endogeneity test</i>
Male	coef.	s.e.	p-value
Probit	0.069	0.013***	-
Bivariate probit	0.081	0.117	0.988
Control functions probit	0.063	0.070	0.927
N	4326		
Female	coef.	s.e.	p-value
Probit	0.110	0.018***	-
Bivariate probit	- 0.055	0.046	0.005
Control functions probit	- 0.072	0.035*	0.001
N	4720		

Note: *significant at the 10% level; **significant at the 5% level; ***significant at the 1% level. The coefficients and standard errors are reported from bootstrapping (500 repetitions).

The results from Table 6.3 and Table 6.4 show that if women's choice of higher education is treated as an exogenous variable, this could lead to misleading conclusions. These tables also show that there is a sizeable difference between men and women, both quantitatively and qualitatively, in the education effect. Higher education does not seem to promote female membership of voluntary groups. A negative estimate of the education effect is observed in the endogeneity models. As for male membership, higher education has a strongly positive effect, and the probit regression produces the same conclusion as the BVP and CFP methods.

The finding that high-educated women are less motivated to join voluntary groups provides an explanation for the divergence in the transitions of higher education and social participation in many Western nations. Women's networks are traditionally more informal due to their lower participation level in formal work organizations. They tend to participate in smaller, more peripheral organizations and activities with a focus on domestic or community affairs (Taniguchi, 2006; Enns et al., 2008). Participation in these voluntary groups is not promoted by the increase of the average education level of the population, or by the increase of gender equality in access to higher education, where higher education adversely impacts female membership of voluntary groups.

The findings from the female study contradict, however, the common belief that schooling promotes social cohesion and strengthens citizenship. Further investigation is essential in the search for potential explanations of the negative education effect.

6.4 Further analysis

In the first part of this section robustness tests are performed on the relaxation of distributional and functional form assumptions by adopting a nonparametric evaluation approach. Robustness tests are performed to examine whether the education estimates are sensitive to missing value in key covariates, and to alterations in the measurement of education. In the second part of the section, further investigations are provided from a mid-life perspective in order to obtain additional insights on the education effects.

6.4.1 Robustness tests

The BVP and the CFP approaches rely on certain functional form assumptions, such as bivariate normality, constant treatment effect, or additive separability in the error term, in order to identify the average treatment effect. The estimation of local average treatment effect (LATE) relies on much weaker assumptions and a nonparametric or a semi-parametric method can be easily integrated in the analysis procedure.

The general identification of LATE comes from a binary instrument that induces exogenous selection into treatment for the sub-population of compliers, where the compliers are all individuals whose choice of treatment would change if the instrument were modified exogenously (Imbens and Angrist, 1994; Angrist et al., 1996). Recently there have been efforts to introduce covariates in LATE estimation because instruments may require conditioning on a set of covariates to be valid (e.g. Hirano et al, 2000; Abadie, 2003; Froelich, 2007). As a robustness test on the relaxation of distributional and functional form assumptions, the nonparametric LATE method proposed by Froelich (2007) is applied to evaluate the effect of higher education on membership of voluntary groups. The binary instrument in the nonparametric LATE analysis is defined on the sign of the residual variable or predicted non-systematic components of the absence length ($z_{LATE} = 1$ if $z > 0$, $z_{LATE} = 0$ otherwise²⁹).

The nonparametric LATE estimation is performed in the restricted sample in which observations with missing value of the absence length are excluded because the nonparametric LATE requires full information of the instrument. The restricted data set contains 76 percent of the observations in the full data set. For comparison, the BVP and CFP methods are also applied to evaluate the education effects in the same data set. It is shown in

²⁹ The binary instrumental variable z_{LATE} indicates schooling absence due to non-systematic factor in illness. It has similar power and exogeneity as the original instrumental variable.

Table 6.5 that the nonparametric LATE method produces qualitatively the same conclusion as the BVP and CFP methods. There are quantitative differences in the estimates, as the LATE estimate is identified for the subpopulation that reacts to change of the binary instrument z_{LATE} . The standard error of the LATE estimate is not reported because it takes an enormous time to compute. Analytic standard errors are instead reported by means of the estimation of asymptotic variance (Froelich, 2007; Froelich and Melly, 2008).

The estimates of ATE obtained by the BVP and CFP methods from the restricted data set are the same as those obtained from the full data set. Robustness tests are also performed on the restricted data set with no missing observations on parental economic class, education, or teacher-reported academic abilities. The estimates obtained from this restricted data set are very similar to the estimates obtained from the full data set. The outcomes from Table 6.5 indicate that the estimates of the education effects are robust to distributional assumption and functional-form restrictions, as well as to missing data in key covariates.

Table 6.5 LATE, BVP and CFP estimation in the restricted sample

	Male		Female	
	coef.	s.e.	coef.	s.e.
LATE estimation	0.252	0.507	-0.095	0.524
BVP estimation (bootstrapping)	0.182	0.056***	-0.050	0.052
CFP estimation (bootstrapping)	0.173	0.093*	-0.060	0.065
N	3239		3573	

Note: *significant at the 10% level; ***significant at the 1% level.

The measurement of higher education is based on information on formal education and qualifications reported in the 1991 survey. An academic sequence is imposed in the measurement of higher education for an unambiguous treatment analysis. Observations with a higher education are assumed to have also received the preceding lower level of education. In other words, an A-level or equivalent qualification is a prerequisite for a higher education attainment, and observations without A-level or equivalent qualification are categorized into

the control group. This education sequence is a common procedure for people who have undertaken an academic route. It is not necessarily true, however, for people who have undertaken vocational routes.

The difference between the reported year (1991) of the education variable and the reported year (2000) of the membership variable also causes concern for the measurement of education. Adult learning during this time interval may lead to a change in the education level. Adult learning also plays an important role in contributing to the small shifts in attitudes and behavior that take place during mid-adulthood (Feinstein et al., 2003). It is possible that the education information from the 1991 survey is not adequate for identifying the total effect of higher education using the education information from the 1991 survey.

Robustness tests are performed on the measurement of higher education. Part A of Table 6.6 presents the results from the analysis in which the restriction on the academic sequence is relaxed: An A-level or equivalent qualification is not a prerequisite for higher education. Part B of Table 6.6 presents the results from the analysis in which the education measurement is adjusted by accounting for the education qualifications respondents have collected since the 1991 survey. Part C of Table 6.6 presents the results from the analysis in which a new binary treatment variable is created to indicate whether respondents left full-time continuous education before the age of 20³⁰. Table 6.6 does not report the estimation results from the BVP method because its bootstrapping calculation does not always converge, and simulated standard error cannot be obtained. Nevertheless, the education effects quantified in the CFP regression (without bootstrapping) are virtually the same as the education effects quantified in the BVP regression (without bootstrapping).

³⁰ The binary treatment variable is coded as 0 if respondent left full-time continuous education before the age of 20; it is coded as 1 otherwise.

Table 6.6 Estimation of the adjusted education measurement

	Male		Female	
A. Relaxation of the education sequence				
	<i>ATE</i>	s.e.	<i>ATE</i>	s.e.
Probit	0.094	0.014***	0.121	0.017***
Control functions probit	0.218	0.101**	-0.046	0.105
B. Inclusion of education qualification obtained since 1991				
	<i>ATE</i>	s.e.	<i>ATE</i>	s.e.
Probit	0.103	0.014***	0.123	0.016***
Control functions probit	0.250	0.109**	-0.061	0.099
C. Binary treatment for age when leaving full-time continuous school (age ≥ 20)				
	<i>ATE</i>	s.e.	<i>ATE</i>	s.e.
Probit	0.091	0.019***	0.126	0.022***
Control functions probit	0.180	0.077***	-0.089	0.050*
N	4720		4326	

Note: *significant at the 10% level; **significant at the 5% level; ***Significant at 1% level; The coefficients and standard errors are reported from bootstrapping (500 repetitions).

As observed in Table 6.6, the estimates of the average education effect based on the adjusted measurement of higher education are quite similar to each other. They are not substantially different from the estimates obtained in the previous analysis. We come to the same conclusions on gender-specific education effects and on the problem of education endogeneity in the female study.

6.4.2 Further investigations

That high-educated women are less motivated to join voluntary groups provides an explanation for the divergence in the transitions of higher education and social participation in many Western nations. The negative causality observed in the female study, however, contradicts the common belief that education promotes social cohesion and strengthens citizenship. There may be a missing link in the association between higher education and voluntary participation.

The changing gender attitudes and the rapid entry of women into the labor force are potential causes for this negative association. Putnam (1996) and Taniguchi (2006) suggest that the movement of women into the labor force is playing a role in the decline of social participation levels. Traditionally, men of working age are expected to devote themselves to

professional life, and women are considered responsible for household welfare and child care, which are unpaid domestic responsibilities. Voluntary group participation is a common and reliable option for women to share social resources and exert their influence in the community. The boost of female (especially high-educated female) participation in the workforce could divert women's interest, time and energy available for participation in voluntary groups. Taniguchi (2006) claims that, for men, the relationship between paid work and voluntary participation would be more consistent with the notion of a non-zero-sum game, whereas, for women, this relationship would resemble the trade-offs implied in a zero-sum game.

In the meantime, the traditional gap in higher education participation between men and women has narrowed or even disappeared. In the UK, women have outnumbered men in higher education programs since 1996, and they now make up almost 60 percent of the full-time student population. High-educated women may be more motivated, because of their education experience or professional expertise, than low-educated women to pursue economic independence and regularity of collective participation. When high-educated women enter the labor market to obtain a return to their education and become more ambitious in competing with men, the role of female participation in voluntary groups is adversely impacted as the means of achieving personal values and fulfilling social responsibilities. High-educated women may also face greater time constraints for voluntary participation due to the intensification of labor force participation and the increasing economic pressure for dual-career families. Since most of these women continue to have the main responsibility for domestic work i.e. child care and housework, they are under more pressure than men to balance career and social activities.

Two investigations are provided using mid-life information to obtain additional insights into the gender-specific effects of higher education. In the first investigation, I collect information of individual employment characteristics and individual attitudes towards workforce participation from the 2000 NCDS survey, and I apply the control functions method by gender to quantify the causal effect of higher education on these employment variables and attitude variables. Information on individual employment characteristics consists of employment status, fixed working hours, weekend shift, night shift, etc. Information on individual attitudes towards workforce participation consists of individual perceptions of the priority of having a job, the importance of staying in job, the benefit of a working mother for the family and for the child.

The main findings from the control functions (CF) estimation are presented in Table 6.7. This CF estimation has the same model specification as the previous estimations. Part A of

Table 6.7 examines the education effects on individual employment characteristics. Higher education has a negative effect for males on workforce participation and a positive effect for females, although the estimates are not statistically significant. Substantial gender differences are observed in the education effects on fixed-time working, weekend working, and night shifts. There is a strong and negative education effect in the male sample for being in a job with fixed working hours. The estimates of the education effects are also negative for working on weekends every week or working on night shifts frequently. In the female sample, higher education turns out to be a significantly positive predictor of fixed-time working, weekend working, and night shift working.

Part B of Table 6.7 examines the education effects on individual attitudes towards workforce participation. High-educated women have a more positive attitude towards the importance of having a job and staying in a job. They are more affirmative about the benefits of being a working mother. High-educated men do not have higher probability than low-educated men to consider participation in the workforce as an indispensable factor of personal life, although they give more affirmative answers towards the benefits of working mother.

Table 6.7 Education effects on individual employment status and attitudes

	Male		Female	
	coef.	s.e	coef.	s.e
<u>A. Employment characteristics at age 42</u>				
Employed	-0.023	0.092	0.073	0.069
Fixed working hours required in job	-0.248	0.091**	0.152	0.084*
Work on weekend every week	-0.098	0.072	0.164	0.083**
Night shift often required	-0.004	0.080	0.146	0.078**
<u>B. Perception on female employment/family life</u>				
Any job is better than being unemployed	-0.017	0.225	0.321	0.191*
Important to stay in job even if unhappy	-0.235	0.224	0.308	0.183*
Mother and family benefit from a working mother	0.461	0.227**	0.404	0.197**
Child benefits from a working mother	0.252	0.228	0.344	0.187*

Note: *significant at the 10% level; **significant at the 5% level. ***significant at the 1% level. Employment variables in Part A are binary indicators: 1=yes, 0=otherwise; Attitude variables in Part B are discrete variables with 5 categories: 0-strongly disagree, 1-disagree, 2-uncertain, 3-agree, 4-strongly agree

Table 6.7 indicates that higher education plays an important role in increasing female employment and developing a positive attitude toward female employment. High-educated women are indeed more motivated than low-educated women to pursue economic independence. This means that the increase of women's education level could bring down the level of voluntary participation when there are trade-offs between female workforce participation and female voluntary participation.

In the second investigation the membership variable is broken down by the mid-life information on individual employment characteristics and individual attitudes towards workforce participation. We obtain the membership variation related to, or predicted by, these mid-life variables, and membership variation unrelated to these mid-life variables. Then control functions regression (with the same model specification as in the previous analyses) is performed by gender to assess the education effects on these membership variables. The purpose of this design is find out whether female employment and attitudes towards female employment are the key channels via which the negative effect of higher education relates to female membership outcome.

When individual employment characteristics and individual attitudes towards workforce participation are both introduced as explanatory variables to break down the membership outcome, the probit model indicates that the value of the pseudo- R^2 is 0.082 for the male membership and 0.072 for the female membership. Therefore, these two categories of mid-life information account for nearly 8 percent of the membership variance. In other words, nearly 92 percent of the membership variance cannot be explained by the contemporary employment characteristics or employment attitudes.

Standardized coefficients (beta coefficients) are reported in Table 6.8 by gender for the education effects on the breakdown of these membership variables. Table 6.8 reports the test statistics (in terms of the p-value) of the presence of education endogeneity by the control functions method.

Part A of Table 6.8 examines the education effects on the membership variable predicted by: individual employment characteristics; individual attitudes toward workforce participation; and both employment characteristics and employment attitudes. A strongly positive beta coefficient is observed in each of the predicted membership variables. These coefficients are very similar, ranging from 0.287 to 0.310 (p -value<0.01 in each equation). When it comes to the predicted variables of female membership, the beta coefficients are significantly negative (p -value<0.05 in each equation). The control functions method indicates strong education

endogeneity in the female sample. We come to the same conclusion on the gender-specific education effects and on the problem of education endogeneity for both the membership outcome and the breakdown of the membership variable predicted by mid-life information.

Part B of Table 6.8 examines the education effects on the breakdown of the membership variable unrelated to individual employment characteristics, the education effects on the breakdown of the membership variable unrelated to individual attitudes toward workforce participation, and the education effects on the breakdown of the membership variable unrelated to either employment characteristics or employment attitudes. In the male sample, the beta coefficient of the education effect is almost 0.22 for each equation of the residual membership variables (unpredicted by mid-life information), and they have a significant statistical level. These beta coefficients are not much different from those obtained from the equations of the predicted membership variables. In the female sample, the beta coefficients are uniformly positive in the residual membership variables. The null hypothesis of exogenous choice of higher education cannot be rejected in both the male and the female sample.

The estimation results in Table 6.7 and Table 6.8 indicate that female participation in the workforce and female attitudes toward employment are indeed the main channels via which higher education exerts a negative impact on the female membership outcome³¹. The beta coefficient is -0.268 (p -value<0.01) in the equation of the predicted variation in female membership, and 0.088 (p -value=0.18) in the equation of the residual variation in female membership where these main effects are isolated. Such a remarkable difference exists in the education effects because higher education promotes female employment (especially for weekend-working and night shift), and generates a positive attitude towards female employment, while female choice of, or preference for, employment diverts women's interest and energy away from joining voluntary or community organizations. The beta coefficients are similar in the male sample because high-educated men do not have more motivation or probability of joining the workforce. The allocation of time between paid work and voluntary work is not entirely a zero-sum game for men.

³¹ It has been shown that female employees can be under more pressure than male employees to balance career and civic activities (Tiehn, 2000; Taniguchi, 2006). Our correlation tests (presented in Table 6B.2 in the Appendix) also show that female participation in the workforce and female occupation motivation are negatively associated with female membership of voluntary groups. There can be a reverse effect from participation in voluntary groups to participation in the workforce (or fixed-time working, weekend working, night shifts), and it is accommodated in the predicted membership variation. We believe this reverse effect, if existing, cannot dominate the effect from workforce participation and occupation time/shift, especially for women.

Table 6.8 Education effects on membership variation broken down by mid-life information

Breakdown of membership	Male			Female		
	Beta estimates		Endogeneity	Beta estimates		Endogeneity
	coef.	s.e.	p-value	coef.	s.e.	p-value
A. Predicted variation						
Explained by employment	0.296	0.081***	0.219	-0.301	0.064***	0.000
Explained by attitudes	0.310	0.082***	0.194	-0.134	0.062**	0.000
Explained by both categories	0.287	0.080***	0.352	-0.268	0.061***	0.000
B. Residual variation						
Unexplained by employment	0.224	0.087***	0.135	0.067	0.065	0.307
Unexplained by attitudes	0.221	0.086***	0.137	0.046	0.065	0.230
Explained by both categories	0.216	0.087**	0.125	0.088	0.065	0.350
N	4720			4326		

Note: *significant at the 10% level. **significant at the 5% level. ***significant at the 1% level.

6.5 Conclusion

This chapter has investigated the impact of higher education on group membership in voluntary associations. It has shown that simple regression could produce misleading conclusions on the causal relationship between higher education and female group membership because of the problem of education endogeneity. Sizeable differences are observed in the education effects between men and women. Higher education adversely impacts female group participation, while it has a strongly positive effect on male group participation.

It is further shown that female participation in the workforce and female attitude toward employment are key factors via which educational attainment exerts a negative effect on the female group membership. Despite the changing gender attitudes and the rapid entry of women into the labor force over the past few decades, women continue to play a major role in running the household and giving care to family members (England, 2000; Taniguchi, 2006). This suggests that female employees from a two-career family may be under more pressure than male employees to balance career and social activities.

Because high-educated women are less likely to join voluntary groups and women are traditionally the main force in the voluntary sector related to community services, voluntary participation is not promoted by the increase of the education level over the population or by

the increase of gender equality in higher education. The findings in this chapter provide a plausible explanation for the divergence in the transitions of higher education and social participation behavior in Western countries.

As women become an increasingly important element of the labor force, the role of female participation in voluntary groups is impacted adversely in terms of achieving personal values and fulfilling social responsibilities. More and more high-educated women are committed to work or motivated to pursue economic independence. This reflects a trend of increasing gender equality in the functioning of society.

The decline of female participation in voluntary group is, however, not a desirable outcome from many perspectives. Workforce participation cannot replace the role of voluntary participation in raising common bonds and civic norms among people. The appreciation and recognition of community work are non-economic returns that paid-jobs do not yield. Participation in voluntary organizations is considered an independent cause of improving health status, while stress from intensive work participation has been considered a key source of health problems in modern life. Many people choose to leave voluntary groups for paid work because of the economic pressure and they continue to hang onto their job even though they do not like it.

Given the importance of voluntary participation and the development of higher education over the population, is there any solution to the problem of promoting female participation in voluntary groups without compromising gender equality in employment or female economic independence? This chapter suggests that fixed-time working, weekend working, and night shifts are important factors via which the adverse education effect goes to female membership. In this perspective, voluntary participation should benefit from a decline in weekend working or night working. Policy makers can also promote voluntary participation by creating more jobs with flexible working hours. Restrictions in work intensity and weekly working hours, especially with respect to working overtime, should also be beneficial for voluntary participation.

Appendix 6 Coding of variables and additional findings in empirical studies

Appendix 6A Coding of variables

6A.1 Coding of indicator of group membership

The dummy indicator of joining social groups is coded as 1, which means being in at least on one of the following social groups; and 0 otherwise (see Table 6A.1).

Table 6A.1 Categories of social groups

-
1. Environmental charity/voluntary
 2. Other charity/voluntary groups
 3. Parents'/school organizations
 4. Tenants'/residents' associations
 5. Women's groups/institutes
-

6A.2 Classification of Higher education

Qualifications for Higher education — HNC/HND, SHNC/SHND; TEC/BEC or SCOTEC/ SCOTBEC higher or higher national certificate or diploma; professional qualification; nursing qualification including NNEB; polytechnic qualification; university certificate or diploma; first degree; postgraduate diploma; higher degree.

Adjustments to guarantee the sequential nature of the educational variable — It is thus essential that higher education also has a preceding lower level of education, which is almost universally true of people who have undertaken an academic route, and this is imposed in the model. It is, however, not necessarily true for individuals who have undertaken vocational routes. If this is the case, their qualification is downgraded by one level to maintain the sequential structure. Specifically: if someone has a first degree or a postgraduate qualification, it is assumed they have all the lower qualifications; if someone has one of the other (i.e. vocational) higher education qualifications but not an A-level or equivalent qualification, their qualification is downgraded to that of the non-higher education.

6A.3 Explanatory variables in membership equation

All covariates are extracted from the 1973-1974 survey except for the basic demographic information and natal health information, which are extracted from the 1958 birth survey. Mid-life information is also collected from the 2000 survey to further investigate the gender-specific education effects.

Information from the 1958 survey:

1. Dummy indicator of parent-reported ethnic group: 1-white, 0-other.
2. Dummy indicator of midwife-reported being low birth weight infant: 1-less than 2500 grams, 0-other.
3. Dummy indicators of the mother-reported breastfeeding habit, whether she was breastfeeding for 3 months and whether she was breastfeeding for less than one month, reference group—breastfeeding for 3 months.
4. Dummy indicators of whether natural parents were younger than 20 in 1958: 1- at least 20 years old; 0-otherwise.
5. Mother-reported smoking behavior during pregnancy: 0-never, 1-seldom, 2-occasionally, 3-often.

Information from the 1973-1974 survey:

6. Six dummy indicators are created for the respondent's self-reported number of siblings in 1974: no

sibling, one sibling, two siblings, three siblings, four siblings, five and more than five siblings; reference group—no sibling.

7. Dummy indicator of whether father was employed in 1974: Six dummy indicators are created for father's social class in 1974 if employed: professional, managerial, non-manual skilled, manual skilled, semi-skilled, unskilled, unemployment; reference group – professional group.

8. Dummy indicator of whether mother was employed in 1974: Six dummy indicators are created for mother's social class in 1974 if employed: professional, managerial, non-manual skilled, manual skilled, semi-skilled, unskilled, unemployment; reference group – professional group.

9. Father's and mother's self-reported age on leaving full-time education with a range of 0-9: 0-under 13 years old; 9-23 years old or older; interaction of parental age on leaving full-time school is also created to capture the influence of parental education.

10. Teacher-rated ability in math and five dummy variables for teacher-rated ability in reading at the age of 16: 0-little ability, 1-below average, 2-average, 3-above average, 4-high ability. Interaction is created for teacher-rated abilities to capture effects of academic abilities.

11. Dummy indicator of parent-reported whether individual suffers non-accidence hospitalization since age 11: 1-yes, 0-otherwise.

12. Dummy indicator of physician-assessed chronic health conditions by age 16: 1-chronic conditions positive, 0-otherwise.

13. Dummy indicators of physician-reported whether the male cohort member has a height lower than 160cm and the female has a height lower than 150cm at the age of 16: 1-lower, 0-otherwise.

14. Dummy variable of parent-reported illness of asthma and bronchitis: 1-suffered from asthma and bronchitis, 0-otherwise.

15. Three dummy indicators of teacher-reported being absent from school for trivial reason: often absent for trivial reason; ever absent for trivial reason; never absent for trivial reason; reference group – never absent for trivial reason.

16. Three dummy indicators of parent-reported seriousness of aching or vomiting: often aching or vomiting, sometimes aching or vomiting, never aching or vomiting; Reference group – never aching or vomiting.

17. Teacher-reported number of pupils at school rounded to a hundred; square number is also created in case of non-linear effect.

18. Teacher-reported teach/student ratio according to teacher-reported school enrollment and number of full-time teachers.

19. Teacher-reported ratio of expelled student/total student.

20. Self-reported voluntary participation behavior at age 16: 0-never participating, 1-seldom participating, 2-occasionally participating, 3-often participating.

21. Five dummy indicators of teacher-reported parental interest in the education of their child (or survey respondent): over concern, very interested, cannot say, with some interest, with little interest; reference group – with little interest.

22. Parent-reported number of family members and its square term to capture the potential non-linear effect.

23. Eight category indicators of the illnesses parent-reported for absence from school: bronchitis, asthma, convulsion, headache, emotional problem, abdominal pain, infectious disease, diarrhea, and other illnesses except for sore throat, accidental injury and a cold; reference group—sore throat, accidental injury and a cold.

6A.4 Information from the 2000 survey—employment status and employment attitudes

1. Dummy indicator of whether the respondent was employed: 1-yes, 0-otherwise.

2. Dummy indicator of whether the respondent was self-employed: 1-yes, 0-otherwise.

3. Dummy indicator of whether the respondent had a fixed-time job: 1-yes, 0-otherwise.

4. Dummy indicator of whether the respondent worked on the weekend once a week: 1-yes, 0-otherwise.

5. Dummy indicator of whether the respondent worked at night frequently: 1-yes, 0-otherwise.

6. Dummy indicator of whether the respondent had a permanent job: 1-yes, 0-otherwise.

7. Dummy indicator of whether the respondent work 40 hours or more than 40 hours a week: 1-yes, 0-otherwise.

8. Dummy indicator of whether the respondent had additional income: 1-yes, 0-otherwise.

9. The respondent agreed that any job is better than being unemployed: 0-strong disagree, 1-disagree, 2-uncertain, 3-agree, 4-strongly agree.

10. The respondent agreed that children benefit if mother has job outside home: 0-strong disagree,

1-disagree, 2-uncertain, 3-agree, 4-strongly agree.

11. The respondent agreed that a mother and family happier if she goes out to work: 0-strong disagree, 1-disagree, 2-uncertain, 3-agree, 4-strongly agree.

12. The respondent agreed that mother should take time off work if a child is ill: 0-strong disagree, 1-disagree, 2-uncertain, 3-agree, 4-strongly agree.

13. The respondent agreed that important to hang onto job even if unhappy: 0-strong disagree, 1-disagree, 2-uncertain, 3-agree, 4-strongly agree.

14. The respondent agreed that pre-school children suffer if mother works: 0-strong disagree, 1-disagree, 2-uncertain, 3-agree, 4-strongly agree.

Appendix 6B Additional findings in empirical studies

6B.1 Robustness tests on missing data of key covariates.

Table 6B.1 Robustness tests on missing data of key covariates

	<i>ATE</i> (probability change)		Endogeneity test
A. Robustness test on male sample	coef.	s.e.	p-value
Excluding missing data of father’s education	0.188	0.109**	0.284
Excluding missing data of mother’s education	0.186	0.108**	0.271
Excluding missing data of father’s social class	0.242	0.016**	0.141
Excluding missing data of mother’s social class	0.153	0.103*	0.451
Excluding missing data of math ability	0.171	0.110*	0.349
Excluding missing data of reading ability	0.098	0.096	0.789
Excluding missing data of change of parent	0.152	0.110*	0.447
N	4326		
A. Robustness test on female sample	coef.	s.e.	p-value
Excluding missing data of father’s education	-0.054	0.067	0.018
Excluding missing data of mother’s education	-0.050	0.066	0.019
Excluding missing data of father’s social class	-0.075	0.064	0.010
Excluding missing data of mother’s social class	-0.060	0.064	0.012
Excluding missing data of math ability	-0.066	0.065	0.013
Excluding missing data of reading ability	-0.062	0.065	0.014
Excluding missing data of change of parent	-0.024	0.076	0.067
N	4720		

Note: *significant at the 10% level; **significant at the 5% level; ***significant at the 1% level. The coefficients and standard errors are reported from bootstrapping (500 repetitions)

6B.2 Pearson test for the correlation between membership outcome and mid-life information

Table 6B.2 Pearson test for the correlation between membership outcome and mid-life information

	Male		Female	
	coef.	s.e.	coef.	s.e.
A. Correlation with employment characteristics				
Employed	0.01	0.46	-0.03	0.04
Permanently employed	0.01	0.55	-0.06	0.00
Work on weekend every week	-0.05	0.00	-0.04	0.00
Fixed working hours required in job	-0.06	0.00	-0.03	0.04
Night shift often required	-0.05	0.00	-0.04	0.00
B. Correlation with employment attitudes				
Any job is better than being unemployed	-0.03	0.07	-0.07	0.00
Important to stay in job even if unhappy	-0.01	0.55	-0.04	0.01
Mother and family benefit from a working mother	-0.03	0.04	-0.01	0.37

Chapter 7

Conclusions

Social capital is considered an important asset for individuals, groups, communities and society because it is related to individual health and socio-economic status, and it affects the crime rate, social cohesion, and social welfare. Education is commonly considered as one of the most important determinants of individual social capital. The extent of the effect of education is, however, an under-studied topic. The purpose of this dissertation was to provide a detailed description the formation of individual social capital and the role of education.

The meta-analysis in chapter 2 showed that one standard deviation of years of schooling accounts for the change in individual social capital by 12-16 percent of the standard deviation in each of its two dimensions: individual social trust, and individual social participation. Gender differences play a role in the mechanism by which education affects social capital. Schooling endogeneity is a critical source of variation of study estimates of social participation, but it does not have any impact in study estimates of social trust. In the meta-analysis, the size of the schooling effect varies with the level of education. Effect sizes are significantly higher for people with a college degree or above. Source of data, controlling for a reciprocity mechanism between the two dimensions of individual social capital, and controlling for the relative effect of education, all turn out to influence the estimates of educational returns.

In order to provide more information on the return to schooling on individual social capital, the one-factor model and the single treatment model are applied to the data set of National Child Development Study (NCDS) to explore the causal relations between social capital factors in early childhood, education and social capital in adulthood, with emphasis on the problem of education endogeneity.

The one-factor model evaluation was performed in Chapter 3 as a reference study. This evaluation suggested that family relations in early childhood are critical in the generation of social capital and education. Schooling has a significant and positive effect in building social trust. There was no convincing evidence from the evaluation to support the positive role of education in promoting social participation involvement, and the estimates were negative in the IV regression model. Education endogeneity turned out to be a major cause for the upward bias in the simple regression model. A further analysis with adolescent information confirmed

that unobserved personality traits and abilities simultaneously affect both education and social participation outcomes.

Chapter 4 provided an illustration of the control functions probit (CFP) and the bivariate probit (BVP) methods and justified the application of these methods in tackling the endogenous relation between a binary treatment variable and a binary outcome variable. The simulation practices showed that the BVP method produces a consistent estimator in this framework, while the CFP method produces an approximate of the bivariate probit estimator at a considerably lower computational cost. These two methods are major approaches in the single treatment framework to isolate the real effects of education on individual social capital from the influence of confounding variables.

Chapters 5 and 6 quantified, respectively, the causal effect of college education on social trust and the causal effect of higher education on membership of voluntary groups. The evaluations based on the single treatment models produced qualitatively similar conclusions to the evaluation based on the one-factor model. These evaluations share the finding that education is a key factor in augmenting individual social trust, while it is not necessarily a positive determinant of the female voluntary participation level in the long term. The single treatment models and the one-factor model also produce identical conclusions on education endogeneity. However, these evaluations did not offer evidence to support the finding from the meta-analysis that college or higher education is more efficient than lower education in developing social trust and promoting social participation. The effect size of the return to a marginal year of schooling from the single treatment evaluation of college/higher education is similar to the effect size obtained from the one-factor model evaluation of schooling years in Chapter 3.

Chapters 5 and 6 examined the potential gender difference in the relation between education and social capital. It turned out that education posts much higher returns for men than for women on both dimensions of individual social capital. The education effect is even negative for women in the study of membership of voluntary groups, whilst there is a strongly positive estimate for men in the studies of social trust and social participation. These findings are consistent with the conclusions from the meta-analysis in Chapter 2 on the gender-specific effects of education.

The analyses in Chapter 5 indicate that college education experience has a direct and lasting effect on the two basic dimensions of individual social trust – individual perception of social environment, and individual moral values. The investigation suggests that social trust as a perception of social uncertainty and fairness is strongly correlated with social

development, and with individual standing in the social environment. It was also confirmed that economic status is an intermediate outcome on the causality from education to the formation of social trust.

The analyses in Chapter 6 indicated that the gendered patterns of workforce participation and social participation are important factors for the divergence in the transitions of higher education and social participation behavior in Western countries. High-educated women are more motivated than low-educated women to pursue economic independence and enter the workforce. The changing gender attitudes and the rapid entry of women into the labor force weaken the role of social participation in achieving personal values and fulfilling social responsibilities. Since women are traditionally the main force in the voluntary sector related to community services, the level of voluntary participation is not promoted by the increase of the education level over the population or by the increase of gender equality in higher education, as high-educated women are less likely to join voluntary groups.

Overall, the empirical findings in this dissertation reveal that schooling variance is a key source of variation in individual social capital outcomes, directly or indirectly. The associations between social capital outcomes and individual standing or bearing in society are not identical, especially when the gender factor is accounted for. Therefore, we observed substantial gender differences in the effects of education on social capital outcomes.

This dissertation suggests that intensification of labor force participation and the increasing economic pressure for two-career families are adversely impacting on both dimensions of individual social capital. Increased pressure from the workplace decreases satisfaction with the job, lowers perception of personal happiness, and diverts available time or energy away from voluntary participation. In this perspective, the social capital stock should benefit from a decrease in work intensity and overtime working. Policy makers can promote social participation by creating more jobs with less working hours and providing flexible working schedule without compromising gender equality in employment or female economic independence. Policy-makers can also contribute to the building of social trust by devoting efforts to achieving racial equality in the labor market and the fair distribution of social wealth.

Reference

- Abadie, A. (2003). Semiparametric Instrumental Variable Estimation of Treatment Response Models. *Journal of Econometrics* 113(2): 231–263.
- Alesina, A. and La Ferrara, E. (2000a) Participation in Heterogeneous Communities. *The Quarterly Journal of Economics* 115(3), 847-904.
- Alesina A. and La Ferrara E. (2000b) The Determinants of Trust. NBER working paper 7621.
- Alesina A. and La Ferrara E. (2002) Who trusts others? *Journal of Public Economics* 85(2), 207-234.
- Angrist, J. D. (1998) Estimating the Labour Market Impact of Voluntary Military Service Using Social Security Data on Military Applicants. *Econometrica* 66(2), 249-288.
- Angrist, J. D., Imbens, G. W. and Rubin, D. B. (1996). Identification of Causal Effects Using Instrumental Variables. *Journal of the American Statistical Association* 91(434): 444-45.
- Angrist, J. D. and Krueger, A. B. (1991) Does Compulsory School Attendance Affect Schooling and Earnings? *The Quarterly Journal of Economics* 106(4), 979-1014.
- Ashenfelter, O., Harmon, C. and Oosterbeek, H. (1999) A review of Estimates of the Schooling/ Earnings Relationship, with Tests for Publication Bias. *Labour Economics* 6, 453-470.
- Baumann, P. (2000) Sustainable livelihoods and political capital: Arguments and evidence from decentralisation and natural resource management in India. *ODI Working Paper 136*, ODI: London. <http://www.odi.org.uk>
- Begg, C. B. and Mazumdar, M. (1994) Operating Characteristics of a Rank Correlation Test for Publication Bias. *Biometrics* 50, 1088-1101.
- Bekker, R., Volker, B., van der Gaag, M., and Flap, H. (2008) Social Networks of Participatants in Voluntary Associations. In: L. Nan, and B. H. Erickson (eds), *Social Capital: An International Research Program*. Oxford: Oxford University Press.
- Blundell, R., Dearden, L. and Sianesi, B. (2005) Evaluating the Impact of Education on Earnings in the UK: Models, Methods and Results from the NCDS. *Journal of the Royal Statistical Society Series A* 168(3), 473-512.
- Bhattacharya, J., Goldman, D. and McCaffrey, D. (2006). Estimating Probit Models with Self-selected Treatments. *Statistics in Medicine* 25(3), 389-413.
- Bourdieu, P. and Passeron, J. C. (1977) *Reproduction in Education, Society and Culture*. London: Sage.
- Bourdieu, P. (1986) The forms of capital. In: J. Richardson (ed.) *Handbook of Theory and Research for the Sociology of Education*. New York: Greenwood Press.
- Bourdieu, P. (1993). *Sociology in Question*. London: Sage.
- Bryant, W. K. and Cathleen D. Z. (1996) An Examination of Parent-Child Shared Time. *Journal of Marriage and the Family* 58(1): 227 – 37.
- Brehm, J. and Rahn, W. (1997) Individual-Level Evidence for the Causes and Consequences of Social Capital. *American Journal of Political Science* 41: 99-1023.
- Camp, W. G. (1990) Participation in Student Activities and Achievement: A Covariance Structural Analysis. *The Journal of Educational Research* 83(5): 272-279.
- Card, D. (1999) The Causal Effect of Education on Earnings. In: O. Ashenfelter and D. Card (eds) *Handbook of Labor Economics*, vol. 3, Amsterdam: Elsevier, 1801-1863.
- Case, A., Fertig, A. and Paxson, C. (2003). From Cradle to Grave? The Lasting Impact of Childhood Health and Circumstance. NBER working paper 9788.
- Case, A., Fertig, A. and Paxson, C. (2005) The lasting impact of childhood health and circumstance. *Journal of Health Economics* 24(2), 365-389
- Choi, L.H. (2003) Factors Affecting Volunteerism among Older Adults. *The Journal of Applied Gerontology* 22(2), 179-196.

- Claibourn, M. P. and Martin, P. S. (2000) Trusting and Joining? An Empirical Test of the Reciprocal Nature of Social Capital. *Political Behavior* 22(4), 267-291.
- Coleman, J. (1988) Social Capital in the Creation of Human Capital. *American Journal of Sociology* 94 (Supplement), 95-120.
- Coleman, J. S. (1990a) *Foundation of Social Theory*. Cambridge, MA: Harvard University Press.
- Coleman, J. S. (1990b) How Worksite Schools and other Schools Reforms can Generate Social Capital: An Interview with James Coleman. *American Federation of Teachers* 14(2), 35-45.
- Coleman, J. (1994) Social Capital, Human Capital and Investment in Youth. In: A. C. Petersen and J. Mortimer (eds), *Youth Unemployment and Society*. Cambridge: Cambridge University Press.
- Collier, P. (1998) Social Capital and Poverty. *Social Capital Initiative Working Paper* no. 4, Washington DC: the World Bank.
- Cooper, H. and Hedges, L. V. (1994) *The Handbook of Research Synthesis*. Russel Sage Foundation, New York.
- Cote, S. and Healy, T. (2001) *The Well-being of Nations. The role of human and social capital*. Organisation for Economic Co-operation and Development, Paris.
- Cutler, S. J. and Hendricks, J. (2000) Age Differences in Voluntary Association Memberships: Fact or Artifact. *Journal of Gerontology: Social Sciences* 55B(2), 98-107.
- Dawson, D. (1991) Family structure and children's health and wellbeing: Data from the 1988 National Health Interview Study on Child Health. *Journal of Marriage and the Family* 59: 573-584.
- Dee, T. S. (2003). Are There Civic Returns to Education? NBER working paper 9588.
- Dekker, P. and Uslaner, E. M. (2001). *Social Capital and Participation in Everyday Life*. London: Routledge.
- Denny, K. (2003) The Effects of Human Capital on Social Capital: a Cross-Country Analysis IFS Working Papers W03/16, Institute for Fiscal Studies. <http://www.ifs.org.uk/wps/wp0316.pdf>
- DiMaggio, P. (1982) Cultural Capital and School Success. *American Sociological Review* 47, 189-201.
- DiPasquale, D. and Glaeser, E. L. (1999) Incentives and Social Capital: Are Homeowners Better Citizens? *Journal of Urban Economics* 45(2), 354-384.
- Enns, S., Malinick, T., And Matthews, R. (2008) It's Not Only Who You Know, It's Also Where They Are: Using the Position Generator to Investigate the Structure of Access to Embedded Resources. In: L. Nan, and B. H. Erickson (eds), *Social Capital: An International Research Program*. Oxford: Oxford University Press.
- Egger, M., Smith, G. D., Schneider, M. and Minder, C. (1997) Bias in Meta-Analysis Detected by a Simple, Graphical Test. *British Medical Journal* 315, 629-634.
- Ermisch, J. and Francesconi, M. (2001a) Family Structure and Children's Achievements. *Journal of Population Economics* 14(2), 249-270.
- Ermisch, J. and Francesconi, M. (2001b) Family Matters: Impacts of Family Background on Educational Attainments. *Economica*, 68, 137-156.
- Feinstein, L., Hammond, C., Woods, L., Preston, J., and Bynner, J.(2003). Wider Benefits of Learning Research Report no. 8. Centre for Research on the Wider Benefits of Learning.
- Flap, H. (2004) Creation and returns of social capital. In: H. Flap, and B. Volker (eds) *Creation and returns of Social Capital*. London: Routledge, pp. 3-24.
- Flap, H. and Boxman, E. (2001) Getting started: the influence of social capital on the start of the occupational career. In: N. Lin, K. Cook, and R. S. Burt, (eds) *Social capital: theory and research*. New York: Aldine De Gruyter, 159 -184.
- Froelich, M. (2007). Nonparametric IV Estimation of Local Average Treatment Effects with Covariates. *Journal of Econometrics* 139(1), 35-75.
- Froelich, M. and Melly, B. (2008). Estimation of Quantile Treatment Effects With STATA. Mimeo.
- Fukuyama, F. (1995). *Trust: Social Virtues and the Creation of Prosperity*. NY: Free Press.

- Fukuyama, F. (1999), *The Great Disruption: Human Nature and the Reconstitution of Social Order*, Free Press, New York.
- Funk, L. (1998) Practicing What I Preach? The Influence of Societal Interest Value On Civic Engagement. *Political Psychology* 19 (3), 601-614.
- Gamson, W. A. (1992) The social psychology of collective action. In: A. Morris and C. Mueller (eds), *Frontiers of social movement theory*. New Haven: Yale University Press, pp. 53–76.
- Gesthuizen, M., de Graaf, P. M. and Kraaykamp, K. (2005) The Changing Family Backgrounds of the Low-Educated in the Netherlands: Socio-economic, Cultural, and Socio-demographic Resources. *European Sociological Review* 21(5), 441-452.
- Gibson, J. (2001) Unobservable family effects and the apparent external benefits of education. *Economics of Education Review* 20, 225-233.
- Glaeser, L. (2001) The Formation of Social Capital. *Canadian Journal of Policy Research* 2 (1), 34-40.
- Glaeser, L. and Sacerdote, B. (2000) The Social Consequences of Housing. *NBER working paper* 8034.
- Glaeser, E.L. and Sacerdote, B. (2001) Education and Religion. *NBER working paper* 8080.
- Glaeser, E. L., Laibson, D., Scheinkman, J. A. and Scoutter, C. L. (1999) What is Social Capital, the Determinants of Trust and Trustworthiness. *NBER working paper* 7216.
- Glaeser, E. L., Laibson, D., Scheinkman, J. A. and Scoutter, C. L. (2000) Measuring Trust. *The Quarterly Journal of Economics* 115(3), 811-46.
- Glaeser, E. L., Laibson, D. and Sacerdote, B. (2002) An Economic Approach to Social Capital. *Economic Journal* 112 (483), 437-458.
- Glass, V. (1976) Primary, secondary, and meta-analysis of research. *Educational Researcher* 5: 3-8.
- Gregg, P., Washbrook, E., Propper, C. and Burgess, S. (2005) The Effects of a Mother's Return to Work. Decision on Child Development in the UK. *The Economic Journal* 115(501), 49-80.
- Grootaert, C. (1998) Social Capital: The Missing Link? Social Capital Initiative Working Paper no. 3, Washington DC: the World Bank.
- Grootaert, C. and Van Bastelaer, T. (2001) Understanding and measuring social capital: a synthesis of findings and recommendations from the Social Capital Initiative. *Social capital Initiative Working Paper* no. 24. Washington, D.C.: The World Bank.
- Haan, M. D. (2009) Family Background and Children's Schooling Outcomes, Doctoral dissertation. University of Amsterdam.
- Han, W., Waldfogel, J. and Brooks-Gunn, J. (2001) The Effects of Early Maternal Employment on Later Cognitive and Behavioural Outcomes. *Journal of Marriage and the Family* 63, 336-354.
- Harmon, C. and Walker, I. (1995). Estimates of the Economic Return to Schooling for the UK. *American Economic Review* 85, 1278-1286.
- Hauser, S. (2000) Education, Ability, and Civic Engagement in the Contemporary United States. *Social Science Research* 29 (4), 556-582.
- Heckman, J. (1978) Dummy Endogenous Variables in a Simultaneous Equation System. *Econometrica* 46 (6), 931-959.
- Heckman, J. and Navarro-Lozano, S. (2004) Using Matching, Instrumental Variables and Control Functions to Estimate Economic Choice Models. *Review of Economics and Statistics* 86 (1), 30-57.
- Hedges, L.V. (1992) Modeling publication selection effects in meta-analysis. *Statistical Science* 7, 246-55.
- Helliwell, J. F. (2001) Social Capital, the Economy and Well-Being. In: K. Banting, A. Sharpe and F. St-Hilaire (eds), *The Review of Economic Performance and Social Progress* 43-60. Available on www.csls.ca/rep/1/03-helliwell.pdf
- Helliwell, J. F. and Putnam, R. D. (1999) Education and Social Capital. *NBER working paper* No.7121.
- Hirano, K., Imbens, G., Rubin, D. and Zhou, X. (2000) Causal Inference in Encouragement Designs with Covariates. *Biostatistics* 1: 69–88.

- Hooghe, M. (2003) Why should I be bowling alone? Results from a Belgian survey on civic participation. *International journal of voluntary and nonprofit organizations* 14 (1), 41-59.
- House, J. S., Landis, K. R. and Umberson, D. (1988). Social relationships and health. *Science*, 241(4865), 540-545.
- Huang, J., Maassen van den Brink, H. and Groot, W. (2009) A Meta Analysis of the Effect of Education on Social Capital. Forthcoming in *Economics of Education Review* 28(4), 454-464
- Huang, J., Maassen van den Brink, H. and Groot, W. (2010a) Higher Education and membership of voluntary groups. Working paper.
- Huang, J., Maassen van den Brink, H. and Groot, W. (2010b) College education and Social Trust Formation. Working paper.
- Hughey, J., Speer, P. and Peterson, N. (1999). Sense of community in community organizations: Structure and evidence of validity. *Journal of Community Psychology* 27(1): 97-113.
- Ibáñez, A., Lindert, K. and Woolcock, M. (2002) Social Capital in Guatemala: A Mixed Methods Analysis. Technical Background Paper No. 12, prepared for the Guatemala Poverty Assessment. Washington, D.C.: The World Bank.
- Imbens, G. and Angrist, J. (1994). Identification and Estimation of Local Average Treatment Effects. *Econometrica* 62(2): 467-475.
- Jimenez, E. and Kugler, B. (1987) The Earnings Impact of Training Duration in a Developing Country. *The Journal of Human Resources* 22(2):228-247.
- Johansson-Stenman, O., Mahmud, M. and Martinsson, P. (2005) Does stake size matter in trust games? *Economics Letters* 88 (3), 365-69.
- Kang, N. and Kwak, N. (2003) A Multilevel Approach to Civic Participation. *Communication Research* 30 (1), 80-106.
- Knack, S. (1992) Civic Norms, Social Sanctions and Voter Turnout. *Rationality and Society* 4(1), 133-56.
- Knack, S. and Keefer, P. (1997) Does Social Capital have an Economic Payoff? A Cross-country Investigation. *Quarterly Journal of Economics* 112 (4), 1251-1288.
- Knoke, D. (1990) Networks of Political Action: Toward Theory Construction. *Social Forces* 68, 1041-1065.
- La Ferrara, E. (2002) Inequality and Group Participation: Theory and Evidence from Rural Tanzania. *Journal of Public Economics* 85 (2), 235-273.
- La Porta, R., Lopez-de-Silanes, F., Shleifer, A. and Vishny, W. (1997) Trust in Large Organizations. *American Economic Review* 87 (2), 333-38.
- Lederman, D. (2005) Income, Wealth, and Socialization in Argentina, *Cuadernos de Economía* 42 (Mayo), 3-30.
- Lee, G., Cappella, J. and Southwell B. (2003) The Effects of News and Entertainment on Interpersonal Trust: Political Talk Radio, Newspapers, and Television. *Mass Communication and Society* 6 (4), 413-434.
- Leigh, A. (2003). Entry on "Trends in Social Capital", prepared for Karen Christensen and David Levinson (eds) (2003) *Encyclopedia of Community: From the Village to the Virtual World*. Thousand Oaks, CA: Sage.
- Leigh, A. (2006) Trust, Inequality, and Ethnic Heterogeneity. *The Economic Record* 82(258), 268-280.
- Letki, N. (2008) Does Diversity Erode Social Cohesion? Social Capital and Race in British Neighbourhoods. *Political Study* 56(1), 99-126
- Levinson, K. (2004) Internet Use and Social Capital in Six European Countries. Working Paper. <http://www.srcosmos.gr/srcosmos/showpub.aspx?aa=5590>
- Li, Y., Savage, M. and Pickles, A. (2003) Social Inequalities and Associational Involvement in England and Wales (1972-1999). *British Journal of Sociology* 54 (4), 497-526.
- Lin, N. (2001) *Social Capital: A Theory of Structure and Action*. Cambridge University Press.

- Lin, N. and Erickson, B. H. (2008) *Social Capital: an International Program*. Oxford University Press.
- Liu, A. Q. and Besser, T. L. (2003) Social Capital and Participation in Community Improvement Activities by the Elderly in Small Towns and Rural Communities. *Rural Sociology* 68(3), 343–365.
- Manski, C. F. (1997) Monotone Treatment Response, *Econometrica* 65(6), 1311-1334
- Manski, C. F. and Pepper, J. V., (2000) Monotone Treatment Response, With an Application to the returns to schooling, *Econometrica* 68, 997-1012.
- Marshall, M. and Stolle, D. (2004) Race and the City: Neighborhood Context and the Development of Generalized Trust. *Political Behavior* 26 (2), 125-154.
- McCulloch, A. and Joshi, H. (2002) Child Development and Family Resources: Evidence from the Second Generation of the 1958 British Birth Cohort. *Journal of Population Economics* 15(2), 283-304.
- McPherson, J. M. and Smith-Lovin, L. (1982). Women and Weak Ties: Differences by Sex in the Size of Voluntary Organizations. *The American Journal of Sociology* 87 (4), 883-904.
- Milligan, K., Moretti, E. and Oreopoulos, P. (2003) Does Education Improve Citizenship? Evidence from the U.S and the U.K. NBER working paper 9584.
- Newton, K. (2001a) Social Trust and Political Disaffection: Social Capital and Democracy. Paper prepared for the EURESCO Conference on Social Capital: Interdisciplinary Perspectives Exeter. Available on <http://huss.exeter.ac.uk/politics/research/socialcapital/papers/newton.pdf>.
- Newton, K. (2001b) Trust, social capital, civil society and democracy. *International Political Science Review* 22(2), 201-14.
- Nie, N. H., Junn, J., and Stehlik-Bany, K. (1996) *Education and Democratic Citizenship in America*. Chicago, University of Chicago Press.
- Norris, P. (1996) Does Television Erode Social Capital: A Reply to Putnam. *Political Science and Politics* 29(3), 474-480.
- OECD (2001) *OECD Employment Outlook 2001*, Paris
- OECD (2007) *OECD Education at a Glance 2007*, Paris
- Offe, C. and Fuchs, S. (2002) A decline of social capital? The German case. In: Robert D. Putnam (ed.) *Democracies in Flux: the evolution of social capital in contemporary society*. Oxford: Oxford University Press, 189-244
- Parcel, T. and Menaghan, E. (1993) Family social capital and children's behavior problems. *Social Psychology Quarterly* 56, 120-135
- Patricia, M., Scheufele, D. and Holbert, R. (1999) Television Use and Social Capital: Testing Putnam's Time Displacement Hypothesis. *Mass Communication and Society* 2, 27-45
- Pattie, C., Seyd, P. and Whiteley, P. (2003) Citizenship and Civic Engagement: Attitudes and Behaviour in Britain. *Political Studies* 51(3), 443–468.
- Paxton, P. (1999). Is social capital declining in the United States? A multiple indicator assessment. *American Journal of Sociology* 105 (1999): 88–127.
- Pearl, J. (2000) *Causality: Models, Reasoning, and Inference*. Cambridge University Press.
- Portes, A. (1998) Social Capital: Its Origins and Applications in Modern Sociology. *Annual Review of Sociology* 24, 1-24.
- Putnam, R. (1995a) Bowling Alone: America's Declining Social Capital. *The Journal of Democracy* 6(1): 65-78.
- Putnam, R. (1995b) Tuning In, Tuning Out: The Strange Disappearance of Social Capital in America. *Political Science and Politics* 28, 664-684.
- Putnam, R. (1996) Tuning In, Tuning Out: The Strange Disappearance of Civic America. *American Prospect* 7(24).
- Putnam, R. (2000) *Bowling Alone: The Collapse and Revival of American Community*. New York: Simon and Schuster.

- Putnam, R., Leonardi, R. and Nanetti, R. (1993) *Making Democracy Work: Civic Traditions in Modern Italy*. Princeton, NJ: Princeton University Press.
- Rahn, W., Yoon, K., Garet, M., Lipson, S. and Loflin, K. (2003) Geographies of Trust. Paper presented at the 58th Annual Meeting of the American Association for Public Opinion Research, Nashville, TN.
- Robinson, J. (1993). *The demographics of time*. Ithaca, NY: American Demographics.
- Rothstein, B. (2001) Creating Trust from Above: Social Capital and Institutional Legitimacy. Paper presented at the conference on "Corruption in contemporary politics".
- Rothstein, B. and Uslaner, E. (2005) All for All: Equality and Social Trust. *World Politics* 58(1), 41-72.
- Roy, A. (1951) Some Thoughts on the Distribution of Earnings. *Oxford Economic Papers* 3, 135-146.
- Rubin, D. (1974) Estimating Causal Effects of Treatments in Randomized and Nonrandomized Studies. *Journal of Educational Psychology* 66, 668-701.
- Ruhm, C. J. (2005) Maternal Employment and Adolescent Development. IZA Discussion Paper 1673.
- Scheufele, D. and Shah, D. (2000) Personality Strength and Social Capital: The Role of Dispositional and Informational Variables in the Production of Civic Participation. *Communication Research* 27(2), 107-131.
- Schmidt, P. and Ann D. (1984) *An Economic Analysis of Crime and Justice*. Orlando, FL: Academic Press.
- Schneider, B. and Coleman, J. (1993) *Parents, Their Children and School*. Boulder: Westview.
- Shah, D. (1998) Civic Engagement, Interpersonal Trust, and Television Use: An Individual Level Assessment of Social Capital. *Political Psychology* 19(3), 469-496.
- Shah, D., Kwak, N. and Holbert, R. (2001) 'Connecting' and 'Disconnecting' with Civic Life: Patterns of Internet Use and the Production of Social Capital. *Political Communication* 18(2), 141-162.
- Sieben, I. and de Graaf, P. (2004) Schooling and Social Origin? The Bias in the Effect of Educational Attainment on Social Orientation. *European Sociological Review* 20(2): 107-122.
- Stoneman, P. and Anderson, B. (2006) Social Capital, Quality of Life, Employment and ICTs. Chimera Working Paper Number: 2006-04. Available on <http://www.essex.ac.uk/chimera/content/pubs/wps/CWP-2006-04-Soc-Cap-Qol-Empl-ICTs.pdf>
- Tang, F. (2006) What Resources Are Needed for Volunteerism? A Life Course Perspective. *Journal of Applied Gerontology* 2(5), 375-390.
- Taniguchi, H. (2006) Men's and Women's Volunteering: Gender Differences in the Effects of Employment and Family Characteristics. *Nonprofit and Voluntary Sector Quarterly* 35, 83-101.
- Thoits, P. A. and Hewitt, L. N. (2001). Volunteer Work and Well-Being. *Journal of Health and Social Behavior* 42(2): 115-131.
- Tiehen, L. (2000) Has Working More Caused Married Women to Volunteer Less? Evidence from Time Diary Data 1965 to 1993. *Nonprofit and Voluntary Sector Quarterly* 29(4), 505-529.
- Uslaner, E. (1997) Voluntary Organization Membership in Canada and the United States. Working Paper. Available on <http://www.bsos.umd.edu/gvpt/uslaner/acsus97.pdf>
- Uslaner, E. (1998) Social Capital, Television and the Mean World, Trust, Optimism and Civic Participation. *Political Psychology* 19(3), 441-467.
- Uslaner, E. (1999). Morality Plays: Social Capital and Moral Behavior in Anglo-American Democracies. In: J. Deth, M. Maraffi, K. Newton, and P. Whiteley (eds), *Social capital and European democracy*. London: Routledge, 213-239.
- Uslaner, E. (2003) Trust and Civic Engagement in East and West. *Social Capital and the Transition to Democracy*. London: Routledge, 81-95.
- Uslaner, E. (2004) Trust, Civic Engagement, and the Internet. *Political Communication* 21(2), 223-242.
- Waldfoegel, J., Han, W., and Brooks-Gunn, J. (2002) The Effects of Early Maternal Employment on Child Cognitive Development. *Demography* 39(2):369-392
- Weber, M. ([1914] 1978) *Economy and Society*. Berkeley: University of California Press.

- Wellman, B., Haase, A. Q., Witte, J. and Hampton, K. (2001) Does the Internet Increase, Decrease, or Supplement Social Capital? Social Networks, Participation, and Community Commitment. *American Behavioral Scientist* 45(3), 436-455.
- Whiteley, Paul. (2000) Economic Growth and Social Capital. *Political Studies* 48(3), 443-466.
- Wilson, J. and Musick, M. (1997) Who Cares? Toward an Integrated Theory of Volunteer Work. *American Sociological Review* 62(5), 694-713.
- Wollebæk, D. and Selle, P. (2003) Participation and social capital formation: Norway in a Comparative Perspective. *Scandinavian Political Studies* 26(1), 67-91.
- Wooldridge, J. M. (1997) On Two Stage Least Squares Estimation of the Average Treatment Effect in a Random Coefficient Model. *Economics Letters* 56, 129-133.
- Wooldridge, J. M. (2002) *Econometric Analysis of Cross Section and Part Data*. Cambridge MA: MIT Press.
- Wright, J. P., Cullen, F. T., Miller, J. T. (2001) Family Social Capital and Delinquent Involvement. *Journal of Criminal Justice* 29(1), 1-9.
- Wuthnow, Robert. (1998) The Foundations of Trust. Report from the Institute for Philosophy and Public Policy 18, 3-8.

Samenvatting

Sociaal kapitaal wordt beschouwd als een belangrijke waarde voor individuen, groepen, gemeenschappen en de samenleving, omdat het gerelateerd is aan gezondheid en sociaal-economische status, en van invloed is op criminaliteit, sociale cohesie en sociaal welzijn. Onderwijs wordt algemeen beschouwd als een van de belangrijkste determinanten van individueel sociaal kapitaal. De omvang van het effect van het onderwijs op sociaal kapitaal is echter een weinig bestudeerd onderwerp. Het doel van dit proefschrift is om een duidelijker beeld van de vorming van de individuele sociaal kapitaal te geven en van de rol van onderwijs daarbij.

Uit de meta-analyse in hoofdstuk 2 blijkt dat een standaarddeviatie van jaren onderwijs, 12-16 procent van de standaardafwijking in elk van de twee dimensies van sociaal kapitaal (vertrouwen in andere mensen en individuele sociale participatie in verenigingen en groepen) verklaart. Gender speelt een rol in het mechanisme waarmee het onderwijs van invloed op sociaal kapitaal. De endogeniteit van het onderwijs is een bron van variatie in de schattingen van de maatschappelijke participatie tussen studies, maar het heeft geen effect in de studies waarin het effect van onderwijs op vertrouwen in de medemens is onderzocht. In de meta-analyse, varieert de grootte van het onderwijs effect met het niveau van het onderwijs. Effect maten zijn significant groter voor mensen met een voortgezet onderwijs diploma of hoger diploma. De aard van de gegevens, of er gecontroleerd is voor een wederkerigheidsmechanisme tussen de twee dimensies van de individuele sociaal kapitaal, en of er gecontroleerd is voor het relatieve effect van het onderwijs, blijken van invloed op de effectgrootte van onderwijs.

Om meer inzicht te krijgen op het effect van onderwijs op individueel sociaal kapitaal, worden het one-factor model en het single-treatment model toegepast op data van het National Child Development Study (NCDS). Doel is om de causale relaties tussen sociaal kapitaal factoren te onderzoeken in de vroege jeugd en tussen onderwijs en sociaal kapitaal op volwassen leeftijd. Hierbij wordt rekening gehouden met het probleem van de endogeniteit van onderwijs.

De evaluatie op basis van het one-factor model is uitgevoerd in hoofdstuk 3 als referentie studie. Deze evaluatie suggereert dat familierelaties in de vroege kinderjaren van cruciaal belang zijn bij het genereren van sociaal kapitaal. Onderwijs heeft een belangrijke en positief effect op de opbouw van sociaal vertrouwen. Er wordt geen overtuigend bewijs gevonden in de evaluatie voor een positieve rol van onderwijs bij de bevordering van maatschappelijke

participatie. De schattingen hieromtrent zijn negatief in het IV regressiemodel. De endogeniteit van het onderwijs blijkt een belangrijke reden voor de opwaartse vertekening in het eenvoudige regressiemodel. Een nadere analyse van de informatie op adolescenten leeftijd bevestigt dat niet waargenomen persoonlijkheidskenmerken en vaardigheden gelijktijdig van invloed zijn op zowel het onderwijs als op de maatschappelijke participatie.

Hoofdstuk 4 geeft een illustratie van de bivariate probit (BVP) en de control functions probit (CFB) methoden en biedt een rechtvaardiging van de toepassing van deze methoden in het modeleren van de endogene relatie tussen een binaire interventie variabele en een binaire uitkomst variabele. De simulaties laten zien dat de bivariate probit methode een consistente schatter oplevert, terwijl de control functions probit methode een benadering oplevert die aanzienlijk minder rekenkracht kost. Deze twee methodes zijn de belangrijkste benaderingen voor het isoleren van de werkelijke effecten van onderwijs op individueel sociaal kapitaal, waarbij rekening wordt gehouden met de invloed van versturende variabelen.

Hoofdstukken 5 en 6 kwantificeren, respectievelijk het oorzakelijk effect van onderwijs op vertrouwen in de medemens en het oorzakelijk effect van hoger onderwijs op het lidmaatschap van verenigingen en groepen. De evaluaties op basis van de single-treatment modellen tonen kwalitatief vergelijkbare conclusies als de evaluatie op basis van het one-factor model. Deze evaluaties tonen aan dat onderwijs een belangrijke factor in het verhogen van vertrouwen in de medemens is. Op lange termijn is onderwijs evenwel niet noodzakelijkerwijs een determinant van deelname aan verenigingen en groepen voor vrouwen. De single-treatment modellen en de one-factor model geven ook identieke conclusies over onderwijs endogeniteit. Deze evaluaties ondersteunen echter niet de conclusies uit de meta-analyse dat een college of hoger onderwijs diploma meer bijdraagt aan vertrouwen in de medemens en het bevorderen van maatschappelijke participatie dan lager genoten onderwijs. De effectgrootte van een extra jaar scholing op het niveau van hoger onderwijs is vergelijkbaar met de effectgrootte verkregen uit de one-factor model evaluatie van onderwijsjaren in hoofdstuk 3.

Hoofdstukken 5 en 6 onderzoeken de mogelijke sekseverschillen in de relatie tussen onderwijs en sociaal kapitaal. Het blijkt dat onderwijs veel hogere rendementen voor mannen opleveren dan voor vrouwen op beide dimensies van sociaal kapitaal. Het onderwijs effect is zelfs negatief voor vrouwen in de studie van het lidmaatschap van verenigingen en groepen, terwijl er een sterk positief effect gevonden wordt voor mannen in de studie van sociaal vertrouwen en sociale participatie. Deze bevindingen zijn in overeenstemming met de conclusies van de meta-analyse in hoofdstuk 2 over de gender-specifieke effecten van

onderwijs.

De analyses in hoofdstuk 5 geven aan dat hoger onderwijs een direct en blijvend effect heeft op de twee fundamentele dimensies van de vertrouwen in de medemens namelijk de individuele perceptie van de sociale omgeving en individuele morele waarden. Het onderzoek suggereert dat vertrouwen als vorm van perceptie van sociale onzekerheid en billijkheid sterk gecorreleerd is met sociale ontwikkeling en de positie in de sociale omgeving. Ook wordt bevestigd dat economische status een intermedierende variabele is in de causale relatie tussen onderwijs en het vormen van vertrouwen.

De analyses in hoofdstuk 6 geven aan dat de gender patronen in arbeidsdeelname en maatschappelijke participatie belangrijke factoren zijn in de verklaring van het verschil in de veranderingen in de deelname aan hoger onderwijs en maatschappelijke participatie gedrag in westerse landen. Hoog opgeleide vrouwen zijn meer gemotiveerd dan laag opgeleide vrouwen om naar economische onafhankelijkheid te streven. De veranderende verhouding tussen mannen en vrouwen en de toename van de deelname van vrouwen aan arbeidsparticipatie verzwakt de rol van sociale participatie in de verwezenlijking van persoonlijke waarden en het vervullen van sociale verantwoordelijkheden. Dit wordt waarschijnlijk veroorzaakt door het feit dat vrouwen traditioneel de belangrijkste kracht in de vrijwilligerssector zijn. Als vrijwilligerswerk in een samenleving wordt gezien als dominante waarde dan kan uit dit onderzoek de conclusie worden getrokken dat de deelname aan vrijwilligerswerk niet wordt bevorderd door de toename van het opleidingsniveau in de bevolking of door een toename van gendergelijkheid in het hoger onderwijs.

In het algemeen blijkt uit de empirische bevindingen in dit proefschrift dat onderwijsverschillen een belangrijke bron zijn van variatie in sociaal kapitaal, direct of indirect. Verder zien we aanzienlijke verschillen tussen mannen en vrouwen in de effecten van onderwijs op sociaal kapitaal.

Gezien de toename in de deelname aan hoger onderwijs en de toename van twee-carrière gezinnen, mogen we dus een verdere afname van sociaal kapitaal verwachten? Dit proefschrift suggereert dat de intensivering van de arbeidsarticipatie en de toenemende economische druk op twee-carrière gezinnen nadelige gevolgen heeft op zowel de beide dimensies van sociaal kapitaal. Een toename van de werkdruk of baantevredenheid, verlaagt de tijd en energie die wordt besteed aan verenigingsdeelname. Sociale participatie kan worden bevorderd door het creëren van meer deeltijdbanen en flexibele werktijden.. Beleidsmakers kunnen ook bijdragen aan de opbouw van sociaal vertrouwen door gelijkheid op de arbeidsmarkt tussen mannen en vrouwen te bevorderen en te zorgen voor een eerlijke

verdeling van de sociale welvaart.

The Tinbergen Institute is the Institute for Economic Research, which was founded in 1987 by the Faculties of Economics and Econometrics of the Erasmus University Rotterdam, University of Amsterdam and VU University Amsterdam. The Institute is named after the late Professor Jan Tinbergen, Dutch Nobel Prize laureate in economics in 1969. The Tinbergen Institute is located in Amsterdam and Rotterdam. The following books recently appeared in the Tinbergen Institute Research Series:

419. L. RATNOVSKI, *A Random Walk Down the Lombard Street: Essays on Banking.*
420. R.P. NICOLAI, *Maintenance models for systems subject to measurable deterioration.*
421. R.K. ANDADARI, *Local clusters in global value chains, a case study of wood furniture clusters in Central Java (Indonesia).*
422. V.KARTSEVA, *Designing Controls for Network Organizations: A Value-Based Approach.*
423. J. ARTS, *Essays on New Product Adoption and Diffusion.*
424. A. BABUS, *Essays on Networks: Theory and Applications.*
425. M. VAN DER VOORT, *Modelling Credit Derivatives.*
426. G. GARITA, *Financial Market Liberalization and Economic Growth.*
427. E.BEKKERS, *Essays on Firm Heterogeneity and Quality in International Trade.*
428. H.LEAHU, *Measure-Valued Differentiation for Finite Products of Measures: Theory and Applications.*
429. G. BALTUSSEN, *New Insights into Behavioral Finance.*
430. W. VERMEULEN, *Essays on Housing Supply, Land Use Regulation and Regional Labour Markets.*
431. I.S. BUHAI, *Essays on Labour Markets: Worker-Firm Dynamics, Occupational Segregation and Workplace Conditions.*
432. C. ZHOU, *On Extreme Value Statistics.*
433. M. VAN DER WEL, *Riskfree Rate Dynamics: Information, Trading, and State Space Modeling.*
434. S.M.W. PHILIPPEN, *Come Close and Co-Create: Proximities in pharmaceutical innovation networks.*
435. A.V.P.B. MONTEIRO, *The Dynamics of Corporate Credit Risk: An Intensity-based Econometric Analysis.*
436. S.T. TRAUTMANN, *Uncertainty in Individual and Social Decisions: Theory and Experiments.*
437. R. LORD, *Efficient pricing algorithms for exotic derivatives.*
438. R.P. WOLTHOFF, *Essays on Simultaneous Search Equilibrium.*
439. Y.-Y. TSENG, *Valuation of travel time reliability in passenger transport.*
440. M.C. NON, *Essays on Consumer Search and Interlocking Directorates.*
441. M. DE HAAN, *Family Background and Children's Schooling Outcomes.*
442. T. ZAVADIL, *Dynamic Econometric Analysis of Insurance Markets with Imperfect Information.*
443. I.A. MAZZA, *Essays on endogenous economic policy.*
444. R. HAIJEMA, *Solving large structured Markov Decision Problems for perishable-inventory management and traffic control.*
445. A.S.K. WONG, *Derivatives in Dynamic Markets.*
446. R. SEGERS, *Advances in Monitoring the Economy.*

447. F.M. VIEIDER, *Social Influences on Individual Decision Making Processes.*
448. L. PAN, *Poverty, Risk and Insurance: Evidence from Ethiopia and Yemen.*
449. B. TIEBEN, *The concept of equilibrium in different economic traditions: A Historical Investigation.*
450. P. HEEMEIJER, *Expectation Formation in Dynamic Market Experiments.*
451. A.S. BOOIJ, *Essays on the Measurement Sensitivity of Risk Aversion and Causal Effects in Education.*
452. M.I. LÓPEZ YURDA, *Four Essays on Applied Microeconometrics.*
453. S. MEENTS, *The Influence of Sellers and the Intermediary on Buyers' Trust in C2C Electronic Marketplaces.*
454. S. VUJIĆ, *Econometric Studies to the Economic and Social Factors of Crime.*
455. F. HEUKELOM, *Kahneman and Tversky and the Making of Behavioral Economics.*
456. G. BUDAI-BALKE, *Operations Research Models for Scheduling Railway Infrastructure Maintenance.*
457. T.R. DANIELS, *Rationalised Panics: The Consequences of Strategic Uncertainty during Financial Crises.*
458. A. VAN DIJK, *Essays on Finite Mixture Models.*
459. C.P.B.J. VAN KLAVEREN, *The Intra-household Allocation of Time.*
460. O.E. JONKEREN, *Adaptation to Climate Change in Inland Waterway Transport.*
461. S.C. GO, *Marine Insurance in the Netherlands 1600-1870, A Comparative Institutional Approach.*
462. J. NIEMCZYK, *Consequences and Detection of Invalid Exogeneity Conditions.*
463. I. BOS, *Incomplete Cartels and Antitrust Policy: Incidence and Detection*
464. M. KRAWCZYK, *Affect and risk in social interactions and individual decision-making.*
465. T.C. LIN, *Three Essays on Empirical Asset Pricing.*
466. J.A. BOLH AAR, *Health Insurance: Selection, Incentives and Search*
467. T. FARENHORST-YUAN, *Efficient Simulation Algorithms for Optimization of Discrete Event Based on Measure Valued Differentiation.*
468. M.I. OCHEA, *Essays on Nonlinear Evolutionary Game Dynamics*
469. J.L.W. VAN KIPPERSLUIS, *Understanding Socioeconomic Differences in Health: An Economic Approach.*
470. A. AL-IBRAHIM, *Dynamic Delay Management at Railways: A Semi-Markovian Decision Approach.*
471. 471. R.P. FABER, *Prices and Price Setting*