Essays on the empirical modelling of the determinants of health and lifestyle

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Abstract

The thesis comprises two essays in health economics.

The first examines the impact of health insurance on lifestyle. The ex ante moral hazard (EAMH) postulates that health insurance reduces prevention effort (healthy lifestyle) since the cost of ill health to the insured individual is reduced. There is little evidence to support this hypothesis. I extend the standard model of EAMH by allowing for the fact that the consequences of a more healthy current lifestyle take some time to affect health. This extended model predicts that anticipated future insurance can alter current behaviour. I test this prediction by using as a natural experiment the granting of Medicare at age 65 to all individuals, including the large proportion who have no insurance when under age 65. I first use classical parametric and semi-parametric empirical methods. Then, these methods are combined into a more robust estimator to compare the changes in lifestyle between ages 59 and 68 for individuals with different amounts of insurance before age 65. The results suggest reductions in physical activity by the uninsured two years before being covered by Medicare. Anticipation of Medicare has no effect on alcohol consumption or smoking behaviour.

The second essay investigates the role of maternal parenting style on child health. The analysis is innovative in using econometric methods that allow for possible biases arising from unobservable family circumstances and from parenting style being influenced also by child health. Using two waves from the Millennium Cohort Study I also develop a set of measures of parenting style and allow for potential reporting bias and for the role of the father. I find that maternal parenting style mainly influences the mental health of the child, rather than the physical health. Parenting style and socio-economic factors do not appear to interact in their effect on child health.

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Parts of my dissertation at various stages were presented at the following conferences: in 2012 at the European Conference on Health Economics, Zürich University, Switzerland; the 4th Biennial Conference of the American Society of Health Economists, University of Minnesota, USA; the Wellbeing Seminar, Centre for Economics Performance, LSE, UK; the PhD Seminar on Health Economics and Policy, Grindelwald, Switzerland; the Seventh PhD Presentation Meeting with the Royal Economic Society, Queen Mary University of London, UK; in 2011 at the 12th National Health Economics Conference in Lisbon, Portugal; the 16th Spring Meeting of Young Economists, University of Groningen, the Netherlands; the Health Econometrics and Data Group (HEDG) Seminar Series, University of York, UK; in 2010 at the Doctoral Workshop in Health Economics and Public Health, University of Lugano, Switzerland; the 19th European Workshops on Econometrics and Health Economics, University of Lausanne, Switzerland; the 3rd Biennial Conference of the American Society of Health Economists, Cornell University, USA; in 2009 at the 11th National Health Economics Conference in Porto, Portugal; the Doctoral Workshop in Health Economics and Public Health, University of Lausanne, Switzerland; the Health Econometrics and Data Group Seminar Series, University of York, UK; in 2008 at the Student Workshop, University of York, UK. I am grateful for comments from participants at these meetings.

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Author's declaration

A paper based on material in Chapter 2 has been published as de Preux, L. (2011), Anticipatory Ex Ante Moral Hazard and the Effect of Medicare on Prevention. *Health Economics*, 20(9): 1056-1072.

I declare that this thesis is my original work and that none of the material contained in this thesis has previously been submitted for a degree in this, or any other awarding institution. The contents and views expressed reflect the best of my own knowledge, investigation, and belief.

Chapter 1

Introduction

Health economics is concerned with the production and consumption of health, health related behaviour, and health care. This thesis consists of two essays. The first investigates the effect of incentives on behaviour, specifically the effect of insurance on activities (drinking, smoking, exercise) which influence the probability of good rather than poor health. The second investigates the effect of behaviour on health, specifically the role of mothers' parenting style on the health of their children.

Although the contexts of these two investigations differ in terms of the sample age, gender mix, country, and the institutional background, they share important features. First, both essays use theoretical economic models of individual behaviour to formulate hypotheses and to make explicit some of the difficulties, especially unobserved heterogeneity and endogeneity, likely to be encountered in testing these hypotheses with observational data. Second, the essays employ relevant econometric methods to mitigate some of the problems suggested by the theoretical models. Some of the methods have not previously been used to address the research questions in the essays. Third, the empirical investigations both use panel data sets with large numbers of observations and with rich socio-economic variables to help mitigate the problem of unobserved heterogeneity. Fourth, in both cases I pay close attention to the fine details of the datasets, particularly in constructing alternative empirical measures of the key concepts suggested by the theoretical models.

The first essay focuses on the consequences of health insurance on individual lifestyle. Almost all developed countries, with the noticeable exception until recently of the USA, provide basic universal health insurance coverage for their citizens. At a time when health care costs are an increasing share of national income, it is important to better understand the unintended side-effects of health insurance for behaviour which may affect health and hence health care costs.

Ex ante moral hazard (EAMH) occurs when insurance against the consequences of illness reduces insured individuals' investments in preventive health activities which reduce the probability of illness. There is no consensus over whether EAMH exists. Past evidence shows that insurance seems to reduce investment in secondary prevention (e.g. check-ups), but has not supported the hypothesis of EAMH in the case of primary prevention (e.g. healthy lifestyles). Since primary and secondary prevention have very different characteristics, we review in this essay first the theoretical predictions about

the effects of insurance on primary and secondary prevention, and then the previous empirical evidence.

We then outline a theoretical model that extends the standard EAMH framework by assuming that healthy lifestyles reduce the probability of illness not only in the current period but also in future periods. If there is a lag before lifestyle affects health, current preventive behaviour will be affected by anticipation of future insurance coverage. We call this effect "Anticipatory Ex Ante Moral Hazard", and test for it by examining the effect of future insurance on current health lifestyle activities.

Most of the available evidence relies on the granting of Medicare to almost all the population at the age of 65 in the United States as a natural experiment. Researchers have tested for a reduction in healthy behaviour of the uninsured relative to the insured at the age of 65. However, as the provision of Medicare insurance at age 65 is certain and longstanding, it cannot be considered as an unanticipated exogenous change in health insurance status. If anticipated health insurance affects behaviour, we should observe a change in the relative lifestyle trends before the age of 65 for those uninsured before the age of 65 compared with those insured before age 65.

We use the nine waves of the US Health and Retirement Study (HRS) to test whether uninsured individuals change their lifestyle (physical activity, smoking, drinking) as they approach the age of 65 and afterwards. First, we test the hypothesis of EAMH using propensity score matching which does not require any assumption on lifestyle functional form. We compare the level of lifestyle activities between the insured and uninsured, and repeat the analysis to compare the changes between two periods for the two groups. This matching Difference-in-Differences (matching DID) accounts for constant differences between the two groups. Second, we replicate the classical linear regression Difference-in-Difference (DID) approach implemented by Dave and Kaestner (2009) and extend it to allow for EAMH to appear some years before receiving Medicare.

These approaches have two potential weaknesses. First, propensity score matching is valid only if selection into the insured or uninsured group is based on observable characteristics and these characteristics do not vary over time. Matching DID accounts for time-invariant unobservable characteristics, and the classical regression based on DID in addition accounts for time-variant observable characteristics, but these methods rely on the correct specification of the functional form. Second, the comparison of changes over the years between insured and uninsured groups (DID) does not allow us to identify a change in the relative trends, as suggested by the hypothesis of Anticipatory EAMH. DID is vulnerable to unobserved linearly time-variant unobservable factors. For example, unobserved lifestyle preferences change with age at different rates

between the groups. Therefore, we also use a third approach that addresses these two issues. We combine DID and propensity score methods in a double-robust estimate that is robust to the miss-specification of one or the other method. Finally, we use difference in double-robust DID estimates (double-robust DIDID) to account for differences in trends and linear-variant unobservables. All the approaches are estimated for three different definitions of the uninsured group and with alternative definitions of healthy lifestyle.

We find no clear effect of the receipt of Medicare or its anticipation on alcohol consumption nor smoking behaviour, but the previously uninsured do reduce physical activity just before receiving Medicare.

The second essay analyses the role of the parenting style of mothers on the physical and mental health of their children. There is an extensive economics literature on the links between socio-economic factors and children's health. But little attention has been given in this literature to the possible pathways, including the relationship between socio-economic factors and parenting style and to whether parenting style affects child health. Possible reasons that could explain the lack of attention in economics on the role of parenting style include, first, the non-availability, until recently, of large representative datasets that collect information on variables that measure parenting style. By contrast, there is an extensive psychological literature on the role of parenting style in influencing the child's health, which tends to rely on data sets with detailed parenting style variables but with small sample size and relatively sparse information on socio-economic characteristics of the families. Second, the problem of endogeneity of parenting style in the child health production function requires either an extensive set of variables to account for the possible confounding factors, or it requires the researcher to make assumptions on the form of the possible endogeneity problem to apply advanced econometric techniques to account for them.

In this second essay, we analyse the role of parenting style in determining the physical and mental health of children. We review the evolution of the definition of parenting style in the psychology literature and discuss the main correlations identified there between the different types of parenting style and children's outcomes. We then use the Millennium Cohort Study data, a UK national longitudinal birth cohort study started in 2000, to examine the associations between parenting style and children's outcomes previously found in the literature. We also attempt to define various types of parenting style using cluster and factor analysis applied to the rich set of parenting style questions in the data. Next, we sketch a simple economic model which allows us to illustrate the different hypotheses about relationships between parenting style,

child outcomes and socio-economic factors. We describe the sources of unobserved heterogeneity and progressively modify our model to take them into account. Our final specification allows us to account for a recursive effect between parenting style and the child outcome.

The empirical models are estimated using linear specifications and a recursive system of equations for health and parenting style, which is jointly estimated by full information maximum likelihood with freely correlated error terms. The recursive system of equations allows us to relax independence assumptions imposed in the ordinary least squares models and to get closer to causal effects of parenting style on child outcomes. The various specifications are estimated for physical health and mental health, measured as externalising and internalising behavioural problems. The former refers to antisocial and aggressive behaviours, whereas the latter refers to emotional problems or aggression directed to the child himself. We also look at cognitive ability and parenting style, and compare the results to the ones obtained for the health outcomes.

A potential difficulty is that health outcomes and parenting style are reported by the mother which may introduce reporting bias. This is addressed by re-estimating all the results using outcomes reported by the child or the teacher. We also estimate models in which we use parenting style as reported by older children in the household.

In order to assess the role of parenting style as a possible pathway between children's outcomes and socio-economic factors, we first compare models where parenting style is not included, then simply add it to the models, and finally assume it to be endogenous. Furthermore, we interact parenting style with a measure of household wealth and an indicator of the mother's level of education.

We find very limited effects of parenting style on the physical health of the children, but their mental health is negatively affected by high levels of mother's supervision, and cognitive ability is decreased when the mother is either too involved or too strict. The results are stronger when unobserved heterogeneity is taken into account. In all models the role of socio-economic factors remains strong, which suggests that parenting style may not be an important pathway between socio-economic factors and children's health.

Chapter 2

Anticipatory Ex Ante Moral Hazard

2.1 Introduction

In the case of illness, insurance can reduce the cost of medical care and may also compensate the individual for her income loss.[1] Ex Ante Moral Hazard (EAMH) is the reduction of preventive effort due to health insurance (Arrow, 1963; Pauly, 1968; Shavell, 1979). It requires that individuals are able to reduce their probability of illness by costly effort, and that these efforts are not directly observable. Theoretical predictions are ambiguous: in their seminal paper, Ehrlich and Becker (1972) conclude that health insurance and preventive effort (referred to as "self-protection") can be complements. Whether there is EAMH depends on the cost of illness (lost of wages, opportunity cost of time and the physical limitations created by the illness) and on individual risk aversion (Zweifel and Manning, 2000).

Empirical evidence is also ambiguous. Using the only study based on a randomised trial, the RAND experiment, Newhouse et al. (1993) conclude that health insurance does not significantly affect lifestyles. Several authors (Decker, 2005; Card et al., 2004, among others) have used the granting of Medicare at the age of 65 to look at a change in behaviour due to an exogenous change in health insurance. However, it cannot be used as a perfect natural experiment without adjustment because this exogenous change is anticipated.[2] For example, a direct consequence in the case of reimbursed preventive care is that individuals tend to postpone them (e.g. Lichtenberg, 2002) which would bias upwards the effect of insurance on the demand of medical care.[3] Anticipation becomes an issue if the benefit of healthy lifestyles are not immediate. In order to test for EAMH, one should take into account that individuals may change their behaviour already before being covered by Medicare because prevention changes future illness probabilities.

Our contribution to the literature on insurance and moral hazard is first that we develop a theoretical model that extends the classical EAMH framework by tak-

[1] Typically with sick leave payments.

[2] Similarly, when evaluating the New Deal for the Young Unemployment program, Blundell et al. (2004) take into account the possibility that individual could react in anticipation of the program, before being actually eligible.

[3] McWilliams et al. (2003), presented below in the literature review, look at secondary prevention and distinguish between reimbursed vs. non-reimbursed preventive care. They find that the demand for reimbursed preventive care increases significantly after 65, but not the demand for not reimbursed preventive care.

ing into account (1) the existence of a lag in the effect of lifestyle on health and (2) anticipated insurance coverage. Our model predicts that EAMH appears some years before receiving insurance (Medicare) and that, at the time of the coverage, lifestyle behaviours have already been adapted. We call this phenomenon *Anticipatory EAMH* (sometimes referred to as EAMH with anticipatory behaviour).

Second, we test this hypothesis using semi-parametric methods. We start with propensity score matching (PSM) that controls for non-random selection based on observable characteristics. PSM compares differences in lifestyles between the two groups, but does not account for unobserved time-invariant differences. Therefore, we then estimate matching on the changes in lifestyles over two interviews to control for constant differences over the years. Third we estimate Difference-in-Differences (DID) models that have been the classical approach in the literature (Dave and Kaestner, 2009). Although it relies on strong assumptions such as common trends in the treatment and control groups, this approach is useful to decompose the incentives between the direct effects of insurance (e.g. EAMH) and its indirect effects (e.g. more contact with doctors who encourage a healthier lifestyle - Dave and Kaestner, 2009). We also estimate non-linear models to account for the nature of the dependant variables (binary and count variables). Those approaches are standard in the policy evaluation literature and have been used for example by McWilliams et al. (2003) to measure the effect of insurance on the demand for secondary prevention.

Fourth, we reconcile these two approaches by using for the first time in this literature, the double-robust (DR) estimator that is robust either if the selection mechanism or the regression model is correctly specified. Although this estimator is more reliable than the DID and PSM alone, it is still affected by unobservable differences. We therefore propose a double and triple differences double-robust estimators that account for time-invariant and linearly-time variant differences, respectively.

We use the Health and Retirement Study, a biennial survey of Americans of 50 and over. We define the uninsured group based in three different ways that take into account the different types of health insurance available for those aged under 65. We estimate the average effect of Medicare and its anticipation effect on the behaviour of the uninsured for different lifestyles: physical activity, drinking and smoking behaviour.

Our results for physical activity support the existence of anticipatory EAMH. Uninsured and insured generally do not differ in terms of their alcohol consumption, although the DR estimates suggest some evidence for EAMH. Based on the DID estimates, we find significant differences in terms of tobacco consumption between the two groups that we attribute to a positive selection rather than EAMH. These results are robust across the three alternative definitions of insured and uninsured groups.

Our results contribute to the current policy debate on universal coverage. Although past evidence has generally rejected the existence of EAMH, we find that insurance coverage may still create incentives to reduce investment in certain types of prevention for a certain part of the population, and this reduction may appear some time before the receipt of insurance if anticipated.

The structure of this chapter is as follows. Section 2.2 surveys previous economic literature on primary and secondary prevention. Section 2.3 presents the U.S. health insurance system. In Section 2.4, we present the theoretical model and discuss its predictions. Section 2.5 introduces the identification approach and the different empirical methods. Section 2.6 describes the data, and the empirical results are analysed in Section 2.7. Finally, Section 2.8 contains a short conclusion.

2.2 Insurance and Prevention: Literature Review

There is a general consensus on the existence of Ex Post Moral Hazard (EPMH): the insured consume more health care when ill. The existence of EAMH is still debated. In order to understand past evidence of EAMH, one should distinguish between two types of prevention: self-protection, which refers to the individual ability to reduce the probability of illness, and self-insurance, which refers to the individual ability to reduce the size of the future costs of illness. This formal distinction comes from the seminal paper of Ehrlich and Becker (1972). Self-insurance, like health insurance provided by an insurer against the cost of healthcare, reduces the monetary cost of bad health and redistributes income from good health states to bad health states. Self-protection reduces the probability of bad health. Ehrlich and Becker (1972) demonstrate that health insurance and self-insurance are substitutes and that health insurance and self-protection can be complements: greater insurance against the costs of bad health can reduce or increase self-protection.

The strict definition of EAMH only concerns activities that reduce the probability of illness, and that are unobserved or uncontractable by the insurance (self-protection). Empirically, self-protection is often associated with primary prevention (e.g. exercise, healthy diet) whereas self-insurance is associated with secondary prevention (e.g. check-ups, screening procedures)[4], but a clear categorisation is generally not possible as there are few activities that only affect either the probability or the consequences of illness (Kenkel, 2000).

However, it is still useful to analyse separately the impact of insurance on these

[4]There also exists a tertiary prevention that we do not consider here: it consists of all the actions that reduce disability associated with a chronic illness.

two types of prevention as they also often differ in observability and therefore in the extent that they can be controlled by insurance contracts. Primary prevention is generally not observed and personal investments in those activities are generally not reimbursed.[5] Secondary prevention may be observed by the insurer and reimbursed. A change in secondary prevention due to insurance is generally due to a direct price effect of reimbursement of these activities, whereas a change in primary prevention, if not contractible, is due to an indirect effect of insurance by changing the cost of ill health. Therefore, although evidence in the case of secondary prevention is instructive, it has no relevance for EAMH.

There is no or very little evidence of EAMH for primary prevention, but an increase in the demand for secondary prevention due to higher insurance coverage is generally observed (Card et al., 2004). We now review separately the main evidence in the case of secondary and primary prevention.

2.2.1 Secondary prevention

Evidence from randomised trials comes from the RAND Health Insurance Experiment (HIE) and the Oregon health insurance experiment. Using HIE, Newhouse & al. (1993) look at different procedures such as immunisations, general medical examinations including mammography and Pap smears, and compare the percentage of individuals that have used some preventive care in the different plans. They conclude that "cost sharing [...] reduces the use of preventive services, but even with the free care this use falls short of widely accepted standards" (Newhouse & al. (1993), p.180).

The Oregon health insurance experiment is the extension of Medicaid to a randomly selected group of low-income adults aged between 19 to 64 years old who were given the opportunity to sign up for Medicaid in 2008 (Baicker and Finkelstein, 2011, Sommers et al., 2012). Finkelstein et al. (2012) estimate the impact of expanding access to Medicaid and the impact of being insured by Medicaid on the demand for preventive care. The impact of expanding access to Medicaid, referred to as the intention to treat effect, is estimated using OLS regressions, and the impact of being insured by Medicaid, referred to as the local average treatment effect, is estimated using instrumental variables where being covered by Medicaid is instrumented with the lottery. The authors find a significant increase in the demand for blood cholesterol checks, blood tests for diabetes, mammograms, and Pap tests due to the availability of Medicaid. The inten-

[5] Past literature assumes that lifestyle is not observed and that its costs are not reimbursed. However a new type of health insurance has recently been marketed that covers some of the costs of primary prevention: for example, via the offer of a gym membership. See for example in the UK, PruHealth (http://pruhealth.pruhealth.co.uk/individuals/home).

tion to treat effect ranges from 2.6% (blood tests) to 5.5% (mammograms), whereas the local average treatment effect ranges from 9% (blood tests) to 18.7% (mammograms).

Kenkel (1994) uses two cross-sectional datasets[6] to estimate the determinants of the demand for preventive care and compares the results from two approaches. First, he implements a probit to estimate the determinants of the demand for breast examinations and Pap tests. Second, he runs a bivariate probit to estimate the determinants of the demand for doctor visits and the demand for the same preventive care conditional on a doctor visit. The second approach allows him to take into account the influence of the physician on the demand for preventive care.[7] This idea of supply induced demand in the case of preventive care has been taken up by Dave and Kaestner (2009) and is described below. In both models, Kenkel (1994) uses a set of dummies to control for age (10-years categories), schooling, health status, type of physician (board certified, gynaecologist, age), and insurance types (private or public coverage for physician services, private insurance for hospital care, membership in Health Maintenance Organisations - HMOs). In order to proxy the price paid by the individual for preventive care, Kenkel (1994) uses the type of insurance coverage (public, private, private with hospital coverage, HMOs).[8] His results indicate that age significantly reduces the demand for preventive services by women whereas more education increases the probability of use of these services. Individuals with a more complete insurance coverage for curative care have significantly higher demand for preventive care compared to individuals with no insurance. Coverage for preventive care in the case of HMOs also significantly increases the demand for preventive care again compared to the case with no insurance, but people with coverage for curative care are less likely to use preventive care than people with the other types of insurance (insurance for physician services and/or hospital care).[9] These results show that the demand for preventive care is price sensitive and increases when insurance reduces the cost of preventive care and decreases when insurance reduces the cost of curative care. As recognised by the author, the main

[6]Kenkel (1994) uses data from (i) a survey conducted by the Center for Health Administration Studies of the University of Chicago and the National Opinion Research Center in late 1975 and early 1976, and (ii) a telephone survey conducted by Louis Harris and Associates in 1982.

[7]The bivariate model can only be estimated using data from the Center for Health Administration Studies of the University of Chicago and the National Opinion Research Center in late 1975 and early 1976 as they contain detailed information about the doctor. However, the data on insurance only contains information about physician services and hospital care coverage but not about HMO coverage.

[8]The insurance types are listed in increasing order in terms of coverage with the most complete one being the HMOs as they "provide complete coverage for preventive and curative care" (Kenkel, 1994, p.317).

[9]The results are the same in the case of univariate and bivariate models, although the positive effect of insurance on the demand for preventive care is less strong. The effect of HMO on the demand of preventive care can only be estimated in univariate model as explained in previous notes.

weaknesses of the results are the use of non-experimental cross-sectional data that does not allow to control for selection into insurance.

Using 11 years of a sample of women aged between 50 to 80 in the Behavioural Risk Factor Surveillance System (BRFSS), Decker (2005) tests whether Medicare increases the use of mammography (covered by the insurance).[10] In order to estimate a discontinuous change in the demand at the age of 65, the following pooled probit model is estimated:

$$\begin{aligned} H_i &= \beta_0 + \beta_1 X_i + \beta_2 AGE_i + \beta_3 A65M_i + \beta_4 LOW\_SES_i \\ &\quad + \beta_5 A65M_i * LOW\_SES_i + \varepsilon_i \end{aligned} \tag{1}$$

where H_i is preventive care, X_i is a vector of covariates including education, race, region, and years effects, AGE_i is vector of powers of age, and cubic specifications, $A65M_i$ indicates whether the individual is eligible for Medicare, and LOW_SES_i allows for a specific effect of individual with low socioeconomic status (SES) in terms of education or race who have a higher probability of being uninsured before 65. The effect of insurance is therefore measured for the whole sample by β_3, but is allowed to differ by SES (β_5). Her results demonstrate a strong and significant increase in the number of mammographies at age 65 when receiving Medicare, and the effect is stronger for women without a high school degree and for Black and Hispanic women.

McWilliams et al. (2003) look at the impact of receiving Medicare on the demand for covered[11] vs. uncovered care using differences in the demand of the insured and uninsured adjusted with a propensity score. Using three waves of the HRS (1994, 1996, and 2000), they define three types of insurance status: (a) the individual is either intermittently insured (n=216) if she reports at least once being insured either by her employer, individually, or by a public insurance; (b) she is continuously insured if she reports at least one of these coverages over the 3 waves (n=1820); (c) she is not insured if she never reports one of these (n=167). First, they compare the continuously uninsured (c) with the continuously insured (b), then the intermittently uninsured (a) with the continuously insured adults (b). The authors find that the increase in the demand at age 65 for preventive care is significantly greater for the continuously uninsured compared to continuously insured. Whereas the effect of Medicare is significant for covered care, the effect may not be significant in the case of uncovered care (they find no effect of

[10] Decker (2005) also tests further whether Medicare improves survival rates of breast cancer.

[11] Medicare covers services such as mammography or office visits with physicians for arthritis, but does not cover services such as cholesterol testing of individuals without diabetes or hypertension or use of medications for arthritis or hypertension. McWilliams et al. (2003) consider cholesterol testing, mammography (in women), prostate examination (in men), and treatment of arthritis and hypertension in the prior 2 years.

Medicare on the demand for anti-hypertensive medications which is not covered by Medicare). This suggests that secondary prevention reacts to an out-of-pocket price effect only, and suggests that, as Medicare is expected at the age of 65, individuals may postpone covered care until this age.

Those studies, either using the only available natural experiment HIE, or using Medicare as a natural experiment, show that the demand for preventive health care (secondary prevention) increases when it is reimbursed by insurance.

2.2.2 Primary prevention

One key difference between primary and secondary prevention is the asymmetry of information between the insured and the insurance. Generally, secondary prevention is observable, and often covered, whereas primary prevention cannot be monitored by the insurance and thus be reimbursed (Bradley, 2005).[12] A change in the demand for secondary prevention, if refunded by the insurance, is a form of EPMH. It is directly due to a change in the price of care paid by the insured.

However, the demand for primary prevention if not contractible can be indirectly affected by insurance. As the curative cost in the case of illness are reduced thanks to the insurance, the financial gains from primary prevention are also reduced. The effect of insurance on non-observed prevention may even be exacerbated if secondary prevention is reimbursed, as the individual will be more likely to demand secondary prevention which reduces the financial consequences of the illness and thus reduces the benefit of investing in primary prevention. This indirect effect of insurance is EAMH. We review here the main evidence from EAMH in the health insurance literature.

Courbage and de Coulon (2004) tackle two previously mentioned problems: first, to compare the effect of insurance on reimbursed and observable preventive care vs. not observed and not reimbursed care, they estimate the impact of having health insurance on the probabilities of having a breast check and a cervical smear (secondary prevention[13]) vs. the probabilities of exercising and of being a smoker (primary prevention, unobserved and uncovered).[14] They use wave 10 of the British Household Panel Survey and define three groups of privately insured based on the burden of cost (in decreasing order): insured at their own cost, at the cost of the their employer, at the cost of a

[12]Quite recently this has changed by the emergence of a new "type" of insurance that constrains their insurees to report their lifestyle to benefit from lower insurance premia.

[13]"The NHS covers those tests and purchasing private health insurance supplements their coverage" Courbage and de Coulon (2004), p. 721.

[14]In the case of secondary prevention, the indicators of breast check and a cervical smear are only measured on women, whereas the lifestyles behaviour variables include both genders.

family member.[15] They first estimate, using a probit model, the probability of preventive care controlling for gender, age, education level, household income quantiles, and subjective well-being. Based on this specification, their results suggest that privately insured individuals compared to individuals only covered by the NHS are significantly more likely to undergo breast screening, but not to have cervical smears, even though both are covered by the insurance. The privately insured are also more likely to have a healthier lifestyle.

In the second part of their paper, in order to take into account the possibility of unobserved characteristics such as unobserved risk aversion that could affect the demand for preventive care and private insurance, the authors use instrumental variables. They use political party affiliation to predict the probability of having a private insurance. They assume that it influences positively the decision to contract for an insurance and to behave in a responsible way (risk averse people). Courbage and de Coulon use as instruments (i) supporting the Conservative party to predict the decision to purchase private insurance and (ii) supporting the Labour party to predict the propensity not to go private. Additionally, they make the strong assumption that the choice of a job offering private insurance is not correlated with risk aversion. The instruments only satisfy the exogeneity condition for the probability of exercising. Their results corroborate previous ones in the case of practising sport, i.e. private insurance encourages more healthy behaviour.

Although their approach is original in distinguishing between covered and not covered preventive care, their identification strategy presents some problems. First, their indicator of physical exercise only indicates some physical activity versus none. It is possible that this indicator captures a change in the mobility status; therefore, the results should be interpreted as having insurance improves mobility or more generally health status (probably by making it easier to contact doctors). Second, the impact of insurance on the demand for primary prevention is measured on the male and female samples jointly, whereas for secondary prevention it is only evaluated on the female sample, and thus their conclusions are not directly comparable. Finally, the IV approach is only applied to the lifestyle variables. Moreover, the IV approach when the second-stage is nonlinear[16] is not consistent due to the non-additivity of the predicted instrumented variables; instead, the first-stage residuals should be used as additional regressors (see Terza et al. (2008) for further discussion).

[15]These categories differ in the burden of the cost of the premium. We view these distinctions as an attempt to control for different degree of self-selection, but it is not really relevant to evaluate the effect of different types of insurance on prevention as only the marginal cost of prevention and the marginal cost of care when ill matter.

[16]Note that this approach is more generally called the two-stage predictor substitution approach.

Card et al. (2004) look at the impact of health insurance coverage on health outcomes[17] and some health related behaviour[18] using a regression discontinuity design and a two-step approach. Their data is two cross-sectional surveys, the National Health Interview Survey (NHIS) and the BRFSS data. Their model[19] is

$$y_{ia} = X_{ia}\alpha + f(a_i) + C_{ia}\delta + u_{ia} \quad (2)$$

where y_{ia} is the outcome variable of individual i at age a, X_{ia} is a set of characteristics, $f(\cdot)$ is a polynomial function of age, C_{ia} is an indicator equal to one if the individual has a health insurance coverage, and u_{ia} is the error term. To take into account the endogeneity of insurance coverage, they define a first stage model as

$$C_{ia} = X_{ia}\beta^C + g^C(a_i) + D_a\pi^C + v^C_{ia} \quad (3)$$

where β^C is a set of coefficients determining the impact of the set of socio-economic characteristics, $g^C(a)$ is a polynomial function of age and D_a is a dummy for Medicare eligibility. Combining both equations, we have

$$y_{ia} = X_{ia}\beta^y + g^y(a) + D_a\pi^y + v^y_{ia} \quad (4)$$

where $\pi^y = \pi^C * \delta_j$ is the reduced form effect of reaching age 65 on outcome y. They find that smoking, exercising and the probability of being overweight smoothly evolve with age with no significant changes at age 65.

The framework to test for the existence of EAMH has been recently extended by Dave and Kaestner (2006, 2009).[20] They argue for the existence of a direct effect of insurance on behaviour and an indirect effect that goes in the opposite direction: health insurance decreases the incentives to invest in prevention but increases the opportunities to visit the doctor, and greater contact with the medical professionals is likely to influence health behaviour positively. Omission of the indirect effect would explain why past research has failed to identify EAMH. Their empirical approach is based on difference-in-differences (DID) and triple differences (DIDID) approaches.

[17] More precisely, Card et al. (2004) look at the impact of insurance on 5 types of variables: (i) probability of visiting the doctor, (ii) probability of a hospital stay, (iii) lifestyle behaviour, (iv) SAH, (v) mortality. We only report here their results on the effect of insurance on lifestyle.

[18] The smoking behaviour variable is captured using an indicator of daily smoking, and the exercise variable is equal to one if the individual reports having participated in the past month in any physical activity or exercise such as running, calisthenics, golf, gardening or walking.

[19] For simplicity, we dropped the subscript j indicating the age group of the individual; all their results are estimated clustering the age group.

[20] Their approach is described in more details as it is similar to the one we use later in our DID approach.

Based on OLS and Poisson regressions, their model is estimated using the Health and Retirement Survey (HRS). BMI[21] and three lifestyle behaviours (Y_{it}) are considered: exercise (a binary variable equal to one if the individual reports participating in vigorous activities at least three times a week), smoking (an indicator of daily smoking, an indicator of quitting, and the number of cigarettes smoked daily), and alcohol consumption (an indicator equal to one if the respondent drinks any alcohol and an indicator of daily drinking). They consider only individuals age 60 to 69 years old.[22] In order to show that the impact of the omission of the indirect effect of insurance (increasing exposure to medical professionals who encourage prevention), they first estimate the following lifestyle model[23]

$$\begin{aligned} Y_{it} &= \alpha_i + \sum_{k=60}^{69} \beta_k AGE_{kit} + \delta MARITAL_{it} + \omega X_{it} + \sum_{t=1992}^{2004} \gamma_t YEAR_t \\ &\quad + \lambda_1 (UNIN_i * POST65_t) + \lambda_2 (UNIN_i * POST63\_64_t) + \varepsilon_{it} \qquad (5) \\ &\quad i = 1, ...N \\ &\quad t = 1992, ...2004 \end{aligned}$$

where AGE, $MARITAL$ and $YEAR$ are dummy variables indicating the age in year, whether the individual is married, and the year of the interview respectively; X is a vector of individual characteristics; α_i is the individual fixed effect. They make the strong assumptions that "while receipt of Medicare at age 65 is exogenous, having health insurance prior to age 65 is a choice. We assume that this choice depends solely on a fixed, personal characteristic, conditional on other observed time-varying factors such as employment, and that once we control for this factor, insurance status prior to age 65 is exogenous" (Dave and Kaestner, 2006, p.11). $UNIN$ indicates whether the individual has been uninsured prior to 65, $AGE63\_64$ and $POST65$ indicate whether a person is 63 or 64 and over 65 respectively. Note that they do not include a term measuring the constant difference between the insured and uninsured groups, and therefore assume that both groups have the same level of lifestyles, except at 63 or 64 and after receiving Medicare.

The coefficient λ_1 is the DID estimator of the treatment "being uninsured before 65": it measures the difference in the change in behaviour between the uninsured before 65 (the treatment group), and those insured before 65 (the control group) when they

[21] This variable was only used in Dave and Kaestner (2006).

[22] Furthermore, they remove from their sample disabled persons and those on Medicare prior to age 65.

[23] Note that the notation is the one used by the authors. However, the model as specified cannot be estimated as such due to the "dummy trap".

were 65 or older compared to being under 63. The key identification assumption is that the effect of having a health insurance on behaviour is the same for both groups, once we condition on observed covariates. The coefficient λ_2 is used to assess the validity of this assumption: as λ_2 is close to zero, Dave and Kaestner assume that the two groups follow the same trend before 65.

Finally, they estimate the DIDID estimator equal to the difference between $\lambda_1 - \lambda_2$: "it would be preferred to the difference-in-differences estimate if the interaction between the uninsured dummy variable and a dummy variable for ages 63 to 64 controlled for any differential trends between individuals who are insured versus uninsured".

The main hypothesis in their paper is the existence of an indirect effect of insurance that would also influence the lifestyles: health insurance increases the opportunity to visit the doctor and greater contact with the medical professionals is likely to influence positively health behaviour. Therefore they also estimate an extended model to allow doctor visits to have a different impact if the individual is uninsured:

$$\begin{aligned} Y_{it} &= \alpha_i + \sum_{k=60}^{69} \beta_k AGE_{kit} + \delta MARITAL_{it} + \omega X_{it} + \sum_{t=1992}^{2004} \gamma_t YEAR_t \\ &\quad + \lambda_1(UNIN_i * POST65_{it}) + \lambda_2(UNIN_i * POST63\_64_{it}) \\ &\quad + \rho_1 DOCTOR_{it} + \rho_2(DOCTOR_{it} * POST65_{it}) + \rho_3(UNIN_i * DOCTOR_{it}) \\ &\quad + \rho_4(UNINS_i * DOCTOR_{it} * POST65_{it}) + \varepsilon_{it} \qquad (6) \\ &\quad i = 1, ...N \\ &\quad t = 1992, ...2004 \end{aligned}$$

The $DOCTOR$ variable indicates whether the individual visited the doctor at time t. In order to identify the treatment effect, they do not include a health indicator that they believe to be correlated with the $DOCTOR$ and the Y variables. Moreover, they assume that the omitted health status is not correlated with the interaction term $UNIN * POST65$, and that the effect of Medicare is the same for those who did not and those who did visit the doctor pre- and post-Medicare. The sign of their estimated coefficients generally indicates that the receipt of Medicare increases unhealthy behaviour and the EAMH effect is even stronger when they control for doctor visits. However the coefficient λ_1 of the interaction term $UNIN * POST65$ is never significant.[24]

Contrary to the previous literature Stanciole (2007) recently found strong evidence of EAMH. Using the PSID panel data, he estimates a multivariate probit model

[24]In Appendix B, we discuss their approach and replicate their results.

where he allows unobservable factors to influence insurance decision and various lifestyle choices, themselves directly affected by the insurance status. This framework supposes that the decision to contract for insurance and the lifestyle choices are sequential but interdependent. His results suggests that insurance strongly encourages heavy smoking, sedentary behaviour, and obesity, but insured individuals are less likely to be heavy drinkers. The analysis of the correlation of the residuals supports the existence of unobserved factors influencing health insurance and lifestyle. With the exception of smoking behaviour, coefficients of the model argue for the existence of EAMH and the correlation of the residuals may suggest the existence of important unmeasured influences. Regrettably, the definition of the insured is not explained in this paper.

The BMI is sometimes also considered as a lifestyle measure. We do not use it our empirical work as we see it rather as a summary of past lifestyles, but it has recently been used in Bhattacharya et al. (2009). The authors look at the extent to which different types of insurance copayments influence BMI. Using the RAND data, they find weak evidence that individuals with higher cost sharing have a larger decrease in BMI during the experiment. Second, they use instrumental variable (IV) methods to investigate the impact of different types of insurance (private, public or none) on body mass. As IVs they use the percentage of workers insured in firms as a predictor of private coverage, and Medicaid coverage in different states as a predictor of public coverage. Their evidence supports the hypothesis that insurance, private or public, increases BMI.

In summary, there exists very little evidence of EAMH. One reason might be that we are omitting part of the whole story. Dave and Kaestner (2009) suggest that we should account for the indirect effect of doctor advice, Stanciole (2007)'s suggests that there is unobserved heterogeneity. We argue that the lack of evidence of EAMH may be due to an anticipation effect in the case of Medicare, and that the impact of insurance may have already appeared before the change in insurance status. Another explanation may be the existence of positive selection.

Recent theory has suggested the possibility of advantageous selection, also called positive or propentious selection (Hemenway, 1990, 1992): more risk averse individuals are more likely to be insured and also more likely to invest more in preventive activities. Evidence exists in the case of life insurance (Cawley and Philipson, 1999), long-term care insurance (Finkelstein and McGarry, 2006), private insurance (Buchmueller et al., 2008), and car insurance (Chiappori and Salanie, 2000) among others. Positive selection is compatible with EAMH, but makes the identification of the EAMH effect more difficult. We discuss this in more detail in in Section 2.5 where we set out the modelling approach.

2.3 The U.S. Health Insurance System

Since we propose to test for EAMH using data from the US, we first provide some background on the US health insurance system. The United States has the highest proportion of uninsured individuals in a developed country, and therefore offers a control group of significant size. In 1992, the first year of our data, 17.4% (38.5 million people) of the non-elderly Americans were not covered by either public or private health insurance and did not receive publicly financed health assistance (Snider and Boyce, 1994). It is the only country of the OECD which does not to provide universal health insurance coverage and the role of the government is the most limited (Scott, 2001). The US health system is the most competitive (Cutler and Zeckhauser (2000), Bureau of Labor Education (BLE), 2001) and the most expensive in the world, not only as a percentage of GDP, but also in terms of health expenditures per capita (BLE, 2001).

The US health insurance system has private and public insurance providers. Private insurance is provided through group or individual health insurance. The predominant source of private coverage is employer-sponsored health insurance which covered 58.8% of Americans in 1992 (Employee Benefit Research Institute - EBRI[25]). Employment-based plans can be accessed through one's employer, union or employed relative, but even when an employer offers a health insurance, not all the workers decide to contract in. There are two reasons for the predominance of this type of insurance; tax exemption and lower experience-rated premiums for large companies. Employer-provided insurance generally covers inpatient hospital and physician services but the type of coverage provided varies widely. Some employers allow employees to choose between several plans (e.g. indemnity insurance, managed care, HMOs), while other employers offer only one plan. Some group plans may offer dental and/or vision benefits as well as medical benefits (Agency for Healthcare Research on Quality - AHRQ[26]). If individuals are self-employed or have no employer-provided insurance, they are able to purchase individual coverage directly from an insurance company, but will be responsible for the entire premium. In 1992, only 11.8% of the population had private insurance that was not from an employer and only 8.5 % among the non-elderly.

Public health insurance only covers subsets of the population. There are two major sources of governmental health insurance: Medicare and Medicaid. Medicare is a federal health insurance program that came into force in 1965 and is now the largest health insurance in the country (Scott, 2001). It is for Americans aged of 65 and older, or with long-term disabilities or end-stage renal disease regardless of their age. In 1992,

[25] www.ebri.org
[26] www.ahrq.gov

it was covering 1.8% of the non-elderly and 96.2% of the elderly (EBRI). Medicare offers different plans: the original Medicare plan, part A, is financed by payroll taxes and covers inpatient hospital expenditures, some nursing home care and home health services (Scott, 2001). Most people do not pay a premium for part A, but the other plans are optional and require generally a monthly payment. Additional plans include part B, covering outpatient hospital treatment and doctor's services, and part D which covers part of the cost of prescription drugs and was available from January 2006. In 1997 part C was established and combines part A and part B, but is provided by approved private insurance companies. Part C is a lower-cost alternative to the original Medicare plans, and providers usually offer extra benefits but care is provided by networks of doctors and hospitals (PPOs, HMOs, etc.) belonging to the plan.[27] Some part C plans may offer part D.

The second main governmental insurance is Medicaid: it is a joint federal and state health insurance program and covers certain groups with very limited income and financial resources (pregnant women or mothers of dependent children, the blind, and disabled (Organization for Economic Cooperation et al., 1994). Medicaid programs vary from State to State, but generally covers nursing home care, home care and prescription drugs that are not covered by Medicare. In 1992, Medicaid was covering 11.6% of the non-elderly and 9.4% of the elderly (EBRI).

Additionally, the government offers various specific health insurance coverage, such as the Civilian Health and Medical Program of the Uniform Services (CHAMPUS), and the Civilian Health and Medical Program of the Department of Veterans Affairs (CHAMPVA). CHAMPUS is an insurance plan that provides medical insurance for active and retired members of the military and their families. The level of cost-sharing depends on the type of plan chosen. At the age of 66, all CHAMPUS beneficiaries move to Medicare. CHAMPVA is a health insurance offered to non CHAMPUS eligible spouses and dependent children of veterans who have been rated disabled due to a service, or to widows and dependent children of a veteran who died disabled or in the line of duty. CHAMPVA covers 75% of inpatient and outpatient care, and prescriptions.

Related types of private insurance used in the analysis include: long-term care (LTC) insurance and life insurance. LTC insurance is voluntary and partially covers chronic or disabling conditions that require care provided in a nursing home, in an assisted living facility, or in an individual's own home. LTC insurance coverage for institutional and non-institutional care varies widely depending on the chosen plan. Life insurance is individually purchased and also varies by type of plan.

Table 1 illustrates the distribution of health insurance coverage in the US for the

[27] www.medicareconsumerguide.com

Table 1: Non-elderly (<65 years old) Americans: sources of health insurance coverage (percentage, and total population in million)

	1992	1994	1996	1998	2000	2002	2004	2006
ESI	62.5	64.4	64.8	67.2	68.4	65.7	63.1	62.2
Individual Purchased	8.5	7.5	7.2	6.9	6.5	6.6	7.1	6.8
Public HI	15.1	17.1	16.2	14.5	14.6	15.9	17.7	18.2
Medicare	1.8	1.6	2.0	2.0	2.2	2.3	2.5	2.5
Medicaid	11.6	12.7	12.2	10.6	10.7	11.9	13.6	13.4
CHAMPUS/VA/TRICARE	2.6	3.8	2.9	2.9	2.8	2.8	2.9	2.7
No HI	17.4	15.9	16.4	16.5	15.6	16.6	16.9	17.2
Total Population (non-elderly)	220.8	229.9	234.1	238.6	244.8	250.8	255.1	260.0

Notes: HI: health insurance, ESI: employer-sponsored health insurance, population is in million. Note that total percentage may not add to 100% as individuals may have more than one coverage. Sources: Employee Benefit Research Institute

non-elderly.

2.4 Theoretical Model

The formal model of self-insurance, self-protection and health insurance was introduced by Ehrlich and Becker (1972) and developed further by Dave and Kaestner (2009) to account for the indirect effects of doctor visits. In Section 2.4.1, we extend the model of self-protection and health insurance by assuming that the benefits of lifestyle only appear in the future. Consequently, individuals' incentives for preventive efforts depend on future insurance: this is the *anticipatory EAMH*. In Section 2.4.2, we combine the anticipatory and classical EAMH, and generalise the model over three time period to illustrate the model's implications in the case of Medicare.

2.4.1 Lagged health effects of lifestyle

We sketch a very simple model of self-protection where the individual maximises her expected utility by choosing her investment in health related behaviour and consumption at each period. Utility is state dependant. In each period (age), the individual can be either in good health ($h = g$) or in bad health ($h = b$). Expected utility at age a is

$$u_a = [1 - \pi_a(L_{a-1})]u_a^g(L_a, x_a^g, 0) + \pi_a(L_{a-1})u_a^b(L_a, x_a^b, c_a m_a^b) \tag{7}$$

where L_a is the lifestyle chosen at age a before the individual knows her health status in that period. The higher L is, the healthier the lifestyle. x_a^h is the composite consumption good consumed at age a with health status h, m_a is medical care received if ill at age a (otherwise 0) and c_a is the coinsurance rate so that the out of pocket cost of medical care is $c_a m_a$. u_a^g and u_a^b are decreasing and convex in lifestyle, and increasing and concave in x_a^g and x_a^b.[28] π_a is the probability of being ill at age a and is decreasing and convex in the last period lifestyle (L_{a-1}). The budget constraint in state h at age a is given by

$$p_x x_a^h + p_L L_a + c_a p_m m_a^h \leqslant I_a \tag{8}$$

where p_x, p_L, p_m are the constant prices of the commodity good, lifestyle and medical care respectively and I_a is the exogenous income received at age a. We assume that the marginal utilities of the commodity good and medical care are positive but decreasing. We restrict the marginality utility of each type of good to be independent of the consumption of the other goods. We assume that the goods are measured in units such that each price is equal to one. Moreover, we assume that there is no inter-temporal transfer of income (no borrowing or lending). The only inter-temporal effect is the benefit of lifestyle: the investment in lifestyle at age a reduces the probability of sickness at age $a+1$.

We assume that the individual first chooses the optimal lifestyle for the age a before knowing her health status at this same age, and then, once the health status is revealed, chooses the commodity good x_a^h. We assume that the exogenous amount of medical care m_a is decided by the doctor in the case of illness. Using Bellman's Optimality Principle, we can solve the maximisation problem. The optimal x_a^h for $h = g, b$ solves

$$Max_{x_a} \;\; u_a^h(L_a, x_a^h, m_a^h) \; s.t. \; x_a^h + L_a + c_a m_a^h \leqslant I_a \tag{9}$$

which gives $x_a^{h*} = x_a^h(L_a, m_a^h, I_a)$.

The optimal L_a solves

$$\begin{aligned} Max_{L_a} \quad U_a = \; & [1-\pi_a(L_{a-1})]u_a^g(I_a - x_a^{g*} - L_a) + \pi_a(L_{a-1})u_a^b(I_a - x_a^{b*} - L_a - c_a m_a) \\ & + \delta\{[1-\pi_{a+1}(L_a)]u_{a+1}^g(I_{a+1} - x_{a+1}^{g*} - L_{a+1}^*) \\ & + \pi_{a+1}(L_a)u_{a+1}^b(I_{a+1} - x_{a+1}^{b*} - L_{a+1}^* - c_{a+1}m_{a+1})\} \\ & + \delta^2 U_{a+2}^* \end{aligned} \tag{10}$$

[28] Although some types of healthy lifestyle may have, at low levels, a positive marginal utility, the individual will never choose L such that her expected marginal utility is positive, and so the assumption of the negative marginal utility of L does not affect the analysis.

where L^*_{a+1} is the level of lifestyle optimally chosen at $a+1$ and U^*_{a+2} is the discounted expected utility from $a+2$ onwards given optimal decisions on L_{a+2}, L_{a+3}, ..., and x^h_{a+2}, x^h_{a+3}, ... δ is a discount factor on expected utility such that $\epsilon(0,1)$.

The first order condition on L_a implies

$$MC_a \equiv \underbrace{\frac{\partial u^g_a}{\partial L_a} + \pi_a \left\{ \frac{\partial u^b_a}{\partial L_a} - \frac{\partial u^g_a}{\partial L_a} \right\}}_{(a)} = \delta \underbrace{\frac{\partial \pi_{a+1}}{\partial L_a}}_{(b)} \underbrace{\left\{ u^b_{a+1} - u^g_{a+1} \right\}}_{(c)} \equiv MB_a \tag{11}$$

where the LHS represents the marginal cost (MC) of lifestyle and the RHS the marginal benefit (MB) at age a. (a) is the direct cost of lifestyle on current utility, (b) is the marginal productivity of lifestyle, and (c) is the future utility gain from better health.

If the individual is uninsured at age $a+1$, her future benefits of today lifestyle depend on the reduction of future probability of illness (b) and the gain from better health (c). However, if the individual is insured at age $a+1$, the latter gain (c) is reduced and is even equal to zero if the individual is fully insured (assuming that the coinsurance rate equal to zero and no other impact of illness on the utility) which removes all the future benefits of a healthy lifestyle.

2.4.2 Generalisation of the model

It is likely that the effects of a healthy lifestyle have a current effect and a delayed effect that lasts over many years on the probability of being ill. We extend the model above by assuming that current lifestyle also has direct effects on the illness probability in the current period and two periods later ($\pi_a(L_a, L_{a-1}, L_{a-2})$) to illustrate how the anticipation of Medicare can affect uninsured individuals two periods before they receive it. We omit the choices of the commodity good to simplify.

At age a, before the state of the world is known, the individual chooses her current lifestyle to maximise her discounted expected lifetime utility

$$\sum_{s=0}^{\infty} \delta^s v_{a+s}(L_{a+s}, L_{a+s-1}, L_{a+s-2}; c_{a+s}) \tag{12}$$

where

$$v_a(L_a, L_{a-1}, L_{a-2}; c_a) = [1 - \pi_a(L_a, L_{a-1}, L_{a-2})] u^g_a(L_a) + \pi_a(L_a, L_{a-1}, L_{a-2}) u^b_a(L_a; c_a) \tag{13}$$

We can now interpret $u^g_a(L_a)$ and $u^b_a(L_a, c_a)$ as quasi indirect utility functions showing utility achieved by optimal decisions as are other variables, except L_a which affects

utility.

Using Bellman's optimality principle, the optimal L_a now satisfies

$$\begin{aligned}\frac{\partial u_a^g}{\partial L_a}+\pi_a\left\{\frac{\partial u_a^b}{\partial L_a}-\frac{\partial u_a^g}{\partial L_a}\right\} &= \frac{\partial \pi_a}{\partial L_a}\left\{u_a^b-u_a^g\right\} \\ &\quad +\delta\frac{\partial \pi_{a+1}}{\partial L_a}\left\{u_{a+1}^b-u_{a+1}^g\right\} \\ &\quad +\delta^2\frac{\partial \pi_{a+2}}{\partial L_a}\left\{u_{a+2}^b-u_{a+2}^g\right\} \qquad (14)\end{aligned}$$

Similarly to equation (11), the marginal cost of a healthier lifestyle when aged a (the LHS of equation (14)) is equated to its marginal benefit which depends on the productivity of lifestyle in reducing the probabilities of ill health and on the loss in utility if ill rather than well not only at age $a+1$ but also at ages a and $a+2$.

The reduction in utility if ill rather than well is greater when the individual is not insured:

$$0 > u_a^b(L_a,0)-u_a^g(L_a) > u_a^b(L_a,m_a)-u_a^g(L_a) \qquad (15)$$

since she must bear the cost of medical care. Thus prevention at age a depends on current insurance and anticipated insurance status at ages $a+1$ and $a+2$. Suppose that the utility and illness probability functions do not vary with age and that the individual is not insured at ages $a < a^M$ but is fully covered from age a^M onward. From ages $a \geqslant a^M$ the individual will therefore choose the same level of prevention at each age, which we denote as L^I. For ages $a < a^M-2$ she is uninsured and the future benefits of prevention arise when she is not insured. Denote the optimal level of prevention at $a < a^M-2$ by L^U. Since the benefits from prevention are less when fully insured, prevention is greater at ages $a < a^M-2$ than at $a \geqq a^M$: $L^U > L^I$.[29] The expected discounted marginal benefits from prevention (the RHS of equation (14)) will also be smaller at age a^M-2 than at a^M-3 and smaller at a^M-1 than at a^M-2. Thus anticipation of full cover insurance at age a^M will lead to the optimal level of prevention trending downward even before the individual is fully insured:

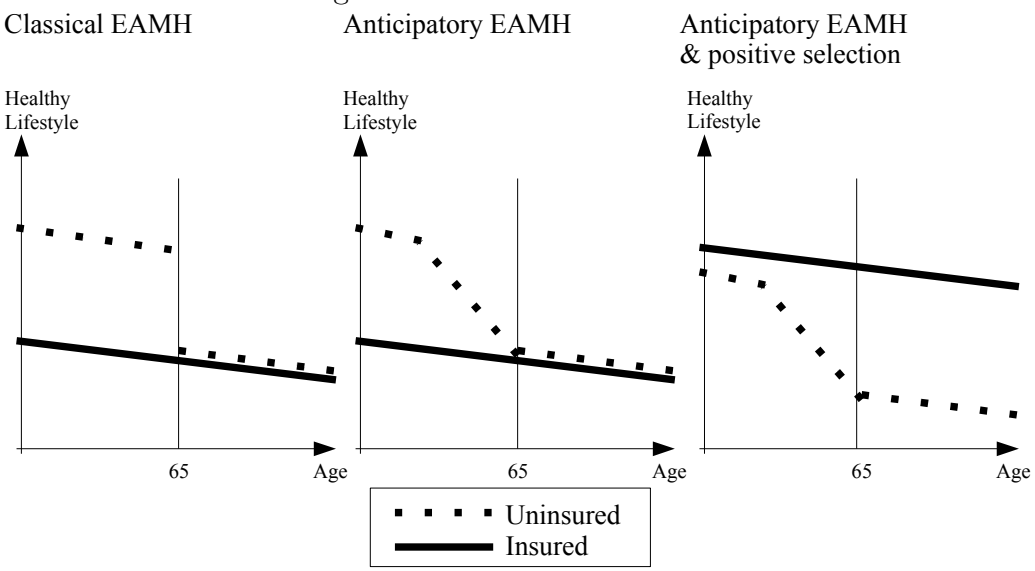
$$... = L^*_{a^M-4} = L^*_{a^M-3} = L^U > L^*_{a^M-2} > L^*_{a^M-1} > L^I = L^*_{a^M} = L^*_{a^M+1} = ... \qquad (16)$$

We call this phenomena *anticipatory EAMH*.

Although utility and probability functions do vary with age, the result that anticipation of future receipt of Medicare at age 65 will affect the behaviour before age

[29] The assumption that $\partial[\partial u_a^b/\partial L_a]/\partial c_a m_a \geq 0$ implies that the expected marginal cost of prevention is not reduced by full cover insurance against medical costs.

Figure 1: Ex Ante Moral Hazard



65 of those who are uninsured before age 65 holds in general. There will be no such anticipatory change in behaviour before age 65 for those who are insured before age 65, assuming that the generosity of the coverage remains very similar. Thus it will be possible to test for anticipatory EAMH by comparing the changes in the trends of lifestyles affecting health before and after age 65 for those previously uninsured and insured before age 65.

Figure 1 illustrates the effects of the receipt of Medicare at age 65 on those previously insured and uninsured, as discussed above. The first graph shows EAMH without anticipation. The uninsured are assumed to have a much more healthy lifestyle before 65 and to suddenly reduce their effort at 65 and thereafter. The second graph presents anticipatory EAMH with prevention by those uninsured before age 65 falling relative to that of the insured as age approaches 65. The third graph combines positive selection and anticipatory EAMH so that the uninsured undertake less prevention even before they start to anticipate the change in their insurance status. Our identification strategy presented in the next section makes no prior assumption on the type of relationships potentially present in the data and is flexible enough to accommodate any of these patterns.

2.5 Estimation Strategy

We use the granting of Medicare to almost all Americans at the age 65 to analyse the impact of an anticipated exogenous change in health insurance on lifestyles. The clas-

sical EAMH hypothesis postulates that the uninsured will adopt a less healthy lifestyle once insured post 65 because health insurance removes the financial consequences of illness. Our theoretical model in Section 2.4 has shown that, if the consequences of a less healthy current lifestyle also affect future health, individuals who anticipate Medicare will change their lifestyle before 65. As we do not know when the anticipation of Medicare has an effect on lifestyles, if any, we use flexible methods that not only allow us to identify an effect of Medicare on lifestyles before 65 years old (if there is anticipatory EAMH), but also after 65 years old (the classical EAMH effect).

Americans not continuously insured generally face the same risk of forgoing needed medical care or having problems paying their medical bills as the ones continuously uninsured (Schoen and DesRoches, 2000). Therefore, we use the continuously insured individuals as our reference or control group as they have been continuously exposed to the treatment (health insurance coverage) and Medicare only prolongs their health insurance. The uninsured or temporally insured are our treatment group as they experience an expected change in exposure at the age of 65. In what follows, we will refer to the "insured" and "uninsured" to distinguish between the two groups. But this appellation does not always correspond precisely to the their actual coverage up to age 65. We use various definitions of the insured and uninsured groups which are described in detail in Section 2.6.2.4.

Our model in Section 2.4 predicts that, if the individual knows that the consequences of her lifestyle will also appear in the future after she is insured, she will reduce her current investment in healthy lifestyle. However, when she starts decreasing her effort depends on when she believes she will experience the consequences. As her beliefs cannot be observed, we adopt flexible models allowing for a change in behaviour in the last 6 years before receiving Medicare.[30] We use different approaches to test for the presence of classical and anticipatory EAMH without imposing a specific age at which Medicare could influence the lifestyles of the uninsured. Our identification strategy is to measure the impact of age on lifestyles allowing for different effects between the treatment (uninsured pre 65) and the control (insured pre 65) groups at all ages.

We seek to measure the average treatment effect (ATE), but, as the uninsured group only represents a sub-sample of the population that is not representative, very often only the average treatment effect on the treated (ATT) will be measured, i.e. the impact of becoming insured on the previously uninsured.

[30]We did not consider more lags as we also want to observe the individual just after receiving Medicare to allow for the classical EAMH effect. Ideally, we would of course prefer to observe more time periods before the age of 65 but we are limited by our data and the size of the sample.

As the interviews are conducted every two years, for each method we compare individuals and their lifestyles by pairs of years; the effect of insurance on lifestyles is measured at ages 59/60, 61/62, 63/64, 65/66 and 67/68. The main reason for comparing individuals by pairs of years is to compare the same group of individuals at all ages. Otherwise, some individuals would only be observed at odd ages and the other at even ages.[31]

We start our analysis with matching methods. Simple comparison of the lifestyles of the insured and uninsured before they are eligible for Medicare will not identify the effect of insurance on lifestyle since selection into insurance is not random. It may be that individuals who are better educated will be more likely to choose a healthy lifestyle and to be richer, hence more able to buy insurance. If such selection depends on observable characteristics then it can be allowed for either via regression or using propensity score methods which make fewer assumptions about the way selection depends on observables. For example, in order to remove the correlation between the observables and the treatment, Horvitz and Thompson (1952) suggest comparing weighted means of the outcome variable using the inverse of the propensity score as weights.

The objective of matching is to recreate post-experiment a random allocation to treatment based on observable characteristics. This is possible if the confounding factors affecting pre 65 insurance status are observable. We limit our sample to individuals aged between 59 and 68 years old, and as the control and treatment groups allocation is defined on the basis of insurance coverage between 61 and 64 years old, we use information at the ages 59 and 60 to estimate the propensity score, assuming that the variables at theses ages are not affected by the allocation of the insurance group defined in the future nor the change in health insurance coverage.

Matching methods allow us to compare the lifestyle variables between the insured and uninsured group at the different ages ($M(a)$). If there are differences between the two groups, these could simply be due to adverse selection, if the uninsured have a more healthy lifestyle than the insured, or to positive selection if the insured generally have a more healthy lifestyle than the uninsured. Therefore, we then compute difference-in-differences matching ($MDID(a, a')$) to analyse the changes over the ages a to a' in lifestyle between the two groups. If the differences remain constant over the years, they cannot be attributed to EAMH. This approach has been suggested by Heckman et al. (1997) to control for bias stability (Eichler and Lechner, 2002): if there are differences between the two groups that are not observed but affect the selection to treatment, this bias can be removed if it is constant over time by taking the difference. The main advantage of these two semi-parametric approaches is that they allow us to

[31] Our data is described in detail in Section 2.6.

control for self-selection based on observables without imposing a type of selection. The simple matching and DID matching methods are complementary. The $M(a)$ estimator informs us about which group has the most healthy lifestyle at a specific age, that is the differences in levels at the different ages. The $MDID(a, a')$ estimators account for constant differences between both groups and only measure the relative changes in behaviour between the two groups. For each estimator, matching is performed with different methods to see how sensitive our results are.

A drawback of the matching methods is that they do not allow us to distinguish between the direct and possible indirect effects of insurance, for example due to the lower cost of a doctor visit if insured that would encourage a healthier behaviour (Dave and Kaestner, 2009). The main purpose of the DID model is to compare the mean of the outcome variable between the two groups before and after the treatment controlling for observable time-varying factors. Adding interactions terms permits us to disentangle direct and indirect effects due to doctors visits.

Difference-in-differences regression methods have been widely used to estimate the impact of a change in policy (for example Ashenfelter, 1978; Ashenfelter and Card, 1985, Blundell et al. (2004)) by comparison of changes in outcomes before and after treatment for the treated and untreated. DID methods can be applied to estimate the effect of Medicare eligibility at age 65 (e.g. Dave and Kaestner, 2009, Decker, 2005). But these methods may not be appropriate if they assume that the change in lifestyle due to Medicare occurs only from age 65 onwards when the previously uninsured are now covered.[32] Comparing lifestyle post 65 with lifestyle immediately before the granting of Medicare does not allow for anticipation effects at earlier ages. It also assumes that those who are insured and uninsured before age 65 would have the same lifestyle trends in the absence of Medicare eligibility at age 65, conditional on observables. Therefore, our approach extends the Dave and Kaestner's model based on DID by allowing for more possible indirect effects and we analyse all the possible differences over the age range of observations not to limit EAMH to age 65. We also estimate the models using non-linear models that better fit the data.

The DID approach identifies the ATE over the whole sample. However, the estimated effect is biased if the different covariates do not overlap between the two groups as some coefficients will be affected mainly by one group, the others by the other group. As illustrated in the descriptive statistics in Section 2.7.1, the two groups are different, but the range of their PSs overlaps, so it is not an issue.

[32]In addition to a dummy variable equal to one if the individual has been previously uninsured and is 65 or more, Dave and Kaestner (2009) include a dummy equal to one if the individual is uninsured and 63/64 years old to assess the validity of their identification assumption at 65. The coefficients on this dummy variable are often but not always equal to zero suggesting some anticipatory EAMH.

The classical DID approach assumes random assignment to treatment after we control for the observable time-variant confounding variables. With non-experimental data, random assignment to treatment is very unlikely and in the context of health insurance; self-selection on observables and possibly unobservables is a recurrent problem. Originally, it was assumed to arise from adverse selection problem: insurance coverage was attracting bad risks (Bundorf et al., 2005; Cardon, 2001) which means that individuals who want to smoke, drink and not exercise, or individuals who already know they have (or will have) bad health, would be more likely to have insurance. However, some authors have recently suggested the existence of positive selection, also called propentious selection (Hemenway, 1990): more risk-averse individuals are more likely to have an insurance and also more likely to have a healthy lifestyle, and probably a better health too. Risk aversion is a major issue as it is not explicitly measured in the data.

In our final approach, we therefore combine matching with regression, first to avoid having to arbitrarily choose the most appropriate method between matching and regression, and second to investigate further more complex forms of unobservable selection. The propensity score model is used to remove the correlation between the observables and the insured and uninsured at the age 59 or 60. The regression models control for the time varying observable confounding factors (Imbens and Wooldridge, 2008). This combination of both the propensity score and DID regressions methods is called the double-robust (DR) estimator (Rubin, 1973, Robins et al., 1995) and estimates the difference $DR(a)$ in lifestyles between those insured and uninsured before age 65 at a given age. The DR method is consistent if either the propensity score model or the regression model is correctly specified (Lunceford and Davidian, 2004, Bang and Robins, 2005). It allows us to relax the assumption that either the parametric model or the use of the propensity score is the appropriate identification method.

The DR estimates measure the lifestyle differences $DR(a)$ between the insured and uninsured groups at each age, adjusted for observable differences (e.g. education) and selection on observables. But it remains potentially affected by time-variant and invariant unobserved differences that do not permit us to distinguish selection from EAMH. We therefore compute the differences in the DR estimates ($DR(a)$) at the different ages ($DRDID(a, a')$) in order to remove unobserved time-invariant differences. $DRDID(a, a')$ estimates close to zero indicate that the observed differences, if any, are due to selection based on time-invariant unobserved factors. Contrarily, $DRDID(a, a')$ estimates different from zero indicate that the two groups follow different trends. Only a *change* in the trend of the uninsured relative to the insured could indicate the presence of EAMH as predicted by the theoretical model in Section 2.4 and illustrated

in Graph 1. Differential linear trends may be due to unobserved time-variant factors changing gradually with age. For example the two groups may have different preferences for physical exercise and those preferences may be diminishing more rapidly with age for the uninsured group. The difference-in-differences of the DR estimates ($DRDIDID(a, a', a'', a''')$) are robust to time-invariant and time-variant factors as long as those latter change linearly with respect to age.

We now explicitly formulate the different methods used in the analysis.

2.5.1 Propensity score matching

Control and treated groups are defined by their insurance status between ages 61 and 64.[33] Let U_i be equal to 0 if the individual is assigned to the pre age 65 insured (control) group or equal to 1 if the individual is allocated to the pre 65 uninsured (treatment) group. Matching can re-create post-experiment the experimental conditions if selection is due only to observable characteristics: matching allows us to select a group of insured individuals (the control group) who are the counterpart of the uninsured individuals so that the only remaining lifestyle differences are due to the receipt of insurance.

As we only match treated individuals to the controls (the insured individuals), the PSM estimation approach only estimates the ATT. Matching requires two main assumptions.[34] First, the (weak) conditional independence assumption (CIA, Rubin, 1974, 1997)[35]

$$L^0_{i,a} \perp U_i | X_{i\tilde{a}} \tag{17}$$

where $L^0_{i,a}$ is the lifestyle for individual i at ages $a = 59/60, ..., 67/68$ if insured ($U_i = 0$) and $X_{i\tilde{a}}$ the pre-treatment ($\tilde{a} = 59/60$) observable confounding factors. The CIA supposes that assignment to treatment is associated only with observable intervention variables $X_{i\tilde{a}}$ (Dehejia and Wahba, 1999). As we are interested in the impact of insurance on the uninsured, we only assume that the insurance assignment is independent of the lifestyle in the case of insurance once we control for the observable factors. This assumption does not exclude selection on unobservables, but they should not be related to the outcome of interest, otherwise our estimate will be biased (Moreno-Serra, 2007).

As a result of the CIA,

[33] As individuals are interviewed every two years, it means that we use the information from the two waves before receiving Medicare.

[34] The assumptions to identify the ATT are weaker than the ones necessary to retrieve the ATE.

[35] The conditional independence assumption is equivalent to the selection on observables assumption, or the unconfoundness assumption (Imbens 2005), or the ignorable treatment assignment assumption (Rubin 1978).

$$E(L^0_{ia}|X_{i\tilde{a}}, U_i = 0) = E(L^0_{ia}|X_{i\tilde{a}}, U_i = 1) \tag{18}$$

which means that the average lifestyle with no insurance is the same for the insured and uninsured individuals once we control for the confounding factors. This allows us to identify the ATT at ages a

$$ATT_a = E(L^1_{ia}|X_{i\tilde{a}}, U_i = 1) - E(L^0_{ia}|X_{i\tilde{a}}, U_i = 1) \tag{19}$$

where the last element (the counterfactual that is not observed) can be replaced by $E(L^0_{ia}|X_{i\tilde{a}}, U_i = 0)$.

The second necessary condition is the the existence of a common support (CS) for the treated individuals. This can be expressed as

$$Pr[U_i = 1|X_{i\tilde{a}}] < 1 \tag{20}$$

where $Pr[U_i = 1]$ is the probability of being uninsured (treated). The CS assumption refers to the joint distribution of the treatment conditional on the covariates and means that if for some individuals, given their $X_{i\tilde{a}}$, we know for sure that they will not be insured, the ATT cannot be retrieved as these individuals will not have a counterfactual with the same characteristics.[36]

If these two assumptions (equations (17) and (20)) are satisfied, we can conclude that the treatment assignment is strongly ignorable given $X_{i\tilde{a}}$ (Rosenbaum and Rubin, 1983) and that an unbiased estimate of the ATT can be computed. The ATT at ages a is defined as

$$ATT_a = E_{X_{i0}\epsilon CS}\{E(L^1_{ia}|X_{i\tilde{a}}, U_i = 1) - E(L^0_{ia}|X_{i\tilde{a}}, U_i = 1)\} \tag{21}$$

for $X_{i0} \in CS$ and for $a = 59/60, ..., 67/68$. Rosenbaum and Rubin (1983) demonstrate that if the treatment assignment is strongly ignorable given X,[37] then it is strongly ignorable given the propensity score (PS). This allows us to match individuals not on the basis of all relevant X, but on the basis of their PS.

The PS is defined as the conditional probability of being treated (uninsured) given some pre-policy-intervention variables X:

$$p(X_{i\tilde{a}}) \equiv Pr[U_i = 1|X_{i\tilde{a}}] = E[U_i|X_{i\tilde{a}}] \tag{22}$$

[36] In practice, when we impose CS to the sample studied it means that we exclude certain individuals having a propensity score not in a certain range, but it has not been necessary in our case as both groups overlap well.

[37] Strongly ignorable means that the CIA and CS assumptions hold.

Rosenbaum and Rubin (1983) show that the PS is a balancing score, which means that individuals with the same PS are identical in terms of their covariates (X_{i0}) independently of their group (Cameron and Triverdi, 2005). This property of the PS simplifies the CIA (equation (17)) to

$$L_{it}^0 \perp U_i | X_{i\tilde{a}} \Rightarrow L_{it}^0 \perp U_i | p(X_{i\tilde{a}}) \tag{23}$$

It implies that the CIA is satisfied once we control for the PS. This is a very convenient result as it is reduces the matching dimension to only one variable. The ATT can be identified as

$$\begin{aligned} ATT_a^{PSM} &\equiv E(L_{ia}^1 - L_{ia}^0 | U_i = 1) \\ &= E\{[E(L_{ia}|p(X_{i\tilde{a}}), U_i = 1) - E(L_{ia}|p(X_{i\tilde{a}}), U_i = 0)]|U_i = 1\} \\ &\equiv MD(a) \end{aligned} \tag{24}$$

for $X \in CS$.

2.5.2 Matching difference-in-differences

Heckman et al. (1997) and (1998) have proposed to combine DID approach with matching ($MDID$) to account for unobservable time-invariant differences that may still be present even after conditioning on observables. Thus, when panel data (or repeated cross-sectional data) is available, MDID eliminates selection on unobservable time-invariant differences that pure PSM estimators fail to account for (Smith and Todd, 2005).

Similarly to the PSM approach, unbiasedness of the MDID estimators relies on the assumptions of CIA and CS. In this case, the weak CIA in equation (23) becomes

$$(L_{ia'}^0 - L_{ia}^0) \perp U_i | p(X_{i0}) \tag{25}$$

where $\tilde{a'} > a$. It assumes that the change in lifestyles of the uninsured group would have been similar to the insured individuals had they received an insurance (common trend assumption). This is different from PSM as here the insurance status (U_i) can be a predictor of the lifestyle if insured (L^0) given the PS, but it must not be correlated with the changes $L_{ia'}^0 - L_{ia}^0$ conditional on the PS (Todd, 2008). As a results of the CIA, we have that

$$E(L_{ia}^0 - L_{ia'}^0 | X_{i0}, U_i = 0) = E(L_{ia}^0 - L_{ia'}^0 | X_{i0}, U_i = 1) \tag{26}$$

The CS assumption is identical as in equation (20) as we have a panel database.[38] Based on these two assumptions, the net ATT using MDID is then defined as

$$\begin{aligned} ATT^{MDID}_{a',a} &\equiv E((L^1_{ia'} - L^1_{ia}) - (L^0_{ia'} - L^0_{ia})|U_i = 1) \\ &= E\{[E(L_{ia'} - L_{ia}|p(X_{i0}), U_i = 1) - E(L_{ia'} \\ &\quad -L_{ia}|p(X_{i0}), U_i = 0)]|U_i = 1)\} \\ &\equiv MDID(a, a') \end{aligned} \tag{27}$$

for $a = 59/60, ..., 67/68$ with age $a < a'$.

2.5.3 Difference-in-differences approach

2.5.3.1 Anticipatory and classical EAMH

The unbiasedness of the DID estimator relies on two crucial assumptions (Blundell and Costa Dias, 2008): (1) the composition of the two groups must remain constant before and after the change in exposure to insurance, and (2) the two groups must be influenced in the same way by the time trend. The first assumption is very strong in the case of repeated cross-sectional data but may still be violated with panel data if attrition or non-response cause a significant change in the groups structure. Moreover, the assumption is violated if unobserved time-variant confounding factors exists.[39] However, if unobserved characteristics vary linearly over time between the two groups, we can still take them into account by taking triple difference (the difference of the DID estimator). This approach is developed in Section 2.5.4.

The common time effect assumption implies that individuals are affected in the same way by aggregate shocks, independently of their group. In our framework, it means that the age effect is not systematically different between both groups in the absence of treatment once we control for individual characteristics.

Although a parametric approach requires stronger assumptions, particularly the specification of the estimated model, it is very useful in decomposing the possible direct and indirect effects of insurance on lifestyle (Dave and Kaestner, 2009). Similarly to the approach adopted by Dave and Kaestner, we start with a linear model but allow the uninsured to be different from the insured at every age group.[40] Our basic regression

[38] In the case of a repeated cross-sectional data, the CS would be a stronger assumption as it must hold between the two periods, which does not have to be the case as the groups' structure may change over time. However, non-random attrition could be an issue in our case.

[39] For example, if risk aversion is time-varying.

[40] Dave and Kaestner (2009) allow insurance to have a different impact at age after 65, as well as one wave before 65 years old.

framework is

$$L_{ia} = \alpha + \beta X_i + \sum_{t=61/62}^{67/68} \eta_t A_{it} + \delta U_i + \sum_{t=61/62}^{67/68} \gamma_t A_{it} U_i + \varepsilon_{ia} \quad (28)$$
$$for \ \ a = 59/60, ..., 67/68$$

where L_{ia} represents the lifestyle of individual i at ages a, X_i are the control variables including a dummy for doctor visits, $A_{ia} = 1[a = A]$ are the age dummy variables and U_i equals 1 if the individual i is in the uninsured group or zero otherwise. The coefficients γ_t in equation (28) measure the difference between the changes in lifestyles between ages a and the baseline ages 59/60 between the uninsured and insured individuals. This can be illustrated as follows:

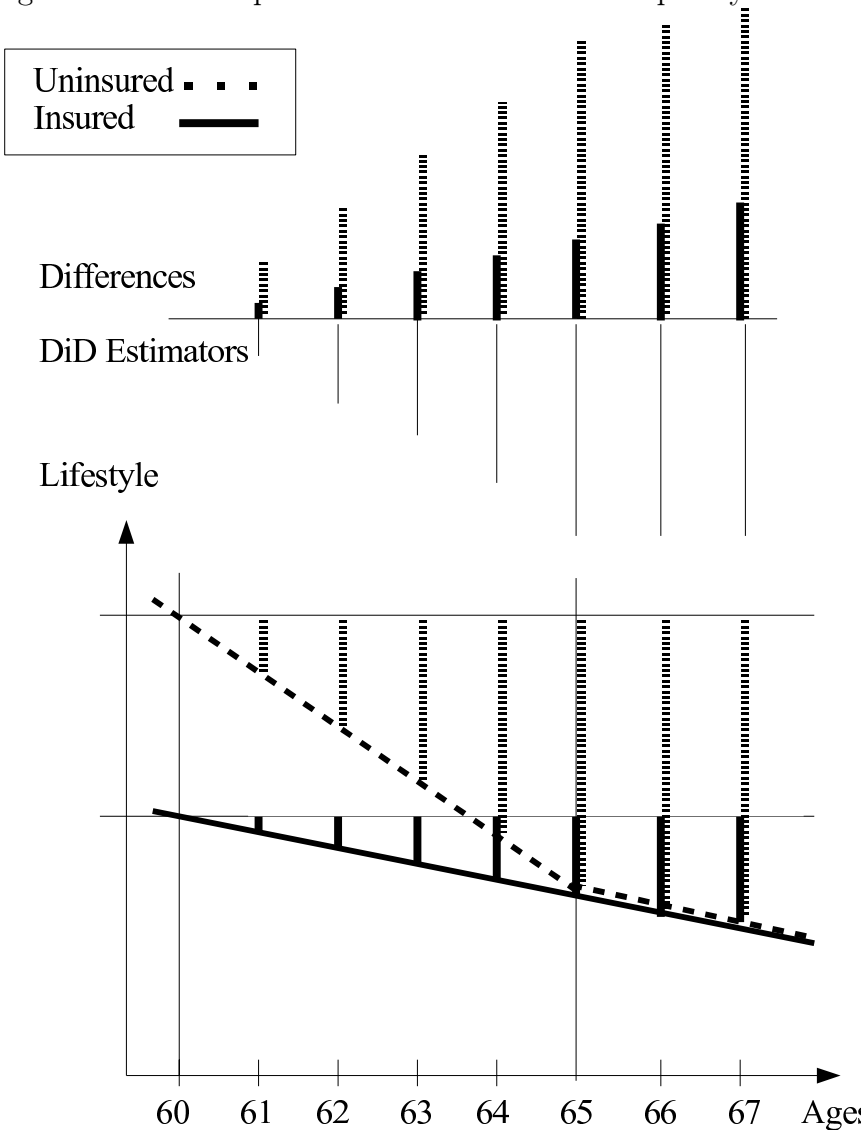
$$\begin{aligned} DID(a,\, 59/60) &= E[L_{ia} - L_{i,59/60}|U_i = 1] - E[L_{ia} - L_{i,59/60}|U_i = 0] \\ &= \{(\alpha + \beta X_i + \eta_a + \delta + \gamma_a) - (\alpha + \beta X_i + \delta)\} \\ &\quad -\{(\alpha + \beta X_i + \eta_a) - (\alpha + \beta X_i)\} = \gamma_a = ATE^{DID}_{a,59/60} \end{aligned} \quad (29)$$

In Figure 2, we illustrate what the DID estimators would be in the case of anticipatory EAMH if the reference age was 60 years old.[41] Here, lifestyle is measured in a positive way (e.g. exercise or quitting smoking), and we assume that it decreases over the years for both groups, but faster for the uninsured before 65. In terms of the DID estimators, from age 60 to 65, the difference between the change in lifestyles for the two groups increases and becomes more and more negative. This is because, if the uninsured group anticipates their insurance coverage and EAMH is present, they will reduce their investment in healthy lifestyles already before 65. From 65 onwards, there is only the age effect and both groups reduce their lifestyle investment of the same amount. This is why after 65 years old the difference between the change compared to the reference age is constant. Therefore, in the case of anticipatory EAMH only, the coefficients would be such that $|\gamma_{61/62}| < |\gamma_{63/64}| < |\gamma_{65/66}| = |\gamma_{67/68}|$. The presence of adverse or positive selection if it only shifts up or down the trends would not affect this conclusion.

It is important to note that the presence of EAMH with anticipatory behaviour implies a change in relative trends that can be examined by taking further differences. These (in)equalities between the different coefficients can be pairwise tested using the Wald test to test equalities and t-tests to perform one-sided tests. Let us define $a' = a+1$

[41] For the intuition, we have represented the DID estimators at all ages, but in our case, we only have five estimators (59/60, 61/62, 63/64, 65/66, 67/68) with respect to the reference ages 59/60.

Figure 2: DID - Expected coefficients with anticipatory EAMH



Notes: We have assumed here that lifestyle is measured in a positive way (e.g. exercise) and that we observe individuals at every age. The graph at the bottom represents possible lifestyle trends for the insured (full line) and the uninsured (dashed line) in the case of EAMH with anticipatory behaviour. The vertical lines are the differences for each group at each age with respect to their baseline age 60. These differences are reported in the top graph on the horizontal line. Below the horizontal line, the vertical lines are the differences between the group differences at each age, i.e. the DID estimates.

so that for example if $a = 61/62$ then $a' = 63/64$. The null hypothesis can be expressed as

$$H_0 : \gamma_{a'} = \gamma_a \tag{30}$$

in the case of a Wald test and $H_0 : \gamma_{a'} >= \gamma_a$ or $H_0 : \gamma_{a'} <= \gamma_a$ in the case of one-sided tests. Equation (30) can be reformulated as $\gamma_{a'} - \gamma_a = 0$ (and $\gamma_{a'} - \gamma_a >= 0$, $\gamma_{a'} - \gamma_a <= 0$ in the case of one-sided tests) which is equivalent to looking at the changes in behaviour between the two groups between two interviews.

Our theoretical model predicts a change in the relative trends between the uninsured and insured if the uninsured anticipate the granting of Medicare in the future, but it does not predict at which age it happens. The age at which anticipatory behaviour appears depends on the individual's discount rate and the time it takes for the reduction in healthy activities to affect health. These are only known to the individuals. However, we can identify the presence of anticipatory behaviour between two interviews if we observe a change in the relative trends at least once before the age of 65. In the case of a healthy lifestyle, the assumption of anticipatory behaviour cannot be rejected if the uninsured start investing less at age $a' < 65$ compared to the age a in the previous wave, relative to the insured between the same age i.e. if $\gamma_{a'} < \gamma_a$. If the relative change in trends appears after 65, we cannot reject the classical assumption of EAMH.

2.5.3.2 Possible indirect effect

Dave and Kaestner (2006; 2009) assume that the effect of insurance on lifestyle may be larger if we take into account the possible indirect effect that insurance has by facilitating the contact to a medical doctor (as it reduces the cost of a doctor visit). Therefore, we extend equation (31) to account for very flexible indirect effects

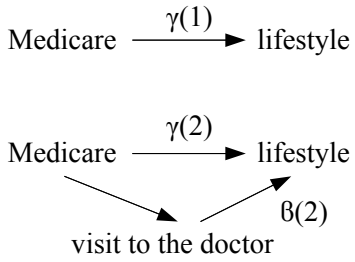
$$\begin{aligned} L_{ia} \;=\; & \alpha + \beta X_i + \sum_{t=61/62}^{67/68} \eta_t A_{it} + \sum_{t=59/60}^{67/68} \gamma_t A_{it} U_i + \beta_{Dr} Dr_{ia} + \beta_{DrA65} Dr_{ia} After65_i \\ & + \beta_{DrB65U} Dr_{ia} Before65_i U_i + \beta_{DrA65U} Dr_{ia} After65_i U_i + \varepsilon_{ia} \\ & for \;\; i = 1, ..., N \;\; and \;\; a = 59/60, ..., 67/68 \end{aligned} \tag{31}$$

where the effect of doctor visits is allowed to be different before and at or after 65 for the insured (β_{Dr} and β_{DrA65}) as well as for the uninsured (β_{DrB65U} and β_{DrA65U}). It allows us to identify separately the possible (indirect) effects of doctor visits on lifestyle.

Using equation (28) and equation (31), we illustrate the direct and indirect effects in Figure 3. In the above relationship corresponding to our first model, γ measures the

direct and indirect effect together, whereas in the second case the possible (positive) effect of a visit to the doctor on the lifestyle is excluded to leave γ measuring only the direct effect of insurance on lifestyle. The indirect effect is measured by β (in equation (31) we have allowed for more flexible indirect effects). Doctor visits for the insured may be beneficial if they receive some advice on their lifestyle during a routine visit, whereas uninsured may visit the doctor when uninsured because of acute health problems and thus the indirect effect of doctor visits maybe negative in this case.

Figure 3: Medicare - Its possible direct and indirect effects



2.5.3.3 Implementation

We apply first the classical DID methods using a linear fixed effect model for comparison with previous results in the literature. However the assumption of linearity might be viewed as inappropriate given the distribution of the various dependant variables used here. Therefore, we then turn to probit and negative binomial[42] methods in order to account for the distribution of the dependent variables.

Although the analysis of the coefficients as described above is straightforward when using linear methods, coefficients from non-linear regressions models just have a qualitative interpretation.[43] Therefore in the results below we present the average marginal effects and test (in)equalities in the changes in the effect over the years.

2.5.4 Double-robust estimator

When we have large samples relative to the number of the covariates, one can be confident using nonparametric or semi-parametric such as the propensity score due to asymptotic efficiency (Imbens and Wooldridge, 2008). With smaller sample, it maybe

[42]For the count variables, we started with a Poisson model but tests of equidispertion suggested that the presence of overdispertion could not be rejected.

[43]There has been in the literature a debate on the interpretation of the interaction coefficients (e.g. Ai and Norton, 2003), but Puhani (2008) shows that it is still relevant to focus on the interaction term that estimates the treatment effect (it also only has a qualitative interpretation and therefore the average marginal effects are always reported).

better to estimate the conditional means using parametric approaches if they are correctly specified. But parametric models generally rely on strong assumptions that are not testable in which case a propensity score approach has a smaller bias (Drake, 1993).

Rubin (1973) suggests combining propensity score and covariate adjustment methods to obtain robust and efficient estimators. Based on the work of Robins and Rotnitzky (1995) and Robins et al. (1995), Scharfstein et al. (1999) develop an estimator combining propensity score matching and covariates to adjust for missing outcome variables. Lunceford and Davidian (2004) adapt it to the case of non-random treatment allocation (if the non-random treatment allocation is based on observables). This approach has been referred to in the literature as double-robust as "it remains consistent when either a model for the treatment assignment mechanism (the PS) or a model for the distribution of the counterfactual data is correctly specified" (Bang and Robins, 2005, p.962). In both cases, the unbiasedness of the estimator relies on the ignorability of treatment assignment assumption.

The form of the double-robust estimator is similar to the inverse probability estimator but augmented for an expression involving the predicted values of the regression model that permits to increase efficiency (Lunceford and Davidian, 2004). As we are interested in the impact of insurance at different ages, we estimate the double-robust estimator of the average treatment effect using the Emsley et al. (2008) implementation but adapt it to measure separately the effect at different ages a:

$$\begin{aligned} DRD(a) &= \frac{1}{N}\sum_{i=1}^{N}\frac{U_i L_{i,a} - (U_i - \hat{p}_i)\widehat{l_{1,a}(X_{ia})}}{\hat{p}_i} \\ &\quad -\frac{1}{N}\sum_{i=1}^{N}\frac{(1-U_i)L_{i,a} + (U_i - \hat{p}_i)\widehat{l_{0,a}(X_{ia})}}{1-\hat{p}_i} \end{aligned} \tag{32}$$

where $\widehat{l_{U,a}(X_{ia})} = E(L_{ia}|U_i = U, Age = a, X_{ia})$ is the lifestyle at age a predicted for individual i using regression models estimated separately for the insured ($U_i = 0$) and the uninsured ($U_i = 1$) and applied to i's characteristics $X_{i\tilde{a}}$. The regression model $E(L_{ia}|U_i = U, X_{ia})$ is estimated separately for the two groups allowing X_{ia} to have different effects on the insured and uninsured lifestyles. The predicted lifestyles $\widehat{l_{U,a}(X_{ia})}$ at the different ages a for the uninsured (insured) from the model estimated on the insured (uninsured) provide counterfactuals. We allow for doctor visits (Dr_{ia}) to have a different effect on the lifestyles of the uninsured, distinguishing between the effect of doctor visits made by the uninsured before being insured and after being insured (Dave and Kaestner, 2009). The regression model $E(L_{ia}|U_i = 1, X_{ia})$ estimated

using the uninsured sample is

$$\begin{aligned} L_{ia} &= \alpha + \sum_{t=61/62}^{67/68} \gamma_t A_{it} + \beta_{DB} Dr_{ia} * Before65 + \beta_{DA} Dr_{ia} * After65 \\ &+ \beta X_{ia} + \varepsilon_{ia} \end{aligned} \tag{33}$$

and the regression model $E(L_{ia}|U_i = 0, X_{ia})$ estimated using the insured sample is

$$L_{ia} = \alpha + \sum_{t=61/62}^{67/68} \eta_t A_{it} + \beta_D DR_{ia} + \beta X_{ia} + \varepsilon_{ia} \tag{34}$$

where the η_t capture the age trend of the insured and the γ_t the age trend of the uninsured. β_D captures the effect of doctor visits on the lifestyle of the insured, β_{DB} and β_{DA} of the uninsured before and after they are insured respectively. X_{ia} is the set of observable covariates affecting lifestyles. Models (33) and (34) allow us to predict the counterfactuals $\widehat{l_{1,a}(X_{ia})}$ for the insured and $\widehat{l_{0,a}(X_{ia})}$ for the uninsured.

The sampling variance can be estimated as

$$\begin{aligned} V(DRD(a)) &= \frac{1}{N^2} \sum_{i=1}^{N} [\frac{U_i L_{i,a} - (U_i - \hat{p_i}) l_{1,a}(X_i)}{\hat{p_i}} \\ &- \frac{(1 - U_i) L_{i,a} - (U_i - \hat{p_i}) l_{0,a}(X_i)}{1 - \hat{p_i}} - DRD(a)]^2 \end{aligned} \tag{35}$$

Similarly to the DID approach, the common support of the covariates maybe an issue. The more confounding factors with lack of overlap between the two groups, the more untrustworthy are the model-based extrapolations (Rubin, 1977). The estimated effect will be determined by one group or the other depending on its predominance on different regions of the control variables (Lunceford and Davidian, 2004). Therefore, we also estimate the model restricting the controls to the ones having a PS in the range of PS of the uninsured individuals.

2.5.5 Double and triple differences in the double-robust estimator

The possible bias due to unobserved confounding factors can be reduced by controlling for the unobserved time-invariant factors. This is achieved by taking the difference between two estimates. Therefore, we present the difference-in-differences estimates

defined as

$$DRDID(a, a') = DRD(a') - DRD(a) \tag{36}$$

for $a = 59/60, ..., 65/66$ and $a' = 61/62, ..., 67/68$ and we estimate their standard errors using bootstrapping. The $DRDID(a, a')$ estimate will be zero if the two groups pursue different levels of lifestyle but follow the same trend. It will be positive if the uninsured have a flatter increasing or a steeper decreasing trend.

Our theoretical model predicts that uninsured individuals progressively reduce their investment in lifestyle, relative to the insured, from the age at which current lifestyle affects health at age 65. To test for a change in trends, we measure difference-in-differences-in-differences in lifestyle using the $DRDID(a)$ estimates:

$$DRDIDID(a, a', a'', a''') = DRDID(a'', a''') - DRDID(a, a') \tag{37}$$

where the differences are measured at the ages $a < a' < a'' < a'''$. For example the $DRDIDID(5960, 6162, 6364, 6566)$ measures the difference between the relative change between the insured and uninsured between ages 63/64 and 65/66 with respect to the relative change between the two groups between ages 59/60 and 61/62. We bootstrap the standard errors. The $DIDID(a, a', a'', a''')$ estimate is robust to linear time-variant unobserved characteristics, but will be biased by other unobserved time-variant factors if the change in those factors is not due to (anticipatory) EAMH (Blundell and Costa Dias, 2008).

2.6 Data

2.6.1 The Health and Retirement Study

The Health and Retirement Study (HRS) is a representative longitudinal survey of Americans over age 50, and their spouse, living in a household. It began in 1992 and has been repeated every two years, adding cohorts to maintain a representative sample. In 1993 and 1995, separate similar interviews were administrated to nationally representative individuals over 70 years. This AHEAD cohort (the Asset and Health Dynamics Among the Oldest Old study) was integrated with the HRS cohort in 1998 (wave 4 of the original HRS).[44] In 1998, two new samples were added to the survey: the Children of the Depression Age (CODA) cohort, who are national representative

[44]The first and second waves of the AHEAD have been added to the second and third waves of the HRS sample. But as we only consider individuals aged between 60 and 69 years old, this addition represents only a few individuals being the young spouses of the original sample. We control for time effect in the analysis using the interview year dummies.

individuals born between 1924 and 1930, and the War Baby (WB) cohort with individuals born between 1942 and 1947. The purpose of the former was to fill the gap between the individuals of the HRS born between 1931 and 1942 and the individuals from the AHEAD cohort born before 1921. The latter have been added in order to keep a representative sample of the American population aged 50 or more. In all cases the same questionnaire has been applied to the spouses of those sampled irrespectively of their age.

The RAND Center for the Study of Ageing has created the RAND HRS data files, which is a user-friendly version of a subset of the HRS containing most of the variables that have been consistently and repeatedly asked over all the waves. In this chapter, we use the RAND data with some additional variables from the HRS.

2.6.2 Selected sample and variables

We use the first nine waves of the HRS. We briefly describe here the key data for the analysis. The insurance variables are detailed in Appendix A.

2.6.2.1 Sample

To concentrate on the impact of Medicare on behaviour pre and post 65, we consider only individuals aged between 59 and 68, and who report being covered by Medicare after 65.[45] We also drop at all the waves those who report being disabled in at least one wave. Disability information is from the working status question and often retirement status takes the precedence over disability status. Typically, this would create a bias if an individual is not in the labour force before 65 years due to disabilities but is then considered as retired after 65 years, although her disability status would not have changed (she may even have taken an early retirement due to her handicap).[46] Moreover, it is very likely that some disabilities may have appeared already some times before someone reports a disability status, which would bias our results.

[45] They are two main reasons why an individual would not report being covered by Medicare after the age of 65. First, because she (or her spouse) has not paid Medicare taxes for at least 10 years (typically if she has not been permanent residents of the United States). Second, we cannot exclude that some individuals may not be aware that they are covered. In both cases, we excluded them from our analysis as they would not anticipate Medicare before the age of 65.

[46] A respondent can give evidence of working, being retired, and disability alone or in combination with other statuses. If a respondent reports both working part-time and mention retirement, then his working status is set to partly retired. If an individual reports a disability status and retirement, then only retirement is reported. Therefore, if the individual reports being disabled in any wave, we drop her at all the waves to avoid reporting bias such as considering him retired, although she may have quit her job due to important disabilities.

2.6.2.2 Dependent variables

We use three lifestyle measures: physical activity, alcohol and cigarette consumption. The HRS has many variables describing these habits, but we only selected the ones likely to vary for those above 60 years old.[47]

The physical activity variable indicates whether the individual reports having some vigorous physical activities defined as sports, heavy housework, or a job that involves physical labour, at least three or more times a week. This question was asked until wave 6 (i.e. 2002).

To study the impact of insurance on drinking behaviour, we construct an indicator of daily alcohol consumption and also use a count variable equal to the average daily number of alcoholic drinks per week. The latter variable is only measured from the third wave (i.e. 1996).[48]

Finally, two variables are used to analyse smoking behaviour:[49] the average number of cigarettes smoked per day and a dummy variable indicating whether the individual has quit smoking if she has ever tried in her life.

2.6.2.3 Insurance variables

We know whether the individual is currently covered by Medicare, Medicaid, a military insurance such as CHAMPUS, VA, or TRI-CARE, or any other governmental insurance. Private insurances are measured by indicators of insurance provided by her own or her spouse's employer, or if she reports having other health insurance than government, employer-provided, or long-term care insurance. These variables are used to define the individual's insurance group. Long-term care and life insurances are also recorded at all the waves, and we use them as proxy for risk aversion.

2.6.2.4 Definitions of the uninsured group

The uninsured group refers to a sub-sample of individuals defined by their insurance status before 65. Thus the classification of a respondent does not change with the age and remains the same after 65 years old, when all the individuals are covered by Medicare.

[47] For example, we do not model the decision to start smoking, but do examine the probability to quit smoking.

[48] If the individual answered positively to the question "Do you ever drink any alcoholic beverages, such as beer, wine, or liquor?" in waves 3 to 9, the individual was then asked for the number of days per week she had any alcohol, and for the number drinks the days she drinks, in the last three month, on average. We multiplied the number of days and drinks.

[49] The questions about smoking only consider cigarettes and unfortunately no other type of smoking (pipes or cigars).

The definitions of the uninsured and insured groups are based on insurance coverage at the ages 61/62 and 63/64 (i.e. for the two interviews preceding the one at age 65/66 when all respondents are insured by Medicare). If the individual reports being uninsured at 61/62 *or* 63/64, she is defined as *uninsured.*[50] Those individuals who are insured at 61/62 *and* 63/64 are defined as *insured.* We use the insured individuals as our reference/control group, assuming that Medicare is a continuation of their previous health insurance.[51] The uninsured are our treatment group as they experience an expected change in health insurance at the age of 65. To test the sensitivity of the results due to the choice of insurance coverage considered, we use three alternative definitions of coverage in a year.[52]

All the estimators are calculated separately for the three definitions. These three definitions of insurance status come from three different insurance indicators at the ages 61/62 and 63/64.

- The first definition (*All Types*) considers all types of health insurance, i.e. it is equal to 1 if the respondent reports any type of insurance either private or public including Medicaid, military insurance or Medicare. For example if an individual reports having only an employer provided insurance at the age 62 (the insurance indicator for this definition is equal to 1 at age 61/62) and no insurance at the age 64 (indicator equal to 0 at age 63/64), she is considered as uninsured as she has not reported any types of insurance at the two interviews preceding Medicare. Had she reported being insured by for example Medicaid at 64, she would have been considered as insured based on this definition.

[50]The decision to consider as uninsured individuals who do not report a coverage for these two interviews is motivated by the conclusion of Schoen and DesRoches (2000): Americans not continuously insured generally face the same risk of forgoing needed medical care or of having problems paying their medical bills as the ones continuously uninsured. We have also used more stringent definitions where the individuals must be uninsured at both waves to be considered as uninsured, but the results are similar.

[51]This is a strong assumption as insurance coverages vary between private insurances and also between the different Medicare plans. The HRS do not contain enough information to control for the generosity of private insurance, but we control for the number of insurance plans in the regressions.

[52]Dave and Kaestner (2009), based on an indicator that includes all types of insurance coverage, propose two definitions: (*def1*) are considered as uninsured the individuals who always have their insurance indicator equal to zero before 65 years old. This means that any individual who reports a health insurance coverage any time before 65 years old is considered as insured. *def2* is less stringent for individuals temporary insured: individuals who are observed fifty percent of the time or more uninsured before 65 are considered uninsured, and all the others are considered insured. The main caveat of these definitions is that it does not impose a minimum number of waves for which the individual must be observed before her 65. If the individual is only observed one wave before 65, being uninsured at this time classifies her in the uninsured group. But had she been observed insured the penultimate wave before 65 years old, she would then be classified in the uninsured group following *def1.* Moreover, this definition can only be used to estimate the simple DID model, as when we estimate the PS we need some variables that can be defined as pre-treatment variables.

- The second definition (*Private Only*) captures privately insured individuals only: it is equal to 1 if the individual reports being insured by an employer provided insurance or any other insurance other than provided by the government.

- The last definition (*Private & Public*) is very similar to *"Private Only"* but also includes military insurance. Apart from the veteran insurance, the government only provide need-specific[53] insurance coverages before the age of 65. Someone may be covered by Medicaid at the age of 40 because ill and very poor, but may no longer be eligible at the age of 60 because richer. Private insurances are less need-specific and the individual may have it for many years, either because she has a stable work paying for it or because she pays for it without the intention to stop. Similarly, military insurance is provided when the military personnel become veterans and is kept until 65 years old. Therefore, this latter definition considers insurances coverages that are less volatile and more independent of the health status compared to the other ones provided by the government. It is a good compromise between the two other definitions and we present the results in more details for this definition.

Section A.2 in Appendix A has further information on these various definitions.

2.7 Results

2.7.1 Descriptive statistics

Descriptive statistics in Tables 3, 4, 5 and 6 are for the baseline age 59/60. Tables 3 and 4 describe the overall sample and also report the total number of observations in column 5.

In terms of lifestyle, 40.1% of the sample has some vigorous physical activity at least 3 times a week or more. 61.1% of the sample has ever smoked cigarettes by age 59/60 but 66.4% of previous smokers have quit by this age, and for the others, they smoke on average 3.3 cigarettes per day. The whole sample has quite moderate alcohol consumption drinking only 1.1 days per week but some individuals drink up to 24 drinks per day. On average, the sample consumes about 2.5 drinks per week.

Physical health is captured by self-assessed health (SAH) and a mobility index. SAH ranges from poor (score of 1) to excellent (score of 5), and the average at the reference age is of 3.5 (between good and very good). The mobility index ranges from 0 to 5 and sums up 'some difficulty' reported by the individual in all the following

[53] Temporary and only for very specific reasons.

activities: walking one block, walking several blocks, walking across a room, climbing one flight of stairs and climbing several flights of stairs activities. On average, each person reports 0.67 disabilities. Finally, 90.1% of the sample has visited the doctor in the last two years.

The baseline age 59/60 is characterised by a majority of women (56.4%) and 83.6% of white individuals. The schooling variables indicate the highest grade achieved; about 79.8% of the sample went to high school, but only 20.3% finished college. Most of the individuals are married (75.5%). Only 49.3% of the sample is working full-time and 21.5% is already retired. 17.6% is working part-time and 7.5% is partly retired.[54] The rest is either unemployed (1.6%) or not in the labour force. On average, individuals have worked for about 27.5 years. The spread in the household assets is ranging from -4,480,701 to 21,199,369 expressed in 1992 dollars, with the average at 290,897 that is, about 1% of the maximum household income. The average household total income is 52,958$ a year.

The government insures about 11.2% of our sample based on any type of insurance provided by the government. The largest governmental insurance at age 59/60 is for the veterans and their family (CHAMPUS/VA: 5.4%), followed by Medicare (4.1%). Private insurance represents 13.7% individually purchased and 74% by an employer. Life insurance has been purchased by 76.5% of the sample whereas long-term care (LTC) insurance covers about 7.8% of the sample when aged 59/60.

The treated groups represent 15.0%, 20.8% and 24.1% of the whole sample at age 59/60 based on the "All Types", "Private & Public" and "Private Only" definitions, respectively. The fewer insurance types we consider to define the insured indicator, the larger the uninsured group.

Tables 5 and 6 describe the sample by uninsured groups at the reference age 59/60. t-tests for the equality of the means between the two groups are also reported for each uninsured definition. The characteristics of the two groups are generally significantly different from one another, with differences depending on the uninsured definition chosen. The uninsured are more likely to be in bad health while less likely to have seen a doctor in the last two years. They are more likely to be a woman, non white, with a lower education level and not married. Uninsured individuals are less likely to be working full-time, although this is not the case in the for the "All Types" definition. This may be because working-full time is important to obtain a private insurance (relevant in the case of the "Private & Public" and "Private Only" definitions), but is likely not to be the case if one is insured by Medicaid. Finally, the uninsured are less likely to be retired but more likely to be unemployed or self-employed. They have

[54]These categories are not mutually exclusive.

Table 3: Descriptive statistics - Lifestyle and control variables

	(1)	(2)	(3)	(4)	(5)
					All waves
	mean	**min**	**max**	**count**	**count**
Lifestyle variables					
vigorous physical activity >2/week (waves 1-6)	0.407	0	1	5,292	21,058
has ever smoked cigarettes	0.611	0	1	5,884	28,415
smokes now	0.204	0	1	5,884	28,415
quit smoking	0.664	0	1	3,571	17,296
# cigarettes smoked per day	3.295	0	100	4,005	24,401
has ever drunk alcohol	0.555	0	1	5,912	28,555
drinks daily (waves 4-9)	0.065	0	1	3,998	24,373
# days/week with alcohol (waves 4-9)	1.125	0	7	3,998	24,373
# drinks/day when drinks (waves 4-9)	0.757	0	16	3,996	24,351
# drinks/week (waves 4-9)	2.532	0	84	3,993	24,337
Covariates					
SAH	3.481	1	5	5,912	28,555
mobility index	0.673	0	5	5,912	28,555
visited the doctor (in the last 2 years)	0.901	0	1	5,890	28,464
male	0.436	0	1	5,912	28,555
age (year)	59.510	59	60	5,912	28,555
white	0.836	0	1	5,912	28,555
black	0.134	0	1	5,912	28,555
hispanic	0.069	0	1	5,912	28,555
other race	0.029	0	1	5,912	28,555
did less than high school	0.200	0	1	5,912	28,555
went to high school	0.385	0	1	5,912	28,555
went to college	0.212	0	1	5,912	28,555
finished college and above	0.203	0	1	5,912	28,555
married	0.755	0	1	5,912	28,555
partnered	0.024	0	1	5,912	28,555
divorced/separated	0.119	0	1	5,912	28,555
widowed	0.074	0	1	5,912	28,555
works full-time	0.493	0	1	5,912	28,555
works part-time	0.176	0	1	5,912	28,555
partly retired	0.075	0	1	5,912	28,555
retired	0.215	0	1	5,912	28,555
unemployed	0.016	0	1	5,912	28,555
self-employed	0.130	0	1	5,912	28,555
# years worked (log)	3.313	0	3.85	5,912	28,555
job requires some physical activity	0.243	0	1	5,835	28,236
household total assets (in 1992$)	290,897	-4,480,701	21,199,396	5,912	28,555
household total income (in 1992$)	52,958	0	1,491,873	5,912	28,555
census: West	0.167	0	1	5,912	28,555
census: Mid West	0.260	0	1	5,912	28,555
census: North East	0.16	0	1	5912	28555

Notes: Descriptive statistics are presented for the reference age 59/60. SAH is for self-assessed health. The total number of observations is reported for age 59/60 as well as for the whole sample.

Table 4: Descriptive statistics - Insurance variables

	(1)	(2)	(3)	(4)	(5)
					All waves
	mean	**min**	**max**	**count**	**count**
Insurance coverage					
by government	0.112	0	1	5,906	28,525
by CHAMPUS/VA	0.054	0	1	5,904	28,532
by Medicare	0.041	0	1	5,907	28,533
by Medicaid	0.022	0	1	5,906	28,512
by employer	0.740	0	1	5,912	28,555
by other health insurance	0.137	0	1	5,906	28,484
number of insurance plans	0.802	0	4	5,275	26,737
life insurance	0.765	0	1	5,912	28,555
LTC insurance	0.078	0	1	5,912	28,555
Uninsured definitions					
"All Types"	0.150	0	1	5,912	28,555
"Private & Public"	0.208	0	1	5,912	28,555
"Private Only"	0.241	0	1	5,912	28,555

Notes: Descriptive statistics are presented for the reference age 59/60. LTC is for long-term care. The total number of observations is reported for age 59/60 as well as for the whole sample.

significantly less assets and also a lower income.

In terms of lifestyle, the uninsured are less likely to have some vigorous physical activity at least three times a week, although the difference is not significant for the "All Types" definition. The probability to have ever smoked is not significantly different at the 10% level, but uninsured are more likely to still be smoking and to smoke more when they smoke. However, the uninsured are less likely to have ever drunk alcohol and drink less on average.

Differences in terms of the specific insurance plans vary accordingly to the various definitions. Note that, following our different uninsured definitions, it is valid to have for example individuals reporting a governmental health insurance but still being considered as uninsured based on "All Types" definition. This happens if they are covered by for example by Medicaid but only in one wave preceding 65 years old and not two, or because they are covered by Medicaid at the reference age 59/60 but are not when aged between 61 and 64. Insured individuals are significantly more likely to have a LTC insurance or a life insurance.

We next explain how we have implemented the different approaches described in Section 2.5, and present the results.

2.7.2 Estimation of the propensity score and matching approaches

In this section, we present the estimation of the propensity score and the results of the different matching methods.

Table 5: Descriptive statistics by uninsured groups - Control variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
	All Types					**Private & Public**					**Private Only**				
	insured		**uninsured**			**insured**		**uninsured**			**insured**		**uninsured**		
	count	**mean**	**count**	**mean**	**difference**	**count**	**mean**	**count**	**mean**	**difference**	**count**	**mean**	**count**	**mean**	**difference**
SAH	5,023	3.530	889	3.205	0.326***	4682	3.608	1,230	3.001	0.607***	4,486	3.613	1,426	3.069	0.544***
mobility index	5,023	0.657	889	0.760	-0.103*	4682	0.572	1,230	1.056	-0.484***	4,486	0.571	1,426	0.992	-0.421***
visited the doctor (2 years)	5,005	0.918	885	0.806	0.112***	4665	0.918	1,225	0.838	0.079***	4,469	0.919	1,421	0.844	0.076***
male	5,023	0.443	889	0.399	0.044*	4682	0.446	1,230	0.402	0.044**	4,486	0.442	1,426	0.419	0.023
age (year)	5,023	59.510	889	59.52	-0.006	4682	59.51	1,230	59.51	0.008	4,486	59.510	1,426	59.510	0.006
white	5,023	0.855	889	0.729	0.127***	4682	0.869	1,230	0.714	0.155***	4,486	0.870	1,426	0.729	0.141***
black	5,023	0.120	889	0.214	-0.093***	4682	0.108	1,230	0.236	-0.128***	4,486	0.107	1,426	0.222	-0.116***
hispanic	5,023	0.048	889	0.190	-0.142***	4682	0.0421	1,230	0.172	-0.130***	4,486	0.043	1,426	0.151	-0.108***
other race	5,023	0.024	889	0.0574	-0.033***	4682	0.0235	1,230	0.050	-0.027***	4,486	0.023	1,426	0.048	-0.025***
did less than high school	5,023	0.160	889	0.422	-0.261***	4682	0.140	1,230	0.427	-0.287***	4,486	0.144	1,426	0.377	-0.233***
went to high school	5,023	0.392	889	0.349	0.043*	4682	0.394	1,230	0.354	0.039*	4,486	0.393	1,426	0.361	0.032*
went to college	5,023	0.224	889	0.144	0.080***	4682	0.229	1,230	0.146	0.083***	4,486	0.223	1,426	0.175	0.048***
finished college and above	5,023	0.224	889	0.0855	0.138***	4682	0.237	1,230	0.073	0.164***	4,486	0.240	1,426	0.087	0.153***
married	5,023	0.780	889	0.616	0.164***	4682	0.800	1,230	0.587	0.213***	4,486	0.800	1,426	0.615	0.185***
partnered	5,023	0.021	889	0.0416	-0.021***	4682	0.0192	1,230	0.043	-0.024***	4,486	0.019	1,426	0.042	-0.024***
divorced/separated	5,023	0.109	889	0.178	-0.069***	4682	0.0980	1,230	0.198	-0.100***	4,486	0.099	1,426	0.180	-0.081***
widowed	5,023	0.066	889	0.119	-0.053***	4682	0.0604	1,230	0.125	-0.065***	4,486	0.059	1,426	0.120	-0.061***
works full-time	5,023	0.496	889	0.478	0.018	4682	0.521	1,230	0.385	0.136***	4,486	0.527	1,426	0.386	0.141***
works part-time	5,023	0.170	889	0.215	-0.045**	4682	0.173	1,230	0.189	-0.016	4,486	0.174	1,426	0.185	-0.012
partly retired	5,023	0.079	889	0.0506	0.028**	4682	0.0820	1,230	0.046	0.036***	4,486	0.081	1,426	0.053	0.028***
retired	5,023	0.235	889	0.105	0.130***	4682	0.207	1,230	0.248	-0.041**	4,486	0.202	1,426	0	-0.055***
unemployed	5,023	0.011	889	0.0439	-0.033***	4682	0.0107	1,230	0.037	-0.027***	4,486	0.011	1,426	0.034	-0.024***
self-employed	5,023	0.119	889	0.191	-0.073***	4682	0.123	1,230	0.156	-0.034**	4,486	0.124	1,426	0.148	-0.024*
# years worked (log)	5,023	3.345	889	3.133	0.211***	4682	3.367	1,230	3.107	0.260***	4,486	3.376	1,426	3.113	0.263***
job requires some physical activity	4,969	0.222	866	0.363	-0.141***	4629	0.227	1,206	0.302	-0.075***	4,436	0.229	1,399	0.287	-0.059***
household total assets (in 1992$)	5,023	318521.6	889	134813.4	183708.2***	4682	334110.4	1,230	126405.1	207705.3***	4,486	###	1,426	132665.3	208530.1***
household total income (in 1992$)	5,023	56848.5	889	30974.6	25873.9***	4682	59539.6	1,230	27903.9	31635.7***	4,486	59,862.4	1,426	31236.8	28625.6***
census: West	5,023	0.166	889	0.169	-0.002	4682	0.165	1,230	0.172	-0.006	4,486	0.165	1,426	0.173	-0.009
census: Mid West	5,023	0.275	889	0.177	0.098***	4682	0.281	1,230	0.180	0.100***	4,486	0.287	1426	0.17	0.113***
census: North East	5,023	0.167	889	0.117	0.050***	4682	0.165	1,230	0.138	0.026*	4,486	0.169	1426	0.13	0.041***

Notes: Descriptive statistics are reported for the baseline age 59/60. SAH is for self-assessed health. Differences between the two groups are tested using t-test assuming equal variances. Stars convention: * for p<0.05, ** for p<0.01, and *** for p<0.001.

Table 6: Descriptive statistics by uninsured groups - Lifestyle variables and insurance coverage

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
	All Types					**Private & Public**					**Private Only**				
	insured		**uninsured**			**insured**		**uninsured**			**insured**		**uninsured**		
	count	**mean**	**count**	**mean**	**difference**	**count**	**mean**	**count**	**mean**	**difference**	**count**	**mean**	**count**	**mean**	**difference**
Lifestyle															
vigorous physical activity >2/week (waves 1-6)	4,505	0.411	787	0.385	0.026	4,204	0.422	1,088	0.352	0.069***	4,036	0.423	1,256	0.357	0.065***
has ever smoked cigarettes	5,001	0.612	884	0.609	0.003	4,663	0.606	1,224	0.631	-0.025	4,468	0.603	1,420	0.639	-0.036*
smokes now	5,001	0.188	884	0.294	-0.106***	4,663	0.180	1,222	0.296	-0.116***	4,468	0.176	1,417	0.292	-0.116***
quit smoking	3,038	0.690	533	0.512	0.178***	2,807	0.701	764	0.526	0.175***	2,673	0.706	898	0.539	0.167***
# cigarettes smoked per day	3,411	3.118	594	4.313	-1.195**	3,170	3.012	835	4.371	-1.359***	3,044	2.903	961	4.538	-1.635***
has ever drunk alcohol	5,023	0.571	889	0.467	0.104***	4,682	0.586	1,230	0.439	0.147***	4,486	0.588	1,426	0.453	0.135***
drinks daily (waves 4-9)	3,405	0.068	593	0.051	0.017	3,164	0.071	834	0.046	0.025**	3,039	0.071	959	0.048	0.023*
# days/week with alcohol (waves 4-9)	3,405	1.163	593	0.904	0.259**	3,164	1.213	834	0.791	0.421***	3,039	1.218	959	0.830	0.388***
# drinks/day when drinks (waves 4-9)	3,406	0.740	590	0.856	-0.116	3,165	0.757	831	0.758	-0.001	3,039	0.751	957	0.775	-0.024
# drinks/week (waves 4-9)	3,403	2.507	590	2.678	-0.171	3,162	2.602	831	2.266	0.336	3,037	2.597	956	2.326	0.271
Covered															
by government	5,019	0.122	887	0.056	0.066***	4,678	0.087	1,228	0.208	-0.121***	4,482	0.054	1,424	0.295	-0.241***
by CHAMPUS/VA	5,017	0.062	887	0.011	0.051***	4,677	0.065	1227	0.013	0.052***	4,481	0.032	1,423	0.125	-0.093***
by Medicare	5,020	0.045	887	0.018	0.027***	4,679	0.020	1228	0.120	-0.010***	4,483	0.019	1,424	0.109	-0.090***
by Medicaid	5,019	0.022	887	0.023	-0.001	4,678	0.003	1228	0.096	-0.093***	4,482	0.002	1,424	0.084	-0.081***
by employer	5,023	0.809	889	0.354	0.454***	4,682	0.848	1230	0.333	0.515***	4,486	0.869	1,426	0.335	0.535***
by other health insurance	5,019	0.141	887	0.117	0.023	4,678	0.144	1228	0.112	0.031**	4,482	0.142	1,424	0.121	0.022*
number of insurance plans	4,424	0.886	851	0.367	0.519***	4,093	0.934	1182	0.344	0.590***	3,907	0.961	1,368	0.349	0.612***
life insurance	5,023	0.796	889	0.591	0.205***	4,682	0.812	1230	0.587	0.225***	4,486	0.811	1,426	0.620	0.191***
LTC insurance	5,023	0.089	889	0.020	0.068***	4,682	0.091	1230	0.029	0.063***	4,486	0.092	1,426	0.034	0.058***
Uninsured definitions															
"All Types"	5,023	0.000	889	1.000		4,682	0.000	1230	0.723		4,486	0.000	1,426	0.623	
"Private & Public"	5,023	0.068	889	1.000		4,682	0.000	1230	1.000		4,486	0.000	1,426	0.863	
"Private Only"	5,023	0.107	889	1.000		4,682	0.042	1230	1.000		4,486	0.000	1,426	1.000	

Notes: Descriptive statistics are reported for the baseline age 59/60. LTC is for long-term care. Differences between the two groups are tested using t-test assuming equal variances. Stars convention: * for p<0.05, ** for p<0.01, and *** for p<0.001.

2.7.2.1 Estimated propensity score

The choice of the appropriate control variables X_0 to estimate the PS is a trade-off since with more variables the CS assumption (equation (20)) is less likely to hold but the CIA (equation (17)) is more likely to be valid (Blundell and Costa Dias, 2008). Using more variables than the confounding factors or variables only weakly correlated with the treatment and/or the lifestyle may decrease the precision of the PS as it reduces the efficiency of the control on the relevant covariates (Rubin, 1977, Imbens, 2004). However, Rubin and Thomas (1996) argue that the bias created by leaving out a weak predictor is larger than the efficiency loss. The variables should be pre-treatment characteristics (i.e. before the insurance status is defined) in order not to have been influenced by the insurance coverage, and simultaneously influence the lifestyle and the insurance status. These variables are also referred to as confounding factors (Moreno-Serra, 2007) as they affect at the same time the outcome and the treatment status. For example, marital status is a confounding factor as it is correlated with the various lifestyle measures of interest and the insurance status. We estimate the PS using a logit model such that

$$Pr[U_i = 1|X_{i0}] = \hat{p}(X_{i0}) = \frac{e^{X'\beta}}{1 - e^{X'\beta}} \tag{38}$$

and control for variables X_0 available at the age 59 or 60 ($t = 0$) for all the individuals. The validity of the estimated propensity score relies on the fact that the confounding factors should not have been influenced by the insurance status. Therefore, this specification implicitly assumes that the set of control variables X_i at age 59/60 have not been influenced by the treatment status which is defined upon variables at the ages 61-64. However, it does not mean that the insurance anticipation effect may not have appeared before 61 years old.

The balancing property of the true PS ($X_{i0} \perp U_i | p(X_{i0})$) implies that the distribution of the covariates are the same across both groups; that is, if the mean of the untreated outcome L_i^0 is independent of the participation status conditional on X_0, it is also independent of the participation status conditional on the estimated PS (Blundell and Costa Dias, 2008). This is only guaranteed for the true PS, but this property should be tested for the estimated PS. Rosenbaum and Rubin (1983) suggest dividing the samples into different subclasses on the basis of the PS and to compare their two first moments. Rosenbaum and Rubin (1984) also suggested adding higher-order and interactions terms of the covariates until the mean of covariates do not differ within strata. To check the balancedness of our estimated PS before matching, we group observations into strata defined on the estimated PS and check if the mean of the co-

variates within strata are different across the two groups (Becker and Ichino, 2002).[55] We try different combination to maximise balancedness of the covariates for the three definitions.

As we define the uninsured group in three different ways, we have to estimate three different PS. However, in order to have balanced means in each strata for each covariate, each PS estimation requires a slightly different combination of the covariates. We decided to keep the same set of covariates and combination for each estimated PS, selected on what covariates could possibly be a confounding factor. If some covariates appear not to be always balanced in each strata and for each definition, we include them in the Mahalanobis metrics described below (i.e. additionally to match on the PS, we also match on these variables).

The regressions that estimate the PS are presented in Table 7 for the "Private & Public" definition, and for the "All Types" and "Private Only" in Appendix C in Tables 64 and 65, respectively. Column 1 reports the estimated coefficients of the logit estimation of the PS. Balancedness is presented for the nearest neighbour matching with replacement. Columns 2 and 3 report the means of the different covariates for the uninsured and insured respectively, for the unmatched and the matched sample. Column 4 reports the percentage bias reduction in the standardised bias before and after matching, and the last column presents the t-tests for the equality of means in the uninsured and insured groups, both before and after matching. After matching, all the coefficients are balanced at least at the 10% significance level.

The distribution of the PS is summarised in Table 8. The range of the distribution of the PS of the uninsured is generally bigger than the one of the insured indicating that in this case, there is no gain of restricting the sample to the common support. Histograms of the estimated PS for the different uninsured definitions are presented in Figure 6 in the Appendix C.1. Graphs on the left represent the distribution of the PS for the insured ($U_i = 0$), and the ones on the right are the uninsured PS distributions. The first two graphs are based on the uninsured definition "All Types", which takes into account all sorts of insurance to define the insured group. The next pair is based on the "Private & Public" definition and the last ones on the "Public Only" definition. From the top to the bottom, being insured is based on more restrictive conditions which is reflected by the increasing uninsured group. The distribution of the PS for the insured

[55] More precisely, we use the algorithm proposed by Becker and Ichino (2002): on the basis of the estimated PS, the sample is split into 5 sub-groups and we test if the mean of the PS differs between the two groups. If there is a significant difference in one interval, it is split again until the mean of the PS is not significantly different between the two groups. Then, within each strata, the means of the covariates for the two groups are compared. If for any of the variable in any strata the means are significantly different at the 1% the level, we add interaction terms and higher-order covariates.

Table 7: Propensity score regression estimates and balancedness tests of the covariates

	(1)		(2)	(3)	(4)	(5)
			Balancedness tests			
			Means			
	Estimates		**Uninsured**	**Insured**	**% bias reduc.**	**P>|t|**
SAH	-0.194***	Unmatched	3.001	3.608		0.000
	(0.041)	Matched	3.001	2.986	97.6	0.744
Mobility index	0.142***	Unmatched	1.056	0.572		0.000
	(0.034)	Matched	1.056	1.068	97.6	0.838
Male	0.252**	Unmatched	0.402	0.446		0.006
	(0.087)	Matched	0.402	0.396	87.0	0.773
White	-0.397	Unmatched	0.714	0.869		0.000
	(0.214)	Matched	0.714	0.701	91.6	0.479
Black	0.214	Unmatched	0.236	0.108		0.000
	(0.233)	Matched	0.236	0.244	93.6	0.637
Hispanic	0.829***	Unmatched	0.172	0.042		0.000
	(0.137)	Matched	0.172	0.167	95.6	0.707
Census West	-0.280*	Unmatched	0.172	0.165		0.602
	(0.113)	Matched	0.172	0.173	73.9	0.915
Census mid-West	-0.473***	Unmatched	0.180	0.281		0.000
	(0.099)	Matched	0.180	0.166	85.4	0.338
Census North-East	-0.448***	Unmatched	0.138	0.165		0.024
	(0.109)	Matched	0.138	0.154	41.6	0.278
Married	-1.049***	Unmatched	0.587	0.800		0.000
	(0.191)	Matched	0.587	0.586	99.6	0.967
Partnered	0.035	Unmatched	0.043	0.019		0.000
	(0.271)	Matched	0.043	0.047	83.0	0.627
Divorced	-0.098	Unmatched	0.198	0.098		0.000
	(0.202)	Matched	0.198	0.192	93.5	0.684
Widowed	-0.137	Unmatched	0.125	0.060		0.000
	(0.217)	Matched	0.125	0.138	79.9	0.340
Went to high school	-0.642***	Unmatched	0.354	0.394		0.012
	(0.092)	Matched	0.354	0.346	79.2	0.673
Went to college	-1.004***	Unmatched	0.146	0.229		0.000
	(0.117)	Matched	0.146	0.137	89.3	0.524
Finished college or more	-1.471***	Unmatched	0.073	0.237		0.000
	(0.144)	Matched	0.073	0.086	92.1	0.234
Works full-time	-0.644***	Unmatched	0.385	0.521		0.000
	(0.160)	Matched	0.385	0.384	98.8	0.934
Works part-time	-0.292	Unmatched	0.189	0.173		0.179
	(0.170)	Matched	0.189	0.159	-88.1	0.043
Retired	-0.133	Unmatched	0.248	0.207		0.002
	(0.152)	Matched	0.248	0.237	72.5	0.510
Unemployed	0.688*	Unmatched	0.037	0.011		0.000
	(0.295)	Matched	0.037	0.055	33.1	0.035
Self-employed	0.996***	Unmatched	0.156	0.123		0.002
	(0.126)	Matched	0.156	0.143	61.2	0.366
# years worked (log)	-0.122*	Unmatched	3.107	3.367		0.000
	(0.053)	Matched	3.107	3.015	64.5	0.035
HH total assets	-1.280**	Unmatched	0.126	0.334		0.000
	(0.428)	Matched	0.126	0.145	91.2	0.223
HH total assets (squared)	0.064**	Unmatched	0.184	0.594		0.114
	(0.020)	Matched	0.184	0.130	86.9	0.478
Has long-term care	-0.824***	Unmatched	0.028	0.091		0.000
insurance	(0.197)	Matched	0.028	0.037	85.8	0.214
Has life insurance	-0.749***	Unmatched	0.587	0.812		0.000
	(0.083)	Matched	0.587	0.593	97.5	0.774
Constant	2.380***					
	(0.348)					
N	5,912					

Notes: The uninsured definition is 'Private & Public'. SAH is self-assessed health. HH (Household) total assets are expressed in million. The propensity score is estimated using logit on individuals 59 or 60 years old and the coefficient estimates are reported in column 1. Matched sample is based on nearest neighbour matching with replacement. Column 2 and 3 report the means of the different covariates for the uninsured and insured respectively, for the unmatched and the matched sample. Column 4 reports the percentage bias reduction in the standardised bias before and after matching, and the last column presents the t-tests for the equality of means in the uninsured and insured groups, both before and after matching. Stars convention: * for $p<0.1$, ** for $p<0.05$, and *** for $p<0.01$.

Table 8: Distribution of the PS for the different uninsured definitions

Uninsured definitions		(1) Count	(2) Mean	(3) SD	(4) Min	(5) Max
All Types	Insured	4,622	0.133	0.118	0.020	0.855
	Uninsured	876	0.307	0.203	0.021	0.877
Private & Public	Insured	4,387	0.165	0.147	0.020	0.897
	Uninsured	1,219	0.412	0.247	0.020	0.971
Private Only	Insured	4,310	0.194	0.149	0.020	0.912
	Uninsured	1,417	0.416	0.235	0.020	0.968

Notes: Distribution of the PS for the different uninsured definitions at the refernce age 59/60.

is always skewed on the right, and as a result, there will be very few individuals in the insured group that will be comparable to the uninsured group for high PS. This suggests that matching without replacement would create important bias for this part of the distribution.

2.7.2.2 Different matching approaches

The ATT defined in equation (24) can be estimated (Moreno-Serra, 2007) by

$$\hat{ATT}_A^{PSM} = \hat{\gamma}_A^{PSM} = \sum_{i\epsilon\{Unin\cap CS\}} \left(L_i^1 - \sum_{j\epsilon\{N(p_i(X_{i0}))\cap CS\}} W_{ij} L_j^0 \right) \frac{1}{M} \tag{39}$$

where $N(p_i(X_{i0}))$ defines the set of (control) neighbours of i based on i's PS, W_{ij} is a weight placed on the compared outcome of insured individual j with $W\epsilon\ [0,1]$ and $\sum_{j\epsilon\{N(p_i(X))\cap CS\}} W_{ij} = 1$, and M represents the number of uninsured individual falling within the region of the CS. $N(p_i(X_{i0}))$ and W_{ij} depend on the type of matching.

Different algorithms have been developed using different numbers of comparison units as well as different weights based on closeness (Caliendo and Kopeinig, 2005). Nearest Neighbour (NN) matching is the most intuitive approach where each treated individual is matched to her closest control. Although easy to implement and to understand, this approach may impose bad matches if the closest individual is far away. Caliper matching avoids this problem by imposing a maximum distance to match two individuals, but it is difficult to know a priory what this optimal distance is (Smith and Todd, 2005). Radius matching (Dehejia and Wahba, 2002) is a variant of the caliper matching: it allows uninsured individuals to be matched to more than one insured individuals as long as the distance between the two is smaller or equal to the pre-defined radius. The more comparison units for one treated individual, the more precise the estimate, but the worse the bias (Dehejia and Wahba, 2002). Kernel matching is similar

to Radius matching but uses weighted average of the controls' outcomes depending on their distance to construct the counter part of treated's outcome. This method reduces the variance as it takes into account more information, but may also increase the bias as it may use more information. Finally, stratification matching (Dehejia and Wahba, 1999) can be used to estimate the ATT: based on strata defined on the basis of the PS where all the covariates are balanced, the ATT is the weighted sum of the within stratum differences in means between the insured and uninsured individuals. The main advantage of this approach is that it does not require a precise estimate of the PS as the process of validating the PS within each strata is "all that is needed for an unbiased estimate of the treatment impact" (Dehejia and Wahba, 1999, p.1058).[56]

These matching methods can be applied with or without replacement. With replacement allows individual to be matched to their most similar counterpart, and thus reduces the bias. But at the same time, it increases the variance of the estimator as it reduces the number of distinct controls (Smith and Todd, 2005). Matching without replacement has the opposite properties but additionally is sensitive to the order of the data. As we have very limited overlap for some part of the distribution of the covariates, we always apply matching with replacement to avoid bad matches.

If we had the true PS, matching on the PS would guarantee that all the covariates were balanced. In practice it may be the case that after matching the distributions of the covariates may no longer be balanced between the two matched groups, although they were before matching. This is the case when not all the controls are matched to a treated observation, which may happen even if the controls were not on the CS. Therefore, we use Mahalanobis metrics to match the individuals not only on the basis of their PS but also to guarantee that some variables are correctly balanced between the two groups. As exact matches are rarely the case, Mahalanobis method uses closeness of the different variables but also takes into account the covariance between the matched variables (Moreno-Serra, 2007). This method permits an equal per cent bias reduction, where the bias is defined at the mean between the treated and the control for the different covariates. The Mahalanobis distance between a treated i and a control individual j is defined as

$$M(X_i^1, X_j^0) = \sqrt{(X_i^1 - X_j^0)'\Sigma^{-1}(X_i^1 - X_j^0)} \tag{40}$$

where X represents the set of covariates (including the PS) to be matched and Σ their variance-covariance matrix. As a result, better measured covariates will be given a higher weight in the computation of the Mahalanobis distance (Moreno-Serra, 2007). We always use the Mahalanobis metrics additionally to the PS to improve the match in

[56] A much more detailed review of these approaches has been written by Moreno-Serra (2007) among others.

the case of NN and Kernel matching to guarantee the balancedness of less well balanced covariates.

The estimation of the variance of the estimator involves the unknown true PS, and thus only the asymptotic variance can be estimated. The most commonly used approach is bootstrapping, although there is no evidence that it will lead to correct standard errors and confidence intervals. Moreover, it is inappropriate when we estimate the ATT for the sample (Imbens, 2004). In the results presented below, we use the analytical variance which assumes that the observations are independent, that the weights are fixed and that the outcomes are homoscedastik within the treated and the untreated groups.[57]

In order to choose the appropriate matching methods, we use similar criteria to Moreno-Serra (2009): t-tests of the balancedness of the covariates, lowest use of each control observations to improve efficiency, lowest standardised bias[58] after matching and lowest pseudo R^2 from the logit estimation of the PS on all the covariates after matching. Based on those criteria, we prefer the NN approach with Mahalanobis, and Kernel matching with a bandwidth of 0.08 with Mahalanobis metrics. The NN is intuitive and only uses the most similar match (based on the Mahalanobis metrics), but the Kernel and stratification approach also allow larger comparison groups to provide a better estimate of the effect and a larger reduction bias. The bias reduction for the NN matching and for the Kernel method is illustrated in Table 9 for vigorous physical activity and the probability to drink daily.[59] In addition, we also use stratification as it does not require the true PS.

For our three preferred matching methods, we calculate p-values assuming that the errors are asymptotically normally distributed (Moreno-Serra, 2009). PSM estimators are simple differences at specific ages between the two groups, and not the change in lifestyle between two ages between the two groups.

It is important to understand how the differences in the number of observations vary for the different approaches. First, the number of observations reported when using NN and Kernel matching are based on the whole sample with no missing observations

[57]When using stratification, it is however possible that there is only one control and/or treated observation in one strata at a specific age. In this case, the variance cannot be computed in this block nor the overall standard error of the estimator at this age. If this occurs, we replace the analytical standard errors by the one estimated using bootstrapping and indicate it with a star next to the coefficient name in the results tables.

[58]The standardised bias is the difference of the sample means in the treated and non-treated (full or matched) sub-samples as a percentage of the square root of the average of the sample variances in the treated and non-treated groups (Rosenbaum and Rubin, 1985).

[59]The additional variables to the PS used in the Mahalanobis metrics are the ones that were not balanced based on the PS only at the 5% significance level between the insured and uninsured individuals. Balancedness of the covariates is presented in details in the next Section.

Table 9: Pseudo R^2 - probit regression, "Private & Public" definition

		(1)	(2)	(3)	(4)	(5)	(6)
		Vigorous physical activity			Drink daily		
Matching		NN	NN Mahalanobis	Kernel Mahalanobis BW(0.06)	NN	NN Mahalanobis	Kernel Mahalanobis BW(0.06)
Complete Sample	R2 (P>chi2)	0.050 (0.000)	0.050 (0.000)	0.050 (0.000)	0.046 (0.000)	0.215 (0.000)	0.046 (0.000)
	Mean Bias	55.839	55.839	55.839	53.34	53.34	53.34
Matched Sample	R2 (P>Chi2)	0.000 (0.231)	0.000 (0.985)	0.000 (0.898)	0.000 (0.982)	0.000 (1.000)	0.000 (0.510)
	Mean Bias	5.457	0.087	0.583	0.116	0.000	3.425

Notes: Pseudo R2 are reported for the probit regressions to estimate the probability of being uninsured based on definition Private & Public. The value are reported for matching based at the age 59/60. Mahalanobis metrics matches, in addition of the PS, on White, works full-time, works part-time, retired, unemployed, and total assets.

necessary to compute the specific ATT, whereas stratification additionally restricts the sample to the CS.[60] NN uses all the treated observations and match each to its nearest neighbour. As the distributions of the PS for the two groups are not the same (the two groups are quite different as discussed in the summary statistics), this approach only uses a very small number of controls, and these controls are used extensively. The Kernel approach uses the same controls but also all the ones that have a distance included in the bandwidth of 0.08. Therefore uninsured individuals that are too different from any control are not accounted for in this method, but better matches are given a higher weight. These estimates are therefore a local ATT. Finally, stratification uses all the observations included in the CS region, and only once.

2.7.2.3 Propensity score matching results

PS estimates are presented and balancedness tests of the covariates are presented in Table 7 for the "Private & Public" definition, and in the Appendix C in Tables 64 and 65 for the "All Types" and "Private Only" definitions, respectively. For all the uninsured definitions, the better the individual's health, the less likely they are to be uninsured. Males are more likely to be uninsured as well as the Hispanic. Married and highly educated individuals are less likely to be uninsured. Individuals working full-time are more likely to be insured whereas self-employed are more likely to be uninsured. The probability to be uninsured is also negatively correlated with the household assets, and LTC and life insurances. The t-tests of the equality of the means show that, before matching, most of the covariates are unbalanced between the two groups, but after performing a NN matching, all the covariates are balanced at least at the 10% significance level.

[60] The CS is defined is defined at the range between the minimum and maximum PS of the uninsured individuals.

Results of the PSM for the binary and count variables are presented in Tables 10 and 11 respectively for the "Private & Public" uninsured definition. In the Appendix C, results for the "All Types" definition are presented in Tables 66 and 67, and for the "Private Only" definition in Tables 68 and 69.

Before describing the results in details, it is worth discussing the differences in the number of observations. Columns 4 and 5 report the number of observations used in the insured and uninsured groups, respectively, whereas columns 6 and 7 report the total number of observations available in the same groups. The number of available observations in the NN and Kernel matching methods is same, but is smaller for the stratification matching as it is restricted to the common support although the difference is very small. Kernel matching uses almost all the uninsured observations available unless there is no match in the bandwidth imposed of 0.08. NN matching uses a very small sub-group of the insured individuals which worsen the precision of the estimates. Kernel and stratification matching use almost the same number of insured individuals, but the former accounts for the distance to the treated observations and gives less importance to further away observations.

The difference between the two groups in the probability to have some vigorous physical activity at least three times a week is generally positive at the age 59/60 for all uninsured definitions and all matching approaches suggesting that the uninsured tend to have a healthier lifestyle at this age, but the the difference is insignificant. At the age 61/62, the difference between the two group is still not significantly different from zero. At the age 63/64, the difference between the two groups is negative and different from zero for all matching methods in the case of "All Types" definition and using Kernel and stratification matching for the "Private & Public" definition. At this age, the uninsured are about 5 percentage points less likely to have some vigorous physical activity, suggesting that either the uninsured suddenly exercise less, or the insured exercise more just before being covered by Medicare supporting the hypothesis of EAMH with anticipatory behaviour. The results are insignificant in the case of the "Private Only" definition implying that the individuals covered by a governmental insurance have a similar lifestyle than the privately insured. After this age, and thus once insured by Medicare, the difference between the two groups is no longer significant ruling out the hypothesis of pure EAMH.

The graphs in Figure 7 in the Appendix represents the various differences for each outcome and all the uninsured definitions and matching methods. The plain and dashed lines, based on the "Private & Public" and "All Types" definitions respectively, illustrate that the difference between the two groups is the largest at age 63/64 supporting the existence of anticipatory behaviour, whereas the dotted line based on the "Private Only"

definition suggests rather the existence of pure EAMH, although only the results based on stratification are significant.

The probability to quit smoking is always smaller for the uninsured group. Based on the "Private & Public" and "All Types" definitions, the differences increase over the years from about 9 percentage points at age 59/60 up to 15 percentage points at the age 67/68. The differences are more stable in the case of the "Private Only" definition. These consistent negative differences suggest the presence of positive selection, that is the insured individuals have a more healthy lifestyle in general compared to the uninsured. However, in order to assess the presence of anticipatory EAMH or classical EAMH we have to test for a change in the relative trends which we do in the next section. The uninsured also smoke more cigarettes than the insured, from one extra on average at age 59/60 and the difference goes up to two at age 67/68. These increasing differences are identifies for all the uninsured definitions and PSM methods as illustrated in the graphs in Figure 7.

The probability to drink daily is generally positive but not significantly different between the two groups, however the number of alcohol drinks per week tends to be significantly larger for the uninsured just before receiving Medicare at the age 65 and up to age 66, suggesting the presence of EAMH possibly with anticipatory behaviour. The last graph in Table 7 shows that the uninsured differ from the insured from age 61/62 or 63/64 with the difference between the two groups remaining relatively stable after these ages. Again, we test for a change in trend in the next section.

2.7.2.4 DID and matching

The DID estimator removes any observed or unobserved systematic time-invariant differences between the individuals, and combined with PSM, it ensures that insurance status and lifestyles dependences are removed if these confounding factors are observable. Positive or adverse selection, if constant over time, are therefore removed by taking the DID. The ATT estimator of the DID using the MDID in Formula 27 can be approximated by

$$\hat{ATT_A^{MDID}} = \sum_{i\epsilon\{Unin\cap CS\}} \left\{ \left(L^1_{ia'} - L^1_{ia}\right) - \sum_{j\epsilon\{N(p_i(X))\cap CS\}} W_{ij} \left(L^0_{ja'} - L^0_{ja}\right) \right\} \frac{1}{M} \quad (41)$$

and can be estimated using the same matching methods described in Section 2.7.2.2. Therefore, similarly to the PSM estimator, we estimate the MDID estimator using NN and Kernel with Mahalanobis metrics, and stratification limited to the CS. However, whereas PSM estimators estimate differences in lifestyle at different ages, we measure

Table 10: Propensity score matching - "Private & Public" definition (binary variables)

		(1) ATT	(2) SE	(3) P-value	(4) uninsured obs. used	(5) insured obs. used	(6) uninsured obs. available	(7) insured obs. available
Vigorous physical activity								
Nearest Neighbour	**age 59/60**	0.014	0.030	0.647	1,078	673	1,078	3,952
	age 61/62	-0.019	0.033	0.566	954	592	954	3,463
	age 63/64	-0.041	0.037	0.264	755	469	755	2,838
	age 65/66	-0.069	0.043	0.107	495	321	495	1,901
	age 67/68	-0.063	0.053	0.234	320	205	320	1,216
Kernel	**age 59/60**	0.013	0.023	0.575	1,078	3,952	1,078	3,952
	age 61/62	-0.039	0.025	0.120	954	3,463	954	3,463
	age 63/64	-0.051	0.028	0.067	755	2,838	755	2,838
	age 65/66	-0.046	0.033	0.164	495	1,901	495	1,901
	age 67/68	-0.005	0.044	0.917	320	1,216	320	1,216
Stratification	**age 59/60**	0.015	0.021	0.462	1,078	3,948	1,078	3,948
	age 61/62	-0.040	0.024	0.101	954	3,459	954	3,459
	age 63/64	-0.059	0.028	0.035	755	2,834	755	2,834
	age 65/66	-0.052	0.032	0.109	495	1,887	495	1,887
	age 67/68	-0.012	0.038	0.754	320	1,156	320	1,156
Quit smoking								
Nearest Neighbour	**age 59/60**	-0.079	0.038	0.035	758	466	758	2,649
	age 61/62	-0.083	0.037	0.025	774	471	774	2,687
	age 63/64	-0.063	0.036	0.081	779	469	779	2,689
	age 65/66	-0.059	0.039	0.132	612	361	612	2,190
	age 67/68	-0.141	0.043	0.001	495	295	495	1,805
Kernel	**age 59/60**	-0.106	0.028	0.000	757	2,649	758	2,649
	age 61/62	-0.109	0.027	0.000	772	2,687	774	2,687
	age 63/64	-0.099	0.027	0.000	778	2,689	779	2,689
	age 65/66	-0.092	0.028	0.001	612	2,190	612	2,190
	age 67/68	-0.112	0.032	0.001	495	1,805	495	1,805
Stratification	**age 59/60**	-0.091	0.032	0.004	758	2,645	758	2,645
	age 61/62	-0.102	0.031	0.001	774	2,683	774	2,683
	age 63/64	-0.083	0.031	0.007	779	2,685	779	2,685
	age 65/66	-0.085	0.029	0.003	612	2,167	612	2,167
	age 67/68	-0.111	0.037	0.003	495	1,783	495	1,783
Drink daily								
Nearest Neighbour	**age 59/60**	-0.023	0.019	0.231	828	511	828	2,934
	age 61/62	0.000	0.016	1.000	1,064	637	1,064	3,703
	age 63/64	0.004	0.014	0.779	1,246	760	1,246	4,464
	age 65/66	0.009	0.015	0.524	956	588	956	3,593
	age 67/68	0.004	0.016	0.817	795	490	795	3,008
Kernel	**age 59/60**	-0.002	0.014	0.887	827	2,934	828	2,934
	age 61/62	0.013	0.013	0.344	1,062	3,703	1,064	3,703
	age 63/64	0.011	0.011	0.353	1,246	4,464	1,246	4,464
	age 65/66	0.011	0.013	0.379	956	3,593	956	3,593
	age 67/68	0.007	0.014	0.638	795	3,008	795	3,008
Stratification	**age 59/60**	0.000	0.009	0.993	828	2,930	828	2,930
	age 61/62	0.014	0.010	0.135	1,064	3,698	1,064	3,698
	age 63/64	0.013	0.009	0.113	1,246	4,459	1,246	4,459
	age 65/66	0.013	0.010	0.165	956	3,588	956	3,588
	age 67/68	0.008	0.010	0.400	795	3,004	795	3,004

Notes: The uninsured definition is 'Private & Public'. The nearest neighbour and Kernel matching use Mahalanobis matching on race, working status, household assets and the estimated propensity score. Kernel matching is based on epanechnikov Kernel with a bandwidth of 0.08. Stratification estimates are based on the common support only. The p-values are computed assuming independent observations asymptotically normally distributed.

Table 11: Propensity score matching - "Private & Public" definition (count variables)

		(1) ATT	(2) SE	(3) P-value	(4) uninsured obs. used	(5) insured obs. used	(6) uninsured obs. available	(7) insured obs. available
# cigarettes smoked per day								
Nearest Neighbour	**age 59/60**	0.092	0.745	0.902	830	512	830	2,940
	age 61/62	0.513	0.612	0.402	1,066	638	1,066	3,711
	age 63/64	0.248	0.537	0.644	1,246	759	1,246	4,467
	age 65/66	0.694	0.534	0.194	957	589	957	3,596
	age 67/68	1.682	0.534	0.002	796	491	796	3,005
Kernel	**age 59/60**	0.231	0.526	0.661	829	2,940	830	2,940
	age 61/62	0.894	0.462	0.053	1,064	3,711	1,066	3,711
	age 63/64	1.049	0.374	0.005	1,246	4,467	1,246	4,467
	age 65/66	1.240	0.391	0.002	957	3,596	957	3,596
	age 67/68	1.712	0.422	0.000	796	3,005	796	3,005
Stratification	**age 59/60**	0.525	0.595	0.378	830	2,936	830	2,936
	age 61/62	1.016	0.544	0.062	1,066	3,706	1,066	3,706
	age 63/64	1.031	0.389	0.008	1,246	4,462	1,246	4,462
	age 65/66	1.206	0.381	0.002	957	3,591	957	3,591
	age 67/68	1.718	0.417	0.000	796	3,001	796	3,001
# alcoholic drinks per week								
Nearest Neighbour	**age 59/60**	-0.279	0.584	0.633	825	509	825	2,932
	age 61/62	0.477	0.430	0.267	1,061	634	1,061	3,697
	age 63/64	0.283	0.388	0.465	1,240	759	1,240	4,457
	age 65/66	0.396	0.416	0.341	956	588	956	3,590
	age 67/68	0.338	0.440	0.442	793	489	793	3,003
Kernel	**age 59/60**	-0.017	0.372	0.963	824	2,932	825	2,932
	age 61/62	0.376	0.354	0.287	1,059	3,697	1,061	3,697
	age 63/64	0.506	0.294	0.085	1,240	4,457	1,240	4,457
	age 65/66	0.333	0.305	0.275	956	3,590	956	3,590
	age 67/68	0.289	0.317	0.363	793	3,003	793	3,003
Stratification	**age 59/60**	0.079	0.327	0.809	825	2,928	825	2,928
	age 61/62	0.475	0.345	0.168	1,061	3,692	1,061	3,692
	age 63/64	0.571	0.255	0.025	1,240	4,452	1,240	4,452
	age 65/66	0.398	0.265	0.132	956	3,586	956	3,586
	age 67/68	0.448	0.247	0.070	793	2,999	793	2,999

Notes: The uninsured definition is 'Private & Public'. The nearest neighbour and Kernel matching use Mahalanobis matching on race, working status, household assets and the estimated propensity score. Kernel matching is based on epanechnikov Kernel with a bandwidth of 0.08. Stratification estimates are based on the common support only. The p-values are computed assuming independent observations asymptotically normally distributed.

here the differences between the changes in lifestyle of the uninsured and insured groups between two ages. The changes over different ages are measured first with respect to the age 59/60 to obtain comparable estimates to the ones presented below in the regression DID approach, and second we look at the change in behaviour between two consecutive interviews (63/64-61/62, 65/66-63/64, 67/68-65/66). This latter approach allows us to decompose the change for each couple of years rather than relative to the 59/60 years old benchmark. If we were able to measure perfectly the differences, the sum of the consecutive two-year effects until age x would be the same as the effect at age x relative to age 59/60.

For the the "Private & Public" definition, results for the binary and count variables are presented in Tables 12 and 13 respectively. Tables 70 and 71 in Appendix C are for "All Types" definition and Tables 72 and 73 in the same Appendix correspond to the "Private Only" definition. The number of observations available and used are based on the same logic as in the case of simple PSM. However, the number of observations is generally lower because the dependant variables cannot be missing for the two age ranges of interest. This is particularly an issue for the variables that are not observed at all waves. For example, in the case of alcohol consumption where our variables are only observed at waves 3-9, the number of observations may be low when looking at the differences with respect to age 59/60 if the individual was 59 or 60 years old in the first wave (the PS can be estimated but not the DID estimates). Similarly, for the physical activity variables, all the DID estimates can only be computed for the individuals that were between 59 and 60 years old in the first wave as this variable is only observed in the first 6 waves.

All the estimates are much less significant than in the PS matching approach. This is due to the small number of observations and therefore high standard errors. In the case of physical activity, the uninsured individuals appear to reduce more their probability to exercise than the insured group relative to the age 59/60. The reduction, ranging from 7 to 9 percentage points based on "Private & Public" definition, is significant between 63 to 66 years old relative to 59/60 except in the case of Kernel matching and supports the assumption of anticipatory EAMH. The lack of significance in the case of Kernel matching is possibly due to the small number of uninsured used in the matching. After 65, there is no change in trends ruling out the presence of pure EAMH. Similar results are obtained with the two other uninsured definitions.

The estimates of the change in the probability to quit smoking have generally very high p-values and, even based on the sign of the coefficients only, it is difficult to distinguish any pattern. The few significant changes in trends observed, for example between 61/62 and 63/64 in the case of Kernel matching and "Private Only" definition

Table 12: MDID estimators - uninsured definition "Private & Public" (binary variables)

		(1) ATT	(2) SE	(3) P-value	(4) uninsured obs. used	(5) insured obs. used	(6) uninsured obs. available	(7) insured obs. available
Vigorous physical activity								
Nearest Neighbour	**age 61/62 – 59/60**	-0.029	0.035	0.412	936	598	936	3,387
	age 63/64 – 59/60	-0.072	0.042	0.083	719	466	719	2,703
	age 65/66 – 59/60	-0.093	0.050	0.060	471	305	471	1,805
	age 67/68 – 59/60	-0.063	0.064	0.326	286	191	286	1,132
	age 63/64 – 61/62	-0.066	0.040	0.097	731	471	731	2,746
	age 65/66 – 63/64	0.037	0.047	0.427	486	317	486	1,874
	age 67/68 – 65/66	0.092	0.061	0.131	273	184	273	1,103
Kernel	**age 61/62 – 59/60**	-0.027	0.032	0.397	646	2,346	936	3,387
	age 63/64 – 59/60	-0.060	0.040	0.134	474	1,641	719	2,703
	age 65/66 – 59/60	-0.021	0.053	0.693	234	858	471	1,805
	age 67/68 – 59/60	0.010	0.067	0.882	121	435	286	1,132
	age 63/64 – 61/62	-0.057	0.038	0.133	480	1,670	731	2,746
	age 65/66 – 63/64	0.078	0.049	0.110	248	899	486	1,874
	age 67/68 – 65/66	0.067	0.070	0.339	115	420	273	1,103
Stratification	**age 61/62 – 59/60**	-0.054	0.026	0.042	936	3,384	936	3,384
	age 63/64 – 59/60	-0.070	0.035	0.048	719	2,700	719	2,700
	age 65/66 – 59/60*	-0.074	0.038	0.051	471	1,792	471	1,792
	age 67/68 – 59/60	-0.030	0.047	0.517	286	1,081	286	1,081
	age 63/64 – 61/62	-0.026	0.033	0.436	731	2,742	731	2,742
	age 65/66 – 63/66	0.036	0.039	0.346	486	1,860	486	1,860
	age 67/68 – 65/66	0.023	0.048	0.629	273	1,056	273	1,056
Quit smoking								
Nearest Neighbour	**age 61/62 – 59/60**	-0.003	0.021	0.901	751	470	751	2,622
	age 63/64 – 59/60	0.012	0.024	0.610	737	463	737	2,570
	age 65/66 – 59/60	-0.002	0.029	0.953	579	354	579	2,091
	age 67/68 – 59/60	-0.025	0.037	0.500	446	276	446	1,677
	age 63/64 – 61/62	0.016	0.022	0.462	753	472	753	2,609
	age 65/66 – 63/64	-0.007	0.022	0.758	592	364	592	2,131
	age 67/68 – 65/66	-0.018	0.024	0.460	443	270	443	1,659
Kernel	**age 61/62 – 59/60**	0.009	0.019	0.627	443	1,511	751	2,622
	age 63/64 – 59/60	0.008	0.021	0.700	433	1,460	737	2,570
	age 65/66 – 59/60	0.000	0.028	0.992	311	1,120	579	2,091
	age 67/68 – 59/60	-0.039	0.032	0.229	215	791	446	1,677
	age 63/64 – 61/62	-0.004	0.019	0.845	446	1,506	753	2,609
	age 65/66 – 63/64	0.018	0.021	0.392	320	1,150	592	2,131
	age 67/68 – 65/66	-0.058	0.020	0.004	211	779	443	1,659
Stratification	**age 61/62 – 59/60**	-0.013	0.023	0.592	751	2,618	751	2,618
	age 63/64 – 59/60	0.010	0.017	0.569	737	2,566	737	2,566
	age 65/66 – 59/60	-0.010	0.029	0.721	579	2,069	579	2,069
	age 67/68 – 59/60	0.006	0.034	0.866	446	1,657	446	1,657
	age 63/64 – 61/62	0.018	0.024	0.454	753	2,605	753	2,605
	age 65/66 – 63/66	-0.022	0.026	0.402	592	2,109	592	2,109
	age 67/68 – 65/66	-0.007	0.017	0.692	443	1,639	443	1,639
Drink daily								
Nearest Neighbour	**age 61/62 – 59/60**	0.008	0.013	0.508	827	521	827	2,932
	age 63/64 – 59/60	0.015	0.014	0.298	821	517	821	2,909
	age 65/66 – 59/60	0.008	0.014	0.568	610	382	610	2,254
	age 67/68 – 59/60	0.007	0.016	0.679	442	282	442	1,676
	age 63/64 – 61/62	0.006	0.014	0.679	1,045	651	1,045	3,645
	age 65/66 – 63/64	0.001	0.012	0.931	942	596	942	3,538
	age 67/68 – 65/66	-0.001	0.014	0.919	706	457	706	2,753
Kernel	**age 61/62 – 59/60**	0.019	0.013	0.152	543	1,971	827	2,932
	age 63/64 – 59/60	0.014	0.014	0.330	539	1,953	821	2,909
	age 65/66 – 59/60	0.020	0.016	0.205	376	1,451	610	2,254
	age 67/68 – 59/60	0.024	0.019	0.227	249	1,006	442	1,676
	age 63/64 – 61/62	-0.002	0.012	0.859	720	2,589	1,045	3,645
	age 65/66 – 63/64	-0.007	0.011	0.515	643	2,469	942	3,538
	age 67/68 – 65/66	-0.010	0.015	0.493	460	1,838	706	2,753
Stratification	**age 61/62 – 59/60**	0.006	0.009	0.509	827	2,928	827	2,928
	age 63/64 – 59/60	0.015	0.010	0.124	821	2,905	821	2,905
	age 65/66 – 59/60	0.007	0.010	0.509	610	2,250	610	2,250
	age 67/68 – 59/60	0.010	0.011	0.379	442	1,673	442	1,673
	age 63/64 – 61/62	-0.001	0.009	0.934	1,045	3,640	1,045	3,640
	age 65/66 – 63/64	-0.003	0.008	0.690	942	3,533	942	3,533
	age 67/68 – 65/66	-0.004	0.009	0.648	706	2,749	706	2,749

Notes: The uninsured definition is 'Private & Public'. The nearest neighbour and Kernel matching use Mahalanobis matching on race, working status, household assets and the estimated propensity score. Kernel matching is based on epanechnikov Kernel with a bandwidth of 0.08. Stratification estimates are based on the common support only. The p-values are computed assuming independent observations asymptotically normally distributed.

Table 13: MDID estimators - uninsured definition "Private & Public" (count variables)

		(1) ATT	(2) SE	(3) P-value	(4) uninsured obs. used	(5) insured obs. used	(6) uninsured obs. available	(7) insured obs. available
# cigarettes smokes per day								
Nearest Neighbour	**age 61/62 – 59/60**	0.196	0.444	0.658	830	521	830	2,940
	age 63/64 – 59/60	-0.226	0.512	0.659	823	516	823	2,914
	age 65/66 – 59/60	0.082	0.516	0.874	612	383	612	2,258
	age 67/68 – 59/60	-0.027	0.608	0.965	444	282	444	1,673
	age 63/64 – 61/62	-0.296	0.367	0.420	1,047	652	1,047	3,652
	age 65/66 – 63/64	0.394	0.348	0.256	943	596	943	3,546
	age 67/68 – 65/66	0.295	0.327	0.368	709	457	709	2,751
Kernel	**age 61/62 – 59/60**	0.380	0.423	0.370	543	1,978	830	2,940
	age 63/64 – 59/60	-0.333	0.452	0.462	539	1,956	823	2,914
	age 65/66 – 59/60	-0.119	0.530	0.823	377	1,452	612	2,258
	age 67/68 – 59/60	-0.357	0.685	0.603	248	1,006	444	1,673
	age 63/64 – 61/62	-0.840	0.317	0.008	722	2,596	1,047	3,652
	age 65/66 – 63/64	0.384	0.307	0.212	642	2,470	943	3,546
	age 67/68 – 65/66	-0.052	0.304	0.865	461	1,836	709	2,751
Stratification	**age 61/62 – 59/60**	0.513	0.315	0.104	830	2,936	830	2,936
	age 63/64 – 59/60	0.091	0.367	0.804	823	2,910	823	2,910
	age 65/66 – 59/60	0.072	0.451	0.873	612	2,254	612	2,254
	age 67/68 – 59/60	0.060	0.492	0.903	444	1,670	444	1,670
	age 63/64 – 61/62	-0.224	0.285	0.432	1,047	3,647	1,047	3,647
	age 65/66 – 63/64	0.277	0.321	0.389	943	3,541	943	3,541
	age 67/68 – 65/66	0.207	0.287	0.471	709	2,747	709	2,747
# alcoholic drinks per week								
Nearest Neighbour	**age 61/62 – 59/60**	0.092	0.318	0.771	822	521	822	2,925
	age 63/64 – 59/60	0.123	0.296	0.678	814	514	814	2,901
	age 65/66 – 59/60	-0.072	0.358	0.840	607	381	607	2,252
	age 67/68 – 59/60	-0.450	0.400	0.260	440	281	440	1,673
	age 63/64 – 61/62	0.109	0.304	0.721	1,038	647	1,038	3,634
	age 65/66 – 63/64	-0.574	0.283	0.042	940	595	940	3,532
	age 67/68 – 65/66	0.146	0.329	0.657	706	457	706	2,746
Kernel	**age 61/62 – 59/60**	0.348	0.317	0.273	539	1,961	822	2,925
	age 63/64 – 59/60	0.148	0.297	0.618	533	1,939	814	2,901
	age 65/66 – 59/60	-0.014	0.403	0.972	373	1,445	607	2,252
	age 67/68 – 59/60	-0.440	0.522	0.399	247	1,000	440	1,673
	age 63/64 – 61/62	0.127	0.301	0.673	713	2,574	1,038	3,634
	age 65/66 – 63/64	-0.532	0.283	0.060	640	2,465	940	3,532
	age 67/68 – 65/66	-0.125	0.328	0.703	459	1,832	706	2,746
Stratification	**age 61/62 – 59/60**	-0.021	0.282	0.940	822	2,921	822	2,921
	age 63/64 – 59/60	0.114	0.306	0.709	814	2,897	814	2,897
	age 65/66 – 59/60	-0.376	0.287	0.190	607	2,248	607	2,248
	age 67/68 – 59/60	-0.219	0.344	0.525	440	1,670	440	1,670
	age 63/64 – 61/62	0.016	0.266	0.952	1,038	3,629	1,038	3,629
	age 65/66 – 63/64	-0.384	0.228	0.092	940	3,528	940	3,528
	age 67/68 – 65/66	0.114	0.257	0.656	706	2,743	706	2,743

Notes: The uninsured definition is 'Private & Public'. The nearest neighbour and Kernel matching use Mahalanobis matching on race, working status, household assets and the estimated propensity score. Kernel matching is based on epanechnikov Kernel with a bandwidth of 0.08. Stratification estimates are based on the common support only. The p-values are computed assuming independent observations asymptotically normally distributed.

hardly support the presence of anticipatory behaviour because of the small number of observations used to calculate this estimate (537 of the uninsured from the 884 available, and 1,518 insured from the 2,539 available). Therefore the absolute differences observed in the previous section are likely due to positive selection. The change in the number of cigarettes smoked per day is often significant in the case of Kernel matching between the reference age 59/60 and Medicare, but rely again on a very limited sample. Although the estimates suggest that the uninsured increase their cigarette consumption relative to the insured by the age 63/64 (MDID<0) and relatively decrease it from 65 (MDID>0), the small number of observations on which these estimates rely provide little support for the existence of anticipatory behaviour.

Finally, we find little evidence of a change in the relative trends of the probability to drink daily. The few significant results again come from Kernel matching and rely on a small number of observations. However, when we analyse the relative changes in the number of alcoholic drinks per week, uninsured individuals significantly decrease their consumption when receiving Medicare relative to age 63/64 compared to the insured. As these estimates capture the direct effect of insurance as well as the possible indirect effect proposed by Dave and Kaestner (2009), it provides support to the existence of a beneficial effect of insurance on the previously uninsured. In order to disentangle the direct and indirect effects, we now turn to the classical DID approach using regression methods.

2.7.3 Linear and non-linear regression methods

In this section, we present the results of the linear and non-linear regression methods.

We first estimate equations (28) and (31) using linear FE models for comparisons with previous results in the literature. Given the distributions of the dependant variables, we then focus on non-linear models with flexible doctor indirect effects. For binary dependant variables, we use pooled probit and fixed effect logit, and for count variables we use negative binomial and fixed effect negative binomial. We use robust and clustered standard errors. For the count variables, we started with Poisson estimation but after testing for over-dispersion, we reject the assumption of equi-dispersion and believe that negative binomial regressions are more appropriate given the shape of the data.[61] For the non-linear models, we report the average marginal effect. Although the fixed effect logit and negative binomial are preferable in the sense that they account

[61]The null hypothesis of equi-dispersion is $Var(y|x) = E(y|x)$ against the hypothesis of over-dispersion of the form $Var(y|x) = E(y|x) + \alpha^2 E(y|x)$. Therefore, we test $H_0 : \alpha = 0$ against $H_1 : \alpha > 0$ (Cameron and Triverdi (2005), p.561). The test indicating the presence of considerable over-dispersion for all the count variables and any uninsured definition, we assumed a variance of the form $V(y|\mu\alpha) = \mu(1 + \alpha\mu)$ (Negative Binomial 2).

for fixed unobserved heterogeneity and better model the dependant variable, they drop individuals for who we have just one observation of the dependant variable or no change in the dependant variable.

The results for the "Private & Public" definition are presented in more detail than for the two other definitions. Table 14 presents the regressions for the binary outcome variables and Table 74 in Appendix C contains the full set of coefficients for these regressions.

Before analysing in detail the coefficients of interest, it is informative to have a look at the various controls used in the regressions presented in Table 74 in Appendix C.4. The full set of coefficients is reported only for the most flexible models, i.e. columns 1, 2 and 3 in Table 74 correspond to columns 2,3 and 4 respectively in Table 14. As expected, a good physical health is significantly positively correlated with the probability to have some vigorous physical activity at least three times a week. Men are more likely to exercise, whereas Hispanic are less likely. The marital status as well as the education does not play a significant role. Individuals working full-time or part-time are less likely to exercise, whereas the self-employed are more likely to keep a healthy lifestyle. Having a job that requires some physical activity significantly increases the probability of reporting exercising three times a week or more but probably because the respondent includes this type of activity when answering the question about her lifestyle.[62] Richer individuals are also more likely to have a regular physical activity, and LTC insurance is positively correlated with the probability to exercise. One could argue that individuals who care about their health in the future also invest today in healthy lifestyle.

The probability to quit smoking is negatively correlated with good health whereas cigarette consumption is positive correlated with good health once we take into account the fixed effects. Individuals living in partnership are less likely to have a healthy lifestyle in terms of cigarette consumption. Working individuals, self-employed and richer individuals are more likely to quit smoking or to smoke less. Similarly to exercise, individuals with LTC insurance also smoke less.

Alcohol consumption is also positively associated with good health, and males are significantly more likely to drink alcohol frequently. Assets are strongly associated with high alcohol consumption. Finally, individuals with high alcohol consumption are more likely to have a life insurance but less likely to have a LTC insurance.

We now turn to the analysis of the effect of insurance on lifestyle and look in detail at Table 14. The first regression does not allow doctor visits to have a different

[62] As example of vigorous physical activity in the questionnaire, physical labour on the job and sports were mentioned.

Table 14: DID - "Private & Public" definition (binary variables)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Vigorous physical activity				**Quit smoking**				**Drink daily**			
	FE	**FE**	**Probit**	**FE Logit**	**FE**	**FE**	**Probit**	**FE Logit**	**FE**	**FE**	**Probit**	**FE Logit**
age 61/62	0.041	0.040	0.013	0.004	-0.007	-0.007	0.103***	0.000	0.009	0.009	-0.000	0.001
	(0.031)	(0.031)	(0.011)	(0.005)	(0.021)	(0.021)	(0.026)	(0.001)	(0.013)	(0.013)	(0.004)	(0.001)
age 63/64	0.063	0.060	0.006	0.006	-0.021	-0.021	0.202***	0.000	0.017	0.017	0.002	0.001
	(0.060)	(0.060)	(0.012)	(0.008)	(0.040)	(0.040)	(0.035)	(0.002)	(0.024)	(0.024)	(0.005)	(0.002)
age 65/66	0.083	0.169*	0.062	0.014	-0.023	-0.008	0.318**	0.001	0.030	0.022	-0.017	0.001
	(0.089)	(0.098)	(0.043)	(0.018)	(0.059)	(0.063)	(0.128)	(0.004)	(0.036)	(0.040)	(0.019)	(0.002)
age 67/68	0.122	0.208*	0.066	0.016	-0.040	-0.024	0.401***	0.001	0.039	0.031	-0.018	0.001
	(0.116)	(0.123)	(0.044)	(0.019)	(0.078)	(0.081)	(0.133)	(0.005)	(0.048)	(0.051)	(0.020)	(0.002)
uninsured x age 59/60			0.037				-0.062				0.016	
			(0.034)				(0.121)				(0.019)	
uninsured x age 61/62	-0.031	-0.029	0.018	-0.004	0.012	0.012	-0.037	0.000	0.015*	0.015*	0.045***	0.001
	(0.022)	(0.022)	(0.036)	(0.006)	(0.014)	(0.014)	(0.123)	(0.001)	(0.008)	(0.008)	(0.017)	(0.001)
uninsured x age 63/64	-0.062**	-0.060**	-0.012	-0.007**	0.013	0.013	-0.063	0.000	0.011	0.011	0.041**	0.001
	(0.025)	(0.025)	(0.036)	(0.009)	(0.015)	(0.015)	(0.125)	(0.001)	(0.009)	(0.009)	(0.017)	(0.001)
uninsured x age 65/66	-0.053*	-0.218***	-0.113*	-0.039***	0.040**	-0.009	-0.078	-0.000	0.001	0.015	0.070***	0.001
	(0.029)	(0.074)	(0.062)	(0.053)	(0.019)	(0.036)	(0.176)	(0.002)	(0.010)	(0.029)	(0.023)	(0.002)
uninsured x age 67/68	-0.044	-0.210***	-0.104	-0.039***	0.023	-0.028	-0.199	-0.001	-0.012	0.002	0.062**	0.000
	(0.034)	(0.077)	(0.068)	(0.053)	(0.021)	(0.037)	(0.186)	(0.002)	(0.010)	(0.030)	(0.026)	(0.001)
dr	0.030*	0.072***	0.053***	0.009***	0.027**	0.032*	0.470***	0.000	-0.007	-0.008	-0.008	-0.000
	(0.018)	(0.023)	(0.020)	(0.011)	(0.011)	(0.017)	(0.072)	(0.001)	(0.007)	(0.010)	(0.011)	(0.001)
dr x 65 or more		-0.094**	-0.064	-0.013**		-0.016	0.049	0.000		0.008	0.019	0.001
		(0.047)	(0.042)	(0.018)		(0.026)	(0.126)	(0.001)		(0.017)	(0.019)	(0.001)
dr x before 65 x uninsured		-0.102**	-0.055	-0.011**		-0.019	-0.131	0.000		0.001	-0.032*	0.000
		(0.041)	(0.034)	(0.016)		(0.026)	(0.119)	(0.001)		(0.018)	(0.017)	(0.001)
dr x 65 or more x uninsured		0.087	0.087	0.009*		0.039	-0.078	0.001		-0.015	-0.064***	-0.001
		(0.068)	(0.064)	(0.013)		(0.031)	(0.181)	(0.002)		(0.026)	(0.025)	(0.003)
individuals	5,019	5,019	5,019	2,214	3,424	3,424	3,424	567	5,571	5,571	5,571	449
observations	15,205	15,205	15,205	8,009	13,004	13,004	13,004	2,275	19,766	19,766	19,766	1,703

Notes: The uninsured definition used here is 'Private & Public'. 'dr' indicates whether the individual has visited the doctor in the last 2 years. The reference age is 59/60. All the regressions control for physical health, gender, race, education, Census regions, marital status, working status, number of years worked, an indicator of whether current job requires some physical activities, household assets in 1992$, whether the individual has a life or a long term care insurance, and dummies for the year of the interviews. The coefficients for the probit and fixed effect (FE) logit regressions reports the average marginal effects and the associated standard errors are obtained using the delta method. Standard errors given in parenthesis are clustered at the individual level and robust to heteroskedasticity and autocorrelation of unknown form. Stars convention: * for $p<0.1$, ** for $p<0.05$, and *** for $p<0.01$. The significance level is reported next to the marginal effects are based on the orginal coefficients.

effect on the uninsured once being insured by Medicare, whereas the other ones allow for different doctor effects on the insured and uninsured before and after 65. The insured individuals generally do not show any age trend, only in the case of simple fixed effects; after 65 the insured become more likely to exercise compared to age 59/60. With the receipt of Medicare, it is possible that they visit a different doctor who encourages a more healthy lifestyle. This result appear in the case of the "Private & Public" and "Private Only" definitions.

The uninsured become significantly less likely to exercise compared to the insured from 63/64 years old. When we allow for doctor visits, the difference remains significantly large until age 67/68 and is the largest just after receiving Medicare at age 65/66 (between 4 to 22 percentage points in the case of "Private & Public" definition). Those results suggest that, once we take into account the possible indirect effect of doctor visit, we find an anticipatory EAMH effect and a larger classical EAMH effect from 65. The effects based on the FE logit are smaller but lead to the same conclusion.

The first regression provides an overall doctor effect of 3 percentage points on the probability to exercise three or more times a week. However, when we allow the effect to vary by insured and uninsured before and after 65, individuals who are insured and see a doctor before 65 are between 1 to 7 percentage points more likely to exercise, but visiting a doctor after 65 is negatively associated with the probability to exercise. The effect ranges from -1 to 7 percentage points. For the uninsured, the effect is the other way around. Seeing a doctor before 65 is associated with a reduction of 1 to 10 percentage points with the probability to exercise, but after 65, doctors have either no effect or a positive effect on the probability to exercise based on the FE logit. These effects are in line with Dave and Kaestner's assumption of an indirect effect of insurance.

In order to better characterise the relative change in the trends of the uninsured and to understand when the relative change appears (the DID estimates are all relative to age 59/60), we now compare the relative changes over two consecutive interviews. Table 15 presents the p-values of Wald and one-sided tests for the pairwise comparison. Between 61/62 and 59/60 years old, and between 63/64 and 61/62 years old, the trends diverge, but we cannot exclude that they diverge at the same rate (Wald tests cannot reject the null). Between 65/66 and 63/64, the relative changes become significantly larger suggesting the presence of EAMH possibly with some anticipatory behaviour. After this age, the relative changes remain constant. Therefore, we conclude that there is EAMH that appears just before or at 65 years old.

We compare this result to the ones obtained with the two other definitions. The results are reported in Tables 76 and 78 for the "All Types" and "Private Only" definitions, respectively. The "Private Only" results support the same conclusion: uninsured

Table 15: Change in the DID coefficients from Table 14

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Vigorous physical activity				**Quit smoking**				**Drink daily**			
	FE	**FE**	**Probit**	**FE Logit**	**FE**	**FE**	**Probit**	**FE Logit**	**FE**	**FE**	**Probit**	**FE Logit**
diff age 61/62 – 59/60	-0.031	-0.029	-0.054	-0.221	0.012	0.012	0.025	0.141	0.015	0.015	0.242	0.622
H0: diff=0	0.154	0.183	0.403	0.138	0.393	0.387	0.582	0.650	**0.078**	**0.078**	**0.007**	0.119
H0: diff<=0	0.923	0.909	0.798	0.931	0.196	0.194	0.291	0.325	**0.039**	**0.039**	**0.004**	**0.059**
H0: diff>=0	**0.077**	**0.091**	0.202	**0.069**	0.804	0.806	0.709	0.675	0.961	0.961	0.996	0.941
diff age 63/64 – 61/62	-0.031	-0.031	-0.086	-0.146	0.001	0.001	-0.025	-0.131	-0.004	-0.004	-0.038	-0.044
H0: diff=0	0.185	0.190	0.204	0.348	0.942	0.936	0.607	0.656	0.635	0.635	0.608	0.902
H0: diff<=0	0.907	0.905	0.898	0.826	0.471	0.468	0.696	0.672	0.683	0.683	0.696	0.549
H0: diff>=0	**0.093**	**0.095**	0.102	0.174	0.529	0.532	0.304	0.328	0.317	0.317	0.304	0.451
diff age 65/66 – 63/64	0.010	-0.158	-0.287	-1.030	0.027	-0.023	-0.018	-0.096	-0.010	0.004	0.243	0.293
H0: diff=0	0.728	**0.031**	0.137	**0.016**	**0.074**	0.503	0.916	0.915	0.260	0.875	0.248	0.702
H0: diff<=0	0.364	0.985	0.932	0.992	**0.037**	0.749	0.542	0.543	0.870	0.438	0.124	0.351
H0: diff>=0	0.636	**0.015**	**0.068**	**0.008**	0.963	0.251	0.458	0.457	0.130	0.562	0.876	0.649
diff age 67/68 – 65/66	0.008	0.007	0.025	0.024	-0.017	-0.019	-0.122	-0.453	-0.014	-0.013	-0.066	-0.686
H0: diff=0	0.812	0.837	0.805	0.911	0.285	0.241	**0.066**	0.223	0.134	0.151	0.484	0.126
H0: diff<=0	0.406	0.418	0.402	0.456	0.857	0.880	0.967	0.888	0.933	0.924	0.758	0.937
H0: diff>=0	0.594	0.582	0.598	0.544	0.143	0.120	**0.033**	0.112	**0.067**	**0.076**	0.242	**0.063**

Notes: The uninsured definition is 'Private & Public'. The change in the sign of the coefficients is tested using Wald test and one-sided tests. The p-values are reported and in bold if below the 10% significance level.

individuals become less likely with age to have some vigorous physical activity and the change appears from 63/64 years old and becomes the largest between 63/64 and 65/66. When using the "All Types" definition, we find similar effects but much less significant, which may be due to the small number of observations in the FE logit.

In conclusion, the analysis of the probability of vigorous physical activity at least three times a week exhibits a pattern in line with the one predicted by anticipatory EAMH. Uninsured individuals reduce more their investment in this healthy lifestyle before the age 65, but then the difference between the two groups remains relatively stable. There is no significant change in behaviour at, or just after, the age of 65 as predicted by classical EAMH (if any, it is rather positive in terms of lifestyle). Therefore, EAMH exists but mainly before the exogenous change in health insurance.

We now look at smoking behaviour in terms of the probability to quit smoking and the number of cigarettes smoked per day (Tables 14 and 16 in the case of "Private & Public" definition). The probit regression suggests that the insured individuals are more likely over the ages to quit smoking (up to 40 percentage points more likely at the age 67/68 compared to age 59/60), however, the age trend for the insured disappear when we account for a fixed effect. The effect of Medicare on the uninsured is generally insignificant and rules out the existence of EAMH. Seeing a doctor in the last 24 months when insured and younger than 65 is positively correlated with the probability to quit smoking but there is no significant doctor effect for the uninsured. The analysis of the number of cigarettes smoked per day leads to very similar results: the insured reduce their cigarette consumption over the years relative to the uninsured, but the effect almost disappears once we take into account the fixed effects. When we look at the age trend of the uninsured in the DID regressions, there is no change relative to the insured, rejecting the assumption of EAMH. However, the pairwise analysis of consecutive DID reveals that the number of cigarettes smoked per day significantly increases between 65/66 and 67/68 years old suggesting the presence of classical EAMH. This change does not appear in the regression because the decrease in cigarette consumption between 59/60 and 65/66 and the increase between 59/60 and 67/68 are not different from zero, but the change between 65/66 and 67/68 is large enough to be different from zero. Therefore, it only provides weak evidence of EAMH. The other two uninsured definitions lead to similar conclusions.

The analysis of drinking behaviour rejects the assumption of EAMH, but suggests the existence of positive selection. The probability to drink daily is higher for the uninsured and does not differ between the two groups once we take into account the fixed effects, which is also supported by the pairwise analysis of the coefficients. The number of drinks consumed by the uninsured is significantly larger than the insured.

Once we take into account the fixed effects, i.e. the possible positive selection, the uninsured reduce their consumption more than the insured relative to age 59/60. This result is also supported by the pairwise analysis of the coefficients. The other two definitions provide similar results.

2.7.4 Double-Robust Approach

In this section, we present the DR, DRDID and DRDIDID results.

The DR estimators combine the PS with regression methods. The PS is the same as the one used in Section 2.7.2.3. We estimate the regression models in equations (33) and (34) separately for the uninsured and insured using logit if the dependent variable is binary and negative binomial if it is a count variable. The set of controls is the same as the one used to estimate the propensity score but additionally includes the number of insurance plans reported at each interview to account for the generosity of insurance. The DR estimates of the differences at each age $DRD(a)$ (equation (32)), the difference-in-differences $DRDID(a, a')$ (equation (36)) and the triple differences $DRDIDID(a, a', a'', a''')$ (equation (37)) are presented in Table 18. The DR estimates are the differences in lifestyle between the uninsured and the insured, $DRDID(a, a')$ estimates assess the differences in the slopes of the two trends, and $DRDIDID(a, a', a'', a''')$ estimates identify a change in the relative trends. If EAMH with or without anticipation is present, we expect to see a change in the relative trends as illustrated in Figure 1. A positive $DRD(a)$ indicates that the uninsured have a more healthy lifestyle on average than the insured at age a in the case of healthy lifestyles such as exercise or the probability to quit smoking, or a less healthy lifestyle in the case of daily drinking, the number of cigarettes per day or the number of alcoholic drinks per week. A positive (negative) $DRDID(a, a')$ implies that the uninsured and insured trends are diverging (converging) if $DRD(a) > 0$, or converging (diverging) if $DRD(a) < 0$. Finally, the $DRDIDID(a, a', a'', a''')$ indicates how much the relative trends change between ages a'' and a''' compared to a and a'. Figure 2 plots the estimated lifestyle differences $DRD(a)$ between the uninsured and insured at different ages, adjusted for observable confounding factors.

Results using the "Private & Public" definition are presented in Table 18, whereas results using the "All Types" and "Private Only" definitions are presented in Tables 80 and 81 respectively in Appendix C.5. For each estimate, we report the ATE, the analytical standard errors, the p-values assuming that the errors are asymptotically normally distributed, and the number of observations used.

In the case of vigorous physical activity, the ATE is negative from 61/62 un-

Table 16: DID - "Private & Public" definition (count variables)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	# cigarettes smoked per day				# alcoholic drinks per day			
	FE	**FE**	**Nbreg**	**FE Nbreg**	**FE**	**FE**	**Nbreg**	**FE Nbreg**
age 61/62	-0.115	-0.114	-0.610***	-0.160***	-0.150	-0.154	-0.109	-0.025
	(0.278)	(0.278)	(0.144)	(0.053)	(0.159)	-0.160	(0.117)	(0.038)
age 63/64	-0.023	-0.020	-1.125***	-0.259***	-0.222	-0.228	-0.195	0.008
	(0.528)	(0.529)	(0.200)	(0.066)	(0.296)	-0.297	(0.136)	(0.053)
age 65/66	-0.031	-0.182	-1.682***	-0.094	-0.333	-0.259	-0.418	0.193
	(0.776)	(0.833)	(0.564)	(0.156)	(0.431)	-0.497	(0.451)	(0.119)
age 67/68	-0.012	-0.164	-2.368***	-0.236	-0.465	-0.393	-0.586	0.186
	(1.023)	(1.066)	(0.587)	(0.167)	(0.563)	-0.617	(0.475)	(0.132)
uninsured x age 59/60			-0.573				1.339**	
			(0.511)				(0.556)	
uninsured x age 61/62	0.346	0.349	-0.146	0.131	0.133	0.129	1.843***	-0.158*
	(0.275)	(0.275)	(0.498)	(0.083)	(0.206)	-0.206	(0.579)	(0.081)
uninsured x age 63/64	-0.245	-0.241	-0.012	0.107	-0.047	-0.053	1.740***	-0.174**
	(0.321)	(0.322)	(0.535)	(0.089)	(0.230)	-0.230	(0.633)	(0.084)
uninsured x age 65/66	-0.416	0.123	0.386	-0.037	-0.394	-1.062	1.754***	-0.775***
	(0.314)	(0.753)	(0.681)	(0.184)	(0.257)	-0.777	(0.594)	(0.169)
uninsured x age 67/68	-0.072	0.475	1.046	0.195	-0.545**	-1.219	2.001***	-0.729***
	(0.367)	(0.794)	(0.710)	(0.196)	(0.245)	-0.758	(0.667)	(0.183)
dr	-0.386*	-0.497	-1.594***	-0.109	-0.346**	-0.186	-0.116	-0.029
	(0.202)	(0.336)	(0.344)	(0.075)	(0.176)	-0.195	(0.291)	(0.060)
dr x 65 or more		0.164	-0.077	-0.397***		-0.087	0.027	-0.185*
		(0.354)	(0.559)	(0.147)		-0.252	(0.448)	(0.102)
dr x before 65 x uninsured		0.355	0.320	0.009		-0.607	-1.456***	-0.368***
		(0.496)	(0.491)	(0.089)		-0.528	(0.561)	(0.088)
dr x 65 or more x uninsured		-0.259	0.097	0.152		0.165	-2.042***	0.098
		(0.587)	(0.720)	(0.188)		-0.591	(0.621)	(0.172)
individuals	5,571	5,571	5,571	1,181	5,569	5,569	5,569	2,458
observations	19,795	19,795	19,795	4,265	19,735	19,735	19,735	8,993

Notes: The uninsured definition used here is 'Private & Public'. 'dr' indicates whether the individual has visited the doctor in the last 2 years. The reference age is 59/60. All the regressions control for physical health, gender, race, education, Census regions, marital status, working status, number of years worked, an indicator of whether current job requires some physical activities, household assets in 1992$, whether the individual has a life or a long term care insurance, and dummies for the year of the interviews. The coefficients for the negative binomial (nbreg) and fixed effect (FE) nbreg regressions reports the average marginal effects and the associated standard errors are obtained using the delta method. Standard errors given in parenthesis are clustered at the individual level and robust to heteroskedasticity and autocorrelation of unknown form. Stars convention: * for $p<0.1$, ** for $p<0.05$, and *** for $p<0.01$. The significance level is reported next to the marginal effects are based on the orginal coefficients.

Table 17: Change in the DID coefficients from Table 16

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	# cigarettes per day				# drinks per week			
	FE	**FE**	**Nbreg**	**FE Nbreg**	**FE**	**FE**	**Nbreg**	**FE Nbreg**
diff age 61/62 – 59/60	0.346	0.349	0.146	0.131	0.133	0.129	0.197	-0.158
H0: diff=0	0.207	0.204	0.101	0.113	0.518	0.530	**0.092**	**0.052**
H0: diff<=0	0.104	0.102	**0.051**	**0.057**	0.259	0.265	**0.046**	0.974
H0: diff>=0	0.896	0.898	0.949	0.943	0.741	0.735	0.954	**0.026**
diff age 63/64 – 61/62	-0.591	-0.590	0.045	-0.024	-0.179	-0.183	-0.040	-0.016
H0: diff=0	**0.025**	**0.025**	0.620	0.779	0.416	0.406	0.720	0.852
H0: diff<=0	0.988	0.987	0.310	0.611	0.792	0.797	0.640	0.574
H0: diff>=0	**0.012**	**0.013**	0.690	0.389	0.208	0.203	0.360	0.426
diff age 65/66 – 63/64	-0.171	0.364	0.136	-0.143	-0.348	-1.008	0.005	-0.601
H0: diff=0	0.502	0.609	0.579	0.458	0.146	0.189	0.986	**0.001**
H0: diff<=0	0.749	0.305	0.290	0.771	0.927	0.906	0.493	1.000
H0: diff>=0	0.251	0.695	0.710	0.229	**0.073**	**0.094**	0.507	**0.000**
diff age 67/68 – 65/66	0.344	0.352	0.225	0.232	-0.151	-0.157	0.097	0.046
H0: diff=0	0.254	0.242	**0.077**	**0.051**	0.496	0.476	0.467	0.666
H0: diff<=0	0.127	0.121	**0.038**	**0.026**	0.752	0.762	0.233	0.333
H0: diff>=0	0.873	0.879	0.962	0.974	0.248	0.238	0.767	0.667

Notes: The uninsured definition is 'Private & Public'. The change in the sign of the coefficients is tested using Wald test and one-sided tests. The p-values are reported and in bold if below the 10% significance level.

Table 18: DR estimates - "Private & Public" definition

	D(a)			DID(a,a')			DIDID(a,a',a'',a''')		
	est.	SE[1]	N		est.	SE[2]		est.	SE[2]
vigorous physical activity									
age 5960	0.005	0.024	4,387	**6162-5960**	-0.035	0.039	**(6364-6162)-(6162-5960)**	-0.007	0.068
age 6162	-0.030	0.029	3,643	**6364-6162**	-0.042	0.038	**(6566-6364)-(6162-5960)**	0.105 **	0.051
age 6364	-0.073 ***	0.028	3,417	**6566-6364**	0.070 **	0.035	**(6768-6566)-(6162-5960)**	0.051	0.067
age 6566	-0.002	0.033	2,286	**6768-6566**	0.016	0.049	**(6566-6364)-(6364-6162)**	0.113 **	0.057
age 6768	0.013	0.039	1,472				**(6768-6566)-(6364-6162)**	0.058	0.063
							(6768-6566)-(6566-6364)	-0.054	0.074
quit smoking									
age 5960	-0.043	0.030	2,997	**6162-5960**	0.014	0.022	**(6364-6162)-(6162-5960)**	-0.046	0.047
age 6162	-0.029	0.032	2,919	**6364-6162**	-0.032	0.031	**(6566-6364)-(6162-5960)**	-0.035	0.036
age 6364	-0.060 **	0.028	2,985	**6566-6364**	-0.021	0.026	**(6768-6566)-(6162-5960)**	-0.044	0.032
age 6566	-0.081 **	0.032	2,330	**6768-6566**	-0.029	0.025	**(6566-6364)-(6364-6162)**	0.011	0.044
age 6768	-0.111 ***	0.034	1,773				**(6768-6566)-(6364-6162)**	0.002	0.041
							(6768-6566)-(6566-6364)	-0.008	0.040
# cigarettes per day									
age 5960	0.324	0.492	3,642	**6162-5960**	0.337	0.410	**(6364-6162)-(6162-5960)**	-0.642	0.890
age 6162	0.661	0.561	4,536	**6364-6162**	-0.305	0.585	**(6566-6364)-(6162-5960)**	0.174	0.606
age 6364	0.356	0.411	4,914	**6566-6364**	0.511	0.443	**(6768-6566)-(6162-5960)**	-0.375	0.416
age 6566	0.867 **	0.430	3,775	**6768-6566**	-0.038	0.306	**(6566-6364)-(6364-6162)**	0.817	0.914
age 6768	0.829 **	0.386	2,928				**(6768-6566)-(6364-6162)**	0.267	0.715
							(6768-6566)-(6566-6364)	-0.550	0.551
drink daily									
age 5960	0.012	0.022	3,633	**6162-5960**	-0.020	0.014	**(6364-6162)-(6162-5960)**	0.020	0.017
age 6162	-0.007	0.017	4,527	**6364-6162**	0.000	0.009	**(6566-6364)-(6162-5960)**	0.042 **	0.019
age 6364	-0.007	0.017	4,909	**6566-6364**	0.022 *	0.013	**(6768-6566)-(6162-5960)**	0.009	0.025
age 6566	0.015	0.019	3,769	**6768-6566**	-0.011	0.017	**(6566-6364)-(6364-6162)**	0.022	0.016
age 6768	0.005	0.020	2,926				**(6768-6566)-(6364-6162)**	-0.011	0.019
							(6768-6566)-(6566-6364)	-0.033	0.024
# alcoholic drinks per week									
age 5960	0.491	0.432	3,629	**6162-5960**	-0.727	0.682	**(6364-6162)-(6162-5960)**	0.435	0.974
age 6162	-0.236	0.567	4,520	**6364-6162**	-0.293	0.375	**(6566-6364)-(6162-5960)**	1.407	1.024
age 6364	-0.529	0.465	4,897	**6566-6364**	0.680	0.530	**(6768-6566)-(6162-5960)**	0.576	0.698
age 6566	0.151	0.429	3,767	**6768-6566**	-0.152	0.340	**(6566-6364)-(6364-6162)**	0.972	0.647
age 6768	0.000	0.289	2,922				**(6768-6566)-(6364-6162)**	0.141	0.547
							(6768-6566)-(6566-6364)	-0.831	0.747

Notes: The uninsured definition is 'Private & Public'. The double-robust estimates D(a) combine regression models, estimated using logit or negative-binomial if the dependent variable is binary or continuous respectively, and estimated propensity score. DID(a,a')=D(a')-D(a) and DIDID(a,a',a",a"')=DID(a",a"')-DID(a,a'). (1) indicates analytical standard errors (SE) and (2) bootstrapped standard errors (50 replications). Stars convention: *** p<0.01, ** p<0.05 and * p<0.1.

til 65/66. The difference is the largest at 63/64 and reduces afterwards and become positive by 67/68. Between 59/60 and 63/64, the uninsured trend falls relative to the insured $DRDID(a, a') < 0$. At 63/64, just before receiving Medicare, the uninsured are 7 percentage points less likely to exercise than the insured (significant at the 1% level). Controlling for systematic differences, the $DRDID(a, a')$ estimate between 61/62 and 63/64 also identifies a reduction in the probability to exercise in the uninsured group relative to the insured group of 4.2 percentage points. After 63/64, the $DRDID(a, a')$ estimates are positive and significant suggesting that the trends converge and the $DRD(a)$ estimates are no longer significant. In summary, the uninsured become less likely to exercise at 63/64, and after this age the differences between the two groups diminish again and are not significantly different from one another. If this is due to anticipatory EAMH, the $DRDIDID(a, a', a'', a''')$ estimates should identify a change in relative trends. The differences in trends between 63/64 and 65/66 relative to 59/60 and 61/62, and also between 63/64 and 65/66 relative to 61/62 and 63/64 are positive and significant, indicating that the trends are diverging before 63/64 and converging afterwards. The largest $DRDIDID(a, a', a'', a''')$ estimate is equal to 11.3 percentage points, which represents the change in the uninsured probability to exercise relative to the insured between 63/64 and 65/66 relative to their relative change between 61/62 and 63/64.[63] It is approximately twice the absolute values of the $DRDID(a, a')$ estimates (0.070 and 0.042), suggesting that the rate of divergence just before 63/64 is equivalent to the rate of convergence just after 63/64, which is in line with the insignificant differences we observe before and after 63/64. We therefore conclude that we observe EAMH with anticipatory behaviour at 63/64. As predicted by our theoretical model, the effect appears to be gradual as it is smaller if we compare the reduced differences between 63/64 and 65/66 to the earlier increasing differences between the two groups (10.5 percentage points relative to 59/60 and 61/62). The reduction in the differences between the two groups after 63/64 is potentially due to a positive impact of insurance on the lifestyle of the uninsured, perhaps because Medicare increases doctor visits for the previously uninsured and doctors advise a healthier lifestyle (Dave and Kaestner, 2009). This conclusion is supported by all the uninsured definitions with the difference significantly negative at the age 63/64 ranging between 6 to 8 percentage points.

[63] In other words, if the relative fall in the trend of the uninsured between 63/64 and 65/66 would have remained of -4.2 percentage points (DID(61/62,63/64)), the uninsured would have had a probability to exercise of 12.2 percentage points lower than the one we observe at 65/66. It is much larger than the D(a) and DID (a,a') estimates as it measures the decreasing differences between 63/64 and 65/66 (DID (63/64,65,66 = 0.057) compared to the increasing differences we observe between 61/62 and 63/64 (DID (61/62,63/64) = -0.065 and thus DIDID (61/62,63/64,63/64,65/66) = 0.122 = 0.057–(-0.065)).

The $DRD(a)$ estimates measure the overall differences between the two groups with all the observable covariates held constant. After we control for the selection on the observables, the uninsured and insured groups significantly differ in their smoking behaviour. The $DRD(a)$ estimates suggest positive selection as the uninsured individuals are generally less likely to quit smoking (between 4.3 to 11.1 percentage points) and to smoke more cigarettes per day (between 0.3 to 0.9 cigarettes) over the years compared to the insured, and the difference is increasing over the years. This is confirmed by the $DRDID(a, a')$ estimates which are not significant, suggesting that these differences remain constant over the years, and the $DRDIDID(a, a', a'', a''')$ are also not significantly different from zero suggesting no change in relative trends. The "All Types" definition support the same conclusion with the positive selection being even stronger. The $DRDID(65/66, 67/68)$ is negative suggesting the presence of the classical EAMH in addition to the positive selection. This is further supported by the significant and negative $DRDID(59/60, 61/62, 65/66, 67/68)$, however the presence of EAMH in the case of smoking is not supported for the three uninsured definition.

Finally, alcohol consumption measured in terms of daily alcohol consumption and the average number of alcoholic drinks per week generally does not differ between both groups rejecting the hypothesis of selection or EAMH.

2.8 Conclusion: Ex Ante Moral Hazard

Most of the previous research on EAMH has found little evidence of the phenomenon. We postulate here that this may be due to the natural experiments in most of the literature: in the case of Medicare, the exogenous change in insurance status for the uninsured at the age of 65 is known and expected. If individuals believe that there is a lag before getting the benefits of healthy lifestyle and if, in their early 60s, they anticipate that they will soon be covered, then they may reduce their effort to invest in healthy lifestyles before receiving health insurance. If this is true, it may explain why past research has failed to identify EAMH.

In this chapter, we have first discussed the evidence on the impact of insurance on primary and secondary prevention in order to better understand the possible implications of insurance coverage on certain types of prevention. Although insurance generally increases the demand for secondary prevention, there is no consensus in the case of primary prevention, i.e. for classical EAMH. Second, we have proposed a simple theoretical model that explains how insurance influences behaviour if it is anticipated and if the benefits of lifestyle are not immediate. Finally, we have applied different identification methods. First, we have estimated our model using matching methods,

comparing the lifestyle of insured and uninsured individuals at different age ranges, but also the changes between these ages.

We also tested our model's predictions by distinguishing between possible direct and indirect effects of Medicare. We have estimated the models using the classical linear DID approach to compare our results to past evidence but then adapted them to the shape of the data and estimated them using probit and negative binomial models for binary and count variables respectively. As these methods rely on specific assumptions that often cannot be tested and as it is not clear which method is the most adequate, we estimated the effects using double robust methods that are robust if either the propensity score or the regression framework is correctly specified.

The results based on propensity score matching are similar for the nearest neighbour and Kernel matching with Mahalanobis metrics, and stratification. They suggest the presence of anticipatory EAMH in the case of physical activity around the age 63/64, and of positive selection in the case of cigarette consumption as the two groups are significantly different at most of the ages at which they are observed. On the contrary, the two groups are generally not significantly different at all the observed ages in the case of alcohol consumption. Conversely, the matching DID approach did not yield clear results for any activity, probably due to the small number of observations matched at different ages.

The results based on DID using linear and non-linear regressions support the presence of anticipatory EAMH in the case of vigorous physical activity. The regression coefficients identify some significant differences between the two groups from age 63/64, and Wald tests and one-sided tests of pairwise comparisons of coefficients suggest that the two trends diverge significantly around 63/64 but that the differences between the two groups remain constant after that age which corresponds to the period covered by Medicare. Accounting for a positive effect of doctor visits generally increased the EAMH effect in the case of physical activity. In the case of cigarette consumption, the two groups do not appear to differ over time as the DID estimates are generally not significantly different from zero. The uninsured seem more likely to drink over the years, though the pairwise tests of coefficients suggest an increase from the baseline age 59/60 with respect to all the future observations. However, this result is not robust across all the specifications.

Finally, our last method is our preferred approach as it analyses the relative simple, double and triple double-robust differences between the two groups to account for the unobserved linearly time-variant differences. In the case of physical activity, the three different definitions to characterise the uninsured group lead to very similar conclusions. The changes over time in the probability to exercise at least 3 times a week

differs between the two groups as predicted by anticipatory EAMH. The difference becomes significantly larger from 63 years old and increases up to 66 and then remains fairly constant. The DRDIDID estimates also support the existence of a change in relative trends over this period. The results for smoking behaviour, measured by the probability to quit smoking, and the number of cigarettes smoked per day, are inconclusive on the presence of EAMH. Only in the case of "All Types" insurance definition we observe a significant change in trends after receiving Medicare relative to the trends observed between 59/60 and 61/62 for the probability to quit smoking, but this result is not supported by the other two uninsured definitions. With the "Private & Public" insurance definition, the smoking habits of the two groups appear to differ over time. This could be due to anticipatory EAMH before 59, or to positive selection if the uninsured are less and less likely to quit smoking and more and more likely to smoke more than the insured over time without a significant change in relative trends. Without more years of observations, it is not possible to disentangle both phenomena. Finally, the results on drinking habits provide some weak evidence of anticipatory EAMH just before receiving Medicare in terms of the probability to drink daily but this result is not supported for the three uninsured definitions. The number of drinks per week do not differ between the two groups at all the observed ages.

In summary, we only find evidence of the presence of anticipatory EAMH in the case of physical activity and neither in the case of smoking nor drinking. A possible explanation is that these latter two lifestyles are subject to addiction. The incentives created by the granting of Medicare may not be strong enough to affect a 60 years old person who has been smoking or drinking all her life. It is possible that physical activity is less subject to addiction and that the anticipation of Medicare reduces the motivation to exercise regularly.

There are three potential weaknesses in our analysis using the granting of Medicare at age 65 to test for EAMH. Our identification strategy accounts for observables and time-invariant characteristics affecting lifestyle and the insurance status. The DRDIDID estimates additionally account for unobserved linear time-variant estimates that are different between the two groups, resulting in different trends. For example, the insured may have a stronger preference for exercise than the uninsured. If this difference remains constant, it does not bias the DRDID estimates. However, if this preference decreases with age and more rapidly for one group than the other, the DRDIDID estimates remain unbiased as long as the preference decreases only linearly. Therefore, the only remaining bias in the DRDIDID estimates is due to time-variant unobserved factors that do not vary linearly with age. Second, there is a great variety of health insurance package in the US and Medicare coverage after 65 is likely to be different

from the coverage provided by private and public insurances available before 65 (Card et al., 2004). However, the similarity of our results estimated using three different definitions of insurance status implicitly comparing different groups with different degrees of coverage suggests that our results are robust to definitions of insurance. The last main issue is the retirement decision around 65. Reduced social security benefits are available from the early retirement age of 62, and full benefits are given for normal retirement between 65 and 66 depending on the year of birth. Although we control for the retirement status, we cannot rule out the possibility that our estimates are affected by the anticipation of social benefits that may be valued differently by the insured and uninsured. We have shown that even when we allow for anticipatory changes in behaviour and adopt estimation methods combining propensity score and regression, there is at most a small effect of insurance on prevention. From a policy point of view, this suggests that a potential incentive effect on lifestyles due to exogenous insurance may be minor.

Care should be exercised in attempting to generalise to different wider populations. Although in some approaches we have considered the whole sample, descriptive statistics suggest that those with and without insurance before 65 are quite different. Matching methods focus on the treated group (uninsured before 65) and try to find similar controls but disregard individuals that are too different. In the parametric approaches, the common support does not seem to be a major issue as the distribution of the covariates is similar between the two groups. Our identification relies on the assumption that, after controlling for gender and race (White, Black, Hispanic), marital (married, partnered, divorced, widowed) and employment (works full-time, part-time, retired, unemployed, self-employed) status, number of years worked, education (went to high-school, college, finished college or more), household assets and its square, health (SAH and a mobility index), some proxies for risk aversion (long-term care and life insurance), time-invariant and linear time-variant unobserved differences, any changes in relative trends are due to the granting of Medicare at 65. The robustness of the results are improved compared to previous studies, first by the use of propensity score that adjusts for observable differences 6 years before receiving Medicare. Second, the results are estimated using a method that combines propensity score and regression methods and that is robust to the misspecification of either the propensity score or the regression. Finally, we analyse the differences between the insured and uninsured using difference-in-differences and triple differences to disentangle positive selection from EAMH by identifying a change in the relative trends between the two groups.

Our results are in line with past evidence on classical EAMH: the phenomenon may exist from 65 years in some cases and is larger if we account for the indirect effect of

Medicare. But the main effect seems to appear before receiving Medicare, possibly due to anticipatory behaviour. The classical theoretical framework should be reformulated to account for possible anticipatory behaviour and, possibly as well, for the existence of positive selection. Moreover, access to care and doctor advice should be taken into account as they are likely to influence primary prevention (Dave and Kaestner, 2009). A better understanding of these phenomena is necessary for future empirical research.

Chapter 3

Parenting Style and Children's Health

3.1 Introduction

How do parents shape their children's life? Infants' outcomes have recently received an increasing amount of attention not only because of the observed persistence of physical health, mental health and cognitive ability in adulthood, but also because of their long-term impacts on other important outcomes such as labour outcomes.[64] The economics literature has focused on the role of socio-economic factors as determinants of children's health and abilities, which are well understood (Currie, 2009, Allin and Stabile, 2012, Machin and Vignoles, 2004, Anger and Heineck, 2010). Children from healthy, wealthy and educated parents have a distinctive advantage that is observed from childhood throughout their whole life cycle. The main framework that economists have used to explain these relationships is the family investment model, proposed by Becker (1981, 1993). It postulates that the socio-economic factors are associated with positive child outcomes by allowing the families to choose and purchase the goods that benefit their children. Although this economic theory enables to explain the observed relationships between socio-economic factors and children's outcomes, it does not explicitly identify the pathways supporting these relationships.

The link between socio-economic factors and children's outcomes is mostly indirect (e.g. Propper et al., 2007). It is not the money per se that affects the child, but the investment decisions of each parent and thus the child's health inputs that makes the difference. Genetic health and cognitive ability inheritance certainly are the exceptions, but do not alter the relative importance of socio-economic factors (Davey Smith and Ebrahim, 2003, Anger and Heineck, 2010, Fletcher and Lehrer, 2009, Crawford et al., 2010). Understanding the pathways from socio-economic factors to the child outcomes is an important research question and crucial from a public health point of view (Hoghughi, 1998). If educated parents have healthier children, should policy makers send parents back to school, or should they try to understand what parenting practices improve the children's health and how they are correlated with the different socio-economic variables? A better understanding of the possible pathways will have important implications on the choices of interventions and could be more effective in

[64]For example see Smith (2009), Case et al. (2005), Case and Paxson (2010) in the case of early physical health and later life outcomes; Case et al. (2005), Contoyannis et al. (2004) on the persistence of health; Heckman and Carneiro (2003), Ermisch (2008) in the case of cognitive and non-cognitive outcomes.

reducing early years inequalities that persist over time.[65]

The interest in understanding the possible pathways between socio-economic aspects and children's outcomes is only recent, and this literature generally refers to the role of parents in the development of children's social capital, that is their skill and behaviour (e.g. Dooley and Stewart, 2007). The distinction between social capital and parenting style is not very clear as argued by Pong et al. (2005). Some insight on the role of family structure in determining children's health and life chances can be found in the psychology literature, but most of the studies have focused on children's behavioural outcomes and school performances (e.g. Aunola and Nurmi, 2005, Denham et al., 2000, Spera, 2005, Astone and McLanahan, 1991, Martin et al., 2007). In economics, Cunha and Heckman (2008) and Cunha et al. (2010) have recently borrowed behavioural concepts from this literature, which has permitted to gain valuable understanding of how to measure behaviours and to incorporate them in a more comprehensive framework.

In this chapter, we focus on the role of parenting style on the child's physical and mental health, and his cognitive achievements. While the psychology literature has been on this track for a long time, identifying all sorts of significant correlations between socio-economic factors, parenting style, and children's outcomes, an econometric approach can make a significant contribution on various aspects. First, evidence in the psychology literature generally relies on very small samples with hundreds of participants at most. Second, possible reverse effects from the child to the parent and parenting style have generally not been accounted for. Third, unobserved heterogeneity in the child circumstances likely to be correlated with parenting behaviour and the child outcomes has not been thoroughly analysed. Finally, they provide estimates of the association between parenting style and children's outcomes, although ultimately it is the causal effect for policy that matters.

We first review the existing literature on parenting style and children's outcomes, with an emphasis on the psychological literature. Second, we use the Millennium Cohort Study to first describe existing associations between parenting style measures, socio-economic variables and children's outcomes. Third we present an economic investigation of the relationship between parenting style and child outcomes, and we describe different specifications and formulate each method's benefits and weaknesses.

In our economic investigation, we implement various empirical methods to analyse how sensitive the results are when we progressively attempt to control for endogeneity and reverse causality. We propose a mother's behavioural model to explain the role of socio-economic factors and mother's preferences. It allows us to derive a joint model

[65]For example, Contoyannis and Jones (2004a) find that accounting for lifestyle reduces the role of socio-economic factors in the health production function.

of parenting style and children's health that accounts for unobservable heterogeneity in the population. We exploit the longitudinal data to estimate a recursive model of parenting style and children's health which is specified as a structural equation and estimated by Maximum Simulated Likelihood (MSL).

Finally, we perform numerous robustness checks on our econometric models. First, in order to account for the problem of reporting bias as the child's main outcomes and mother's parenting style are reported by the mother, we repeat our analysis using measures of physical and mental health that are not reported by the mother. Second, we analyse the main outcomes and their relationship with parenting style reported by the siblings. Third, although the main results focus on the role of the mother, we specifically analyse the role of the mother's partner in relation to their parenting involvement. Fourth, we split our sample in boys and girls to understand how the effects vary by gender. Finally, we interact parenting style with indicators of high education or high income to analyse what socio-economic aspects matter the most.

Our results suggests that the physical health of the child is moderately affected by parenting style, and that endogeneity is not an issue when analysing this relationship. The mental health of the child is worsened by strictness methods. Cognitive ability is lower when parents are too involved or strict. Unobserved heterogeneity may be an issue with models of mental health outcomes.

Finally, while parenting style has a significant impact on the child's outcomes, the effect of socio-economic factors is not influenced by parenting style, except in the case of externalising behavioural problems.

3.2 Literature Review

3.2.1 Parenting styles in the psychology literature

3.2.1.1 Definitions and measures of parenting styles

Parenting style refers to parents' child rearing practices, mainly the demands and rules set by parents as well parent's response to their children's needs and their involvement in the child's evolution. The role of parenting style in the course of the child's evolution has primarily interested psychologists. They have analysed the associations between parenting style and various outcomes in children. This literature, summarised in Tables 21 and 22, supports the idea that parenting plays a significant role throughout the whole development of the child and that significant associations are also observed later in life. Furthermore, recent literature in economics has emphasised the cumulative process of the child's development (e.g. Cunha and Heckman, 2006; Todd and Wolpin, 2003),

emphasising the importance of inputs at early ages but also of the production process.

In a review of the dimensions of parenting, Maccoby and Martin (1983) report that the first two dimensions identified in the literature were warmth/hostility and control/autonomy (Schaefer, 1959, Becker, 1964). These concepts have been modified subsequently as the age range of children analysed has increased. The main evolution has been the replacement of warmth by responsiveness (Ainsworth et al., 1971). This aspect is related to warmth, but refers specifically to reinforcement, that is "when parents respond contingently, they may be seen as providing children with control over their environment, and thus fostering the development of efficacy as distinct from helplessness" (Maccoby and Martin, 1983, p. 38-9). This dimension refers to parents' sensitivity and adaptation to the child's signals and needs. In the same spirit, Lamborn et al. (1991), after observing about 4,100 families of 14-18 years-olds, propose instead to focus on acceptance/involvement.

The control/autonomy dimension has also undergone some refinements with, for example, Lamborn et al. (1991) referring to it as strictness/supervision. Some other authors have introduced the distinction between behavioural (discipline, monitoring) and psychological control (emotions and behaviour affected through psychological means, see for example Barber (1996)), but the two general ideas behind the involvement and strictness dimensions remain identical.

Over the years, some authors have suggested further refinement of these two categories. Grusec and Davidov (2010) propose five domains of parent-child interactions that matter to understand the evolution of the child socialisation process (protection, reciprocity, control, guided learning, and group participation). This definition emphasises the role of parents' involvement rather than control. These multiple dimensions assume that the parent-child relationship is actually much more complex and varies depending on the age of the child, his mental and physical conditions. However, all these further refinements are generally covered by the controlling versus responsiveness dimensions and the rest of the literature review covers the main evidence with this classification in mind.

Based on involvement/affection and demandingness/strictness, first three, then four categories of parenting style have been defined. First, based on the observation of three and four years-olds, Baumrind (1966) proposed three types of parents that are considered as the foundation of the modern analysis of the role of parenting:[66] the permissive, the authoritarian, and the authoritative (Baumrind, 1966, 1968). The first categories refers to parents that are non-punitive and respond affirmatively to the child's impulsive desires and actions. Permissive parents make few demands to the

[66]See Maccoby (1992) for an historical overview of the parenting concepts over the last century.

Table 19: Four types of parenting style

		Involvement / Affection	
		high	low
Demandingness /	high	Authoritative	Authoritarian
Strictness	low	Permissive	Neglectful

Notes: The way the literature refers to these dimensions varies. High involvement is also referred to as warmth, accepting, responsive, or child-centred parenting style, whereas low involvement is also referred to as hostile, rejective, unresponsive, parent-centred parenting style. The definition of the demandingness definition also vary in the literature, and highly demanding parents can also be referred to as restrictive, or controlling, whereas the opposite is referred to as permissive or low controlling.

child and let her auto-regulate her behaviour and activities. Authoritarian parents are the opposite and have standards of conduct and impose them favouring forceful and punitive measures. They do not want to enter in a discussion with the child as they believe she should accept their word for what is right. Authoritative parents are similar to authoritarian in the sense that they also exert control and hold their position, but are loving and conscientious in handling their children. They attempt to direct the child's behaviour but allow for a discussion on the rational of their requests. Parents recognise the child's needs and interests, and try to adopt their own upraising standard on the child best interest. This last category is sometimes referred to as democratic parenting.

Extending Baumrind's typology, Maccoby and Martin (1983) propose to classify parenting style along two dimensions: the amount of control parents impose on their child, and the quantity of affection and involvement. The former dimension comprises consistency in enforcing rules and willingness to influence the child. The latter refers to the ability to recognise the child's need and to respond to them. The interactions of these two dimensions yield four parenting styles, adding the neglectful type of parents to Baumrind's classification. These parents are characterised by acceptance toward the child's impulses, use little punishment as well as avoid as much as possible imposing control or restriction. They make few demands for a mature behaviour and allow the child to regulate her own behaviour and schedule. The four categories are summarised in Table 19.

These four categories are associated with different types of child behaviour that are summarised in Table 20. Despite these clear-cut categories, one has to bear in mind that the evidence varies widely, depending on the setting of the measurements, the child's age and the methods of assessment. The table only represents the conclusions found in the majority of studies, as in almost all cases, contradictory evidence has been found in the literature. We now review in greater details the association

Table 20: Four types of parenting style and children's outcomes

		Involvement / Affection	
		high	low
Demandingness / Strictness	high	independent, polite, socially responsible, self-confident, high self-esteem, higher school performances	lack of spontaneity, affection and curiosity, shyness and quarreling with peers, socially withdrawn, low in adult role taking, low intellectual performances
	low	impulsive, lack independence and the ability to take responsibility	impulsive, aggressive, delinquent, noncompliance

Sources: Maccoby and Martin 1983, and other references cited in this review.

between each category of parents defined by the two dimensions of parenting style and child's behaviour, cognitive ability, physical and mental health. The main references are summarised in Tables 21 and 22.

3.2.1.2 Parenting style and child conduct

The majority of evidence on parenting style relates to the child's conduct and socialisation development. Studies have considered children from very young ages reflecting the assumption that "childhood is a particularly malleable period, and it is the period of life when enduring social skills, personality attributes, and social orientations and values are laid down" (Maccoby, 1992). Baumrind (1966) argues for the imposition of authority even against the child's will during the first years of the childhood (defined as the Authority Inception Period, that lasts until about 6 years old). She argues that, during those years, the parents' authority is perceived as legitimate by the child. She believes that parents have the ability to provide the child at this age with the resources she needs at a time at which the child will be the most grateful and parents will be successful at enforcing their rules. Authoritative parents have then the ability to affect the child's development. By the early adolescence, she recommends limited use of authority as the child is now capable of forming his own opinions.

Observations of children made by Baumrind support the claimed benefit of early parental authority, but only when it is combined with parental involvement. Based on structured observation of three and four years-old middle-class American children in nursery school and at home, and based on parents' interviews, Baumrind (1967) find the following associations: children with authoritarian[67] parents are socialised and independent. Children with authoritative parents are significantly less happy, more insecure, and less affiliated with peers, and more likely to be hostile under stress. Finally, children from permissive parents exhibit lack of self-control and self-reliance.

[67]The use of "authoritarian, authoritative, and permissive" only appears in Baumrind (1966) and afterwards, but the three groups of parents defined in her article correspond to this classification.

Table 21: Summary of the psychology literature

Reference	Outcomes	Children	Parenting style	Methodology	Conclusion
Aunola and Nurmi (2005)	Internalising and externalising problem behaviour assessed by means of structured interviews performed by trained investigators	5 to 6 years old children (N=191), observed 6x between 1999-2002, Finland	Mothers' and fathers' affection, behavioural control, and psychological control, captured by mailed individual questionnaire	Latent growth curve modelling	* Internal problem behaviour significantly increases with high level of maternal psychological control and affection * Children's external problem behaviour is significantly associated with high level of behavioural and psychological control, as well as maternal affection combined with high level of psychological control * Fathers' parenting had only a marginal role
Abar et al. (2009)	Student academic self-regulation and academic achievement based on questions asked to the student	African-American youth attending a parochial college (N=85)	authoritativeness, authoritarianism, and permissiveness, each based on 10 questions asked to the student	Correlations	* Significant positive association between maternal authoritative parenting and study skills * highly authoritarian maternal parenting are associated with poorer academic skills
Astone and McLanahan (1991)	6 measures of success in secondary school (educational aspirations, grades, school attendance, positive attitude toward school, stayed continuously in school until graduation, diploma or GED by 1986)	15-16 years when reported parenting style in 1980 (N=10,438), US	Analyse individually 5 school-related parenting style (parental college aspirations, mother and father monitoring of the student's progress, parent supervision, parents spend time talking to the student weekly)	Regressions (OLS and logit), bivariate probit	* Children from non-intact (single parent or step parent) families have parents with lower educational expectation, less monitoring of school work by mothers and fathers, and less overall supervision of social activities than children from intact families. An exception is children in single-parent families who spend significantly more time talking to their parents than children in two-parent families * Children from single-parent families and step parent families are more likely to exhibit signs of early disengagement from school * Differences in parenting style are significantly related to differences in children's school commitment up through the senior year, parenting practices explain less than 10 percent the difference in graduation between children from intact and non-intact families
Belsky et al. (2006)	Average of the child health at ages 6.6 and 7 years old reported by the mother on a 4-point scale	First 7 years of life (N=1,041)	Mothers' warmth, negativity and positive control measures created by averaging scores across ages provided by raters on the basis of tasks observed at ages 6, 15, 24, 36 and 54 months	Multiple regression analyses (hierarchical, logistic) with statistical testing of mediational processes	* Warmth and positive control are positively correlated with child health, whereas negativity has the opposite correlation * Warmth only is significantly positively correlated with health, but once socio-economic variables are included, the coefficient is no longer significant
Bush et al. (1987)	Students reported grades	High school students (N=7,836), US	Authoritative, authoritarian, and permissive based on 25 questions asked to the teenagers, the grouping of questions being an arbitrarily choice of the authors	Regressions	* Both authoritarian and permissive parents are negatively associated with grades * Authoritative parents is positively associated with grades
Chan and Koo (2011)	Subjective well-being and self-esteem, health and risky behaviour, and academic achievement and school enrolment	15 year old interviewed between 1994 and 2001 (N=1,456), Youth Panel of the BHPS, UK	Authoritative, authoritarian, and permissive based on 3 questions related to strictness and 3 to closeness.	Latent class analysis, regressions (OLS, logit and multinominal logit)	With respect to authoritative parents children with authoritarian and permissive parents are: * significantly less happy and have less self-esteem * significantly more likely to have ever smoked, fight with others and have friends who use drugs * significantly less likely to have good school results, and more likely to be employed than being in full-time education at the age of 17
Denham et al. (2000)	Externalising problems reported by the mother and the teacher	4 to 5 years old (N=80), outcomes reassessed at 7 and 10 years old, US	Supportiveness, happiness, anger, hostility, restrictivity,... Mother-child and father-child interactions assessed in a laboratory environment	Correlations and regressions	* Externalizing problems exhibit continuity between the various years of observations * A mixture of supportive parents and clear instructions and limits predicted fewer behaviour problems over time, after controlling for initial problems * Parental anger was positively associated with behavioural problems, but no association were found between positive emotion and child behavioural problem
Gibson et al. (2007)	BMI (z-score, age and gender specific) measured at the interviews	6-13 years old (N=329), Australia	Laxness, over-reactivity and verbosity derived from 30 questions asked to mothers or fathers	Univariate and multivariate linear regression	* No association is found between the different parenting style measures and the child BMI
Huppert et al. (2010)	Psychological well-being at age 52 years (Ryff's scales of psychological well-being)	Women from the 1946 British birth cohort study (N=984), UK	Retrospective parenting practices with instructions to consider the period up to the age of 16 years collected at age 43 years (Parental Bonding Instrument)	Factor analytic models in Mplus, Structural equation modelling	* Higher levels of parental care were associated with higher psychological well-being * Higher parental non-engagement or control were associated with lower levels of psychological well-being * Well-being of adult women was affected by their father as well as their mother, particularly in terms of non-engagement and control

Table 22: Summary of the psychology literature (continued)

Reference	Outcomes	Children	Parenting style	Methodology	Conclusion
Kiernan and Huerta (2008)	Cognitive development, tested via the Bracken Basic Concept Scale, internalising and externalising behaviour, reported by the mother – the raw scores of the different questions were added up	3 year-olds (N=13,877), Millennium Cohort Study, UK	Family's reading activities, mother's affection and strictness, reported by the mother – the raw score of the different questions were added up	Structural equation modelling	* Cognitive score is significantly associated with reading activities and positive mother-child relationship * Externalising behavioural problems are lower with higher family's reading activity and good mother-relationship, but higher with disciplinary practices * Internalising behavioural problems are negatively associated with good mother relationship and higher with disciplinary practices
Lamborn et al. (1991)	Psychosocial development, school achievement, internalized distress, and problem behaviour measured by different scores	14-18-year-olds (N=4,081), US	Authoritative,authoritarian, indulgent, or neglectful based on adolescents' ratings of their (both if possible) parents on 2 dimensions: acceptance involvement and strictness/ supervision	Exploratory factor analyses using an oblique rotation to define the parenting style categories, and four-way multivariate analysis of variance	* Authoritative parents had adolescents with highest measures of psychosocial competence and lowest measures of psychological and behavioural dysfunction * Authoritarian parents had adolescents with good measures of obedience, with but with poorer self-conceptions than other youngsters * Adolescents from indulgent homes have a strong sense of self-confidence but report higher frequency of substance abuse and school misconduct and are less engaged in school * Neglectful parents had adolescents that were the opposite to the ones with authoritative parents
Pong et al. 2005	Grade-point-average (GPA), is the arithmetic mean of the self-reported grades in math, science, and English	Adolescents (N=17,996), first wave of the National Longitudinal Study of Adolescent Health (Add Health), US	Demandingness, based on six decisions (choice of clothing, amount of TV, etc.) and whether the decision is unilaterally made by the parent, the child or both (reported by the parent) Responsiveness is the average of a score given by the child to parent's warmth, closeness and type of relationship	Regressions	* Hispanic 1st generation families are generally more strict than White 3rd generation families, but Asian families do not different significantly from the White 3rd generation * 1st generation Asian tend to be closer than White 3rd generation, this is however not the case with Hispanic * There is no differences between ethnicity whether parents have dinner with children, however Asian and Hispanic 3rd generation tend to have more social talk with their children than 3rd generation White * Parenting style, once socio-economic background is taken into account, cannot explain ethnicity-generation differences in school grades among Hispanic and Asian adolescents
Rhee et al. (2006)	Overweight defined as BMI measured during laboratory visits ≥95th percentile of the US National Center for Health Statistics growth curves	54 months old (N=872), US	Authoritative, authoritarian, permissive, and neglectful defined on the basis of maternal sensitivity to the child's needs coded by observers in laboratory and expectations for self-control derived 32 questions asked to the mother, and the cutoffs were based on the medians	Multivariate logistic regression analysis	* Children of authoritative mothers are the less likely to be overweight * Authoritarian parenting style is associated with the highest risk of having overweight children * Children of permissive and neglectful mothers are twice as likely to be overweight, compared with children of authoritative mothers
Stewart-Brown et al. (2005)	Physical health	Outcomes measured at age 43 for the 1946 cohort (N=3,254), 33 for the 1958 cohort (N=7141), and 26 for the 1970 cohort (N=4,493), UK	1946 cohort: mistreated by parents, asked at age 43 1958 cohort: how get on with father and mother at age 16 1970 cohort: parental relationship at age 16 captured in 11 points and analysed individually	Logistic regression and multinomial logistic regression	* Subjective perceptions of the quality of parent–child relationships predict physical health experience in later life, independently of social class and gender
Wake et al. (2007)	BMI	4-5 years old (N=4,983), Longitudinal Study of Australia	Authoritative, authoritarian, permissive, and disengaged defined on the basis of internal warmth and control tertile cut points and based on fathers and mothers self-reported parenting style	Univariate and multivariable ordinal logistic regression	* Mothers' parenting style is not associated with their children's BMI * Higher father control scores are associated with lower odds of the child being in overweight or obese
Wickrama et al. (1997)	Poor adolescent physical health, sum of 12 physical complaints (e.g. headaches, sore throats)	Median age of 12 in 1989, and interviews repeated in 1990, 1991, 1992, 1994 (N=310), US	Supportive parenting constructed as the sum of scores based on mother'; and fathers' warmth and low hostility behaviour for a series of tasks, evaluated by external coder Perceived parental support is the sum of score of a series of question asked to the adolescent	Latent growth curve analysis	* Level of and change in observed parental support are linked to the level and changes of adolescents physical health, respectively, through the adolescents' perception of their parents' support

Other studies suggest that parents' involvement is equally important as control, if not more. But for both dimensions of parenting style, contradictory evidence can be found. For example, in their review of the literature, Aunola and Nurmi (2005) find that authoritative parenting style, with high behavioural or psychological control, is associated with child's pro-social behaviour, whereas parental affection alone has a more ambiguous effect. In their own research, Aunola and Nurmi analyse 191 children aged 5 and 6 years old and followed up six times from kindergarten to the second grade. They investigate the combination of mothers' and fathers' parenting style in terms of affection, behavioural and psychological control. Their empirical approach is a latent growth curve modelling to investigate intra-individual changes over time in the variables of interest. The analysis of individual parenting style measures reveals that only affection is associated with an increase in child's external problems. A further analysis including interaction terms of the parenting style measures suggests first that internalising and externalising problems are increasing with high level of affection and psychological control, and second, that externalising problems are also increasing with high level of behavioural and psychological control. A possible explanation for the first result is that affection reinforces the communication of guilt and psychological restrictions. It may also reflect a problem of unobserved heterogeneity.

Kiernan and Huerta (2008) use the Millennium Cohort Study to investigate the role of reading activities, positive relations, and disciplinary practices on the child's externalising and internalising behaviour at the age of three, taking into account mother's depression and economic deprivation. They use factor analysis and structural equation modelling and find that reading activities are significantly negatively correlated with externalising behavioural problems but not with internalising problems. On the contrary, disciplinary practices is associated with a significant increase in both types of behavioural problems, whereas a positive mother-child relationship reduces both types of negative behaviour.

More robust evidence is essential to support families in their attitude with respect to their children, especially because continuity of the behaviours appear to be strong (Campbell and Ewing, 1990). However, Denham et al. (2000) show that parenting style can still affect the child's behaviour, even after controlling for initial problems. They observed both mothers and fathers interacting with their children in a variety of representative contexts, and child outcomes were assessed at the ages 4.6, 7 and 9.7 years over 60 participants in the three waves. Based on correlations and regressions, their results indicate that proactive parenting, defined as supportive and setting clear rules, predicts fewer behaviour problems over time, after controlling for initial problems; the converse was true for parental anger.

Despite the sometimes contradictory evidence, the combination of parental involvement and rules appears to play a crucial role on the child's behaviour, and probably suggests that a distinction between moderate and extreme authoritarian parenting style is necessary to better understand the role of involvement and strictness individually and in combination.

3.2.1.3 Parenting style and child mental health

Evidence on the role of parenting style on child mental health, which is often defined in the literature to cover both behavioural and emotional problems, is more limited. For three-year old children, Kiernan and Huerta (2008) find no association between mothers' involvement and children's emotional problems broadly measured as the sum of questions on whether the child is often unhappy, often complains of headaches, has many worries, is nervous or clingy, and has many fears. Yamauchi (2009) adopts a broader framework and investigates the role of parental educational attainment and mental health on their children's mental health. Her results, based on the 2004 Longitudinal Study of Australian Children and 4,898 children aged four to five years old, show that more educated and mentally healthier parents have also mentally healthier children. This appears to be partially due to the fact that more educated parents engage more frequently in educational activities with their children. At the same time, mentally healthy parents exhibit a more disciplined parenting style.

Chan and Koo (2011) use the Youth Panel of the British Household Panel Survey to explore the association between parenting style and indices of child self-esteem and happiness. Parenting style is reported by the 15-years-old teenagers and the parenting style indices sum up their answers. The authors use latent class analysis to identify three types of parenting style, namely authoritative, authoritarian and permissive. They find that teenagers' self-esteem and happiness is not associated with family structure (single-parents or step-families), nor social class. Authoritarian and permissive parents are significantly more likely to have teenagers who are happier or have high self-esteem compared to children from authoritative parents. These results suggest therefore that the lack of parents' involvement may play an important role in the adolescent's mental health equilibrium (Peterson et al., 1991).

The effect of control on the child's mental health is more ambiguous. Although Chan and Koo (2011) do not directly test the difference between the authoritarian and permissive coefficients, it is also relatively large, suggesting that the absence of rules accentuates the detrimental effects (Lamborn et al., 1991). However, if the lack of control is bad for children, it has also been shown that excessive level of control tends to undermine the child's self-expression and self-esteem, which in turns increases

depressive symptoms (Kaslow et al., 1994, Hill et al., 2003).

It is important to note that, in the case of mental health, differences between genders are observed, even after controlling for parenting style. Typically, girls are more likely to show some depressive symptoms (Peterson et al., 1991). Furthermore, Huppert et al (2010) find a long term effect of parenting style on wellbeing. They consider 984 women in the 1946 British birth cohort study and analyse the link between psychological wellbeing at the age of 52 and reported retrospective parenting style at age 43 referring to age 46. They identify three relevant dimensions of parenting style using factor analytic models: care, non-engagement, control, and analyse the relationship between adults' well-being and adolescent's parents using structural equation modelling. Higher level of psychological well-being were significantly associated with parental care and negatively with control and non-engagement. Although this suggests that parenting still persists well into adulthood, the results may be affected by the retrospective parenting style which is likely to be affected by current well-being. Adults who feel good might be less likely to remember bad parents, whereas less happy adults might be more likely to blame their parents for their lack of well-being.

3.2.1.4 Parenting style and child physical health

Although it is plausible that parenting style has an important role on the child health by affecting the child vulnerability to illness or risk of accidents (Hoghughi, 1998), evidence on the role of family practices on child health is scarce. More is known on the correlation between parenting style and child health-related activities. For example, Ornelas et al. (2007), Hennessy et al. (2010), and Jago et al. (2011) find that physical activity is the highest among the children of permissive parents and the lowest among children of uninvolved parents. Similar results can be found in the case of fruit consumption (Kremers et al., 2003), whereas parents' rules and involvement reduce smoking initiation or adolescents' smoking probability (Hill et al., 2005, Chassin et al., 2005) as well as substance abuse (Kosterman et al., 2000, Adalbjarnardottir and Hafsteinsso, 2001).

Belsky et al. (2006) use the first six years of the National Institutes of Child Health and Human Development Study of Early Child Care, a longitudinal study initiated in 1989, that collects videotaped semi-structured interaction tasks at the child ages 6, 15, 24, 36 and 54 months and coded by raters to derive three measures of parenting (warmth, negativity and positive control) calculated as average scores across ages. Based on the sample of 1,041 women, they estimate OLS models of the child's health captured as the sum of health reported by the mother at the child ages 6.6 and 7 years. Their limited set of socio-economic variables (mother's years of education, mother's age, partner presence and races) are not significantly correlated with the child's health in an

OLS regression, apart from mother's education that is positively correlated with child health. The inclusion of parenting style variables in the child health equation suggests that the presence of a partner in the household is significantly correlated with child health, but the parenting style variables are not significant in the equation. However, as the R-square is improved, the authors argue that parenting is a partial mediator of the impact of SE factors on child health. The coefficients' standard errors are also reduced, but the standardised coefficients remained virtually unchanged. Among the parenting style measures, warmth has the largest positive effect on the child's health despite being non-significant.

Wickrama et al. (1997) use a five-year interview panel of 310 adolescents in Iowa to investigate the effect of parental support on adolescent physical health measured as a sum of 12 common complaints (e.g. headache, skin rashes, vomiting, etc.). Parental support is measured by an external coder based on interaction tasks between the adolescent and the parents. Additionally, the authors also ask the child to report perceived parental support. Using latent growth curve modelling, the authors find that supportive parents reduce their adolescent risk for physical health problems, through adolescent perceived parental support. However, the strictness dimension is ignored in this study.

Stewart-Brown et al. (2005) use three UK national birth cohort studies to investigate the role of parent-adolescent relationship on physical health in adulthood. In the 1946 cohort, health is measured at 43 years old and parental mistreatment in childhood is asked at the same age. In the 1958 cohort, 16 years old cohort members responded to a self-completion questionnaire to whether it was true or not that they were getting on well with their mother and father separately, and health is measured at age 33. Finally, in the 1970 cohort, 16 years old interviewees could choose a statement that best described their relationship with their parents, and health is measured at 26 years old. Using logistic regression for the oldest cohort and multi-nominal logistic regressions for the others, the authors find that reports of neglect (1946 cohort), poor quality relationship with parents (1958 cohort), and a negative relationship (1970 cohort) predicted reports of three or more health problems in adulthood.

If most research finds a significant association between parents' involvement and their children health,[68] the scarce evidence available in the case of child obesity is more ambiguous. For example, Gibson et al. (2007) analyse 329 children aged 6–13 years find that childhood obesity is not associated with adverse maternal or family characteristics such as maternal depression, negative life events, poor general family functioning or

[68]See also Swanson et al. (2011) in a sample of 240 predominantly Mexican American early adolescents.

ineffective parenting style. Wake et al. (2007) analyse the role of father and mother parenting style separately and jointly on the BMI of 4,983 4 to 5-year-old children of the Longitudinal Study of Australian Children. They find that, mothers' parenting style was not associated in any model with higher odds of children being in a heavier BMI category, whereas higher father control scores were associated with lower odds of the child being in a higher BMI category. Rhee et al. (2006), in a study of 872 children aged of 54 months, find that children of authoritarian mothers were the most likely to be overweight and the authoritative ones had the lowest risk of being overweight. This result suggests that involved mothers can play a role in reducing their children probability of being overweight. von Hinke Kessler Scholder (2008) studies the timing of mothers' employment on children's obesity, and she finds that mother's employment around mid-childhood (age 7) is the most detrimental for the child's later weight as opposed to earlier or later mother's employment.

3.2.1.5 Parenting style and child cognitive ability

Chan and Koo (2011) find that authoritative parents are more likely to have teenagers scoring better at the GSCE and less likely to be unemployed compared to authoritarian and permissive parents who are more likely to have children who have left full-time education at the age of 17. This conclusion is the most commonly found in the literature (see for example Abar et al., 2009).

By contrast, authoritarian parents tend to have children with lower academic achievement (Abar et al., 2009). Dornbusch et al. (1987) extend Baurmind's analysis to adolescents and control for ethnic group, age, gender, single-parent family, and parents' education. They find that authoritative parents, as reported by the adolescent, are associated with children with better school performance. The same analysis made separately by ethnic groups reveals that this is particularly true for Whites and Hispanics, but the correlations is not significant for Asians and Hispanics.[69] This association is also found by Lamborn et al. (1991) based on approximately 4,100 14-18 year old teenagers. The parenting style is reported by the teenagers, and the authors undertake a multivariate analysis of variance. In their study, children from authoritarian parents score lower than authoritative family children, but better than neglectful or permissive ones.

Astone and McLanahan (1991) consider specific school-related parenting style on a sample of 10,438 children aged 15-16. They separately analyse six measures of success in secondary school (educational aspirations, grades, school attendance, posit-

[69]This is probably due to the small proportion of Asians and Hispanics in their sample.

ive attitude toward school, stayed continuously in school until graduation) using OLS regressions. The role of parenting style is very moderate. Parents' aspirations have often the largest and strongest correlation with the outcomes, but specific parenting practices are less correlated with the outcomes. Mother or father's monitoring as well as general strictness are more strongly associated with successful outcomes, than actually talking to the child on a weekly basis.

These results support the idea that school performance is mainly affected by parents' strictness instead of parents' involvement, although contradictory examples exist. Kiernan and Huerta (2008) find that involvement matters more than disciplinary practices in the case of children at the age three. The results are also not consistent across ethnicity (African American, Hispanic, and Asian) as noted by Spera (2005) in his review on parenting style and adolescent school achievement. Pong et al. (2005), in a regressional analysis using the National Longitudinal Study of Adolescent Health finds differences in parenting practices by ethnicity (White, Hispanic and Asian) but they are not large enough to explain differences in average grades scores.

3.2.1.6 Parenting substitution

The role of the father, and the role of any other types of maternal parenting style substitution such as grand-parents or nursery, have received very little attention in the literature. With more families separating, and mothers being more involved in the labour market over the years, it is crucial to understand the role that fathers play in rearing their children. Reviews of the literature generally do not distinguish between parenting style measured only by the mother or both parents. Although the conceptual framework of parenting style refers to parents in general, most of the studies limit their attention to the mother. This relies on the implicit assumption of perfect substitution, that is that the parents-child relationship would not depend on the gender of the parent involved with the child (Maccoby and Martin, 1983), nor the possibility of complementarity between the two parents. However, it is very likely that both the mother and the father play a salient role in the child's evolution that may not be fully interchangeable.

The evidence on parents' substitution is mixed. Based on 196 children, Aunola and Nurmi (2005) finds that father's parenting style only plays a marginal role but this may be due to too few father's observations (about 76% of the 196 children had observations for the father), or because they do not account for parents' time or occupation. On the contrary, Averett et al. (2005) show that father care for infants is as good as other types of arrangements, but that toddlers in non-paternal modes of child-care have slightly better cognitive outcomes, although the possible reasons explaining this result

are not clear. Parental practices may also vary by parents. For example Lundberg (2005) reveals that fathers tend to be more involved when they have boys.

The literature does not account for further types of care substitution such as child care. Although our analysis also focuses on mother's care only, it is worth mentioning that parents unable to be involved but willing the best for their offsprings may substitute their presence by good quality of care which may bias our results. For example, Felfe and Lalive (2011) investigate how centre-based care compared to mother care affects the child's development. They find that there is only a marginal gain of child care for the average child, but that it is much more beneficial to children from low socio-economic background. Chetty et al. (2010) find that better quality kindergarten improves non-cognitive outcomes and increases long-term earnings.

The last important issue to mention that has received very little attention in the literature is the difference not only of the effects of parenting style on boys and girls, but also the different parenting style adopted by parents depending on their child gender. In a country like India where boys are generally preferred over girls, Barcellos et al. (2012) show that boys receive significantly more time than girls, are more likely to be breastfed longer, and to be given vaccinations and vitamin supplementation, despite these differences not being due to greater needs. Among Arab adolescents, Dwairy (2004) finds that parenting style with regard to boys tends to be less authoritative and less authoritarian than with regards to girls. In order to address this issue, we also model boys and girls separately.

3.2.2 Economic approach of the role of parenting style on children

The role of parenting style in the production process has generated much less interest in economics. Parenting style has been implicitly considered as one of the numerous inputs affecting the child's health and behaviour. From the seminal work of Becker (1991) the main focus has been on income as a means to buy the investment in the child. However, parenting style is potentially endogenous which suggests that the estimated correlations may be biased estimates of the causal effect (Rosenzweig and Schultz, 1983).

Economics can make major contributions to the analysis. The first is a theoretical framework for the analysis of the parent-child relationship. This permits a clarification of the different effects and interactions, an explicit exposition of the possible dynamics, the formulation of assumptions related to the actors motivations, and an explicit acknowledgement of omitted factors. The second contribution is an applied econometrics approach that accounts for confounding factors, with specific methods to

account for the influence of unobservable factors, modelling endogeneity and reverse causality. In the psychological studies summarised above, the main focus is generally on overall correlations without much interest for the relationship with socio-economic characteristics, unobserved, reverse and endogenous effects, making it impossible to obtain estimates of the causal effect of parenting style on children outcomes.

The economics literature is much smaller than the psychology literature but does provide a framework to examine the effect of child rearing practices on the child's development. Burton et al. (2002) propose a theoretical model where the child is a participant in the development process. They model the parent-child interactions as a game where the child has a utility function increasing in praise received by the parents, but decreasing in effort. The parent maximises a family welfare function depending upon her own current well-being, the child's current utility, and the child's future well-being. The equilibrium effort and praise level depends on the child's type, the parent's praise and the child's behaviour. This is modelled empirically using a simultaneous system of equations for the child's conduct disorder score and a parental score, and estimated via three-stage least squares (3SLS) using the 1994 National Longitudinal Survey of Children and Youth. When taking into account endogeneity compared to simple OLS regressions, the parenting score and child conduct variables are much stronger predictors respectively of child conduct and parenting score.

Based on who establishes three limits at home (stay out at night, TV shows child may watch, and who the child is allowed to go out with), Cosconati (2009) defines three types of parenting style: strict limits (parent decides), permissive (parent and child's decision), and permissive (child's decision). He proposes a model of parent-child interaction where the parents can place limits to the child's leisure time, and thus encouraging him to spend more time studying. The author tests his structural model using the National Longitudinal Study of Youth 1997. His results indicate that strictness of parenting style varies with how much the child values human capital. Children who have initially a high level of human capital, measured by the time spent doing homework, would benefit more of less strict parents, whereas children with a low initial level of human capital would achieve a higher level of human capital with strict parents. This article illustrates that optimal parenting style is a function of the child's characteristics, but is weakened by the lack of the child's ability measure to better capture effects of the child's studying efforts.

Cunha and Heckman (2006) propose a model to explain the dynamic complementarity of cognitive and non-cognitive skills taking into account parental investment. The model is estimated using the male children of the National Longitudinal Survey of Youth born in 1979 in the US, and parent investments is measured by number of

books available to the child, whether the child has a musical instrument, whether the family receives a daily newspaper, whether the child receives special lessons, how often the child goes to museums, and how often the child goes to the theatre. They use a dynamic factor model to construct an index of the latent parental investments. Using measures of cognitive and non-cognitive skills at ages 6/7, 8/9. 10/11, 12/13, they find that these skills develop over the child's life cycle with an important role of parental inputs on cognitive skill formation at an early age, and on non-cognitive skill at a later age. Their approach however does not identify which parent input matters.

Dooley and Stewart (2007) study the relationship observed between income and child outcomes. They assess the causal effect of income on the child, taking into account the role of parenting style. They use three waves (1994-5, 1996-7, 1998-9) of the National Longitudinal Survey of Children and Youth to implement different strategies aiming at estimating the possible endogeneity bias, postulating that parenting style is one source of heterogeneity that may induce bias. Their strategy does not allow fully for unobservable effects but provides some insight on the extent of possible bias. First, they analyse how the relationship between income and child behavioural–emotional outcomes varies for outcomes reported by the teacher, a parent, and by the children when aged above 10. Then they incorporate four aspects of parenting style: positiveness, hostility, consistency, and punitiveness, which are measured as the sum of scores received on the answers to four to eight questions. They consider children aged four and up to 11, and income is measured as permanent income which is proxied by the average income over the three waves. As permanent income may be affected by change in household composition, they include only families that remained with the same two parents and same single mother across the period of study. The outcomes of interest are the sum of scores based on hyperactivity disorder, conduct disorder, emotional disorder, and property offence scores, which are themselves also measured as the sum of scores received from the answers asked to the three different respondents. They start with an OLS model, then estimate the model with separated child and a family fixed effects to take into account unobserved heterogeneity constant over time. Then, they estimate the outcomes relationship in wave two with income and parenting style measured in waves two and three. The aim of this strategy is first to check whether parents have better information about their past income than the future one, and second, to test whether past parenting style has a stronger impact on child outcomes than the future one. Their last empirical specification applies only to the income effect. Their estimate of the income effect is in the range of what has been previously estimated: a unit increase in the log of income is associated with a decrease of about 0.15–0.10 of a SD in the outcomes indices. The authors conclude that the exclusion of parenting style does

not bias the income effect, but parenting style has a consistent impact on behavioural-emotional problems, with positive parenting having generally a negative effect on the outcome, hostile parenting a positive one, consistency and punitive parenting a non-significant one, although the quantitative effects vary substantially depending on who reports the outcome.

Violato et al. (2011) also examine the relationship between child outcomes and parental income, but using the MCS data. In order to identify pathways through which income translates into child's behaviour[70] and cognitive development,[71] they adopt as their main econometric strategy a "mopping-up" approach. This method exploits the richness of the MCS data by including as many confounding factors as possible in order to "mop-up" the residual heterogeneity in the income-child outcomes relationship and minimise the omitted variable bias. The authors distinguish four types of control variables: standard socio-economic variables (e.g. birthweight, gender, parental education), parental stress variables that are a mix of parental views and parenting practices (e.g. what the mother does when the child is naughty), parental investment variables (e.g. home atmosphere, activities with the child), and other family-related pathways (parents' health and lifestyle, and grand-parents' socio-economic status). This grouping comes from various economic theories in family behaviour (see Violato et al. (2011) for more details) and does not relate to the demandingness and involvement classifications used in the psychology literature. As the authors do not aggregate their various measures, we can summarise the effects of the variables related to demandingness and/or involvement. Child outcomes are measured at 3 and 5 years old, and, in order to limit reverse causality, the time-varying controls that they use are measured one interview before the one at which each outcome is measured.

The association between income and child outcomes is significantly reduced once they take all the controls into account. In some cases, even the correlation between income and child outcomes is no longer significant. Child cognitive outcomes are mostly explained by parenting style and parental investment. The lack of strictness, measured by whether the mother tells off a naughty child and whether rules are strict in the family, are detrimental to the child's cognitive ability. Similarly, the lack of reading to the child, either from the mother or the father, is associated with lower cognitive outcomes. By contrast parental strictness is detrimental to the child behaviour, whereas going frequently to the library is associated with fewer behavioural problems. The results are

[70]Child's behaviour is measured as the sum of parents' answers to the Strengths and Difficulty Questionnaire. This questionnaire combines questions on externalising and internalising behavioural problems.

[71]The appendix of their article also looks at the child's temperament, but this is only measured at 9 months.

supported by family fixed effects models. Violato et al. (2011) repeat their analysis for two-parent and single-parent families in order to analyse the role of the father. The main father's effect is through reading with the child which is positively associated with cognitive outcome.

In summary, their analysis support the role of parenting style in the child (mental) health production function, but contrarily to Dooley and Stewart (2007), the authors find that the income-child outcomes relationship is mostly indirect and that it can be captured by four groups of mediating factors. The authors justify their choice of mediating factors by referring to the parental investment and parental stress theories, but they do not discuss the involvement and strictness dimensions used in the psychology literature. Their choice of controls appears to be more guided by what is available in the data than specific dimensions that they want to capture. The parenting style variables used are likely to be biased by unobserved heterogeneity; for example, in using the question about whether the mother tells off the naughty child, one should also consider whether the child is naughty, otherwise answers are also picking up child behaviour as well as parenting style.

Our approach differs in several ways. First, because these dimensions have been claimed to capture the main aspects in the child-parent relationship, and to have comparable results to the existing literature on parenting style, we clearly distinguish between parental strictness and involvement. The inclusion of so many correlated variables also makes the interpretation of these variables difficult due to collinearity. Second, we modify the parenting style variables so that we do not measure whether the child is actually naughty, but what the mother does when the child is naughty (see Section 3.3 for more details). Third, it is difficult to assess the role of the father in Violato et al. (2011)'s article as the single-parent and two-parent families regressions are run on two different samples. It would have been better to have the results for the two-parent family sample without and with the father variables so that we could assess the impact of the father. This is what we do in this chapter. Finally, some of their results such as the significant positive correlation between the time the father spends with the child and the child's behavioural problems suggest that unobserved heterogeneity is still present in the data. Even if the father's involvement comes from the pervious interview, this result seems to suffer from reverse causality. We address this problem by allowing the parenting style and child outcomes to be subject to unobserved heterogeneity using a recursive specification.

Waldman et al. (2012) investigate the health consequences of early childhood television watching using a natural experiment to account for the possible problem of reverse causality. They use the proportion of children's cable stations between 1972 and

1992 in California and Pennsylvania counties to understand the relationship between television watching, mental retardation and autism. They find that, for children below three, there is a positive correlation with autism diagnosis rates. However, for mental retardation, the correlation is negative, in contrast to early studies that only investigate correlations without accounting for possible reverse causation.

Aside from parenting style, other factors that have important effects on children outcomes have been identified in the economics literature. If these factors are correlated with parenting style but not accounted for in the regressions, there is an endogeneity bias. For example, mother physical and mental health play an important role. Using the Millennium Cohort Study, Kiernan and Huerta (2008) analyse the association between children economic circumstances, including mother's mental well-being, and children's cognitive development and behaviour problems at age three. Using structural equation modelling, they show that mother's depression is significantly correlated with their parental practices although depression only has a direct effect on children's behaviour but not cognitive development.

In summary, the literature suggests that children from neglectful families have worse outcomes, and children with authoritative parents are the most healthy, physically and mentally, and report the highest test scores. However, little attention has been given to possible unobserved heterogeneity bias, and to the specific parental rearing practices rather than overall measures of involvement and demandingness. In this chapter, we analyse the role of mother's parenting style on child health and cognitive ability, taking into account unobserved heterogeneity. We measure parenting style as overall indices to capture quantity, and as specific measures to capture quality. The next section presents the data, Section 3.4 introduces the estimation approaches, and Section 3.5 presents the results.

3.3 Data

3.3.1 Descriptive statistics

We use the Millennium Cohort Study. The initial sample was nearly 19,000 babies born between 1 September 2000 and 31 August 2001 in England and Wales, and between 22 November 2000 and 11 January 2002 in Scotland and Northern Ireland. Information has been collected from parents when the children were aged nine months and has been repeated when the children were three (sweep 2), five (sweep 3) and seven (sweep

4) years old, interviewing as well partners, school teachers, and older siblings.[72] The sample was a random sample of electoral wards.

We restrict the sample to families where the main carer is the natural mother. We exclude twins and triplet since their birth weights and other health outcomes are not comparable to singletons. Furthermore, parenting style is likely to differ with more than one child of the same age. Finally, we exclude children with birth weight in the first and last percentiles.

3.3.1.1 Outcome variables

We focus on physical health and mental health which is captured as externalising and internalising behavioural problems. The outcomes variables are summarised in Table 23.

Physical health Child physical health is based on the following question asked to the mother in sweeps 3 and 4: "In general would you say your child's health is: excellent, very good, good, fair, or, poor?". We code the answer from 1 to 5, with 5 being excellent, and dichotomise the answers with 1 meaning that the child is in good, very good or excellent health, and 0 if the mother reports poor or fair health. 97% of the children are in good or better health.

Mental health To capture *externalising behaviour*, we compute indices of externalising behaviour problems and of hyperactivity. The indices are based on the following questions asked to the mothers in sweeps 3 and 4: over the last six months, the child

- often fights with other children or bullies them
- often has temper tantrums or hot tempers
- often is generally obedient, usually does what adults request (coded the other way around)[73]
- often co-operates with requests (coded the other way around)[73]
- often is considerate of other people's feelings (coded the other way around)[73]
- is restless, overactive, cannot stay still for long

[72]The main child carer and his/her partner were interviewed at all the sweeps. The school teachers were interviewed in the 3rd sweep in Wales, Scotland and Northern Ireland only, and in the 4th sweep across the UK. The older siblings were interviewed in the 2nd and 3rd sweeps in England only.

[73]The original coding ranges from 1 "not true" to 3 "certainly true". We have replaced the score 1 by 3 and the score 3 by 1.

- is constantly fidgeting or squirming
- is easily distracted, concentration wanders
- sees tasks through the end, good attention span (coded the other way around).[73]

The possible answers are not true (1), somewhat true (2) or certainly true (3). The externalising behavioural problem index sums up the first four questions and the hyperactivity index the remaining ones of the above list.[74] The externalising behaviour index ranges from 5 to 15 and is on average 7. The hyperactivity index ranges from 4 to 12 and is on average 6.

Internalising behaviour problems, also called emotional problems, are captured in an index that sums up the following aspects: over the last six months the child

- is often unhappy, down-hearted or tearful
- often complains of headaches, stomach-aches or sickness[75]
- has many worries, often seems worried
- is nervous or clingy in new situations, easily loses confidence
- has many fears, easily scared.

The possible answers are the same as for the externalising aspects.[76] The index ranges from 5 to 15 and the average is 6.

As these variables are reported by the mother, as well as the parenting style measures presented in Section 3.3.1.2, which induces a possible reporting bias problem, we also consider other physical and mental health measures that are not reported by the mother.

Body mass index As another proxy for physical health, we look at the child's body mass index (BMI). The child's height and weight is measured by the interviewer and the BMI is computed as the weight in kilo divided by the height in squared centimetres (kg/cm^2).[77] In our sample, the BMI ranges from 9 to 33 at the age of 7.

[74] Our approach is the same as Kiernan and Huerta (2008) who used the equivalent questions available at the age of three to create externalising and internalising behavioural problem measures.

[75] This variable should be viewed as a psychosomatic measure.

[76] Again, similarly to Kiernan and Huerta (2008)'s approach.

[77] The NHS recommends to interpret the child's weight in relation to their height, age and sex, and the adults' bounds for under- or over-weight cannot be directly applied to child's BMI. However, child's BMI can be used to analysis how it is affected by parenting style.

Mental health reported by the child As an alternative measure to the mother reported mental health of the child, we use an index of mental health reported by the child. At the age of 7 (sweep 4), the child is asked to fill a questionnaire with the following questions:

- how often do you feel happy (coded the other way around)[78]
- how often do you get worried
- how often do you feel sad
- how often are you quiet
- how often do you like to be alone
- how often do you laugh (coded the other way around)[78]
- how often do you lose your temper (coded the other way around)[78]

The child can choose one of the following options: never (1), some of the time (2) or all of the time (3). We sum up the child answers to get an index of the child mental health defined by himself. The index ranges from 0 to 12 and is on average 4.

Mental health reported by the school teacher In the last wave (sweep 4), teachers in England are also interviewed. They are asked whether specific problems apply to the MCS child, including "behavioural problems/hyperactivity" and "mental illness/depression" to which they answer by yes or no. Based on the teachers' reports, about 22.4% of the children have some hyperactivity problem but only 1% of them appears to suffer from depression. Because of the very low proportion with depression, we only analyse the hyperactivity reported by the teacher.

Cognitive ability reported by the teacher As an important and related aspect to the child's development, we investigate the role of parenting style in the child's cognitive ability. The child's teacher is asked to rate the child, based on her/his experience, in relation to all children of this age on the following aspects: speaking and listening, reading, writing, science, math and numeracy, physical education, information and communication technology, expressive and creative arts. For each of these eight categories, the teacher can chose: well above average, above average, average, below average, well below average. We gave a score from 1 for the lowest evaluation, up to a score of 5. We

[78]The original coding ranges from 1 "never" to 3 "all of the time". We have replaced the score 1 by 3 and the score 3 by 1.

Table 23: Descriptive statistics: outcome variables by sweeps

	Count	Mean	Std. dev.	Min.	Median	Max.
Physical health						
Child overall heath (S3)	10,280	4.347	0.842	1	5	5
Child overall heath (S4)	7,063	4.483	0.780	1	5	5
Child in good health (S3)	10,280	0.963	0.188	0	1	1
Child in good health (S4)	7,063	0.971	0.167	0	1	1
BMI (S3)	10,184	16.379	1.848	10.27	16.11	42.80
BMI (S4)	6,990	16.665	2.299	8.74	16.21	32.56
Externalising behavioural problems						
Externalising behavioural problems (S3)	9,992	7.025	1.744	5	7	15
Externalising behavioural problems (S4)	6,915	6.838	1.772	5	6	15
Hyperactivity index (S3)	9,898	6.280	2.035	4	6	12
Hyperactivity index (S4)	6,871	6.463	2.204	4	6	12
Hyperactivity reported by teacher (S4)	735	0.224	0.418	0	0	1
Internalising behavioural problems						
Internalising behavioural problems (S3)	9,840	6.251	1.461	5	6	15
Internalising behavioural problems (S4)	6,811	6.443	1.696	5	6	15
Inter. behavioural pbs reported by child (S4)	6,489	4.307	1.626	0	4	12
Depression reported by teacher (S4)	711	0.010	0.099	0	0	1
Cognitive ability						
Cognitive ability reported by teacher (S4)	4,478	25.988	5.456	8	26	40

Notes: S3: sweep 3, S4: sweep 4.

then sum up all the categories to obtain an index of the child's cognitive abilities. The cognitive ability index is available in sweep 4 only for England and ranges from 8 to 40 with an average of 26.

3.3.1.2 Parenting style variables

Parenting style is often referred to as a general measure, but it is important to understand how it is captured and what it measures.

Some studies in the psychology literature on parenting style capture it by direct observation (e.g. Wickrama et al., 1997, Belsky et al., 2006, Rhee et al., 2006). Parents are examined pursuing different tasks and their attitude is evaluated by independent and trained raters. However, more commonly, studies use parenting style reported by the parents, by the children themselves, or by the siblings of the children analysed. The main advantage of studies using reported variables is that they have generally a much larger number of observations. However, when parenting style is reported by the parents, it may create a bias that is related to the outcomes of interest.

In the MCS, parenting style is mainly reported by the mother. A few aspects are also asked to the father or mother's partner, and some more general questions about the rules in the family are asked to the older sibling. In order to test for potential bias in the mother's responses, we also reestimate our main models using the partner and

sibling reports.

There are many ways to measure parenting style. The most common method in the psychology literature is to combine questions on related aspects into an index, either by taking the mean (e.g. Dornbusch et al., 1987) or the sum of items (e.g. Kiernan and Huerta, 2008). Others have used factor analysis (e.g. Huppert et al., 2010) or latent class models (e.g. Chan and Koo, 2011). In psychology, the indices are generally constructed to measure the main two dimensions of parenting style: acceptance/involvement and strictness/supervision. However, in the economics literature, there is a greater variety of parenting style measures. For example, in Burton et al. (2002), the parent score sums up how often parents calmly discuss the problem, raise their voices, scold or yell, use physical punishment, describe more acceptable alternatives. These questions can be viewed as a mixture of the two classical parenting style dimensions.

We have performed both cluster and factor analysis in an attempt to reduce the number of different possible measures of parenting style. The results are reported in Appendix A. While cluster analysis allows us to obtain parenting style categories that are similar to the ones in the literature, the results are very sensitive to the selected specification. Factor analysis results did not lead to clear or readily interpretable combinations of variables.

We decided to pursue our main analysis by entering the parenting style variables separately which enables us to identify the separate effects of parenting style. In addition, in order to have results that can be compared to what has been previously done in the literature, we distinguish between measures that can be considered either as involvement or strictness, and construct two summary indices for the two main dimensions of parenting style (involvement and strictness) by summing up the parenting style variables. Finally, we also consider measures described below that proxy the child's lifestyle imposed by the parents to connect our research to the health economics literature which has focused on the lifestyle's role as an important determinant of health (Kenkel, 1995, Contoyannis and Jones, 2004a, Balia and Jones, 2008).

The distinction between quality or quantity of time is not discussed in the literature, although this might be an important aspect affecting children's outcomes. This issue is briefly reviewed by Hsin (2009) in the case of cognitive abilities. The author concludes that on average, maternal time, both total quantity and type of activities, is uncorrelated with the child's outcomes. As we have seen in the literature review strictness rather than involvement is what matters the most to improve child cognitive ability, which may explain Hsin's conclusion. In our analysis of parenting style, we distinguish between specific parenting style measures that characterise strictness and

supervision, and total ruling and strictness measures to address the distinction between quantity and quality. We estimate these effects in separated regressions.

In this chapter, we focus primarily on the role of the natural mother, mainly due to data availability. We then include in our analysis the father's parenting style variable available to see how the results change. We now describe the parenting style measures in our analysis.

Involvement The interviewer has a list of activities and for each of them, the mother is asked whether she does each activity with the child every day (score of 5), several times a week, once or twice a week, once or twice a month, or less often (score of 1). The different activities with the child include (i) reading, (ii) telling stories, (iii) playing music, (iv) drawing, painting or making things, (v) playing sports or physically active games outdoors or indoors, (vi) taking the child to the park or to an outdoor playground, and (vii) playing with toys or games indoors. In order to avoid collinearity as some of these aspects are very similar, we group them by taking the maximum of reading and telling stories, of playing music and drawing, painting or making things together, and of playing sports and going to the park.[79] As the question on playing games with the child has no similar question, it is left how it is.

If certain mothers have a tendency to over-report for example, the involvement magnitudes will be biased. Therefore, in order to know what mother's practice matters the most, we transform each of the four variables by dividing them by the most undertaken involvement measure. This gives us for each parenting style the propensity of each practice with respect to the most frequent activity undertaken by the mother at each sweep.

As the psychological literature has generally focused on total involvement, we also construct a total involvement index which is the sum of the four measures analysed. It captures the quantity of mothers' involvement, but might be biased by systematic over-reporting.

Table 24 summarises the magnitude measures, the propensities and the index. The first four variables represent the different mother's practices once we have taken the maximum of similar activities. The averages ranges from 3.07 for physical activities to 4.27 for reading literary activities. The four next ones are the proportions. Based on the median, reading and having some artistic activities with the child are undertaken by the majority of mothers. Having some physical activity with the child is what the mothers do the least relative to the other activities. The last row represents the overall

[79]The new variables represent what the mother does the most between the two activities. As the possible answers are categories that are not proportional, it would not be correct to take the average or the sum.

Table 24: Descriptive statistics: involvement measures

	Count	Mean	Std. dev.	Min.	Median	Max.
Involvement magnitude						
Reads/tells stories with child	17,342	4.27	0.95	0.00	5.00	5.00
Plays music/paint with child	17,343	3.88	1.12	0.00	4.00	5.00
Does sport with child/takes to park	17,338	3.07	1.03	0.00	3.00	5.00
Plays game with child	17,343	3.31	1.19	0.00	3.00	5.00
Propensities						
Mostly reading	17,334	0.92	0.16	0.00	1.00	1.00
Mostly art (music/painting)	17,334	0.84	0.21	0.00	1.00	1.00
Mostly physical activities (sport/park)	17,334	0.67	0.22	0.00	0.60	1.00
Mostly games	17,334	0.72	0.25	0.00	0.75	1.00
Index						
Total involvement	17,334	14.52	2.95	1.00	15.00	20.00

Notes: The variables are summarised over sweeps 3 and 4.

mother's involvement ranging from 1 to 20. The majority of the mothers are fairly involved with an index of 15. In our analysis, we focus on the propensities and total involvement.

Strictness The punitive practices of the mother are measured by asking the frequency at which the mother resorts to different methods of punishment when the child is naughty. These include telling off the naughty child, ignoring him, reasoning with him and shouting at him. For each method, the mother can report whether she does it daily (score of 4), often -about once a week or more-, sometimes -about once a month-, rarely, or never (score of 0). These variables capture not only the mother's punitive strategy, but also how naughty the child is. In order to understand what punishment methods matter irrespectively of how naughty the child is, we create a propensity measure of strictness as the share of the most frequently used method by each mother.[80]

The strictness variables are summarised in Table 25. The first panel reports the original variables, where reasoning with the child is the most frequent punitive measure used, and ignoring the naughty child is the least used on average. The second panel reports the strictness propensities for the different variables defined as the ratio of the different strictness measure relative to the most frequently undertaken strictness activity by sweep. Finally, the last row reports the strictness index that is the sum of the original strictness measures and ranges from 1 to 16 with an average of 8.

For the involvement and strictness measures, we drop 55 observations where the mother reports that she never does anything with the child nor imposes any rules or punishment.

[80]The propensities are constructed as follows: $p_{ia}^{j} = \frac{m_{ia}^{j}}{max\{m_{ia}^{1}, m_{ia}^{2}, m_{ia}^{3}, m_{ia}^{4}\}}$ for child i at age a where m_{ia}^{j} represents the strictness magnitude j for $j = telling\ off, ..., shouting$.

Table 25: Descriptive statistics: strictness measures

	Count	Mean	Std. dev.	Min.	Median	Max.
Strictness magnitude						
Reasons with naughty child	17,301	2.67	0.93	0.00	3.00	4.00
Shouts at naughty child	17,320	2.13	0.91	0.00	2.00	4.00
Takes away treat from naughty child	17,305	1.78	0.88	0.00	2.00	4.00
Ignores naughty child	17,263	1.45	1.06	0.00	1.00	4.00
Propensities						
Mostly reasons with naughty child	17,182	0.91	0.22	0.00	1.00	1.00
Mostly shouts at naughty child	17,182	0.74	0.27	0.00	0.75	1.00
Mostly takes away treats from naughty child	17,182	0.62	0.30	0.00	0.67	1.00
Mostly ignores naughty child	17,182	0.50	0.35	0.00	0.50	1.00
Index						
Total 'rules' methods	17,182	8.03	2.49	1.00	8.00	16.00

Notes: The variables are summarised over sweeps 3 and 4.

Child health related activities The psychology literature has focused on two dimensions that characterise parenting style, namely involvement and strictness. Coming from a health economics perspective, it appears relevant to also consider the child's lifestyle imposed by the parents as an additional parenting style aspect given the clear benefits of a healthy lifestyle on health established in this literature (Contoyannis and Jones, 2004b). The first results of the analysis are extended to include the following measures of lifestyle: the number of days per week the child usually has breakfast, and whether on weekdays during term-time, the child goes to bed at a regular time. For the latter, the possible answers are: "no, never or almost never" (0), "yes, sometimes", "yes, usually", or "yes, always" (4).

These variables are summarised in the first two rows of Table 26 pooled over sweeps 3 and 4. The majority of children have breakfast every day and go to bed at a regular time.

Parenting style measures reported by siblings For the robustness check on reporting bias, we use parenting style reported by siblings. Up to two older siblings, aged between 10 and 15, are interviewed in England in sweeps 2 and 3. They are asked to complete a questionnaire which includes questions about their parents. If more than one sibling is interviewed, we first keep the sibling who reported the largest number of answers, and if equal, the youngest of the two, assuming that the parenting style adopted with this sibling will be more similar to the MCS child. The questions are not the same as the ones asked to the parents but serve as proxies to capture the same aspects. We use the following questions:

- Do your parent/s set any limits on the kinds of TV programmes you can watch?

Table 26: Descriptive statistics: other parenting style measures

	Count	Mean	Std. dev.	Min.	Median	Max.
Child lifestyle						
Nb. of breakfast per week (s34)	17,342	6.76	1.00	0	7	7
Goes to bed at regular time (s34)	17,344	2.49	0.77	0	3	3
Siblings reported parenting style						
Parents set limit to TV watching (s23)	1,136	0.65	0.48	0	1	1
Tells parents where goes when out (s23)	1,134	2.74	0.55	0	3	3
Has been out after 9pm without parents knowing (s23)	1,136	0.07	0.25	0	0	1
Child only decides what eats at home (s23)	1,145	0.17	0.37	0	0	1
Parents are strict with household chores (s23)	1,137	0.49	0.50	0	0	1
Parents check how doing in school (s23)	1,099	0.54	0.50	0	1	1
Partner's presence						
Partner looks after child (s34)	17,338	2.20	1.68	0	3	5

Notes: we report in brackets sweeps (s) at which these variables are available (sweeps 2, 3 and/or 4).

Yes (1), no (0)[81]

- When you go out, do you tell your parent/s where you are going? Always/nearly always (4), sometimes (3), hardly ever (2), never (1). We create a dummy equal to one if the child says sometimes, nearly always or always.
- In the last few weeks, have you been out after nine o'clock at night without your parent/s knowing where you were? Yes (1), no (0)
- Who usually chooses what you eat at home? We create a dummy equal to one if the child reports that she does, and equal to zero if someone else does it for her, or they do it together.
- Are your parent/s strict about making you do household chores? For example, washing up or tidying your bedroom. Yes (1), no (0)
- Which statement best describes the way your parent/s check how you are doing at school? They watch what I am doing very closely (1), they prefer me to be independent (0)

Table 26 summarises the parenting style reported by the sibling in sweeps 2 and/or 3. These variables suggest that the majority of the sample has involved parents with relatively strict rules: siblings have rules to watch TV, they always tell the parents where they go when they go out, the sibling does not decide alone what she eats, parents are strict about household chores and check how the sibling is doing at school.

Table 27 reports correlations between the parenting style measures reported by the parents and the ones reported by the siblings for the third sweep. In the literature,

[81] We set this variable to missing if the household does not have a television.

only two articles have parenting style rated by the children as well as someone else (the parents or an external rater), and the correlations between these two measures vary widely between the two surveys. In Wickrama et al. (1997), parenting style is evaluated by an external coder and is significantly associated with parenting style reported by the adolescents themselves in a latent growth curve modelling analysis. Cosconati (2009) uses how the decision to set the curfew is made among the family. Only in 66% of the cases, parents and children agree on the person who sets the limit. With respect to the decisions concerning TV watching and who they are allowed to hang out with, parents and children disagree in 56.45% and 58.69% of the cases, respectively.

In the MCS, parents who set limit on TV watching as reported by the siblings are significantly more likely to have physical activity with the MCS child, to be more involved in general, and to impose a regular bed time. Siblings who tells parents where they go out are more likely to have mothers who reason with the MCS child when naughty (correlation of 8%). Parents who do not know where the siblings go out at night are less likely to exercise with the MCS child, to impose rules and a regular bed time to the MCS child. Children who decide what they eat at home have their MCS sibling less likely to have breakfast every day and to go on time to bed. Parents who are strict with household chores are less likely to play, more likely to take away treats from naughty children, and more likely to be strict as well in terms of bed times. Finally, parents who are involved in their children school activities are more likely to be also involved with their younger MCS child and to take away treats when the child is naughty. While the sibling and parent reported parenting style are not the same, these correlations suggest that siblings responses are in line with the parents reported parenting style.

Parenting style of the father In the MCS, the partner of the mother, who is not necessarily the child's father, is interviewed if living with the mother. Questions related to his parenting style focus on his involvement with the MCS child but nothing is asked about his strictness. In order to test how sensitive our results are to the inclusion of the partner's parenting style, we use as a proxy for partner involvement the question asked to the partner "How often do you look after the child on your own?". We code the answer from 0 (not at all) to 5 (every day). This variable is summarised in the last row of Table 27. The majority of the partners look after their child more than once or twice a week (score of 2).

Table 27: Correlations between parenting style reported by the mother and the sibling

	Sibling reported					
Mother reported	Parents set limit to TV watching	Tells parents where goes when out	Has been out after 9pm without parents knowing	Child only decides what eats at home	Parents are strict with household chores	Parents check how doing in school
Prop. to read with child	0.032	0.044	-0.007	-0.046	0.007	0.025
Prop. to do art with child	0.033	-0.012	0.046	0.016	0.039	0.032
Prop. to do physical act. with child	0.070**	0.013	-0.075**	-0.002	0.033	0.017
Prop. to play with child	0.037	0.037	-0.021	0.003	-0.064**	0.068**
Total 'involvement' practices	0.076**	0.027	0.002	-0.016	0.013	0.060**
Prop. to reason naughty child	-0.021	0.080***	0.016	-0.031	-0.052*	-0.029
Prop. to shout at child	-0.009	-0.037	-0.002	-0.010	0.011	0.001
Prop. to take away treats from naughty child	0.033	-0.050*	-0.033	-0.010	0.108***	0.083***
Prop. to ignore naughty child	-0.001	-0.028	-0.003	0.017	0.010	0.020
Total 'strictness' practices	0.029	-0.018	-0.052*	0.000	0.034	0.035
Goes to bed regularily (0-3)	0.056*	-0.001	-0.054*	-0.130***	0.070**	0.032
Nb. of breakfast per week	-0.024	0.030	-0.043	-0.130***	0.030	-0.006
Observations	1,078					

Notes: Sweep 3. The columns represent the parenting style reported by the sibling, and the line by the mother. Stars convention: * for p<0.1, ** for p<0.05, and *** for p<0.01.

3.3.1.3 Socio-economic variables and other controls

Table 28 summarises the different control variables measured at sweep 3 that we use in our analysis for the overall sample and by the child's physical health status in sweep 4. The last column reports t-tests for the equality of means between the children in poor health and the ones in excellent health. Strong gradients are already present at seven years old. Children were born with an average weight of 3.4kg and 19.2% of them at the age of 5 already have longstanding illnesses. 70% of the mothers tried breastfeeding at birth and they stopped on average at 6.6 weeks. Mothers are on average 34 years old when the MCS child is 5, and 87.3% of them are in good health. Children in better health have mothers in good health and with no longstanding illness. 76.2% of the mothers did not smoke during pregnancy, and at the child's age of 5, still 72.2% do not report smoking. 78% of the children have both their parents in the household, including adoptive fathers, and 70% of the mother's partners are the natural father of the MCS child. Partners' interviews, whether they are the child's father or not, are available in 73.8% of the cases.

In terms of the family's socio-economic characteristics, the majority of the mothers are married (67%) and children are more likely to be in better health when parents are married. The marital status changes relatively little: between sweeps 3 and 4, 4.1% of the mother became married, 3.4% separated, 5.3% divorced and 0.3% became widow. The largest household income group has an income between £3,100 and £20,800, with mainly children in fair health. The 59.1% of sample that are above that income range tend to have children in better health. Average household size is of 4.2 persons, including the parents and the MCS child, but is not associated with a child health gradient.

Table 28: Descriptive statistics: socio-economic characteristics and other controls, overall and by child health

	Overall Mean/SD	Poor Mean/SD	Fair Mean/SD	Good Mean/SD	Very good Mean/SD	Excellent Mean/SD	Poor /Excellent ttest
Child's age (Y)	5.219	5.189	5.220	5.222	5.214	5.216	-
	(0.246)	(0.286)	(0.242)	(0.248)	(0.240)	(0.247)	
Child is a boy	0.511	0.600	0.572	0.559	0.524	0.505	-
	(0.500)	(0.500)	(0.496)	(0.497)	(0.500)	(0.500)	
Weight at birth (kg)	3.399	3.112	3.275	3.333	3.382	3.412	***
	(0.513)	(0.514)	(0.523)	(0.516)	(0.506)	(0.512)	
Child has longstanding illness	0.192	0.800	0.572	0.423	0.261	0.116	***
	(0.394)	(0.408)	(0.496)	(0.494)	(0.439)	(0.320)	
M. has tried breastfeeding	0.703	0.720	0.604	0.657	0.669	0.703	**
	(0.457)	(0.458)	(0.491)	(0.475)	(0.471)	(0.457)	
Age stopped breastfeeding (w)	6.595	11.258	4.351	5.678	6.371	6.911	-
	(13.799)	(17.690)	(11.374)	(12.787)	(13.681)	(13.982)	
M.'s age (year)	34.067	33.200	32.075	32.743	33.853	34.236	***
	(5.771)	(5.370)	(6.211)	(5.824)	(5.728)	(5.702)	
M. is in good health	0.873	0.560	0.686	0.812	0.850	0.906	***
	(0.333)	(0.507)	(0.466)	(0.391)	(0.357)	(0.292)	
M: currently pregnant	0.051	0.000	0.050	0.045	0.056	0.050	-
	(0.221)	(0.000)	(0.219)	(0.208)	(0.230)	(0.219)	
M. has longstanding illness	0.240	0.480	0.409	0.304	0.261	0.214	***
	(0.427)	(0.510)	(0.493)	(0.460)	(0.440)	(0.410)	
M.'s depression index	4.449	6.042	5.471	4.818	4.533	4.296	***
	(1.994)	(3.605)	(2.733)	(2.257)	(1.967)	(1.872)	
M. didn't smoke pregnant	0.761	0.720	0.629	0.726	0.745	0.789	***
	(0.426)	(0.458)	(0.485)	(0.446)	(0.436)	(0.408)	
M.'s nb of cigarettes during preg. (log)	0.450	0.576	0.746	0.530	0.488	0.384	***
	(0.899)	(1.038)	(1.098)	(0.969)	(0.924)	(0.839)	
M. does not smoke	0.722	0.560	0.572	0.642	0.692	0.732	***
	(0.448)	(0.507)	(0.496)	(0.480)	(0.462)	(0.443)	
M. smokes other tobacco products	0.003	0.000	0.006	0.004	0.003	0.004	-
	(0.057)	(0.000)	(0.079)	(0.061)	(0.058)	(0.062)	
M.'s alcohol cons. (scale 0-6)	2.241	1.520	1.629	1.923	2.110	2.359	***
	(1.522)	(1.475)	(1.376)	(1.469)	(1.492)	(1.509)	
Both parents are in HH	0.780	0.640	0.635	0.719	0.768	0.797	***
	(0.414)	(0.490)	(0.483)	(0.450)	(0.422)	(0.403)	
M.'s partner is child's father	0.703	0.640	0.579	0.649	0.685	0.726	***
	(0.457)	(0.490)	(0.495)	(0.478)	(0.465)	(0.446)	
Partner interviewed	0.738	0.720	0.648	0.707	0.718	0.756	***
	(0.440)	(0.458)	(0.479)	(0.455)	(0.450)	(0.430)	
M. is single	0.241	0.480	0.340	0.323	0.266	0.230	***
	(0.428)	(0.510)	(0.475)	(0.468)	(0.442)	(0.421)	
M. became single	0.011	0.040	0.025	0.015	0.010	0.009	*
	(0.106)	(0.200)	(0.157)	(0.122)	(0.101)	(0.096)	
M. is married	0.670	0.520	0.516	0.598	0.649	0.683	***
	(0.470)	(0.510)	(0.501)	(0.491)	(0.478)	(0.465)	
M. became married	0.041	0.040	0.063	0.053	0.046	0.039	**
	(0.198)	(0.200)	(0.244)	(0.223)	(0.210)	(0.194)	
M. is separated	0.034	0.000	0.069	0.039	0.038	0.030	**
	(0.180)	(0.000)	(0.255)	(0.195)	(0.190)	(0.172)	
M. became separated	0.026	0.000	0.044	0.034	0.030	0.024	**
	(0.159)	(0.000)	(0.206)	(0.181)	(0.170)	(0.153)	
M. is divorced	0.053	0.000	0.069	0.036	0.045	0.053	-
	(0.225)	(0.000)	(0.255)	(0.186)	(0.207)	(0.225)	
M. became divorced	0.024	0.000	0.031	0.011	0.021	0.024	-
	(0.153)	(0.000)	(0.175)	(0.106)	(0.144)	(0.152)	
M. is widowed	0.003	0.000	0.006	0.004	0.003	0.003	**
	(0.052)	(0.000)	(0.079)	(0.061)	(0.053)	(0.053)	
M. became widowed	0.001	0.000	0.006	0.000	0.001	0.002	-
	(0.036)	(0.000)	(0.079)	(0.000)	(0.024)	(0.041)	
Financial means index	4.368	4.000	3.830	4.137	4.341	4.458	***
	(0.849)	(0.866)	(0.943)	(0.984)	(0.854)	(0.793)	
Nb. rooms in house	6.049	5.720	5.434	5.720	5.945	6.173	**
	(1.699)	(1.487)	(1.276)	(1.530)	(1.633)	(1.708)	
Whether own the house	0.702	0.560	0.528	0.597	0.679	0.742	***
	(0.458)	(0.507)	(0.501)	(0.491)	(0.467)	(0.437)	

Notes: The first column summarises the socio-economic characteristics at sweep 3. The next five columns summarises the same variables by the child health measured at sweep 4. The last column reports the differences between the variables when the child is in bad health vs. excellent health, and the stars reports the ttest for equality of the means between the two groups. Stars convention: * for $p<0.1$, ** for $p<0.05$, and *** for $p<0.01$.

Table 29: Descriptive statistics: socio-economic characteristics and other controls, overall and by child health (continued)

	Overall Mean/SD	Poor Mean/SD	Fair Mean/SD	Good Mean/SD	Very good Mean/SD	Excellent Mean/SD	Poor /Excellent ttest
Annual income <£1600	0.009	0.000	0.013	0.014	0.005	0.011	***
	(0.095)	(0.000)	(0.115)	(0.117)	(0.074)	(0.104)	
Annual income [£1600-£3100]	0.134	0.217	0.221	0.193	0.142	0.110	***
	(0.341)	(0.422)	(0.417)	(0.395)	(0.349)	(0.313)	
Annual income [£3100-£10400]	0.266	0.391	0.403	0.319	0.283	0.238	**
	(0.442)	(0.499)	(0.492)	(0.466)	(0.451)	(0.426)	
Annual income [£10400-£20800]	0.244	0.087	0.255	0.231	0.261	0.252	**
	(0.430)	(0.288)	(0.437)	(0.422)	(0.439)	(0.434)	
Annual income [£20800-£52000]	0.239	0.130	0.107	0.181	0.230	0.259	***
	(0.426)	(0.344)	(0.311)	(0.386)	(0.421)	(0.438)	
Annual income >£52600	0.108	0.174	0.000	0.062	0.078	0.130	-
	(0.310)	(0.381)	(0.000)	(0.242)	(0.277)	(0.341)	
Nb. people in HH	4.228	3.880	4.333	4.220	4.186	4.186	-
	(1.142)	(0.881)	(1.310)	(1.221)	(1.094)	(1.116)	
Nb. siblings in HH	2.322	2.120	2.516	2.313	2.291	2.289	-
	(0.988)	(0.666)	(1.124)	(1.010)	(0.937)	(0.993)	
Nb. natural siblings	1.233	1.160	1.277	1.266	1.231	1.236	-
	(0.423)	(0.374)	(0.449)	(0.442)	(0.422)	(0.425)	
Grand-parents in the HH	0.032	0.040	0.031	0.047	0.039	0.026	-
	(0.177)	(0.200)	(0.175)	(0.212)	(0.193)	(0.160)	
Freq. sees grand-parents (0-5)	3.299	3.360	3.535	3.340	3.374	3.333	-
	(1.335)	(1.524)	(1.377)	(1.402)	(1.316)	(1.290)	
M. has A level	0.110	0.200	0.094	0.068	0.111	0.117	-
	(0.313)	(0.408)	(0.293)	(0.251)	(0.314)	(0.321)	
M. has diploma in higher educ.	0.106	0.040	0.044	0.090	0.101	0.114	-
	(0.308)	(0.200)	(0.206)	(0.287)	(0.301)	(0.318)	
M. has first degree	0.160	0.120	0.050	0.103	0.136	0.180	***
	(0.366)	(0.332)	(0.219)	(0.304)	(0.343)	(0.385)	
M. has higher degree	0.047	0.000	0.013	0.043	0.044	0.051	-
	(0.212)	(0.000)	(0.112)	(0.203)	(0.205)	(0.221)	
M. has job	0.607	0.320	0.421	0.535	0.614	0.646	***
	(0.488)	(0.476)	(0.495)	(0.499)	(0.487)	(0.478)	
M. hours works per week	14.567	7.240	9.981	12.998	14.528	15.860	***
	(14.416)	(11.399)	(13.705)	(14.458)	(14.297)	(14.380)	
M.'s life satisfaction (1-10)	7.628	6.609	7.098	7.279	7.467	7.804	***
	(1.852)	(2.518)	(2.012)	(1.915)	(1.824)	(1.773)	
P. has job	0.682	0.680	0.553	0.619	0.661	0.712	***
	(0.466)	(0.476)	(0.499)	(0.486)	(0.474)	(0.453)	
P. hours works per week	29.287	29.200	25.032	25.976	28.103	30.672	***
	(21.814)	(22.011)	(24.219)	(21.848)	(21.739)	(21.279)	
White	0.894	0.800	0.836	0.839	0.891	0.920	***
	(0.308)	(0.408)	(0.371)	(0.368)	(0.311)	(0.272)	
Asian	0.048	0.080	0.082	0.086	0.052	0.031	-
	(0.214)	(0.277)	(0.275)	(0.281)	(0.223)	(0.174)	
Black	0.018	0.080	0.025	0.026	0.017	0.016	-
	(0.133)	(0.277)	(0.157)	(0.160)	(0.127)	(0.124)	
Other background	0.040	0.040	0.057	0.049	0.040	0.033	***
	(0.196)	(0.200)	(0.232)	(0.216)	(0.196)	(0.180)	
England	0.607	0.720	0.566	0.614	0.595	0.603	-
	(0.489)	(0.458)	(0.497)	(0.487)	(0.491)	(0.489)	
Wales	0.163	0.120	0.195	0.156	0.169	0.171	-
	(0.369)	(0.332)	(0.397)	(0.363)	(0.374)	(0.376)	
Scotland	0.129	0.000	0.094	0.122	0.128	0.131	*
	(0.335)	(0.000)	(0.293)	(0.328)	(0.334)	(0.338)	
Northern Ireland	0.101	0.160	0.145	0.109	0.109	0.096	-
	(0.301)	(0.374)	(0.353)	(0.312)	(0.311)	(0.294)	
Observations	1,0280	25	159	533	1,756	4,209	

Notes: The first column summarises the socio-economic characteristics at sweep 3. The next five columns summarises the same variables by the child health measured at sweep 4. The last column reports the differences between the variables when the child is in bad health vs. excellent health, and the stars reports the ttest for equality of the means between the two groups. Stars convention: * for $p<0.05$, ** for $p<0.01$, and *** for $p<0.001$.

As grandparents may play a important role in the child's development, we control for the frequency at which they see the MCS child. The variable ranges from 0 for not at all or dead, to 5 for almost every day or everyday. Only 3.2% of the grandparents live in the same household as the MCS child but the children in the sample still see their grandparents more than once or twice a week (score of 3 on average). Grandparents' presence is not associated with difference in child health.

A higher educational degree than a first degree is only held by 4.7% of the mothers and their child is more likely to be in a very good health. 16% of the sample have a first degree and similarly are more likely to have children in better health. By contrast, mothers with an A-level, who represent 11% of the sample, are more likely to have a child in poor health. 60.7% of the mothers currently have a job, but work on average 14.6 hours per week. Mother's life-satisfaction is on average of 7.6 on a range from 1 to 10, and it is positively correlated with the child health.

68.2% of the mothers have a partner who has a job. The majority (89.4%) of the MCS children is White, among which 92% are in excellent health. Other background, including Asian, Black and any mix origins, are more likely not to be in excellent health. Children in England and Northern Ireland tend to be in worse health than children in Wales and Scotland.

3.3.2 Unconditional correlations

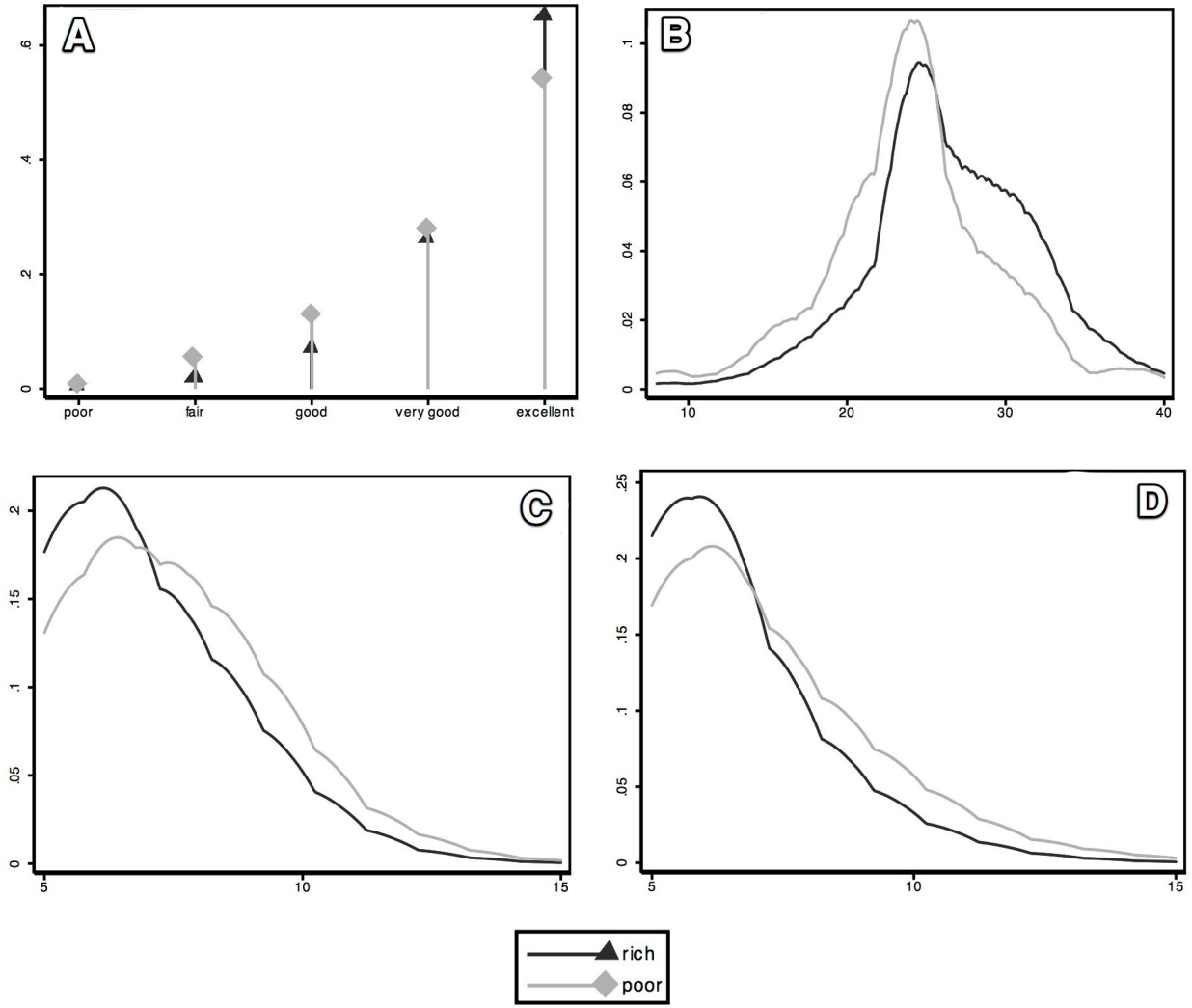
We start by presenting some simple correlations between the outcomes of interest, the different parenting style measures and the socio-economic variables.

3.3.2.1 Child outcomes and socio-economic variables

The literature has shown associations between income and various children's outcomes. For example, parents with higher income have children who perform better in school, and have better mental and physical health (Currie, 2009, Currie and Stabile, 2003). Figure 4 illustrates that similar associations are found in our data in terms of parents' financial means.[82] In the first graph (A), we see that the proportion of healthy children as reported by the parents is much higher in the wealthier group. The wealthier parents are also associated with a higher children's distribution of the cognitive ability score (graph B), lower externalising behavioural problems (graph C) and child emotional symptoms (graph D).

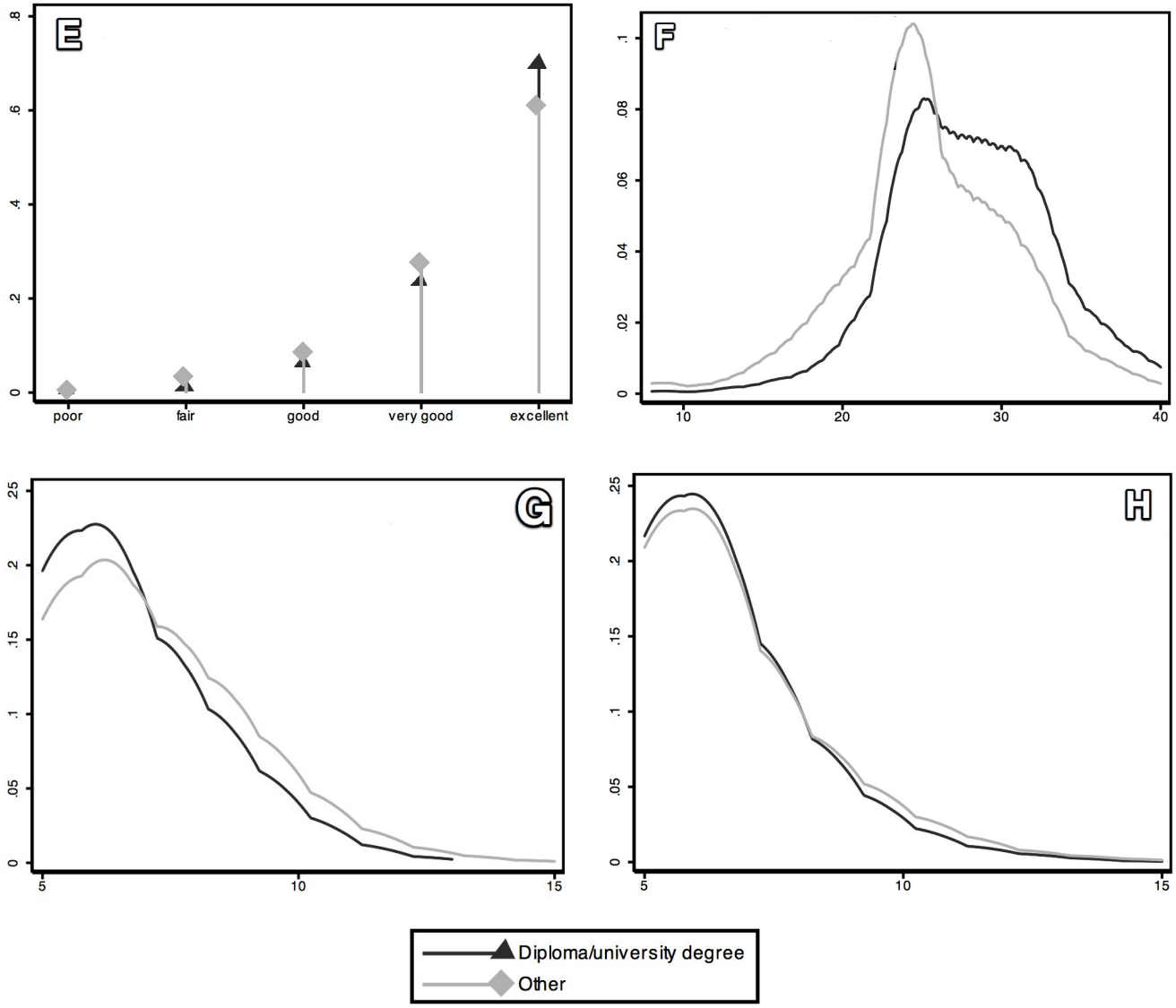
[82]We construct an indicator of financial means as the positive answers to: the child has a waterproof coat, the child has at least two pairs of shoes, family can afford holiday, mother has some money left to spend for herself, and she has money for special occasions. Child Parents belong to the wealthy group when their financial means index is 4 or above.

Figure 4: Parent's income and children's outcomes



Notes: The child's outcomes are reported for sweep 4 (age 7) and the financial means index at sweep 3 (age 5). Figures A, B, C and D represent the child health, cognitive ability, external behavioural problems and emotional symptoms by their parents' financial means, respectively.

Figure 5: Parent's education and children's outcomes



Notes: The child's outcomes are reported for sweep 4 (age 7) and the financial means and education indices at sweep 3 (age 5). Figures E, F, G and H represent the child health, cognitive ability, external behavioural problems and emotional symptoms by the mother's education, respectively.

Figure 5 represents the relationship between the mother's education and the same children outcomes. Mothers with a high educational degree, defined as having a diploma in higher education or more, have children in better physical health (graph E), who perform better in school (graph F), less externalising behavioural problems (graph G), and slightly less emotional symptoms (graph H).

3.3.2.2 Parenting style and socio-economic variables

We start by describing how our parenting style measures are correlated with the main socio-economic measures. The correlations are reported in Table 30.

First, marital status is significantly correlated with certain measures of mother's involvement. For example, married mothers are more likely to read with the child, but less likely to have some artistic activities with the child. Divorced and separated mothers have the opposite correlations. Married mothers are also more likely to reason with a naughty child and less likely to ignore him. Finally, they are also more likely to impose regular breakfast and bed times. Divorced mothers are generally less likely to be involved with the child nor to supervise him. Second, financial means is significantly positively associated with all the involvement measures, except artistic activities. Higher financial means is positively associated with reasoning with a naughty child, and negatively associated with all the other punishment methods. Similar to married mothers, household with higher financial means are also associated with a healthier lifestyle for their child. Third, working mothers, similar to mothers with some educational degrees, are more likely to spend time reading to their child. However, working mothers are less likely to be involved with their child in general. However, there is no significant correlations between a working mother, or the amount she works, and strictness. Forth, White women are more likely to be involved and strict. Finally, non-smoking mothers are more likely to reason with naughty children, but less likely to be very strict, and are more likely to impose a healthy lifestyle to their child. Similarly, mothers who consume alcohol are also more likely to reason with a naughty child and to impose a healthy lifestyle.

3.3.2.3 Parenting style and children outcomes

As emphasised in the psychology literature, strong correlations exist between parenting style and children outcomes. These are reported in Table 31. For example, children in better health are more likely to have involved parents, and less likely to have parents using numerous punishment measures. BMI is however not correlated with parenting practices. Externalising behavioural problems are associated with restrictive parents,

Table 30: Correlations of parenting style and socio-economic status

	(1) **M. is married**	(2) **M. is separated**	(3) **M. is divorced**	(4) **Financial means index**	(5) **Nb. people in HH**	(6) **M. has job**	(7) **M. hours works per week**	(8) **M. has A level**	(9) **M. has diploma in higher educ.**	(10) **M. has first degree**	(11) **M. has higher degree**	(12) **White**	(13) **Asian**	(14) **Black**	(15) **M. does not smoke**	(16) **M.'s alcohol cons.**
Prop. to read with child	0.092***	-0.022*	-0.038***	0.107***	-0.065***	0.051***	0.035***	0.034***	0.045***	0.095***	0.049***	-0.000	-0.004	-0.007	0.107***	0.017
Prop. to do art with child	-0.092***	0.027**	0.006	-0.031**	-0.011	-0.040***	-0.025*	-0.001	-0.002	-0.056***	-0.022*	0.030**	-0.035***	0.000	-0.080***	-0.011
Prop. to do physical act. with child	-0.011	-0.015	-0.029**	0.035***	-0.022*	-0.011	-0.027**	-0.011	0.001	-0.020*	0.001	0.026**	-0.029**	-0.010	0.002	0.010
Prop. to play with child	0.005	-0.029**	-0.025*	0.054***	-0.083***	0.015	0.020*	0.018	0.017	-0.009	0.015	0.088***	-0.056***	-0.072***	0.002	-0.008
Total 'involvement' practices	-0.010	-0.013	-0.038***	0.077***	-0.128***	-0.017	-0.029**	0.020*	0.024*	0.037***	0.030**	0.081***	-0.060***	-0.063***	0.009	-0.003
Prop. to reason naughty child	0.081***	-0.004	0.002	0.106***	-0.015	0.075***	0.063***	0.037***	0.015	0.096***	0.045***	0.049***	-0.058***	-0.016	0.072***	0.087***
Prop. to shout at child	0.009	-0.010	-0.023*	-0.025*	0.025*	0.006	-0.016	0.004	-0.015	-0.062***	-0.043***	0.020*	-0.011	0.003	-0.017	0.026**
Prop. to take away treats from naughty child	-0.034***	0.018	-0.022*	-0.030**	-0.006	0.004	0.010	0.016	0.003	-0.053***	-0.024*	0.043***	-0.054***	-0.002	-0.049***	-0.010
Prop. to ignore naughty child	-0.042***	0.015	-0.004	-0.039***	0.000	-0.010	-0.013	-0.001	0.001	-0.010	-0.004	0.010	0.004	-0.008	-0.047***	-0.005
Total 'strictness' practices	-0.005	0.016	-0.024*	-0.017	-0.020*	0.016	0.012	0.041***	0.015	0.029**	0.019	0.063***	-0.074***	-0.032**	-0.033**	0.089***
Goes to bed regularily (0-3)	0.053***	-0.004	-0.016	0.081***	-0.036***	0.024*	0.011	0.037***	0.022*	0.071***	0.016	0.024*	0.001	-0.058***	0.070***	0.022*
Nb. of breakfast per week	0.094***	-0.039***	-0.017	0.103***	0.004	0.057***	0.053***	0.041***	0.015	0.078***	0.026**	0.034***	-0.039***	-0.014	0.103***	0.070***
Observations	10,281															

Notes: Correlations reported for sweep 3. Stars convention: * for p<0.05, ** for p<0.01, and *** for p<0.001.

and only reasoning with a naughty child appears to be negatively related with those problems. Contrarily, internalising problems reported by the child are significantly correlated with the lack of the mother's involvement with her child, and mothers who ignore their naughty child increase their malaise. Finally, cognitive ability reported by the teacher is significantly positively correlated with the propensity of the mother to read with her child, but negatively with the other involvement measures such having some artistic activity or physical activity with the child. Reasoning with the child instead of taking away treats from him, as well as healthy lifestyle, are positively associated with the child's cognitive abilities.

Table 31: Correlations of parenting style and child outcomes

	(1) Child health	(2) BMI (interviewer)	(3) Externalising behaviour	(4) Hyperactivity	(5) Internalising behaviour	(6) Internalising behaviour (child rep.)	(7) Cognitive ability (teacher)
Prop. to read with child	0.050***	-0.001	-0.095***	-0.091***	-0.025*	-0.008	0.109***
Prop. to do art with child	-0.013	0.008	-0.001	0.011	0.030*	-0.027*	-0.032*
Prop. to do physical act. with child	0.036**	0.009	0.008	0.005	-0.026*	-0.036**	-0.038*
Prop. to play with child	0.032**	-0.001	-0.016	-0.028*	-0.000	-0.040**	-0.008
Total 'involvement' practices	0.038**	0.020	-0.081***	-0.050***	0.007	-0.065***	0.006
Prop. to reason naughty child	0.042***	-0.018	-0.050***	-0.045***	-0.050***	0.020	0.083***
Prop. to shout at child	0.001	0.012	0.124***	0.073***	0.022	0.008	0.000
Prop. to take away treats from naughty child	-0.006	-0.003	0.113***	0.090***	0.007	-0.006	-0.059***
Prop. to ignore naughty child	-0.031*	-0.034**	0.128***	0.069***	0.058***	0.029*	-0.025
Total 'strictness' practices	-0.028*	-0.011	0.295***	0.219***	0.117***	0.066***	-0.017
Goes to bed regularily	0.063***	-0.061***	-0.094***	-0.089***	-0.055***	0.018	0.110***
Nb. of breakfast per week	0.060***	-0.072***	-0.079***	-0.070***	-0.079***	0.001	0.103***
Observations	10,281						

Notes: Correlations reported for sweep 3. Child health is a binary variable equal to 1 if the child is in good, very good or excellent health, and 0 otherwise. Stars convention: * for $p<0.05$, ** for $p<0.01$, and *** for $p<0.001$.

3.4 Estimation Methods

Our objective is to understand the role of parenting style in the child's development, particularly of physical and mental health. We start with a simple child health production function to understand the correlations between parenting style and the different outcomes of interest. Second, we want to understand the role of unobserved heterogeneity and reverse causality in this relationship. We therefore investigate different specification to see how sensitive our results are. Third, we investigate the robustness of the results to possible reporting bias by replacing mothers reported outcomes and parenting style by measures reported by someone else. We use child's health outcomes reported by the teacher and the child, and parenting style reported by the siblings. Fourth, we include in our main specification the partner's presence to get some estimates of the effect of the role of the male figure. Finally, as we have assumed that parenting style may be a pathway through which socio-economic factors affect the child's health, we compare

how the effect of socio-economic factors varies over the different methods, and how it varies within different socio-economic subgroups.

3.4.1 Ordinary least squares and probit cross-section models

We start with a simple model where a mother choses her parenting style P_{ia} to maximise at age a her current utility $U(P_{ia}, H(P_{ia}, X_{ia}^H, \mu_{ia}^H), X_{ia}^U, \mu_{ia}^U)$ which depends on the child's health H_{ia}, P_{ia}, and some observable X_{ia}^U and unobservables exogenous factors μ_{ia}^U. The child's health is affected by his mother's parenting style P_{ia} as well as observable X_{ia}^H and unobservables μ_{ia}^H covariates. In this simple framework, everything is measured simultaneously at the age a for child i.

When the mother solves her maximisation problem, her optimal parenting style $P_{ia} = P^*(X_{ia}^H, X_{ia}^U, \mu_{ia}^H, \mu_{ia}^U)$ is a function of all the observables and unobservable covariates, and the child's health $H_{ia} = H(P_{ia}^*(X_{ia}^H, X_{ia}^U, \mu_{ia}^H, \mu_{ia}^U), X_{ia}^H, \mu_{ia}^H)$ can be expressed as a function of the current optimal parenting style. The child's health production function can then be estimated as

$$H_{ia} = \beta_0^{OLS} + P_{ia}^* \beta_P^{OLS} + X_{ia}^H \beta_X^{OLS} + \mu_{ia} \tag{42}$$

where the outcome H represents physical health, mental health, or behavioural problems and is measured for the child i at age a.[83] We first estimate equation (42) for ages $a = 5, 7$ using ordinary least squares (OLS). This approach gives us an idea of the different conditional correlations between the parenting style measures and the outcomes captured by the β_P^{OLS}. As we separately analyse total mother's involvement and punitive measures, and specific measures of parenting style, P^m is either a two-dimensional vector that reports the total of mother's involvement and rules or a vector of eight[84] specific mother's rearing practices.

The child physical health is captured by a binary variable which is equal to one if the child is in good, very good or excellent health, and zero otherwise. We define the underlying child health as

$$H_{ia}^* = \beta_0^{latent} + P_{ia}^* \beta_P^{latent} + X_{ia}^H \beta_X^{latent} + \mu_{ia} \tag{43}$$

where H_{ia}^* is the continuous latent child physical health. As we observe $H_{ia} = 1$ if

[83] We also analyse the role of parenting style on cognitive ability in which case H represents cognitive ability, but as our main focus is health outcomes, we present the regressions in terms of health production functions.

[84] Or ten when including the lifestyle related parenting practices.

$H^*_{ia} > 0$ or $H_{ia} = 0$ if $H^*_{ia} \leqslant 0$ we can estimate

$$\begin{aligned} Pr(H_{ia} = 1) &= Pr(\beta_0^{latent} + P^*_{ia}\beta_P^{latent} + X^H_{ia}\beta_X^{latent} + \mu_{ia} > 0) \quad (44) \\ &= F(\beta_0^{latent} + P^*_{ia}\beta_P^{latent} + X^H_{ia}\beta_X^{latent}) \quad (45) \end{aligned}$$

where $F(\cdot)$ is the cumulative distribution function of $-\mu_{ia}$. We assume that it follows a standard normal distribution.

3.4.2 Unobserved heterogeneity and reverse causality

From a policy point of view, it is important to know whether and to what extent these effects can be causal. The identification of the causal effect is difficult using survey data. Unmeasured variables, such as parental skills may be correlated with the child's outcomes as well as parenting style. If these unobservable variables are not accounted for, the estimated effects will be biased estimates of the true causal effect. Therefore, we progressively control for these unobservable confounding factors to get closer to causal estimates.

The unbiasedness of the β_P^{OLS} coefficients relies on strong assumptions. The error term can be decomposed such that $\mu_{ia} = \varepsilon_{ia} + \eta_i$ where ε_{ia} contains the time-varying unobservable characteristics such as abilities, and η_i the unobservable time-invariant characteristics such genetic endowment. We refer to η_i as the family effect, but as we observe one child by family and natural mothers only, it is equivalent to a child's or mother's fixed effect. Equation (42) can be expressed as

$$H_{ia} = \beta_0^{FE} + P^*_{ia}\beta_P^{FE} + X^H_{ia}\beta_X^{FE} + \varepsilon^H_{ia} + \eta^H_i \ . \quad (46)$$

If the fixed component of the error term is correlated with the parenting style variable P_{ia}, the estimated coefficients β_P^{OLS} will be biased. One can think of various reasons for which this would be the case, such as genetic endowment, or mother's or child's characteristics that affect the mother's parenting style and the outcomes. Family's beliefs or other family's characteristics could also be an issue like a residence close to a noisy road could affect the mother's parenting style, and at the same time the noise could have a detrimental effect on the child. Depending on the direction of the effects, the coefficients over- or under-estimate the causal effects.

We allow for fixed unobserved heterogeneity by using a fixed effect (FE) model that removes the fixed effects by taking the first age differences. We performed Hausman tests that rejected the null hypothesis that the random effect model provides consistent estimates. For the child physical health that is measured as a binary variable, we use

a FE logit that can be estimated using the conditional maximum likelihood estimator (Cameron and Triverdi, 2005). FE probit cannot be estimated due to the problem of incidental parameters (Neyman and Scott, 1948).

The FE approach is common and straightforward to implement, but has three major weaknesses. First, it does not allow us to estimate the coefficients of the variables that are constant over time (e.g. gender), as it removes these variables from the equation when taking the first differences. Second, it cannot be estimated if there is too little variation in parenting style or in the child's outcome. Finally, simultaneity and reverse causality are potentially still an issue.

Very little attention has been given in the parenting style literature to simultaneity. The bulk of the studies on the parent-child relationship has been conceptualised as a flow from the parents to their children. It is unlikely however to be a uni-directional process, but rather a process where the children are also active agents (see Maccoby and Martin, 1983, Kuczynski, 2003 among others). For example, a disciplinary correction is often triggered by a child's inappropriate behaviour. Research such as Cunha and Heckman (2008) and Cunha et al. (2010) emphasise the importance of unobserved child-specific endowments that affect the inputs' effects. Based on five parenting style domains, Grusec (2010) illustrates that the optimal parenting style to favour the child's socialisation process should be in response to the child's behaviour. This bidirectionality of the relationship creates an endogeneity problem.

The simultaneity problem is reduced if we assume that parenting style does not have an immediate effect on the child's health, but only in the next period so that the health production function is now $H(P_{ia-1}, X^H_{ia}, \mu^H_{ia})$. Optimal parenting style, given sufficient separability in preferences, is now $P_{ia} = P^*(X^H_{ia+1}, X^U_{ia}, \mu^H_{ia+1}, \mu^U_{ia})$ so that the mother chooses her parenting style as function of the current covariates that affect her utility as well as the anticipated factors that affect her child's health.

With parenting style assumed to have only a lagged effect on the child's health, the estimated health production function becomes

$$H_{ia} = \beta_0^{LAG} + P^*_{ia-1}\beta_P^{LAG} + X^H_{ia}\beta_X^{LAG} + \mu^H_{ia} \tag{47}$$

where a is measured at the age of 7 (sweep 4) and $a-1$ at the age of 5 (sweep 3).

The unbiasedness of equation (47) relies among others on the assumption that there is no unobserved factor affecting the child health at age a and parenting style at age $a-1$. If this assumption is violated, this possible unobserved heterogeneity can be taken into account either using a two-step approach that exploits exogenous variation in the parenting style variables that are independent of the children's future outcome, or by

estimating jointly the parenting style and the health production function. The former approach requires instrumental variables to estimate in a first step the optimal parenting style. However, the validity of instrumental variables requires that they do not influence the child's health apart from an indirect effect via parenting style. For example, a good instrument would be whether the mother has attended parenting classes that discuss the benefit of certain rearing practices. However, such information is not available in the data, and related variables such as the presence of the mother's mother to help her in her household management could have a direct effect on the child's wellbeing. As it is difficult to find a variable that is a robust instrument, we implement the approach that relies on identification on the structural form. This identification strategy has been introduced by Contoyannis and Jones (2004a) and further developed by Balia and Jones (2008) to disentangle physical health, morbidity, mortality and lifestyle. Parallels can be drawn to disentangle here parenting style and children's outcomes.

Contoyannis and Jones (2004a) show that the model can be empirically specified in a recursive form with a reduced form equation for parenting style (lifestyles in their case), and a structural form for the child's production function (the individual's health production function in their case). In this specification, the endogeneity of parenting style comes from unobservable heterogeneity, and not from a direct effect of child's outcome on parenting style as parenting style is assumed to have a delayed effect on the outcome. To illustrate the unobserved heterogeneity problem, let us formulate the child's health production function and the parenting style equation as

$$H_{ia} = \beta_0^{REC} + P_{ia-1}\beta_P^{REC} + X_{ia}^H\beta_X^{REC} + \mu_{ia}^H \quad (48)$$

$$P_{ia-1} = \alpha^{REC} + X_{ia-1}^P\alpha_X^{REC} + \mu_{ia-1}^P \quad (49)$$

As before, the child's health H_{ia} is either a measure of physical or mental health. Parenting style P_{ia} is a vector of two dimensions when we analyse total involvement and total strictness, or a vector of eight measures of parenting style when we look at the specific practices, or of ten when we include two parenting style aspects related to the child's lifestyle. By estimating the system of equations jointly, we are able to take into account the the unobserved heterogeneity and the endogeneity of the parenting style measures in the health equation.

Depending on the health outcome of interest, the dependant variable H_{ia} can either be cardinal (e.g. hyperactivity index) or binary (e.g. whether the child is depressed as reported by the teacher). The errors terms of the equations have a multivariate normal distribution $\mu_i \sim MVN(0, \Sigma)$ where Σ is the correlation matrix of the multivariate normal. As only the final stage, that is the health outcome equation (48),

is fully specified, the system of equation can be estimated by maximum simulated likelihood, and the evaluation of the multidimensional integral can be implemented using the Geweke–Hajivassiliou–Keane (GHK) simulator (Hajivassiliou et al., 1996).[85]

Identification only requires variations in the set of exogenous regressors and exclusion restrictions are not necessary, so that identification is by functional form. Nevertheless, as the identification relies on the assumption of multivariate normality and exclusion restrictions are often used to improve identification (Jones, 2006), we include additional covariates in the parenting style equations that are summarised in the Appendix B.1 in Table 82. First, we include variables related to the mother's life experience before she had the MCS child (whether her own parents have ever lived together, whether they divorced, and whether she left home before age 17). We assume that these events could have an effect on her character and thus her parenting style, but not directly on her child's health. Second, we include more information on the type of work she does (whether she is self-employed, whether she is a manager or a supervisor at work, whether she works from home or at night, the number of days per week she works, whether she works at night), controlling for whether the mother works and the number of hours she works in both equations. The same type of information is included for the partner if he is present assuming his level of stress also affects the mother's parenting style (whether he is self-employed and whether he is a manager or a supervisor at work). The argument, similar to Burton et al. (2002), is that if a mother works, she will have less time to take care of her child which directly influences his health. However the type of works she does, such as being an employer, a manager or self-employed, certainly affects her attitude at home and thus her parenting style. Third, we include information on the mother's personality traits such as whether she spends time with friends, has a religion and attends religious meetings, as these aspects may affect her values and thus her parenting style. Finally, we also control for whether the mother and partner disagree on child's related issues.

3.4.3 Robustness checks

3.4.3.1 Reporting bias

The main measures of child health and parenting style used to estimate the health production functions are reported by the mother. However, the mother may introduce a systematic reporting bias. In order to estimate the importance of the bias, we use alternative outcomes of the child's physical and mental health that are not reported by the mother. For physical health, we consider the child's BMI measured the by

[85]In practise, we implement the regressions in STATA using the "cmp" command.

interviewer, and for the mental health, we analyse measures reported by the school teacher. Similarly, we use parenting style reported by the older siblings.

3.4.3.2 Role of the father

Most of the literature on parenting style has focused on the mother's parenting style, and very little is known about the role of the father. However, it is important to know whether the father's parenting style also plays a role in the child's health production function. We are not able to distinguish between a complementary or substitute role of the father to the mother's parenting style because of the lack of information on the father within the family, but can assess the sensitivity of our results to the inclusion of the father's role. We replicate our results (equations (48) and (49)) to account for the involvement of the mother's partner. Our system of equations becomes:

$$H_{ia} = \beta_0^{PAR} + P_{ia-1}^{*}\beta_P^{PAR} + X_{ia}^{H}\beta_X^{PAR} + Partner_{ia-1}\beta_X^{PAR} + \mu_{ia}^{H} \quad (50)$$

$$P_{ia-1} = \alpha^{PAR} + X_{ia-1}^{P}\alpha_X^{PAR} + \mu_{ia-1}^{P} \quad (51)$$

where $Partner_{ia-1}$ captures the father's role in the health production function (this variable is described in the last part of Section 3.3.1.2). Although all our results account for the presence of a partner, whether this partner is the child's father, and his working status to proxy his available time for the family, the inclusion of the partner's involvement allows us to see whether the effect of the mother's parenting style depends on the partner's role.

3.5 Results

3.5.1 Mother's parenting style and children's outcomes

For each estimation method, we present in the first column the results using the total involvement and total strictness indices. This allows us to capture parenting style in the same way as it has been done in the literature. Then, in the following columns of each estimation approach, we use the specific measures of parenting style. For each of the physical and mental health outcomes, we present the results of the pooled probit or OLS (equation (42)). Then, we attempt to account for unobserved heterogeneity using FE in columns 3 and 4 (equation (46)) for the same measures of parenting style.[86] In

[86]For the child physical health measured as a binary variable, the recursive system of equations, which is our most robust method, can only be estimated using a probit specification. Therefore, all

columns 5 and 6, we start by addressing the problem of simultaneity using parenting style reported at age 5 and the child's outcome at age 7 (equation (47)). Finally, we account for simultaneity and unobserved correlations (equations (48) and (49)) in columns 7-9. Column 7 and 8 report the results using indices and the different measures of parenting style, respectively, and controlling for the parenting style related to the child's lifestyle but assuming they are exogenous (frequency of breakfast per week, and going to bed regularly). Finally, column 9 includes the child health related activities as additional endogenous parenting style measures. We describe each outcome in details below. We refer to the mother as "she" and to the child as "he".

In each estimation of the health production function, we control for the child's age and gender, his weight at birth, whether he has any longstanding illness, whether the mother tried breastfeeding him and at which age (in weeks) she stopped, mother's age and age squared, whether she reports having a good health, whether she is currently pregnant, whether she has any longstanding illness or is depressed, the number of cigarettes she smoked during pregnancy, whether she currently smokes cigarettes or any other tobacco products, her frequency of alcohol consumption, whether both parents live in the household and whether the mother's partner is the MCS child's father, the mother's marital status and any change since last interview, the household income range and whether they own their house, the mother's highest educational degree, her and her partner's job status, the size of the household and the presence of grandparents, the mother's life satisfaction, the child's origin, where they live in the UK, and a sweep dummy for the last interview when we pool the data over sweeps 3 and 4.

In the models for parenting style, we control for the same regressors, as well as the additional variables (working responsibilities, previous life experiences, religious views, quality of relationship between parents) described in details at the end of Section 3.4.2 to improve the identification of the recursive system of equations.

3.5.1.1 Physical health

The analysis of parenting style and the child's probability to be in good health is reported in Table 32, and the full set of results with the whole set of covariates for some of the selected health regressions is presented in Appendix B in Tables 83 and 84. The models are estimated using probit and logit fixed effect and the average marginal effects are reported.[86]

the other methods use probit for comparison, except the FE model which can only be estimated using FE logit.

Table 32: Child physical health (probability to be in good health)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Probit		**FE Logit**		**Probit**		**Recursive specifications (P)**		
	PS S3,4		PS S3,4		Health S4, PS S3		Health S4, PS S3		
Total 'involvement' practices	0.000		0.006		0.000		-0.003		
	(0.000)		(0.015)		(0.000)		(0.004)		
Prop. to read with child		-0.001		-0.132		-0.001		0.201	0.222
		(0.005)		(0.381)		(0.005)		(0.530)	(0.276)
Prop. to do art with child		-0.003		0.032		-0.004		0.386	0.268
		(0.004)		(0.098)		(0.004)		(0.738)	(0.241)
Prop. to do physical act. with child		0.009**		0.089		0.006		-0.327	-0.335
		(0.004)		(0.242)		(0.003)		(0.760)	(0.341)
Prop. to play with child		0.000		0.014		0.002		0.124	0.161
		(0.003)		(0.070)		(0.003)		(0.485)	(0.278)
Total 'rules' actions	0.000		-0.016		0.000		0.005		
	(0.000)		(0.031)		(0.000)		(0.004)		
Prop. to reason naughty child		0.002		0.048		0.002		0.086***	0.011**
		(0.003)		(0.135)		(0.003)		(0.519)	(0.227)
Prop. to shout at child		0.001		-0.077		0.005**		0.179	0.079
		(0.003)		(0.220)		(0.003)		(0.209)	(0.150)
Prop. to take away treats from naughty child		0.004*		0.008		0.006**		0.199**	0.153**
		(0.002)		(0.060)		(0.002)		(0.220)	(0.141)
Prop. to ignore naughty child		-0.001		-0.061		0.001		-0.119	-0.031
		(0.002)		(0.166)		(0.002)		(0.174)	(0.124)
Goes to bed regularily (0-3)	0.000	0.000	-0.038	-0.025	0.000	0.000	0.018***	0.009	-0.044
	(0.001)	(0.001)	(0.073)	(0.072)	(0.001)	(0.001)	(0.004)	(0.015)	(0.056)
Nb. days has breakfast	0.002***	0.002***	0.056	0.034	0.000	0.000	0.004	-0.004	0.155
	(0.001)	(0.001)	(0.086)	(0.087)	(0.001)	(0.001)	(0.003)	(0.012)	(0.064)
N_clust	9,038	9,038	248	248					
N	14,944	14,944	496	496	6,546	6,546	12,061	12,061	12,061
r2	0.251	0.253	0.295	0.317	0.281	0.290			

Notes: S: sweep, PS: parenting style. Child health is dichotomised (0 for poor and fair health, 1 for good, very good or excellent). The results are the average marginal effects at means for the following regressions: columns 1 and 2 are estimated using pooled probit over sweeps 3 and 4. Columns 3 and 4 report the results from fixed effect (FE) logit regressions. Columns 5 and 6 regress child health in sweep 4 on controls in sweep 4 and parenting style in sweep 3 is estimated using probit. The recursive specifications estimate the child health production function for health measured at age 7 (sweep 4) and the reduced form of parenting style measured at age 5 (sweep 3) based on probit. Colums 7 and 8 assume that the overall parenting style indices and the specific measures of parenting style, respectively, are endogenous but not the lifestyle measures. Column 9 allows the parenting style variables as well as the lifestyle variables to be endogenous. Robust standard errors clustered at the family level are given in parenthesis. Stars convention: * for p<.1, ** for p<.05, and *** for p<.01.

First of all, the mother's total involvement and strictness is never significantly correlated with the child physical health in any of the models.

When we look at the specific measures of involvement, first in the naive pooled OLS over sweeps 3 and 4, only physical activity is beneficial to child health. However, this seems to be due to endogeneity as all the other following approaches do not find a significant effect of physical activities on health. The analysis of the specific measures of strictness in the OLS specification suggests that taking away treats from a naughty child is beneficial to his health, whereas the other measures are not significantly correlated with the child physical health. Having breakfast in the morning is positively associated

with the child's health whereas having regular bed times is not correlated with the child physical health.

Theses results are associations and can be quite remote from the causal effects of parenting style on the child's health. A way of capturing unobserved heterogeneity is to keep only the effect of variation around the overall health's mean and parenting style measures' means by including a fixed effect (equation (46)). This is done in columns 3 and 4. The first striking point is that the sample is reduced from 14,944 observations to 496 observations. This is because FE logit can only be identified for the children that have a change in their reported physical health between sweeps 3 and 4.

Although fixed effect is attractive as it removes some of the bias associated with unobservable time-invariant factors, it may not be a good approach to investigate the role of parenting style on the child's health. There is not much variation in parenting style and outcomes over the two sweeps. Table 33 summarises for the measures of parenting style, physical and mental health the changes between sweeps 3 and 4. The child's overall health improves on average by 0.141 on a range of 1 to 5. However, at least 80% of the sample experience, if anything, a change of just one point in their reported physical health. When we look at the change in the probability to be in good health, similarly at least 80% do not change their health status. This suggests very small health shocks at these ages and thus makes difficult the identification of the model using fixed effect.

In order to avoid the problem of simultaneity, columns 5 and 6 present the results where parenting style is measured at sweep 3 when the child is 5 years old and the outcome is measured at sweep 4 when the child is 7 years old. This removes the simultaneity bias if the lagged specification of the health production function is correct.

The various measures of involvement still do not affect the child's health, however the analysis of the specific measures of strictness suggests that shouting at the naughty child and taking away treats may be beneficial for his health. Lifestyle measures are now insignificant.

Finally, simultaneity and unobserved heterogeneity are jointly taken into account in columns 7-9. The results are based on the recursive system of equations ((48) and (49)) which incorporates unobservable heterogeneity affecting both the child's health and the parenting style. Unobserved heterogeneity includes factors that affects the mother's marginal utility of the child's health and parenting style which may be related to preferences, beliefs, or family characteristics including genetics. The difference between this approach and fixed effect is that it allows us to use the overall variation in the mother's parenting style on the child's health, not just the effect of within variation when estimating the effect of parenting style. At the same time, it also addresses the

Table 33: Changes in parenting style and outcome measures between sweeps 3 and 4

	Count	Mean	Std. dev.	Min.	P10	Median	P90	Max.
Child overall health	6,681	0.141	0.823	-4.000	-1.000	0.000	1.000	4.000
Child in good health	6,681	0.011	0.208	-1.000	0.000	0.000	0.000	1.000
Externalising behaviour	6,381	-0.241	1.548	-7.000	-2.000	0.000	2.000	8.000
Hyperactivity	6,323	0.137	1.667	-7.000	-2.000	0.000	2.000	8.000
Internalising behaviour	6,210	0.180	1.514	-8.000	-1.000	0.000	2.000	8.000
BMI	6,574	0.278	1.492	-21.920	-0.901	0.092	1.847	16.126
Prop. to read with child	6,676	-0.023	0.201	-1.000	-0.250	0.000	0.200	1.000
Prop. to do art with child	6,676	-0.047	0.251	-1.000	-0.400	0.000	0.200	1.000
Prop. to do physical act. with child	6,676	-0.028	0.262	-1.000	-0.400	0.000	0.267	1.000
Prop. to play with child	6,676	-0.109	0.283	-1.000	-0.400	-0.100	0.200	1.000
Total 'involvement' practices	6,676	-1.466	2.746	-16.000	-5.000	-1.000	2.000	12.000
Prop. to reason naughty child	6,601	-0.020	0.251	-1.000	-0.333	0.000	0.250	1.000
Prop. to shout at child	6,601	0.032	0.299	-1.000	-0.333	0.000	0.333	1.000
Prop. to take away treats from naughty child	6,601	0.021	0.333	-1.000	-0.333	0.000	0.500	1.000
Prop. to ignore naughty child	6,601	-0.050	0.396	-1.000	-0.500	0.000	0.500	1.000
Total 'strictness' practices	6,601	-0.443	2.231	-11.000	-3.000	0.000	2.000	11.000
Goes to bed regularily	6,682	-0.008	0.835	-3.000	-1.000	0.000	1.000	3.000
Nb. of breakfast per week	6,682	0.067	1.087	-7.000	0.000	0.000	0.000	7.000

simultaneity problem if the lagged specification of the child's health is correct.

As previously observed, total mother's involvement and specific measures of involvement do not affect the child's health. Reasoning with the naughty child and taking away treats are beneficial to his physical health, even when we assume that the parents' lifestyle measures are also endogenous, although the effect is then reduced. There is a difference of 11 percentage points in the probability to report good health between a mother who never reasons her naughty child and a mother who does it as her main strictness measure. The difference is of 15.3 percentage points for taking away treats from a naughty child, again between a mother who never does it and a mother who does it most of the time. Going to bed regularly has a positive effect on the child's health, but the significant effect of the lifestyle measures disappears once we allow them to be endogenous.

The importance of the unobserved heterogeneity can be assessed by looking at the correlation matrix of the error terms of the system of equations. These are reported in Table 34 for the specification in column 9 of Table 33. There is moderate support for endogeneity; only unobservables which affect the propensity to take away treats from naughty children are positively and significantly correlated with unobservables affecting the child's health. It explains why the effect of taking away treats from a naughty child becomes larger once we take into account unobserved heterogeneity. However, having just this aspect correlated with the child's outcome suggests only a moderate gain in estimating the recursive system of equations.

The errors terms in the parenting style equations are strongly related to each other. For example, unobserved factors positively affecting the propensity to read with the child are also positively correlated with the propensity to have some physical activity with the child, to reason with him, ignore or take away treats from the naughty child, to put the child to bed at regular time to give him breakfast regularly, and significantly negatively correlated with the propensity to shout at the naughty child. Parents who have a child who has regularly breakfast in the morning are also more likely to read and play with their child and have some physical activity with him. They are more likely to reason with their naughty child and to put him in bed regularly, but less likely to shout at him or ignore him.

Reporting bias - BMI We now compare these results to the ones obtained when the child's health is not reported by the mother. The other advantage of analysing BMI is that it is also a more objective measure of the child's overall physical health. We analyse the same regressions as in the case of the probability to be in good health, but now use linear models, as the variable is cardinal. The results are presented in Table

Table 34: Correlation of the residuals across the equations (physical health)

	1	2	3	4	5	6	7	8	9	10	11
1 Child physical health	1.000	0.034	-0.062	-0.059	0.079	0.175**	0.104	-0.107	-0.071	0.039	0.043
2 Prop. to read with child	0.034	1.000	-0.146	0.087**	0.051	0.035***	-0.053***	0.032***	0.012***	0.062***	0.037***
3 Prop. to do art with child	-0.062	-0.146	1.000	0.145	0.133***	0.008***	-0.054***	-0.008***	-0.023	0.007***	-0.003
4 Prop. to do physical act. with child	-0.059	0.087**	0.145	1.000	0.261**	0.030	-0.081	0.020***	-0.025***	0.030***	0.020*
5 Prop. to play with child	0.079	0.051	0.133***	0.261**	1.000	-0.006**	-0.064***	0.021*	0.001	0.000	0.011*
6 Prop. to reason naughty child	0.175**	0.035***	0.008***	0.030	-0.006**	1.000	-0.150	-0.029	-0.059	-0.003***	0.010**
7 Prop. to shout at child	0.104	-0.053***	-0.054***	-0.081	-0.064***	-0.150	1.000	0.109***	0.124	-0.014	-0.007***
8 Prop. to take away treats from naughty child	-0.107	0.032***	-0.008***	0.020***	0.021*	-0.029	0.109***	1.000	0.121***	0.030	0.031
9 Prop. to ignore naughty child	-0.071	0.012***	-0.023	-0.025***	0.001	-0.059	0.124	0.121***	1.000	-0.024***	-0.016***
10 Goes to bed regularly (0-3)	0.039	0.062***	0.007***	0.030***	0.000	-0.003***	-0.014	0.030	-0.024***	1.000	0.128***
11 Nb. days has breakfast	0.043	0.037***	-0.003	0.020*	0.011*	0.010**	-0.007***	0.031	-0.016***	0.128***	1.000

Notes: The table reports the correlations between the unobserved error terms of each equation. We report the correlation matrix for the specification where all the specific parenting style measures as well as the lifestyle measures are assumed to be endogenous. Stars convention: * for p<.1, ** for p<.05, and *** for p<.01.

85 in Appendix B.

Before interpreting these results, it is important to note that the estimated effect of parenting style on BMI specified as such does not allow us to assess the beneficial effect of parenting style, but just whether there is any association. BMI for children cannot be directly used to define under-weight or over-weight children, but should be interpreted relative to peers in terms of age and gender. Moreover, a healthy BMI has an inverted U-shape which implies that depending on where the average BMI is, a healthy measure can either be one that reduces or increases the BMI. Therefore, what we want to see here is whether parenting style has any effect on BMI.

The results suggest that very few aspects of parenting style seem to affect BMI, apart from the lifestyle related measures. Overall involvement is significantly positively correlated with the child's BMI when we take into account unobserved heterogeneity, but no specific measure of involvement appears to matter more than another. Strictness generally does not affect BMI. The lifestyle variables have a more consistent effect. Going to bed at a regular time and having breakfast in the mornings reduce BMI, although only the latter remains significant in the endogenous specification (column 9). Its effect is the largest once unobserved heterogeneity is taken into account.

The analysis of the correlation matrix in Table 86 in Appendix B suggests that unobservable factors affecting BMI are also positively correlated with unobservable factors affecting the mother propensity to read with the child and to reason with naughty child, but negatively with the propensity to have some artistic activities with the child. However, while the unobserved heterogeneity seems to be more of an issue in the case of BMI, there remains little effect of parenting style on the child's BMI.

In summary, in the case of physical health, the effects of parenting style are quite weak and endogeneity of parenting style appears not to be a crucial issue. These results are comparable to Belsky et al. (2006) who find a significant correlation between parenting style and children's health at the age of six, but the significance of the results disappear once they control for the socio-economic factors. The weak association we find between parent practices and BMI is supported by Gibson et al. (2007) and Wake et al. (2007) who find no association between childhood obesity and a broad range of family factors and mother's parenting style. This may explain why parenting style has attracted so little attention in the health literature.

Is parenting style a pathway between socio-economic factors and children's physical health? The final aspect to analyse is the role of socio-economic factors and whether accounting for parenting style explains some of this relationship.

Tables 83 and 84 in Appendix B report the average marginal effects of the full set

of controls when we do not control for parenting style, and for the pooled specification in columns 1 and 2 in Table 32 when we do. The probability to be in good health is positively associated with birth weight, and unsurprisingly negatively related to the presence of longstanding illnesses. The age of the mother is not significant, but her health is positively associated with her child's health. The cigarette consumption of the mother is not associated with the child's health, but the child is more likely to be in better health if she smokes another tobacco product than cigarettes. High annual income is positively associated with the child's health, although owning her own house is negatively associated with the child's health. More educated mothers have children in significantly better health. The three sets of estimates of the effect of socio-economic variables are almost identical suggesting that parenting style does not explain the association between socio-economic factors and children's physical health.

3.5.1.2 Externalising behavioural problems

We now investigate the relationship between rearing practices and externalising behavioural problems. Table 35 reports the results for the various regressions. The results are robust throughout the different methods. The mother's total involvement is beneficial to the child and reduces his behavioural problems. Although having some artistic activity with the child and some physical activity reduce his behavioural problems, only reading to the child has a consistent effect throughout the different approaches, and its effect is much stronger once we account for unobserved heterogeneity. A mother who mostly reads to her child compared to a mother who never does, reports on average a lower externalising behavioural index of 0.8.

However, many rules increase externalising behavioural problems, and the overall effect is constant even after allowing for endogeneity. The strictness measures that matter are shouting at a naughty child or ignoring him. The negative impact of shouting is twice as big once we take into account unobserved heterogeneity. Mothers who mostly shout compared to mothers who do not shout at their naughty child have children with on average an index of externalising behaviour that is 1.234 larger.

Good lifestyle practices improve the child's behavioural problems. Going to bed regularly compared to not going to bed regularly decreases the index of 0.189. Accounting for the endogeneity of parenting style practices related to lifestyle (column 9) suggests that going to bed regularly is even more important in reducing the hyperactivity problems than when we omit to account for the unobserved heterogeneity.

These results can be compared to those for the hyperactivity index which is

Table 35: Externalising behavioural problems index

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Pooled OLS		**FE**		**Lagged OLS**		**Recursive specifications**		
	PS S3,4		PS S3,4		Health S4, PS S3		Health S4, PS S3		
Total 'involvement' practices	-0.040***		-0.019**		-0.030***		-0.050**		
	(0.005)		(0.008)		(0.008)		(0.021)		
Prop. to read with child		-0.411***		-0.102		-0.399**		-0.806*	-0.748*
		(0.096)		(0.104)		(0.162)		(0.436)	(0.437)
Prop. to do art with child		-0.245***		0.029		-0.205*		-0.138	-0.120
		(0.070)		(0.083)		(0.116)		(0.341)	(0.339)
Prop. to do physical act. with child		0.026		-0.157*		0.115		0.053	0.048
		(0.070)		(0.081)		(0.107)		(0.305)	(0.304)
Prop. to play with child		-0.153**		0.001		-0.064		0.005	0.014
		(0.064)		(0.076)		(0.101)		(0.296)	(0.295)
Total 'rules' actions	0.257***		0.134***		0.189***		0.257***		
	(0.006)		(0.010)		(0.009)		(0.022)		
Prop. to reason naughty child		0.337***		0.169**		0.086		0.393	0.391
		(0.069)		(0.085)		(0.109)		(0.302)	(0.300)
Prop. to shout at child		0.577***		0.114		0.554***		1.243***	1.234***
		(0.053)		(0.070)		(0.078)		(0.229)	(0.228)
Prop. to take away treats from naughty child		0.369***		0.035		0.369***		0.203	0.225
		(0.049)		(0.063)		(0.070)		(0.210)	(0.211)
Prop. to ignore naughty child		0.639***		0.263***		0.400***		0.792***	0.776***
		(0.042)		(0.055)		(0.061)		(0.186)	(0.186)
Goes to bed regularily (0-3)	-0.149***	-0.164***	-0.056**	-0.055**	-0.120***	-0.125***	-0.118***	-0.124***	-0.189**
	(0.019)	(0.020)	(0.026)	(0.026)	(0.028)	(0.029)	(0.028)	(0.028)	(0.082)
Nb. days has breakfast	-0.045***	-0.037**	-0.036*	-0.035	-0.057**	-0.052**	-0.053**	-0.050**	-0.119*
	(0.016)	(0.017)	(0.021)	(0.022)	(0.023)	(0.024)	(0.022)	(0.023)	(0.061)
N_clust	8,918	8,918	8,918	8,918					
N	14,582	14,582	14,582	14,582	6,468	6,468	10,251	10,251	10,251
r2	0.263	0.174	0.078	0.049	0.210	0.164			

Notes: S: sweep, PS: parenting style. Columns 1 and 2 are pooled OLS over sweeps 3 and 4. Columns 3 and 4 report the results from fixed effect (FE) regressions of child health measured in sweeps 3 and 4. Columns 5 and 6 report the results from a regression of the mental health of the child measured in sweep 4 on controls in sweep 4 and parenting style in sweep 3. The recursive specifications estimate the child health production function for mental health measured at age 7 (sweep 4) and the reduced form of parenting style measured at age 5 (sweep 3). Colums 7 and 8 assume that the overall parenting style indices or the specific measures are endogenous, but not the lifestyle measures. Column 9 allows the parenting style variables as well as the lifestyle variables to be endogenous. Robust standard errors clustered at the family level are given in parenthesis. Stars convention: * for p<.1, ** for p<.05, and *** for p<.01.

an alternative measure of externalising behavioural problems.[87] The main difference between Tables 35 and 36 is that the overall index of involvement that is no longer significant once we take into account unobserved heterogeneity. However, reading with the child has a beneficial effect on the child's behaviour in the same proportion as with the externalising behavioural problems index. The total strictness index still has a negative effect of about 2.5 on the child's behaviour. The effect of shouting remains bad for the child but is less strong than it was on the externalising behavioural problems index (0.5 on the hyperactivity index vs. 1.2 on the externalising behavioural index). Ignoring a naughty child also increases his hyperactivity and is stronger once

[87] See Section 3.3.1.2 for more details on its construction.

Table 36: Hyperactivity problems index

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Pooled OLS		**FE**		**Lagged OLS**		**Recursive specifications (cont)**		
	PS S3,4		PS S3,4		Health S4, PS S3		Health S4, PS S3		
Total 'involvement' practices	-0.015**		-0.006		-0.024**		-0.023		
	(0.006)		(0.008)		(0.010)		(0.025)		
Prop. to read with child		-0.332***		-0.045		-0.454**		-1.006*	-0.971*
		(0.110)		(0.116)		(0.193)		(0.536)	(0.538)
Prop. to do art with child		-0.108		-0.072		-0.025		0.116	0.124
		(0.086)		(0.092)		(0.140)		(0.424)	(0.425)
Prop. to do physical act. with child		0.127		-0.010		0.057		-0.182	-0.214
		(0.084)		(0.090)		(0.131)		(0.372)	(0.372)
Prop. to play with child		-0.223***		0.143*		-0.341***		0.113	0.130
		(0.079)		(0.085)		(0.123)		(0.363)	(0.361)
Total 'rules' actions	0.209***		0.101***		0.166***		0.242***		
	(0.007)		(0.011)		(0.010)		(0.026)		
Prop. to reason naughty child		0.097		0.164*		0.056		0.218	0.220
		(0.085)		(0.091)		(0.130)		(0.367)	(0.364)
Prop. to shout at child		0.465***		0.089		0.319***		0.512*	0.489*
		(0.066)		(0.077)		(0.096)		(0.294)	(0.293)
Prop. to take away treats from naughty child		0.390***		0.098		0.342***		0.228	0.263
		(0.059)		(0.070)		(0.087)		(0.272)	(0.270)
Prop. to ignore naughty child		0.323***		0.226***		0.183**		0.547**	0.535**
		(0.050)		(0.059)		(0.075)		(0.246)	(0.244)
Goes to bed regularily (0-3)	-0.169***	-0.179***	-0.052*	-0.050*	-0.158***	-0.158***	-0.150***	-0.158***	-0.340***
	(0.023)	(0.024)	(0.028)	(0.029)	(0.034)	(0.034)	(0.033)	(0.034)	(0.100)
Nb. days has breakfast	-0.049***	-0.043**	0.005	0.007	-0.058**	-0.058**	-0.060**	-0.057**	-0.034
	(0.019)	(0.019)	(0.022)	(0.022)	(0.026)	(0.026)	(0.026)	(0.026)	(0.063)
N_clust	8,836	8,836	8,836	8,836					
N	14,470	14,470	14,470	14,470	6,436	6,436	10,239	10,239	10,239
r2	0.212	0.168	0.037	0.025	0.197	0.170			

Notes: S: sweep, PS: parenting style. Columns 1 and 2 are pooled OLS over sweeps 3 and 4. Columns 3 and 4 report the results from fixed effect (FE) regressions of child health measured in sweeps 3 and 4. Columns 5 and 6 report the results from a regression of mental health of the child measured in sweep 4 on controls in sweep 4 and parenting style in sweep 3. The recursive specifications estimate the child health production function for mental health measured at age 4 and the reduced form of parenting style measured in sweep 3. Colums 7 and 8 assume that the overall parenting style indices or the specific measures are endogenous, but not the lifestyle measures. Column 9 allows the parenting style variables as well as the lifestyle variables to be endogenous. Robust standard errors clustered at the family level are given in parenthesis. Stars convention: * for p<.1, * for p<.05, and ** for p<.01.

we take into account unobserved heterogeneity. A strict lifestyle also reduces the child's hyperactivity problems, although only regular bed time is significantly beneficial once we allow for lifestyles measures to be endogenous.

These results can also be compared to the literature. Kiernan and Huerta (2008) use the MCS and investigate the role of parenting style on children's externalising problems at the age 3 using structural equation modelling. They conclude that reading and good mother relationship, based on mother's affection, values, etc., reduces externalising behavioural problems, whereas disciplinary practices increase them. We use additional controls such as household income and more detailed household's composition measures. Our results are similar for children four years older and we are also able to identify specific strictness practices that are harmful to the child's behaviour.

The analysis of the correlations of the unobserved error terms for the externalising behavioural problems index is presented in Table 37. Unobserved factors affecting the child's externalising behavioural problems are strongly and positively correlated with unobserved factors affecting the propensity to read with the child and to put him in bed at regular time whereas they are negatively correlated with the propensity to have artistic activities with the child. The presence of these unobserved factors explain why the results change when we take them into account and suggests that previous evidence that does not account for unobserved heterogeneity is biased. The analysis of the matrix also reveals strong correlations between the error terms of the parenting style equations. These are identical to the ones found in the case of physical health in Table 34 as they are estimated on the same observations.

Reporting bias - Hyperactivity reported by the teacher We now compare these results to the ones obtained using the same approach but having as the dependant variable the hyperactivity reported by teacher. This variable is binary, hence the models are estimated using probit, and average marginal effects are reported. Hyperactivity reported by the teacher is available for the last sweep so we only estimate the regressions where the outcome is measured at age 7 and the parenting style at age 5. The results are reported in the Table 88 in Appendix B.

Fewer parenting style measures are significant, but this may be due to the small number of observations for which we have hyperactivity reported by the teacher. The only robust result is that more strictness increases the probability of the child to be hyperactive. Surprisingly, once we take into account unobserved heterogeneity, having regular breakfast increases the probability to be hyperactive from the point of view of the teacher, but again, due to the small number of observations, these results are not reliable.

Table 37: Correlation of the residuals across the equations (external behaviour)

	1	2	3	4	5	6	7	8	9	10	11
1 Child externalising behavioural problems	1.000	0.046***	-0.008***	0.007	0.015	-0.019	-0.135	0.009	-0.103	0.048***	0.059
2 Prop. to read with child	0.046***	1.000	-0.146	0.087**	0.051	0.035***	-0.053***	0.032***	0.012***	0.062***	0.037***
3 Prop. to do art with child	-0.008***	-0.146	1.000	0.145	0.133***	0.008***	-0.054***	-0.008***	-0.023	0.007***	-0.003
4 Prop. to do physical act. with child	0.007	0.087**	0.145	1.000	0.261**	0.030	-0.081	0.020***	-0.025***	0.030***	0.020*
5 Prop. to play with child	0.015	0.051	0.133***	0.261**	1.000	-0.006**	-0.064***	0.021*	0.001	0.000	0.011*
6 Prop. to reason naughty child	-0.019	0.035***	0.008***	0.030	-0.006**	1.000	-0.150	-0.029	-0.059	-0.003***	0.010**
7 Prop. to shout at child	-0.135	-0.053***	-0.054***	-0.081	-0.064***	-0.150	1.000	0.109***	0.124	-0.014	-0.007***
8 Prop. to take away treats from naughty child	0.009	0.032***	-0.008***	0.020***	0.021*	-0.029	0.109***	1.000	0.121***	0.030	0.031
9 Prop. to ignore naughty child	-0.103	0.012***	-0.023	-0.025***	0.001	-0.059	0.124	0.121***	1.000	-0.024***	-0.016***
10 Goes to bed regularly (0-3)	0.048***	0.062***	0.007***	0.030***	0.000	-0.003***	-0.014	0.030	-0.024***	1.000	0.128***
11 Nb. days has breakfast	0.059	0.037***	-0.003	0.020*	0.011*	0.010**	-0.007***	0.031	-0.016***	0.128***	1.000

Notes: The table reports the correlations between the unobserved error terms of each equation. We report the correlation matrix for the last specification where all the specific parenting style measures as well as the lifestyle measures are assumed to be endogenous. Stars convention: * for p<.1, ** for p<.05, and *** for p<.01.

Is parenting style a pathway between socio-economic factors and children's externalising problems? We now compare how the socio-economic variables affect the child's externalising behavioural problems and if they vary once we take into account parenting style. The estimates are reported in Tables 90 and 91 in Appendix B.

The older the child, the less likely he is to have externalising behavioural problems, but boys are more likely to have some problems. Weight at birth does not play a role, but children with longstanding illness are more likely to have behavioural problems. Mothers who tried breastfeeding, and thus possibly mothers who try to be more involved with their child, are less likely to have children with behavioural problems. Mothers who suffer from depression are more likely to have children with hyperactivity problems, but there is no association between mothers with longstanding illnesses and children's behaviour. Mother's smoking seems to matter more if it is during pregnancy. Alcohol consumption is not related to the child's behaviour. The presence of a male figure appears to increase the child's externalising behavioural problems. Married and widowed mothers are more likely to have calmer children. Income is not associated with the child's behaviour, but owning his house decreases the child's hyperactivity. The education of the mother is negatively correlated with the child's problems. Mothers with higher life satisfaction are also more likely to have children with less problems. Children with a White or Black background are more likely to have some problems compared to the Asian or to other mixed backgrounds.

The role of these socio-economic variables changes once we take into account parenting style. The largest reductions appear with cigarette's consumption during pregnancy, the presence of a male partner, mother's marital status, mother's life satisfaction and child's race. However, the role of mother's education becomes more important.

3.5.1.3 Internalising behavioural problems

The second main aspect of mental health is the internalising behavioural problems. The results for this index are presented in Table 38. Mother's total involvement as well as the specific measures of involvement do not have a robust effect on the child's internalising problems. However, as with externalising behavioural problems, the mother's overall strictness, and ignoring a naughty child increases internalising problems, and the effects are much stronger once we take into account unobserved heterogeneity. In addition, reasoning with a naughty child improves his internalising behavioural problems.

Regularity in health behaviour is also beneficial to the child as it was in the case of externalising behavioural problems, however the effect of regular breakfast disappear once we take into account unobserved heterogeneity.

Table 38: Internalising behavioural problems

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Pooled OLS		**FE**		**Lagged OLS**		**Recursive specifications (cont)**		
	PS S3,4		PS S3,4		Health S4, PS S3		Health S4, PS S3		
Total 'involvement' practices	0.010*		0.006		0.017**		0.007		
	(0.005)		(0.008)		(0.008)		(0.024)		
Prop. to read with child		0.091		0.089		0.300*		-0.274	-0.242
		(0.087)		(0.105)		(0.160)		(0.475)	(0.473)
Prop. to do art with child		0.070		0.092		0.161		0.226	0.235
		(0.069)		(0.083)		(0.119)		(0.398)	(0.397)
Prop. to do physical act. with child		-0.021		-0.010		-0.146		-0.150	-0.177
		(0.066)		(0.086)		(0.116)		(0.328)	(0.329)
Prop. to play with child		-0.111*		-0.103		-0.044		0.030	0.045
		(0.062)		(0.078)		(0.108)		(0.316)	(0.315)
Total 'rules' actions	0.065***		0.043***		0.062***		0.124***		
	(0.006)		(0.010)		(0.009)		(0.023)		
Prop. to reason naughty child		0.034		0.126		-0.020		-0.776*	-0.780*
		(0.062)		(0.089)		(0.116)		(0.405)	(0.406)
Prop. to shout at child		0.076		0.071		0.048		-0.004	-0.021
		(0.051)		(0.071)		(0.082)		(0.270)	(0.269)
Prop. to take away treats from naughty child		-0.090*		-0.034		-0.116		0.109	0.138
		(0.047)		(0.064)		(0.074)		(0.233)	(0.231)
Prop. to ignore naughty child		0.187***		0.036		0.142**		0.370*	0.360*
		(0.038)		(0.053)		(0.063)		(0.209)	(0.209)
Goes to bed regularily (0-3)	-0.063***	-0.061***	-0.005	-0.003	-0.045	-0.043	-0.051*	-0.052*	-0.155*
	(0.019)	(0.020)	(0.025)	(0.026)	(0.030)	(0.030)	(0.028)	(0.028)	(0.085)
Nb. days has breakfast	-0.069***	-0.066***	0.001	0.001	-0.069***	-0.065**	-0.066***	-0.066***	-0.076
	(0.015)	(0.016)	(0.021)	(0.021)	(0.027)	(0.027)	(0.024)	(0.024)	(0.064)
N_clust	8,829	8,829	8,829	8,829					
N	14,364	14,364	14,364	14,364	5,535	5,535	10,244	10,244	10,244
r2	0.115	0.108	0.034	0.031	0.123	0.117			

Notes: S: sweep, PS: parenting style. Columns 1 and 2 are pooled OLS over sweeps 3 and 4. Columns 3 and 4 report results from fixed effect (FE) regressions of child's emotional problems measured in sweeps 3 and 4. Columns 5 and 6 regress child's internalising problems in sweep 4 on controls in sweep 4 and parenting style in sweep 3. The recursive specifications estimate the the child health production function for health measured at age 7 (sweep 4) and the reduced form of parenting style measured at age 5 (sweep 3). Colums 7 and 8 assume that the overall parenting style indices or the specific measures are endogenous, but not the lifestyle measures. Column 9 allows the parenting style variables as well as the lifestyle variables to be endogenous. Robust standard errors clustered at the family level are given in parenthesis. Stars convention: * for p<.1, ** for p<.05, and *** for p<.01.

The amplitude of the unobserved heterogeneity can be assessed by the analysis of the correlations between the error terms of the different equations reported in Table 87. There exist unobserved factors that are positively correlated with the child's internalising problems and the mother's propensity to read with the child, and negatively with the mother's propensity to have some artistic activity with the child as well as the propensity to ignore her child when naughty. The facts that the estimated effects are amplified once we allow for unobserved heterogeneity and that the unobserved factors influencing both the outcome and the parenting style suggest other estimates not accounting for unobserved heterogeneity are biased.

Table 39: Correlation of the residuals across the equations (internalising behavioural problems)

	1	2	3	4	5	6	7	8	9	10	11
1 Child internalising pb.	1.000	0.056***	-0.020***	0.002	-0.002	0.095	-0.019	-0.052	-0.068*	0.060	0.017
2 Prop. to read with child	0.056***	1.000	-0.146	0.087**	0.051	0.035***	-0.053***	0.032***	0.012***	0.062***	0.037***
3 Prop. to do art with child	-0.020***	-0.146	1.000	0.145	0.133***	0.008***	-0.054***	-0.008***	-0.023	0.007***	-0.003
4 Prop. to do physical act. with child	0.002	0.087**	0.145	1.000	0.261**	0.030	-0.081	0.020***	-0.025***	0.030***	0.020*
5 Prop. to play with child	-0.002	0.051	0.133***	0.261**	1.000	-0.006**	-0.064***	0.021*	0.001	0.000	0.011*
6 Prop. to reason naughty child	0.095	0.035***	0.008***	0.030	-0.006**	1.000	-0.150	-0.029	-0.059	-0.003***	0.010**
7 Prop. to shout at child	-0.019	-0.053***	-0.054***	-0.081	-0.064***	-0.150	1.000	0.109***	0.124	-0.014	-0.007***
8 Prop. to take away treats from naughty child	-0.052	0.032***	-0.008***	0.020***	0.021*	-0.029	0.109***	1.000	0.121***	0.030	0.031
9 Prop. to ignore naughty child	-0.068*	0.012***	-0.023	-0.025***	0.001	-0.059	0.124	0.121***	1.000	-0.024***	-0.016***
10 Goes to bed regularly (0-3)	0.060	0.062***	0.007***	0.030***	0.000	-0.003***	-0.014	0.030	-0.024***	1.000	0.128***
11 Nb. days has breakfast	0.017	0.037***	-0.003	0.020*	0.011*	0.010**	-0.007***	0.031	-0.016***	0.128***	1.000

Notes: The table reports the correlations between the unobserved error terms of each equation. We report the correlation matrix for the last specification where all the specific parenting style measures as well as the lifestyle measures are assumed to be endogenous. Stars convention: for p<.1, * for p<.05, and ** for p<.01.

Reporting bias - Emotional symptoms reported by the child As for the probability to be in good health and the externalising behavioural problems, the internalising behavioural problems as well as the parenting style are reported by the mothers. Therefore we re-estimate our results using as dependant variable the emotional symptoms reported by the child himself.[88] This variable is only available in the last sweep, we therefore only estimate the lagged and recursive specifications. The results are reported in Table 89 in Appendix B.

Although the sample size is larger in the case of the lagged regressions than in Table 38, the R^2 are smaller suggesting that the models are less precisely estimated. However, based on the lagged OLS regressions, mother's strictness also increases the child's internalising behavioural problems. Mother's involvement appears to be beneficial for the child, as in previous literature. Once we allow for unobserved heterogeneity, these effects are not significant, but the mother's propensity to read with the child appears to be beneficial.

When internalising behavioural problems are reported by the mother, regular bed times and breakfasts are beneficial, whereas when internalising problems are reported by the child going to bed at a regular time increases them.

Is parenting style a pathway between socio-economic factors and children's internalising problems? In Tables 92 and 93 we report the full list of coefficients used to estimate the regressions in columns 2 and 3 of Table 38 as well as the coefficients of the same regressions but without parenting style. The child's internalising problems are much more an issue for girls, and more likely to appear if the child has some longstanding illnesses. The mother's physical health does not play a role, but the child is more likely to have some emotional problems if the mother has some longstanding illnesses or is depressed. The child's problems are not affected by the mother's cigarette consumption when she was pregnant, but he is more likely to have some emotional problems if the mother does not smoke, and less like likely to have some problems if the mother drinks regularly. Higher income households are less likely to have children with emotional symptoms. The child has fewer emotional problems if the mother works. Finally, the higher her life satisfaction, the smaller the emotional problems.

When we compare the coefficients in column 1 where we do not include the parenting style variables to columns 2 and 3 where we include the parenting style indices and the specific mother's practices, respectively, we observe very little change among the significant coefficients. This result suggests that parenting style is not an

[88]The questions asked to the child are not the same as the ones asked to the mother. See Section 3.3 for more details.

important pathway that explains the relationship between socio-economic variables and children's internalising behavioural problems.

3.5.1.4 Cognitive ability

The cognitive ability of the child, similarly to the health of the child, has long-term impacts on the individuals. It is therefore interesting to examine the effect of parenting style on the child cognitive ability. Cognitive ability is only reported in the last wave, and we therefore limit our analysis to the lagged and recursive specification. This outcome is reported by the teacher and not by the mother so that there is no potential problem with reporting bias. Results are reported in Table 40.

In the lagged model, where we only assume that parenting style has a lagged effect but do not account for unobserved heterogeneity, the total involvement and strictness indices do not have an impact on the child cognitive ability. However, specific measures such as mostly reading with the child, reasoning with or shouting at the naughty child improve the child's score, whereas mostly having some physical activity with the child or taking away treats from the naughty child decrease his school performance. Lifestyle is beneficial to the child's cognitive ability.

Once we take into account unobserved heterogeneity, the mother's overall involvement reduces the child's performance, especially mostly taking the child to the park or having some physical activity with him. However, a mother who is more likely to read to her child compared to the other "involvement" activities has a significant positive effect on his cognitive ability of 4.9 points on average. Overall strictness, that may simply capture the child's naughtiness, negatively affects the child's performance, but when we analyse the specific measures of the strictness index, no specific measures appear to be particularly harmful to the child. The lifestyle variables are both beneficial to the child, but having regular bed times appears to have an important role once we allow it to be endogenous whereas the number of breakfasts per week becomes insignificant once we allow for endogeneity.

Table 40: Cognitive ability

	(1)	(2)	(3)	(4)	(5)
	Lagged OLS		**Recursive specifications (cont)**		
	Health S4, PS S3		Health S4, PS S3		
Total 'involvement' practices	-0.035		-0.179**		
	(0.031)		(0.079)		
Prop. to read with child		1.391**		4.959**	4.913**
		(0.542)		(1.949)	(1.957)
Prop. to do art with child		0.253		-0.604	-0.558
		(0.429)		(1.569)	(1.553)
Prop. to do physical act. with child		-0.675*		-3.417**	-3.372**
		(0.399)		(1.457)	(1.456)
Prop. to play with child		0.194		1.311	1.259
		(0.385)		(1.463)	(1.462)
Total 'rules' actions	-0.050		-0.209***		
	(0.032)		(0.080)		
Prop. to reason naughty child		0.750*		0.364	0.360
		(0.429)		(1.196)	(1.194)
Prop. to shout at child		0.515*		-0.119	-0.040
		(0.300)		(1.035)	(1.036)
Prop. to take away treats from naughty child		-0.520*		-0.416	-0.434
		(0.269)		(0.992)	(0.988)
Prop. to ignore naughty child		-0.141		0.199	0.155
		(0.230)		(0.905)	(0.908)
Goes to bed regularily (0-3)	0.415***	0.402***	0.408***	0.400***	0.604*
	(0.103)	(0.103)	(0.102)	(0.102)	(0.358)
Nb. days has breakfast	0.205***	0.201***	0.200**	0.208***	0.051
	(0.077)	(0.077)	(0.078)	(0.077)	(0.232)
N	4,216	4,216	8,395	8,395	8,395
r2	0.187	0.190			

Notes: S: sweep, PS: parenting style. Columns 1 and 2 regress child cognitive ability in sweep 4 on controls in sweep 4 and parenting style in sweep 3. The recursive specifications estimate the child production function for cognitive ability measured at age 4 and the reduced form of parenting style measured in sweep 3. Columns 3 and 4 assume that the overall parenting style indices or the specific measures are endogenous, but not the lifestyle measures. Column 5 allows the parenting style variables as well as the lifestyle variables to be endogenous. Robust standard errors clustered at the family level are given in parenthesis. Stars convention: * for p<.1, ** for p<.05, and *** for p<.01.

We analyse the importance of unobserved heterogeneity in Table 41. Unobserved factors that affect the child cognitive ability are also positively correlated with the mother's propensity to read with the child and to put him in bed at regular times, whereas they are negatively correlated with the mother's propensity to have some artistic activities with the child. These correlations could be explained, for example, by the mothers' unobserved cognitive ability. Mothers who are more intellectual may prefer reading compared to having some more creative activities, and may be more likely to have a healthy lifestyle as they are more aware of its benefit. These mothers are therefore more likely to impose these activities on their own children. It suggests that unobserved heterogeneity should be taken into account when analysing parenting style and children's cognitive ability.

Table 41: Correlation of the residuals across the equations (cognitive ability)

	1	2	3	4	5	6	7	8	9	10	11
1 Child cognitive ability	1.000	0.046***	-0.008***	0.007	0.015	-0.019	-0.135	0.009	-0.103	0.048***	0.059
2 Prop. to read with child	0.046***	1.000	-0.146	0.087**	0.051	0.035***	-0.053***	0.032***	0.012***	0.062***	0.037***
3 Prop. to do art with child	-0.008***	-0.146	1.000	0.145	0.133***	0.008***	-0.054***	-0.008***	-0.023	0.007***	-0.003
4 Prop. to do physical act. with child	0.007	0.087**	0.145	1.000	0.261**	0.030	-0.081	0.020***	-0.025***	0.030***	0.020*
5 Prop. to play with child	0.015	0.051	0.133***	0.261**	1.000	-0.006**	-0.064***	0.021*	0.001	0.000	0.011*
6 Prop. to reason naughty child	-0.019	0.035***	0.008***	0.030	-0.006**	1.000	-0.150	-0.029	-0.059	-0.003***	0.010**
7 Prop. to shout at child	-0.135	-0.053***	-0.054***	-0.081	-0.064***	-0.150	1.000	0.109***	0.124	-0.014	-0.007***
8 Prop. to take away treats from naughty child	0.009	0.032***	-0.008***	0.020***	0.021*	-0.029	0.109***	1.000	0.121***	0.030	0.031
9 Prop. to ignore naughty child	-0.103	0.012***	-0.023	-0.025***	0.001	-0.059	0.124	0.121***	1.000	-0.024***	-0.016***
10 Goes to bed regularly (0-3)	0.048***	0.062***	0.007***	0.030***	0.000	-0.003***	-0.014	0.030	-0.024***	1.000	0.128***
11 Nb. days has breakfast	0.059	0.037***	-0.003	0.020*	0.011*	0.010**	-0.007***	0.031	-0.016***	0.128***	1.000

Notes: The table reports the correlations between the unobserved error terms of each equation. We report the correlation matrix for the last specification where all the specific parenting style measures as well as the lifestyle measures are assumed to be endogenous. Stars convention: * for p<.1, ** for p<.05, and *** for p<.01.

Is parenting style a pathway between socio-economic factors and children's cognitive ability? The association between socio-economic factors and children's cognitive ability is reported in Tables 94 and 95 in Appendix B. Cognitive ability is positively associated with the child's age and mother's age, but is lower for boys or if the child has some longstanding illnesses. Weight at birth, as well as whether the mother tried breastfeeding is also positively associated with his school performance. Whether the mother is depressed or whether she smoked during pregnancy is negatively associated with the child cognitive ability. Changes in the mother's martial status such as becoming married or divorced is negatively correlated with the child's school performance. Household income does not appear to make a difference but whether the family owns his house is positively associated with cognitive ability. Mother's education is also positively associated with the child's performance. The presence of the grandparents in the household is beneficial to the child cognitive ability. Children from White, Asian or Black background perform less well in school than children from a mixed background. Accounting for parenting style does not change these results.

3.5.2 Sibling reported parenting style

A possible problem is that both the outcomes and the parenting style are reported by the mother. Our first attempt to address this reporting bias has been to use the physical and mental health outcome measures that are not reported by the mother. We here address the problem of parenting style reported by the mother by using parenting style reported by the older sibling. We focus on the outcomes that are the most affected by parenting style: externalising behavioural problems, hyperactivity, internalising behavioural problems and cognitive ability. We present the lagged specification as the larger number of observations reported by the siblings is in sweep 3. For each outcome in Table 42, we report the results for the indices, and then the specific measures of parenting style, both restricted to the sample for which we have the siblings' information.

In Table 42, despite the significant drop in the sample size for the externalising behavioural problems (652 observations compared to 6,468 in the full sample) and hyperactivity (654 compared to 6,436 in the full sample), the conclusions as regards to parenting style reported by the mother are similar. Total mother's involvement reduces these behavioural problems and total mother's strictness increases them. The effect of mother reading to her child and taking away treats are however no longer significant, but the propensity to play with the child reduces his behavioural problems.

When we compare these results to the ones where parenting style is reported

by the siblings, we notice first that the beneficial effect of going to bed regularly remains. However, when siblings do not tell their parents where they go, it improves the MCS child's externalising behavioural problems suggesting that a too strict parenting style is bad for the externalising behavioural problems as we found in the main results. However, without knowing the age of the sibling, this result must be interpreted cautiously.

When we compare the hyperactivity results between the full and reduced sample for mother reported parenting style, the main difference is that taking away treats from a naughty child increases the behavioural problems, whereas in the full sample shouting at the naughty child and ignoring him are bad for him. The parental practices related to lifestyle are also no longer significant in the reduced sample for the hyperactivity.

When we analyse the effects of the sibling reported parenting style, siblings with parents who are strict with household chores have MCS siblings with more hyperactivity problems. This result supports the conclusion that too much strictness is bad for the hyperactivity problems.

The results for the internalising problems in the reduced sample of the mother parenting style are very similar in the case of total involvement and strictness. However none of the specific measures of parenting style are significant, and this is also an issue with the parenting style reported by the siblings.

Finally, the reduced sample regressions for the cognitive ability lose all their significant coefficients compared to the full sample. When analysing the parenting style reported by the siblings, only being out after 9pm without the parents knowing reduces the MCS child cognitive ability. This result suggests that not enough strictness is bad for the cognitive ability as found in our full sample results, but it certainly depends on the age of the child and the results are only significant at the 10% level.

In summary, parenting style reported by the siblings offers very limited support to our results. This is may be to be due to the small sample size. Moreover, the sibling questions about their parents' parenting style are not identical to the ones asked to the mothers. Most of them can be considered as measures of strictness and only whether the parents check how the sibling is doing in school can be considered as an involvement measure. Furthermore, they refer to the parents in general and not specifically to the mother. The siblings' questions are also about the parenting style of the parents with the sibling, and not the MCS child.

Table 42: Comparison of the effects of mother and sibling reported parenting style

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	External behavioural pb			**Hyperactivity**			**Internal behavioural pb**			**Cognitive ability**		
	Total	Specific	Siblings	Total	Specific	Siblings	Total	Specific	Siblings	Total	Specific	Siblings
Total 'involvement' practices	-0.070***			-0.052*			0.048**			-0.051		
	(0.022)			(0.031)			(0.024)			(0.086)		
Prop. to read with child		0.146			-0.343			-0.155			-1.764	
		(0.381)			(0.488)			(0.359)			(1.511)	
Prop. to do art with child		-0.565*			-0.349			-0.029			1.802	
		(0.322)			(0.412)			(0.335)			(1.322)	
Prop. to do physical act. with child		-0.070			0.345			0.003			-0.253	
		(0.331)			(0.397)			(0.290)			(1.236)	
Prop. to play with child		-0.551**			-0.771**			0.389			-0.886	
		(0.272)			(0.361)			(0.255)			(1.120)	
Total 'rules' actions	0.295***			0.259***			0.071**			-0.038		
	(0.029)			(0.035)			(0.033)			(0.115)		
Prop. to reason naughty child		-0.303			-0.319			0.202			0.851	
		(0.346)			(0.433)			(0.354)			(1.448)	
Prop. to shout at child		0.565**			0.254			-0.220			0.355	
		(0.239)			(0.316)			(0.253)			(1.029)	
Prop. to take away treats from naughty child		0.265			0.537*			0.291			-0.760	
		(0.227)			(0.286)			(0.220)			(0.768)	
Prop. to ignore naughty child		0.696***			0.292			0.250			-0.205	
		(0.185)			(0.226)			(0.189)			(0.728)	
Goes to bed regularily (0-3)	-0.168**	-0.180**	-0.209***	0.021	-0.002	-0.023	-0.038	-0.024	-0.015	0.061	0.125	0.050
	(0.071)	(0.077)	(0.078)	(0.089)	(0.091)	(0.091)	(0.073)	(0.074)	(0.072)	(0.299)	(0.307)	(0.293)
Nb. days has breakfast	-0.009	0.029	0.019	-0.064	-0.043	-0.048	-0.074	-0.060	-0.070	0.405	0.387	0.359
	(0.060)	(0.065)	(0.068)	(0.074)	(0.080)	(0.080)	(0.065)	(0.067)	(0.068)	(0.255)	(0.266)	(0.249)
Parents set limit to TV watching			0.040			0.006			0.076			0.109
			(0.148)			(0.177)			(0.148)			(0.524)
S. always tells parents where going			-0.317*			-0.284			-0.160			0.752
			(0.178)			(0.232)			(0.187)			(0.674)
S. has been out after 9pm without parents knowing			0.381			0.236			0.267			-1.653*
			(0.287)			(0.332)			(0.342)			(0.970)
S. only decides what eats at home (s23)			-0.283			-0.316			0.062			-0.122
			(0.177)			(0.204)			(0.189)			(0.593)
Parents are strict with household chores			-0.018			0.292*			0.042			-0.460
			(0.133)			(0.168)			(0.143)			(0.511)
Parents check how doing in school			-0.003			0.069			-0.046			-0.273
			(0.133)			(0.165)			(0.131)			(0.518)
Observations	652	652	652	654	654	654	638	638	638	425	425	425
R2	0.344	0.262	0.226	0.280	0.237	0.226	0.162	0.159	0.153	0.330	0.341	0.342

Notes: S. stands for "sibling". The outcomes and controls are measured in sweep 4, parenting style reported by the mother or the sibling in sweep 3. The models are estimated using OLS with robust standard errors. Stars convention: * for p<.1, ** for p<.05, and *** for p<.01.

3.5.3 Role of the partner

So far, we have focused on the role of the mother's parenting style because the mother in our sample is the main child carer, and also because there is good information on her style. The literature has also focused on the role of the mother, but the role of the father is of interest per se because of possible complementarity or substitution with the mother. There is little evidence on these issues.

So far, we have accounted for indirect father's involvement by controlling for his working status and the type of responsibilities he has (employee vs. self-employed, whether he has a supervisor role). The MCS data has some but limited information on the involvement of the partner and we use it to investigate whether the presence of the father can affect the role of the mother's parenting style in the child health production function.

We present in Table 43 the results of the recursive regressions in which we allow the partner's involvement to be endogenous as well as the other parenting style measures (i.e. these regressions are equivalent to the penultimate ones in the main tables but in addition allow for the partner's involvement). The first regressions of each outcome are the same as the recursive ones in the main tables, but we limit the sample to the observations for which we have the partner's involvement.

When we analyse the first columns of each outcome, it is important to note that we lose about 4,477 observations in the case of physical health, 2,683 observations with externalising behavioural problems, 2,680 observations with emotional symptoms, and 1,014 observations with cognitive ability. The effects of the mother's parenting style are similar to the full sample results but a few coefficients lose their significance levels.

On the reduced sample, the probability to be in good health is no longer significantly affected by the mother's propensity to reason with the naughty child, and the effect even becomes negative in the reduced sample. Only the propensity to take away treats from the naughty child remains significantly beneficial for the child in the reduced sample. Once we introduce the partner's involvement, the results do not change and partner's involvement is not significant.

With externalising behavioural problems, the results based on the reduced sample are very similar to the ones obtained with the whole sample. The inclusion of partner's involvement does not affect these results and the role of the partner is not significant. The same conclusion is reached with the emotional problems.

Finally, the reduced sample also gives us similar results in the case of cognitive ability compared to the whole sample, and the results are not affected when accounting for the partner's involvement.

Table 43: The role of the partner

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Child in good health		**Externalising behavioural pb.**		**Emotional symptoms**		**Cognitive ability**	
Prop. to read with child	-0.001	-0.001	-0.695	-0.695	-0.638	-0.643	6.141***	6.163***
	(0.010)	(0.010)	(0.566)	(0.566)	(0.515)	(0.513)	(1.908)	(1.907)
Prop. to do art with child	-0.002	-0.004	0.077	0.075	0.868**	0.906**	-0.952	-0.984
	(0.010)	(0.010)	(0.486)	(0.487)	(0.428)	(0.428)	(1.812)	(1.833)
Prop. to do physical act. with child	-0.007	-0.008	0.080	0.079	-0.173	-0.168	-3.369**	-3.368**
	(0.008)	(0.008)	(0.405)	(0.405)	(0.352)	(0.354)	(1.618)	(1.622)
Prop. to play with child	0.007	0.008	-0.167	-0.164	-0.095	-0.122	1.443	1.468
	(0.008)	(0.008)	(0.408)	(0.407)	(0.373)	(0.373)	(1.550)	(1.552)
Prop. to reason naughty child	-0.012	-0.012	0.184	0.183	-0.952*	-0.948*	1.107	1.097
	(0.009)	(0.009)	(0.429)	(0.428)	(0.493)	(0.497)	(1.341)	(1.348)
Prop. to shout at child	-0.003	-0.003	1.330***	1.331***	0.043	0.047	-0.915	-0.917
	(0.006)	(0.006)	(0.308)	(0.308)	(0.293)	(0.293)	(1.053)	(1.056)
Prop. to take away treats from naughty child	0.011*	0.012*	0.248	0.247	0.005	0.015	-0.346	-0.354
	(0.006)	(0.006)	(0.268)	(0.268)	(0.260)	(0.261)	(0.991)	(0.995)
Prop. to ignore naughty child	0.007	0.008	1.034***	1.033***	0.478**	0.470**	-1.007	-1.000
	(0.005)	(0.005)	(0.238)	(0.238)	(0.228)	(0.228)	(0.977)	(0.981)
Goes to bed regularily (0-3)	-0.001	-0.001	-0.123***	-0.123***	-0.031	-0.031	0.383***	0.385***
	(0.001)	(0.001)	(0.033)	(0.033)	(0.032)	(0.032)	(0.120)	(0.120)
Nb. days has breakfast	0.000	0.000	-0.062**	-0.063**	-0.066**	-0.067**	0.290***	0.289***
	(0.001)	(0.001)	(0.029)	(0.029)	(0.029)	(0.029)	(0.095)	(0.095)
Partner looks after the child		0.002		0.005		-0.063		0.065
		(0.001)		(0.056)		(0.054)		(0.215)
N	7,584	7,584	7,568	7,568	7,564	7,564	7,381	7,381

Notes: Parenting style and father's involvement is measured in sweep 3 and the child's outcomes in sweep 4. For each regression, the first one restricts the sample to the one with no missing information about the partner's involvement and the second one control for father's involvement allowing it to be endogenous as well as the other measures of mother's parenting style. child physical health is binary and the average marginal effects are reported. Stars convention: * for p<.05, ** for p<.01, and *** for p<.001.

Table 44: Differences between boys and girls

	(1)	(2)	(3)	(4)	(5)	(6)
	Child in good health		**Externalising behavioural pb.**		**Emotional symptoms**	
	Boys	Girls	Boys	Girls	Boys	Girls
Prop. to read with child	-0.001	0.000	-0.156	-0.510**	2.504***	0.000
	(0.006)	(0.003)	(0.318)	(0.234)	(0.836)	(0.223)
Prop. to do art with child	-0.003	-0.004	-0.012	-0.230	1.229**	0.178
	(0.004)	(0.003)	(0.207)	(0.179)	(0.596)	(0.184)
Prop. to do physical act. with child	0.005	0.004	0.255	0.107	-0.382	-0.267
	(0.004)	(0.003)	(0.204)	(0.157)	(0.603)	(0.169)
Prop. to play with child	-0.000	0.003	-0.237	-0.186	0.374	-0.180
	(0.004)	(0.002)	(0.197)	(0.143)	(0.586)	(0.151)
Prop. to reason naughty child	0.002	0.003	-0.052	0.222	1.333*	0.008
	(0.004)	(0.002)	(0.235)	(0.137)	(0.696)	(0.150)
Prop. to shout at child	0.006**	0.003	0.035	0.528***	1.129**	0.140
	(0.003)	(0.002)	(0.156)	(0.113)	(0.441)	(0.114)
Prop. to take away treats from naughty child	0.010***	-0.001	0.414***	0.338***	-1.080***	-0.077
	(0.003)	(0.002)	(0.143)	(0.097)	(0.410)	(0.099)
Prop. to ignore naughty child	-0.001	0.002	0.134	0.216**	-0.176	0.113
	(0.002)	(0.001)	(0.119)	(0.089)	(0.341)	(0.091)
Goes to bed regularily (0-3)	-0.002	0.000	-0.211***	-0.052	0.374**	-0.033
	(0.001)	(0.001)	(0.053)	(0.042)	(0.157)	(0.045)
Nb. days has breakfast	0.001	0.000	-0.050	-0.062*	0.064	-0.058*
	(0.001)	(0.000)	(0.046)	(0.033)	(0.127)	(0.034)
N	3,401	3,375	3,323	3,145	2,484	3,051

Notes: Outcomes and control variables are measured at sweep 4, whereas parenting style is measured at sweep 3. Stars convention: * for p<.1, ** for p<.05, and *** for p<.01.

Theses results suggest that the effect of mothers' parenting style is not affected by the partners' involvement in looking after the child. It is important to remember that we have analysed the involvement of the mother's partner, and the role of the natural father's involvement may be different. Had we had more data on the father's parenting style, we would have carried the same analysis as for the mothers but for the fathers alone which may have lead to different conclusions on the fathers' role.

3.5.4 Differences between boys and girls

In this section, we examine if the effect of the mother's parenting style is different for boys and girls. Table 44 presents the results of the lagged regressions for the main health outcomes.

The probability of the child to be in good health depends on the mother's propensity to shout at naughty child and to take away treats from naughty child in the whole sample. The analysis of the split sample by gender suggests that these effects are significant for boys, whereas parenting style style does not affect the physical health of girls.

When we look at externalising behavioural problems, mainly girls are affected by

their mother's parenting style. Apart from the lifestyle measures, the parenting style effect is generally stronger on the girls' sample. Boys are also affected by their mother's parenting style, but mainly taking away treat when naughty and going to bed regularly seem to significantly affect their behaviour.

Finally, internalising behavioural problems are positively correlated with the mother's propensity to read with her boy, to do some artistic activities, to reason her naughty boy and to put him in bed regularly, but negatively with the propensity to take away treats from the naughty child. These effects are not observed in the girls' sample. Note that these are results may be affected by unobserved heterogeneity. We did not use however the FE specification because the FE logit likelihood maximisation did not converge on these reduced samples.

In summary, mother's parenting style mainly affects boys in the case of physical health and internalising problems whereas girls are more affected by their mother's parenting style in terms of their externalising behavioural problems.

3.5.5 Socio-economic differences

We next investigate whether mothers' education and household income influence the effects of parenting style on the mental health and cognitive ability of children. We do so by alternatively interacting mothers' education and household wealth with the parenting style variables.

In Table 45, we report the results for an indicator of high education. The high education dummy equals one if the mother has a diploma, a first degree or more. It appears that, in the case of externalising behaviour, the propensity to read with the child is negatively correlated with the child's behaviour, whereas shouting, taking away treats or ignoring the naughty child increase significantly his externalising problems. The coefficients of these parenting practices interacted with the mother's education are not significant suggesting that these effects, which are similar to the ones obtained in the main specification in Table 35, are not different between the two groups.

Mostly reading with the child when the child has a mother with a low education level is significantly positively correlated with the child's cognitive ability, whereas the propensity to have some physical activity with the child as well as taking away treats from the naughty child decrease his school performance among children with low education mothers. As the same parenting style methods are not significant when interacted with the mother's education, these practices do not differ between the two groups. The propensity to play with the child is not significantly correlated with the child's cognitive ability among the low income group, but appears to significantly reduce

Table 45: Parenting style and mother's education

	(1) Exter. Behavioural pb.	(2) Inter. Behavioural pb.	(3) Cognitive ability
Prop. to read with child	-0.315*	-0.171	1.423**
	(0.187)	(0.165)	(0.567)
Prop. to read with child x High educ.	0.301	0.272	0.962
	(0.294)	(0.303)	(1.179)
Prop. to do art with child	-0.038	-0.146	0.258
	(0.156)	(0.143)	(0.533)
Prop. to do art with child x High educ.	-0.368	0.050	0.009
	(0.234)	(0.224)	(0.823)
Prop. to do physical act. with child	0.212	-0.170	-1.008**
	(0.139)	(0.131)	(0.466)
Prop. to do physical act. with child x High educ.	-0.273	-0.072	1.197
	(0.240)	(0.240)	(0.879)
Prop. to play with child	-0.139	-0.166	0.746
	(0.133)	(0.119)	(0.469)
Prop. to play with child x High educ.	0.210	0.082	-1.855**
	(0.220)	(0.221)	(0.817)
Prop. to reason naughty child	0.099	0.114	0.677
	(0.135)	(0.127)	(0.485)
Prop. to reason naughty child x High educ.	0.030	0.077	0.950
	(0.238)	(0.235)	(0.924)
Prop. to shout at child	0.470***	0.029	0.582
	(0.104)	(0.095)	(0.366)
Prop. to shout at child x High educ.	0.229	-0.001	-0.371
	(0.159)	(0.163)	(0.605)
Prop. to take away treats from naughty child	0.373***	-0.010	-0.752**
	(0.093)	(0.086)	(0.323)
Prop. to take away treats from naughty child x High educ.	0.170	-0.104	0.842
	(0.150)	(0.152)	(0.583)
Prop. to ignore naughty child	0.441***	0.062	-0.061
	(0.080)	(0.074)	(0.277)
Prop. to ignore naughty child x High educ.	-0.184	0.108	-0.362
	(0.136)	(0.134)	(0.492)
High educ.	-0.243	-0.229	-0.024
	(0.211)	(0.203)	(0.970)
N	6,436	5,535	4,216

Notes: Outcomes and control variables are measured at sweep 4, whereas parenting style is measured at sweep 3. Stars convention: * for p<.1, ** for p<.05, and *** for p<.01.

cognitive ability among children with highly educated mothers.

In Table 46, we present the same approach but with a high household income indicator interacted with the parenting style measures. A household is considered to have high income if its income is above £20,800 a year.

Externalising behavioural problems are reduced in the low income families if the mother mostly reads to the child, does not mainly shout or ignore the child, or takes away treats from the naughty child. The effects are the same for both groups, except that mainly ignoring a naughty child is not as bad in the high income group. Furthermore, mainly reasoning a naughty child significantly increases his externalising behavioural problems in the high income families.

In the high income households, the propensity to have some artistic activities

Table 46: Parenting style and household wealth

	(1) Exter. Behavioural pb.	(2) Inter. Behavioural pb.	(3) Cognitive ability
Prop. to read with child	-0.342*	-0.182	1.179**
	(0.194)	(0.182)	(0.596)
Prop. to read with child x Rich	0.305	0.446	0.053
	(0.266)	(0.277)	(1.002)
Prop. to do art with child	-0.001	-0.272*	-0.280
	(0.158)	(0.151)	(0.555)
Prop. to do art with child x Rich	-0.432*	0.437**	1.262
	(0.226)	(0.220)	(0.811)
Prop. to do physical act. with child	0.103	-0.101	-0.865*
	(0.143)	(0.140)	(0.493)
Prop. to do physical act. with child x Rich	0.123	-0.273	0.723
	(0.235)	(0.240)	(0.846)
Prop. to play with child	-0.003	-0.015	0.556
	(0.135)	(0.128)	(0.488)
Prop. to play with child x Rich	-0.274	-0.407*	-1.016
	(0.220)	(0.223)	(0.796)
Prop. to reason naughty child	0.024	0.217*	0.754
	(0.137)	(0.130)	(0.515)
Prop. to reason naughty child x Rich	0.423*	-0.205	-0.613
	(0.226)	(0.248)	(0.891)
Prop. to shout at child	0.495***	0.077	0.653*
	(0.104)	(0.100)	(0.382)
Prop. to shout at child x Rich	0.146	-0.085	-0.302
	(0.158)	(0.161)	(0.598)
Prop. to take away treats from naughty child	0.487***	-0.026	-0.596*
	(0.095)	(0.090)	(0.342)
Prop. to take away treats from naughty child x Rich	-0.156	-0.053	0.246
	(0.150)	(0.156)	(0.571)
Prop. to ignore naughty child	0.502***	0.068	-0.223
	(0.082)	(0.080)	(0.293)
Prop. to ignore naughty child x Rich	-0.378***	0.136	0.106
	(0.132)	(0.131)	(0.483)
Rich	-0.099*	-0.064	0.539**
	(0.059)	(0.060)	(0.216)
N	6,436	5,535	4,216

Notes: Outcomes and control variables are measured at sweep 4, whereas parenting style is measured at sweep 3. Stars convention: * for p<.1, ** for p<.05, and *** for p<.01.

with the child decreases his externalising problems, but in the high income family, this significantly increases these problems. Mostly playing with the child reduces his externalising behavioural problems in the high income family, but not significantly in the low income families.

Finally, children from high income families are significantly more likely to have a high cognitive ability despite accounting for parenting style. Certain practices such as mostly reading with the child are beneficial, but it does not differ between the two groups.

3.6 Conclusion: Parenting Style and Children's Outcomes

Understanding the determinants of children's physical and mental health raise important questions which research has not yet fully answered. In this chapter, we focus on the role of the mother's parenting style, not only as a determinant of children's health and cognitive ability, but also as a possible pathway that could explain the observed relationships between socio-economic factors and children's outcomes.

Most of the evidence comes from the psychology literature. Although it finds significant correlations between parenting style and health outcomes, significant problems such as unobserved heterogeneity and recursivity have not been addressed in this literature and sample sizes are typically small.

Our analysis contributes to the literature in several ways. First, we not only look at measures of overall involvement and strictness, but also analyse specific measures of parenting style to understand what practices matter the most. Second, in addition to the main classical two dimensions of parenting style, involvement and strictness, we include a third dimension: practices related to the child's lifestyle (going to bed regularly and number of breakfasts in a week). Third, we make use of the rich data in the Millennium Cohort Study to allow for a wide range of potential confounding variables. Fourth, we explicitly address possible unobserved heterogeneity and recursivity, comparing results from simple cross-section models, models with family fixed effects, models with lagged effects of parenting style, and models which allow for child outcomes and parenting style to be recursively determined. Fifth, we examine whether the effect of parenting style varies with family socio-economic circumstances. And finally, we undertake extensive robustness checks for reporting bias.

Our results suggest that physical health is not strongly affected by parenting style, although some practices such as reasoning with a naughty child or punishing him by taking away treats are beneficial to his health once we account for unobserved heterogeneity. Surprisingly, the benefits of healthy practices imposed by the parents disappear once we take into account parenting style. Unobserved heterogeneity seems to be only a minor issue in the case of physical health.

Externalising behavioural problems and hyperactivity are reduced when mothers are involved but worsen when they are very strict. Lifestyle measures, such as going to bed regularly and having breakfast in the morning, are beneficial and significantly reduce the child's externalising behavioural problems. The effects are much larger once we account for unobserved heterogeneity.

Internalising behavioural problems are increased by mother's strictness, although

certain measures such as reasoning with the child are beneficial. In terms of lifestyle, going to bed regularly is beneficial to the child's emotional problems. In this case as well, unobserved heterogeneity appears to be an issue and the effects of parenting style are larger once we account for it.

Finally, cognitive ability is reduced by mother's overall involvement and strictness, but going to bed at a regular time is beneficial to the child achievements.

Our results in terms of physical and mental health are in line with the existing evidence. However, unobserved heterogeneity appears to be an important issue that suggests that previous evidence that does not account for it may be biased. The results in the case of cognitive ability differed from the literature; strictness reduces child achievements, which is the opposite of what the rest of the literature finds.

We pursue two robustness checks. First, because the outcomes are reported by the mothers as well as the parenting style, we use similar outcomes that are not reported by the mothers. For physical health, we use BMI measured by the interviewer. For externalising behavioural problems, we use hyperactivity reported by the teacher. For internalising behavioural problems, we use emotional problems reported by the MCS child. With these alternative outcome measures, the results are broadly similar but generally less precisely estimated.

Our second robustness check is to replace parenting style reported by the mother by parenting style reported by an older sibling. These sibling reported variables however have some important drawbacks: first, they refer to the parenting style of the parents in general and not to the mother specifically. Second, they are about the parenting style adopted with the sibling who is older than the MCS child. Third, fewer observations are available. Fourth, the questions are different. Most of the parenting style reported by the sibling are not significant in our regressions. In the case of externalising behavioural problems, only going to bed at a regular time reduce the index. Internalising behavioural problems are increased when the parents are strict with the household chores, supporting the results that too much strictness increases the emotional problems.

Next, as the parenting style measures focus on the mothers, we try to shed some light on the role of the father. We use the mother partners' involvement as an additional parenting style measure and control for unobserved heterogeneity. Most of the effects of mother's parenting style remain unchanged, and the partner's involvement is not significant.

After analysing the role of parenting style in the child health production function, we attempt first to understand whether parenting style could be a pathway that explains the relationship between parenting, and second how parenting style vary with socio-economic factors.

Parenting style did not appear to be a pathway in the case of physical health, emotional problems and cognitive ability, but it reduces the role of mother's cigarette consumption during pregnancy, the role of a male's presence in the household, and the role of the mother's marital status in the case of externalising behavioural problems.

We then interact parenting style practices with an indicator of mother's high education. For externalising behavioural problems, strictness measures appear to be the most harmful to children with mothers with a low education level, whereas reading is positively correlated with the children's cognitive ability when the mother has a low educational level.

We also interact parenting style practices with an indicator of household's wealth. Children in poor households are more affected by their mother's parenting style. In this group, externalising behavioural problems are reduced when mothers read to the child, and increased when mothers shout at the child when naughty, take treats away, or ignore the naughty child. Cognitive ability in this group is positively correlated with mothers who read to the child, or shout at the naughty child. Only a few parenting practices in rich households are significantly associated with children's outcomes. For example, ignoring a naughty child is negatively correlated with the child externalising behavioural problems.

These results have potential implications for policy makers since they will help them target their interventions to improve children's health and wellbeing. However, some important aspects remain to be addressed in future research. First, we have assumed that parenting style has a linear effect, but non-linearity should be investigated. Second, we have analysed each parenting style measure separately, but possible interactions may exist and should be identified. Finally, it is crucial to investigate the complementary or substitution role not only of the father but also of other types of care such as nursery care. The family is not the only arena where adults affect the child's health and development. Extended family members, school and peer groups also play an important role that we have put aside in this research to focus on the mother's effects. It is not clear however how the identified effects would vary once we take into account these other influences. The effects are likely to depend on the duration and quality of exposure, which in turn depends on parents' socio-economic background and their own relationship with their child. For example, a working mother with comfortable financial means is likely to compensate her lack of time with the child with a school that provides a good education to the child. Possible heterogeneity in these different complementarity or substitutive relationships remains an important question for future research.

Chapter 4

Conclusion

This thesis has applied economic models to examine the effect of incentives on behaviour (Chapter 2) and the effect of behaviour on health (Chapter 3). In investigating both topics we have set out simple models of behaviour, which are extensions of those previously considered, to suggest possible hypotheses and to guide the empirical analysis in the light of potential problems suggested by the models. We have exploited large and complex panel datasets to test our predictions, taking care to construct key variables that correspond to theoretical concepts. Finally, we have applied appropriate advanced econometric techniques to analyse possible dynamic effects and unobserved behaviours.

The first essay focused on the role of health insurance on individuals' preventive activity. We discussed the different characteristics of primary and secondary preventive activities and explained why the effect of insurance may be different for these two types of prevention. We reviewed the literature on the effects of health care insurance on prevention. We extended the Ex Ante Moral Hazard (EAMH) model by making two additional assumptions that explain why available evidence may be misleading. First, we argued for the existence of a lag before receiving the benefits of current healthy lifestyle or the consequences of less healthy behaviour. Available evidence does not account for this dynamic effect. Second, we postulated that previous evidence based on the granting of Medicare in the USA as a natural experiment should account for anticipation of insurance. This exogenous change is expected by most of the population; this has been observed for example in the case of the demand for health care that tends to be postponed to post 65 (e.g. Lichtenberg, 2002). We incorporated these assumptions into the classical framework of EAMH, and our model predicted that uninsured individuals would start reducing their investments in healthy lifestyle before being insured by Medicare from age 65. We called this effect "anticipatory EAMH".

We used the Health and Retirement Study (HRS) to test the model's prediction. The HRS is a representative longitudinal survey of Americans over age 50. We focused on the individuals aged between 59 and 68 years old, and proposed three definitions of the uninsured group based on their health insurance coverage reported at the two interviews before they received Medicare.

As the granting of Medicare is not a randomised experiment, our empirical approach had to account for selection on observables and unobservables. We started the analysis of exercising, smoking and drinking using Propensity Score (PS) match-

ing to account for observable confounding variables. Then, we compared changes in lifestyle between the insured and uninsured using PS matching to account for time-invariant unobservable characteristics. We did the same analysis using Difference-in-Differences (DID) regressions to account for time-variant observable characteristics, and time-invariant unobservable characteristics. Finally, we combined the two methods into a double-robust estimate which remains consistent when either model is correctly specified. As we were interested in the relative change in trends between the insured and uninsured groups, we computed the double and triple differences of the double-robust estimates that are robust to unobserved linearly time-variant unobservable factors.

The results indicated the presence of anticipatory EAMH in the case of physical health about two years before being insured by Medicare. The analysis of smoking behaviour provided weak evidence of anticipatory EAMH, but suggested the existence of positive selection. Finally smoking behaviour did not vary as predicted by EAMH or anticipatory EAMH.

The direct policy implication of this research is that the anticipated introduction of a universal health insurance in countries which currently do not have one could temporarily discourage healthy behaviour. In the elderly population, we observe a reduction of about 5% in physical activity just before becoming insured in those previously uninsured relative to those previously insured. This difference disappears once both groups are insured by Medicare, suggesting that easier access to doctors can have a positive effect on behaviour (Dave and Kaestner, 2009). Our results imply that the introduction of a universal insurance coverage should happen as soon as possible once it has been approved to moderate the anticipatory EAMH effect. Otherwise, the reduction in healthy activities could increase the future costs of health care for the newly insured.

Recently, some health insurance policies have started to offer coverage for primary prevention (lifestyle). In our research we find that the gap in relative trends between the insured and uninsured is reduced once both groups are insured. However, it would be an interesting research question to ask whether health insurance covering primary prevention can encourage even more healthy practices. A great amount of care would have to be put into dealing with the problem of selection of this type of insurance.

The second essay analysed the role of maternal parenting style on the physical and mental health, and cognitive ability of children. We first focused on the psychology literature which has been studying parenting style for decades. We reviewed the main association found between parenting style, children's health and cognitive ability. We then explicitly formulated the relationship between parenting style and the children's outcomes in an economic context where the mother maximised her utility as a function

of the child's health and her parenting style. We illustrated the problems of unobserved heterogeneity and recursivity, which suggested that previous evidence that does not account for these effects cannot be considered as causal effects and only provides estimates of the correlations.

For our analysis, we used the Millennium Cohort Study (MCS), a UK national longitudinal birth cohort study started in 2000. We analysed the various measures of parenting style available in this data and attempted various summary measures in terms of mother's involvement and strictness as it has been done in the psychology literature. We also analysed the effects of specific parenting style measures to better understand which practice mattered, as a proxy for quality.

We mainly exploited the two last sweeps of the MCS when the child is 5 and 7 years old. We started with pooled regressions to have estimates of the conditional correlations. The next approach used fixed effect to account for unobserved heterogeneity. The third approach estimated a lagged specification which allowed us to account for recursivity. Finally, we estimated a recursive system of equations that addressed these two issues at once, and allowed us to obtain estimates of the effect of parenting style on the child outcomes. These approaches required successively weaker assumptions for the estimated correlations to be causal.

We replicated these results using child outcomes not reported by the mother to address the reporting bias problem. We also used parenting style reported by the child's elder sibling to test the sensitivity of our results. In addition, we included the involvement of the mother's partner to see whether it played a role by itself or whether it affected the mother's role. Finally, we analysed the socio-economic factors by asking first whether the effects of socio-economic factors on child outcomes were affected once we took into account parenting style. If the effects of socio-economic factors had been reduced, parenting style could have been a pathway explaining some of the relationship. Second, we looked at whether the effects of parenting style on child outcomes varied by socio-economic factors. For that, we interacted parenting style with an indicator of high mother's education, and an indicator of high household income.

Our results suggested first that the child physical health was not affected by mother's overall involvement or overall strictness, but some specific measures such as reasoning with the naughty child or taking away treats from him positively affected his health. In the case of physical health, the endogeneity of parenting style did not seem to be a major issue, which was also supported by the results using child BMI. The endogeneity of parenting style was an issue in the case of mental health, measured as externalising and internalising behavioural problems. Externalising behavioural problems were reduced when the mother was involved, and reading to the child was particu-

larly beneficial. Lifestyle practices such as going to bed at a regular time and having regularly breakfast in the morning also reduced behavioural problems. By contrast greater strictness increased the child externalising behavioural problems as reported by the mother, which was supported by the results using hyperactivity reported by the teacher. Internalising behavioural problems were increased by the mother's strictness, and in particular, ignoring a naughty child increased the child behavioural problems. Reasoning with the naughty child reduced his internalising behavioural problems. When we used internalising problems reported by the child, the results suggested instead that reading was beneficial to the child. Some results for cognitive ability were counterintuitive: mother's total involvement and strictness reduced the child achievements. It is possible that children who are particularly gifted are negatively affected by their mother's involvement and strictness. The specific measures of parenting style suggested that cognitive ability was improved when mothers read to the child and when they imposed regular bed times.

Girls' externalising behavioural problems appeared to be particularly affected by the mother's parenting style, whereas it was the boys' internalising behavioural problems which were more affected by mother's parenting style. When we looked at how parenting style effects varied by the mother's education level, strictness measures worsened externalising behavioural problems and reading with the child was beneficial to cognitive ability when the mother had a low education level. Children in poorer households had fewer externalising behavioural problems when the mother ignored the naughty child or reads with the child.

The partner's involvement did not affect these results.

Avenues for future research include the use of more flexible models of parenting style to allow for non-linear effects of parenting style. It is also important to analyse the interactions of these different parenting style measures with one another. Finally, it would be interesting to investigate the interaction of the mother's parenting style with not only the father's parenting style, but also the practices adopted by other types of child care which may be a substitute to the mother's care. This is however impossible without more detailed datasets.

In terms of policy recommendations, our research shows that parenting style is not a major pathway between socio-economic status and children's outcomes, except in the case of externalising behavioural problems. As some socio-economic groups appear to be differently affected by the mother's parenting style, it suggests that policy to support the development of the child should be differentiated depending on to whom it is addressed.

Chapter 5

Appendix: Anticipatory Ex Ante Moral Hazard

A Definition of the Variables

A.1 Insurance variables

All the insurance variables come from the RAND version of the HRS data. Information about individual governmental coverage is provided by four variables. In all the waves the individual is asked whether she is currently covered by Medicare, Medicaid, CHAMPUS/VA, or any government health insurance program. In 2002, CHAMPUS is replaced by TRI-CARE.

The source of private health insurance is not very specific, except for employer provided insurance for which we know the source of the coverage (actual or past employer, spouse employer). We summarise this information in one variable, the employer insurance indicator, equal to one if the individual has any employer provided insurance. Other types of private insurance are less detailed; a question about "other type of insurance, other than government, employer-provided, or long-term care insurance" is asked to respondent inconsistently. The RAND defines it as follow: "Generally, if R[espondent] indicates that s/he is currently covered by Basic health, Medigap or any other health insurance programs besides long-term care insurance, and the coverage is not clearly provided by the government or an employer or union, then we set the variable to yes =(1). If R responds no to questions about these types of insurance coverage then it is set to no (=0)" (p. 863, HRS codebook J). As recommended by the RAND, we only use this variable in conjunction with other types of insurance coverage.

Questions about current long-term care and life insurances vary slightly across waves but the information can be consistently obtained at all the waves.

A.2 Summary of the different definitions of the uninsured group

We illustrate in Table 47 the different definitions of the uninsured group used in this chapter (*Private Only, Private & Public, All Types*) and for comparison the uninsured definitions used by Dave and Kaestner (2006, 2009) (*def1, def2* - see Section B for the definitions*)*. In order to keep things simple, we only consider two governmental health insurance (Medicaid and any military insurance) and two indicators of private coverage

Table 47: The different uninsured definitions

	Age brackets			Different uninsured groups				
individuals	**age 59-60**	**age 61-62**	**age 63-64**	**def1**	**def2**	**All Types**	**Private & Public**	**Private Only**
1	Medicaid=0 CHAMPUS=0 Empl. ins=1 Other ins.=0	Medicaid=1 CHAMPUS=0 Empl. ins=. Other ins.=0	Medicaid=0 CHAMPUS=0 Empl. ins=0 Other ins.=0	0	0	1	1	1
2	-	Medicaid=1 CHAMPUS=0 Empl. ins=0 Other ins.=0	Medicaid=0 CHAMPUS=0 Empl. ins=0 Other ins.=0	1	1	1	1	1
3	-	-	Medicaid=0 CHAMPUS=0 Empl. ins=0 Other ins.=0	1	1	.	.	.
4	Medicaid=0 CHAMPUS=1 Empl. ins=0 Other ins.=0	Medicaid=0 CHAMPUS=1 Empl. ins=0 Other ins.=0	Medicaid=0 CHAMPUS=1 Empl. ins=0 Other ins.=0	1	0	0	0	1
5	Medicaid=0 CHAMPUS=0 Empl. ins=1 Other ins.=0	Medicaid=0 CHAMPUS=. Empl. ins=0 Other ins.=0	Medicaid=0 CHAMPUS=0 Empl. ins=1 Other ins.=0	0	1	.	.	1
6	Medicaid=0 CHAMPUS=0 Empl. ins=1 Other ins.=0	Medicaid=0 CHAMPUS=. Empl. ins=0 Other ins.=0	Medicaid=0 CHAMPUS=0 Empl. ins=1 Other ins.=0	0	0	.	.	1
7	Medicaid=0 CHAMPUS=0 Empl. ins=0 Other ins.=.	Medicaid=0 CHAMPUS=0 Empl. ins=1 Other ins.=0	Medicaid=0 CHAMPUS=0 Empl. ins=1 Other ins.=0	0	0	0	0	0

Notes: For simplicity, we have listed here four types of insurance (2 public, 2 privates). 1 indicates that an individual is considered as uninsured, and 0 if insured. For comparison we have also included Dave & Kaesnter (2006, 2009) definitions (def1 and def2). Empl. ins.: employer insurance provided by own employer or spouse's employer. Other ins.: other insurance includes any other type of private insurance that is not provided by the employer, "" : not observed at these ages, "." : missing values (the insurance group cannot be determined).

(employer provided insurance and insurance other than non governmental, employer or long-term care insurance).

First, it is clear that Dave and Kaestner's definitions and our three different definitions classify the individuals very differently. We focus on the insurance status at ages 61/62 and 63/64 whereas Dave and Kaestner use any information available. For example, in the case of individual 3, we believe it is not possible to classify this individual, although Dave and Kaestner assume that she is uninsured. If they had more information, this individual could have been considered as insured like in case 1. Second, they do not distinguish between the type of insurance coverage.

Third it is important to note that our definitions ignore the insurance status at age 59/60. Furthermore in the cases 5 and 6, we are able to determine the private insurance status as this private insurance coverage is not missing, however, we do not

know whether the individual is covered by a public insurance at age 61/62 and therefore the two other insurance status cannot be determined. In case 1, the missing value is not an issue as we already know that the individual has no insurance coverage at age 63/64. Individual 1 should have been insured in these two waves to be considered as insured.

B Replication of Dave and Kaestner (2009)

To check the results in Dave and Kaestner (2009) and to ensure that we have correctly constructed our database, we replicate Dave and Kaestner (2009)'s paper. We have been able to qualitatively replicate all of their estimates. Some numerical differences exist due to the lack of details on the samples they used. We first describe our steps in detail to replicate their results and discuss the possible reasons for the remaining differences. Then we comment their approach and suggest possible improvements.

B.1 Description of their sample

In their paper, Dave and Kaestner (D&K) use the first eight waves of the HRS and restrict their sample to "individuals who are between the ages of 60 and 69 [...]. Disabled persons and those on Medicare prior to age 65 are excluded from the analysis. The sample is further restricted to adults who have not completed high school" (p.8). Disabled are dropped on a wave-to-wave basis.[89] They obtain 9,782 person-wave observations for 3,396 persons. Their descriptive statistics are reported for the pre-age 65 with less than high school education, and the number of observations represents the maximum sample size for the pre-age 65 group with non-missing information on doctor visits.

D&K consider two types of uninsured individuals. The individuals who have been continuously uninsured during all the waves prior to 65 (we refer to it as *def1*), and the individuals who have been uninsured more than half of the time prior to age 65 (we refer to it as *def2*). At each wave, the insured indicator is equal to one if the "individual reports being covered by health insurance under any governmental program including Medicare or Medicaid, under his own current or previous employer, under his spouse's current or previous employer, or under any other supplemental insurance" (p.9).[90] The descriptive statistics that they present in their paper are only presented for the two groups separately based on *def1* and only for the individuals before 65.

In the descriptive statistics presented in Table 48, we present D&K estimates in columns 1 and 2, and our estimates in columns 3 and 4. Both results are fairly similar, the only major difference is the number of cigarettes smoked per day that is higher in our sample for the insured individual. The number of observations varies significantly between the two samples. Our final sample has 102 additional observations, with our

[89] Information obtained in a correspondence with the authors.

[90] In a correspondence with the authors, Prof Dave adds that the insurance indicator is also equal to one if the respondent reported that her physician expenses were at least partially covered since last wave (this question is however only asked from the 5th wave).

uninsured group being much larger (636 compared to 470). Although some differences could be explained by the released version of the data that we have used, this gap cannot be reduced in the absence of more detailed information about their sample definition.[91]

An important aspect that remains unclear is the classification of the individuals who were insured by Medicare prior 65: in the definition of their sample, these individuals seem to be excluded from their sample, but D&K take this information into account when defining the insurance indicator. In our results presented below, we have dropped these individuals from the analysis. Another issue is at which step D&K define their uninsured groups: is it on the whole sample or on the restricted sample? This could a be a problem for example for disabled individuals: if D&K define the uninsured status before excluding the disabled on a wave-to-wave basis, then these individuals will probably appear as being insured as they may be receiving Medicaid or Medicare, but if the uninsured status is defined after dropping them on a wave-to-wave basis these individuals will be considered as uninsured. It would have been useful to have the descriptive statistics for the whole sample as well as the total number of observations, and the total number of individuals.

B.2 A preliminary step: the demand for doctor visits and hospital stays

D&K analyse first the impact of receiving Medicare on the demand for medical services. The purpose of these regressions is to show that Medicare is associated with a significant increase in health care use.[92]

As measures of health care utilisation, D&K use the indicators of any doctor visit, of any hospital stay, and the number of physician visits. These questions cover the two years before the interview, whereas the insurance questions refer to the actual insurance status. In order to have that medical care and insurance coverage referring to the same period, D&K assign the health care utilisation variables "to the respondent's mean age between the prior and the current wave" (p.9). In a correspondence with the authors, they suggest redefining the cutoff point not at the age of 65 but after 65. This is the adjustment we use in our results presented in Table 50.

D&K use OLS regression for the "any doctor visit" and "any hospital stay" variables, and Poisson regression to estimate the number of doctor visits. They control for

[91] We have exchanged various emails with the authors, but there are some aspects that they could not clarify.

[92] We only briefly discuss this part as first, this is an ex post moral hazard problem and thus out of the scope of this chapter, and second, the HRS data are not directly appropriate for this kind of analysis as the questions related to medical visits refer to the period since last interview whereas most of the other variables refer to the current period.

Table 48: Descriptive Statistics: Dave & Kaestner (2009)

	(1)	(2)	(3)	(4)
	D&K Results		Our Sample	
Variables	Insured	Uninsured	Insured	Uninsured
Age	61.807	61.926	61.82	61.82
Male	0.454	0.412	0.456	0.397
White	0.772	0.752	0.782	0.705
Black	0.167	0.138	0.165	0.150
Other Race	0.061	0.110	0.0529	0.145
Hispanic	0.192	0.404	0.185	0.385
Married	0.685	0.571	0.693	0.528
Divorced	0.139	0.131	0.104	0.104
F-t Employment	0.332	0.321	0.336	0.301
P-t Employment	0.080	0.115	0.0808	0.0999
Retirement	0.345	0.220	0.347	0.237
Partial Retirement	0.073	0.049	0.0730	0.0584
Unemployed	0.012	0.033	0.0116	0.0291
HH Size	2.530	2.878	2.520	2.830
Parents Alive	0.276	0.290	0.270	0.315
Assets	100909.8	57803.5	144601.8	75414.2
Any Dr Visit	0.857	0.663	0.873	0.618
Nb of Dr Visits	7.793	4.414	8.020	4.211
Any Hospital Stay	0.200	0.097	0.205	0.104
Vigorous Physical Activity	0.355	0.386	0.386	0.374
Daily Cigarette Consumption	0.272	0.323	0.180	0.239
Number of Cigarette (D)	7.032	12.008	11.63	12.28
Quit Cigarette	0.585	0.474	0.606	0.423
Daily Alcohol Consumption	0.060	0.077	0.0571	0.0604
Alcohol Participation	0.276	0.237	0.277	0.265
Number of Observation	4,166	470	3,898	636

Notes: D&K report assets in 1982-84 dollars, whereas we report them in 1992 dollars. All means are weighted by the sampling weight.

Table 50: Demand for Doctor Visit - Dave and Kaestner (2009)

Male		**Any Dr Visits**		**# Dr Visits**		**Any Hosp. Stay**	
		D&K	**Our est.**	**D&K**	**Our est.**	**D&K**	**Our est.**
Def1	**Uninsured***	0.080*	0.104*	0.532***	0.501**	0.075	0.046
	65orM	(0.045)	(0.047)	(0.169)	(0.163)	(0.055)	(0.043)
	Uninsured*	0.004	0.0323	0.223	0.298	0.027	-0.022
	A6364	(0.046)	(0.048)	(0.181)	(0.198)	(0.055)	(0.041)
	MDVPU	0.615	0.727	5.013	5.843	0.149	0.197
Def2	**Uninsured***	0.084**	0.112**	0.552***	0.418**	0.037	0.028
	Post65	(0.036)	(0.037)	(0.130)	(0.134)	(0.043)	(0.0356)
	Uninsured*	0.010	0.0198	0.238*	0.188	-0.007	-0.022
	A6364	(0.035)	(0.039)	(0.131)	(0.155)	(0.042)	(0.033)
	MDVPU	0.601	0.719	4.414	5.843	0.128	0.180

Female		**Any Dr Visits**		**# Dr Visits**		**Any Hosp. Stay**	
		D&K	**Our est.**	**D&K**	**Our est.**	**D&K**	**Our est.**
Def1	**Uninsured***	-0.015	0.0421	0.315**	0.527***	0.059	0.0271
	65orM	(0.033)	(0.036)	(0.118)	(0.136)	(0.046)	(0.036)
	Uninsured*	-0.043	-0.00203	-0.073	0.235	0.026	0.0473
	A6364	(0.033)	(0.036)	(0.119)	(0.121)	(0.046)	(0.033)
	MDVPU	0.787	.8424528	7.308	8.352	0.150	0.189
Def2	**Uninsured***	0.055**	0.0387	0.276***	0.331**	0.010	0.027
	Post65	(0.025)	(0.027)	(0.087)	(0.106)	(0.035)	(0.031)
	Uninsured*	0.006	0.008	0.002	0.080	0.011	0.020
	A6364	(0.025)	(0.028)	(0.088)	(0.112)	(0.034)	(0.029)
	MDVPU	0.796	0.845	7.564	8.563	0.140	0.184

Notes: D&K: these columns report the D&K estimators. Our est.: our estimates. *MDVPU: Mean of dependent variable for previously uninsured*. Note that here we have taken into account the adjustment suggested by D&K: 65orM is in fact an indicator of post 65, and 6364 is actually an indicator of 64 or 65 years old. The stars are for the p-value if $\leq$1% (***), $\leq$5% (**), $\leq$10% (*).

person-specific fixed effect; therefore we estimate the model using fixed-effect (FE) OLS for the binary variables and FE Poisson otherwise. Like D&K, we also control for age (single year age dummy variables), marital status (married and divorced), employment status (indicators of full-time and part-time job, full-time and partial retirement, unemployment), household size, number of living parents, assets, total years worked and year dummy variables. They present the results only for the male and female sub-samples.[93] We assume that they use now the sample of individuals aged between 60 and 69 years old, with no disabled, no individuals benefiting from Medicare prior to age 65 and only the ones with less than a high school degree. In Table 50, the results are based on *def1.*

Using the male sample, we obtain very similar estimates, although for some the magnitude varies. The probability to have doctor visits is significantly higher after 65 for the uninsured; using *def1* and based on our estimates, they are about 10 percentage points more likely to visit a doctor, but only 8 percentage points based on D&K's estimates. The number of doctor visits for the uninsured after 65 years old is also significantly higher of about 0.5. Both results are very similar for *def1* but differ of 0.134 when using *def2*. The probability to have any hospital stay does not differ between the insured and uninsured based on their or our estimates.

Using the female sample, the insured and uninsured are generally less different at the ages 65 when comparing the probability to have a doctor visit or a hospital stay (apart from *def2* in D&K's results where the uninsured are 5 percentage points more likely to visit the doctor). The uninsured are however more likely to have a higher number of doctor visits if uninsured and 65 or more. D&K obtain estimates around 0.3 whereas our estimates vary between 0.3 (*def2*) and 0.5 (*def1*).

As D&K do not provide the total number of observations used in the regressions, it is not possible to know how different our samples are. The main problem we encountered here when trying to replicate D&K's results is the dependent variable adjustment. We have chosen to assume that the treatment (receiving Medicare) is from the age 66 as suggested by the authors and so we do not loose any observation, but it is possible that D&K use the average over two interviews which would reduce the sample. As the number of observations for each regression is not provided, we cannot confirm that.

B.3 The Ex Ante Moral Hazard effect

D&K study six measures of lifestyle (L_{it}): indicators of participation in vigorous physical activities three or more times a week (*VIGPHYS* - only available in waves 1 to

[93]Probably because this allows them to estimate the impact of gender, which would not be possible by running a FE regression on the whole sample.

6), of daily cigarette consumption ($CIGD$), of cigarette ending ($CIGQUIT$), of current alcohol participation ($DRINKER$), of daily drinking ($DRINKD$), and the number of cigarettes smoked daily ($CIGNB$).

D&K present the effect for male and female separately. They apply a FE OLS for binary dependent variables and FE Poisson for count dependent variables. For each dependent variable, the first regression represents the effect of Medicare on lifestyles without controlling for doctor visits (equation (52)), whereas in the second one (equation (53)), we take into account whether the individual has had any doctor visits and allow for interactions with age and the indicator of insurance status. D&K also include a dummy variable for ages 63 and 64 ($A6364_{it}$) to control for pre-age 65 differences in the age pattern of the outcomes between the two groups. Finally, in both equations, we also control for age (AGE_{at}), marital status, employment, household size, number of living parents, assets, total years worked and the year of the interview (all included in X_{it}). The uninsured group ($UNINS_i$) is defined following *def1* in the results presented below. The different models are

$$\begin{aligned} L_{it} &= \alpha_i + \beta_x X_{it} + \sum_{a=61}^{69} \eta_a AGE_{at} + \gamma_{U65} UNINS_i * A65M_{it} \\ &\quad + \gamma_{U6364} UNINS_i * A6364_{it} + \varepsilon_{it} \end{aligned} \tag{52}$$

$$\begin{aligned} L_{it} &= \alpha_i + \beta_x X_{it} + \sum_{a=61}^{69} \eta_a AGE_{at} + \gamma_{U65} UNINS_i * A65M_{it} \\ &\quad + \beta_D DOC_{it} + \beta_{D65} DOC_{it} * A65M_{it} + \gamma_{UD} UNINS_i * DOC_{it} \\ &\quad + \gamma_{UD65} A65M_{it} * UNINS_i * DOC_{it} \\ &\quad + \gamma_{U6364} UNINS_i * A6364_{it} + \varepsilon_{it} \end{aligned} \tag{53}$$

with $i = 1, ..., N$ and $t = 1992, ..., 2006$. We define the uninsured group on the subsample of individual aged between 60 and 69, we restrict the sample to individuals with less than high school and drop the disabled on a wave-to-wave basis.[94]

Male sample

The estimates for the male sample are presented at the top of Tables 53, 56 and 59.[95] We obtain very similar results as D&K, and as theirs, they are rarely significant, so it is a bit surprising that they say they have found (robust) evidence of EAMH.

[94] We do not drop the individuals insured by Medicare before 65 years old as D&K do not remember having dropped them.

[95] D&K results are from Table 3 in Dave and Kaestner (2009).

In the case of vigorous physical activity, the change between 63/64 years old and 65 or more is of about -1 percentage point without controlling for doctor visits and about -3 percentage points when controlling for doctor visits based on our estimates compare to about -9 percentage points and -15.1 percentage points respectively in their case, but none of these results are significant. Regarding the number of cigarettes smoked, based on our estimates, we observe a reduction between 63/64 and 65 or more, whereas D&K find a reduction when not controlling for doctor visits and an increase of 0.227 cigarettes when controlling for doctors visits. The probability to smoke daily (to quit smoking) increases (decreases) based on all estimates between 63/64 and 65 or more, but in their case, the main difference between the two groups seems to be around 63/64 years suggesting rather the presence of anticipatory behaviour at least if we do not account for doctor visits. The probability to have ever drunk increases after receiving Medicare, but the change is only significant in our case when we account for doctor visits. Finally, the difference between the two groups in terms of the probability to drink daily is not significant and does not change once the individuals receive Medicare.

Female sample

The estimates for the male sample are presented at the bottom of Tables 53, 56 and 59.[96] Our results differ more from D&K compared to the analysis on the male sample. In the case of vigorous physical activity, D&K find significant results in terms of EAMH and anticipatory behaviour when not controlling for doctor visits whereas we find significant evidence of EAMH once we control for doctor visits which better supports their assumption of indirect effect. The analysis of the number of cigarettes smoked per day does lead D&K to suggest the presence of EAMH, whereas our estimates suggest the presence of anticipatory behaviour, at least when we do not control for doctor visits, i.e. the uninsured are much more likely to smoke more around 63/64 years old (about 0.3 cigarettes per day). The probability to smoke daily (to quit smoking) is significantly reduced (increased) if the individual has seen a doctor, but the EAMH estimates, although positive (negative) when getting covered by Medicare, are not significant in any of their or our regressions. The probability to have ever drunk alcohol is smaller for the uninsured when becoming 65 or more and when controlling for the doctor visits based on D&K estimates, but based on our estimates, when controlling for the doctor visits as well, the uninsured becomes 2.1 percentage points more likely to ever drink. However none of these estimates are significant. Finally, the difference between the insured and uninsured in term of the probability to drink daily becomes positive after 65 years old

[96] D&K results are from table 5 in Dave and Kaestner (2009).

or more; the change is of about 2 percentage points based on D&K's estimates and of about 1.5 percentage points in our case.

B.4 Discussion

D&K argue that they have identified EAMH when they account for doctor visits, but their results are almost never significant. Overall our approximation of D&K results allow us to draw the same conclusions on the weak existence of EAMH and possibly anticipatory behaviour (although D&K do not discuss it). Differences between the estimates can be explained by the lack of details on some crucial issues, such as whether individuals insured by Medicare are really dropped, on which sample is the health insurance status defined, and what is the adjustment used for the medical care variables.

The main difficulty in their paper is the definitions of the uninsured group (*def1*, *def2*). First, we believe it is necessary to impose a minimum number of years for which the individual must have been observed before her 65. Moreover only a few individuals report no cover for all the waves, but we know that individuals who are not continuously covered are very similar to the continuously uninsured. Therefore, allowing to have only one interview before the granting of Medicare to define whether the individual is considered as uninsured or not is likely to bias the results (see for example individual 3 in Table 47 who illustrates this problem).

Another major issue in the D&K paper is that they do not allow the uninsured individuals to be different from the insured ones before 63. Their model assumes that the uninsured and insured individuals behave in the same way before 63 year old. If adverse (or positive) selection exists and EAMH does not, by construction the dummies *A6364* and *A65M* capture the self-selection effect and not the EAMH effect. Similarly, if anticipatory behaviour is present it will only be identified from 63 years old.

We estimate the following model, allowing the uninsured to differ at younger ages (Equation 54):[97]

$$\begin{aligned} L_{it} &= \alpha_i + \beta_x X_{it} + \sum_{a=61}^{69} \eta_a AGE_{at} + \gamma_{U65} UNINS_i * A65M_{it} \\ &\quad + \beta_D DOC_{it} + \beta_{D65} DOC_{it} * A65M_{it} + \gamma_{UD} UNINS_i * DOC_{it} \\ &\quad + \gamma_{UD65} A65M_{it} * UNINS_i * DOC_{it} \\ &\quad + \gamma_{U6364} UNINS_i * A6364_{it} + \gamma_{\mathbf{U6162}} \mathbf{UNINS_i} * \mathbf{A6162_{it}} + \varepsilon_{it} \end{aligned} \tag{54}$$

[97] It is however not possible to have an interaction term of the uninsured indicator with all age ranges because of the FE that has to drop at least one of the them.

Table 53: EAMH - Dave & Kaestner (2009)'s main results (1)

Male	**VIGPHYS16**				**CIGNB**			
	D&K		**Our estimates**		**D&K**		**Our estimates**	
Unins*	-0.067	-0.123	-0.053	-0.076	0.007	0.290	-0.079	0.243
65M	(0.071)	(0.132)	(0.059)	(0.099)	(0.150)	(0.223)	(0.179)	(0.422)
Unins*	0.024	0.028	-0.044	-0.048	0.020	0.063	0.385	0.407
A6364	(0.068)	(0.069)	(0.062)	(0.061)	(0.150)	(0.159)	(0.282)	(0.267)
Dr		0.002		-0.010		-0.100		-0.097
		(0.037)		(0.034)		(0.082)		(0.143)
Dr*		0.079		0.104		0.011		-0.097
Unins		(0.095)		(0.086)		(0.210)		(0.143)
Dr*		-0.045		-0.*034*		0.037		0.222
65M		(0.060)		(0.063)		(0.136)		(0.342)
Dr*Unins*65M		0.041		-0.009		-0.421		-0.382
		(0.147)		(0.108)		(0.277)		(0.439)
MDVPU	0.380	0.380	0.313	0.313	13.346	13.346	12.972	12.972

Female	**VIGPHYS16**				**CIGNB**			
	D&K		**Our estimates**		**D&K**		**Our estimates**	
Unins*	-0.132**	-0.219	-0.098	-0.350*	-0.025	-0.224	0.115	-0.0486
65M	(0.064)	(0.166)	(0.053)	(0.151)	(0.160)	(0.376)	(0.126)	(0.336)
Unins*	-0.104*	-0.091	-0.059	-0.068	-0.114	0.085	0.329*	0.310
A6364	(0.057)	(0.059)	(0.054)	(0.054)	(0.168)	(0.155)	(0.162)	(0.159)
Dr		0.076*		0.081*		0.045		0.0976
		(0.041)		(0.040)		(0.110)		(0.0820)
Dr*		-0.160		-0.160		-0.033		0.0452
Unins		(0.089)		(0.088)		(0.235)		(0.129)
Dr*		-0.058		-0.112		-0.268		-0.185
65M		(0.083)		(0.084)		(0.189)		(0.192)
Dr*Unins*65M		0.119		0.290		0.214		0.144
		(0.177)		(0.158)		(0.409)		(0.373)
MDVPU	0.297	0.297	0.304	0.301	8.008	8.008	11.233	11.233

Notes: Dr: indicator of doctor visits, 65M: indicator of 65 years old or more (to adjust for the doctor visit variable, it is in reality more than 65 only), A6364: to adjust for the doctor visit variable, this is in reality an indicator of 64 or 65 years old, MDVPU: Mean of dependent variable for previously uninsured. Stars convention: *** p<0.01, ** p<0.05 and * p<0.1.

Table 56: EAMH - Dave & Kaestner (2009)'s main results (2)

Male	**CIGD**				**CIGQUIT**			
	D&K		**Our estimates**		**D&K**		**Our estimates**	
Unins*	-0.035	0.028	-0.025	0.014	0.047	-0.028	0.015	-0.064
65M	(0.028)	(0.048)	(0.044)	(0.072)	(0.036)	(0.062)	(0.039)	(0.050)
Unins*	-0.047*	-0.039	-0.050	-0.051	0.064*	0.053	0.040	0.045
A6364	(0.028)	(0.029)	(0.044)	(0.043)	(0.036)	(0.037)	(0.038)	(0.034)
Dr		-0.032**		0.004		0.031*		0.0251
		(0.014)		(0.022)		(0.018)		(0.019)
Dr*		0.025		-0.011		-0.037		-0.021
Unins		(0.040)		(0.058)		(0.050)		(0.039)
Dr*		0.022		0.0279		-0.017		-0.031
65M		(0.023)		(0.038)		(0.030)		(0.029)
Dr*Unins*65M		-0.084		-		0.106		0.117
		(0.055)		0.054(0.072)		(0.070)		(0.061)
MDVPU	0.425	0.425	0.237	0.237	0.451	0.451	0.569	0.569

Female	**CIGD**				**CIGQUIT**			
	D&K		**Our estimates**		**D&K**		**Our estimates**	
Unins*	-0.010	0.025	0.041	0.061	0.044	-0.030	0.021	-0.005
65M	(0.024)	(0.059)	(0.030)	(0.071)	(0.044)	(0.117)	(0.047)	(0.087)
Unins*	0.006	0.006	0.038	0.036	0.005	0.013	-0.032	-0.034
A6364	(0.024)	(0.024)	(0.027)	(0.027)	(0.045)	(0.046)	(0.035)	(0.037)
Dr		-		-0.056*		0.088		0.108**
		0.044***		(0.025)		(0.028)		(0.037)
		(0.017)						
Dr*		0.044		0.020		-0.095		-0.144*
Unins		(0.038)		(0.049)		(0.074)		(0.061)
Dr*		-0.019		-0.044		0.042		0.061
65M		(0.029)		(0.039)		(0.051)		(0.065)
Dr*Unins*65M		-0.049		-0.027		0.103		0.040
		(0.064)		(0.076)		(0.124)		(0.094)
MDVPU	0.230	0.230	0.146	0.145	0.561	0.561	0.603	0.605

Notes: Dr: indicator of doctor visits, 65M: indicator of 65 years old or more (to adjust for the doctor visit variable, it is in reality more than 65 only), A6364: to adjust for the doctor visit variable, this is in reality an indicator of 64 or 65 years old, MDVPU: Mean of dependent variable for previously uninsured. Stars convention: *** $p<0.01$, ** $p<0.05$ and * $p<0.1$.

Table 59: EAMH - Dave & Kaestner (2009)'s main results (3)

Male	**DRINKE**				**DRINKdaily**			
	D&K		**Our estimates**		**D&K**		**Our estimates**	
Unins*	0.014	0.087	0.007	0.171*	-0.053	-0.037	0.021	-0.002
65M	(0.047)	(0.082)	(0.042)	(0.074)	(0.040)	(0.066)	(0.037)	(0.072)
Unins*	-0.026	-0.029	0.0267	0.018	-0.055	-0.058	0.020	0.020
A6364	(0.048)	(0.048)	(0.0423)	(0.042)	(0.039)	(0.040)	(0.043)	(0.044)
Dr		-0.068***		-0.053*		0.006		0.003
		(0.024)		(0.023)		(0.018)		(0.026)
Dr*		0.140**		0.108		-0.055		-0.0246
Unins		(0.067)		(0.056)		(0.058)		(0.055)
Dr*		0.030		0.052		-0.004		0.011
65M		(0.039)		(0.043)		(0.029)		(0.039)
Dr*Unin*65M		-0.113		-0.229**		-0.017		0.038
		(0.093)		(0.081)		(0.071)		(0.075)
MDVPU	0.365	0.365	0.481	0.484	0.135	0.135	0.095	0.096

Female	**DRINKE**				**DRINKdaily**			
	D&K		**Our estimates**		**D&K**		**Our estimates**	
Unins*	-0.001	-0.042	-0.0209	0.017	-0.017	0.007	0.001	0.019
65M	(0.031)	(0.076)	(0.0279)	(0.062)	(0.017)	(0.036)	(0.011)	(0.021)
Unins*	-0.003	-0.003	0.00214	-0.004	-0.015	-0.013	0.004	0.004
A6364	(0.031)	(0.032)	(0.0269)	(0.027)	(0.16)	(0.016)	(0.012)	(0.012)
Dr		-0.036*		-0.011		0.008		0.006
		(0.021)		(0.026)		(0.011)		(0.014)
Dr*		0.012		-0.010		0.020		0.020
Unins		(0.049)		(0.046)		(0.025)		(0.025)
Dr*		0.002		0.035		-0.001		0.001
65M		(0.038)		(0.045)		(0.018)		(0.013)
Dr*Unin*65M		0.052		-0.040		-0.033		-0.025
		(0.081)		(0.067)		(0.038)		(0.026)
MDVPU	0.104	0.104	0.199	0.201	0.026	0.026	0.015	0.015

Notes: Dr: indicator of doctor visits, 65M: indicator of 65 years old or more (to adjust for the doctor visit variable, it is in reality more than 65 only), A6364: to adjust for the doctor visit variable, this is in reality an indicator of 64 or 65 years old, MDVPU: Mean of dependent variable for previously uninsured. Stars convention: *** p<0.01, ** p<0.05 and * p<0.1.

Table 62: Classical and anticipatory EAMH in the Dave and Kaestner's sample

	VIGPHYS16		**CIGD**		**CIGQUIT**		**DRINKE**		**DRINKdaily**	
Unins*	-0.072	-0.090	-0.028	0.009	-0.029	-0.101	0.042	0.205**	0.035	0.012
65M	(0.074)	(0.107)	(0.053)	(0.079)	(0.045)	(0.053)	(0.051)	(0.078)	(0.048)	(0.075)
Unins*	-0.063	-0.062	-0.054	-0.056	-0.003	0.0076	0.061	0.052	0.034	0.034
A6364	(0.077)	(0.0774)	(0.054)	(0.053)	(0.045)	(0.038)	(0.048)	(0.049)	(0.050)	(0.051)
Unins*	-0.031	-0.023	-0.006	-0.009	-0.079	-0.068	0.061	0.061	0.023	0.023
A6162	(0.075)	(0.077)	(0.048)	(0.048)	(0.049)	(0.048)	(0.050)	(0.050)	(0.043)	(0.044)
Dr		-0.011		0.004		0.025		-0.053*		0.002
		(0.034)		(0.022)		(0.019)		(0.023)		(0.022)
Dr*		0.102		-0.011		-0.020		0.109		-0.023
Unins		(0.086)		(0.058)		(0.039)		(0.056)		(0.055)
Dr*		-0.034		0.028		-0.031		0.052		0.011
65M		(0.063)		(0.038)		(0.029)		(0.043)		(0.039)
Dr*Unins*65M		-0.008		-0.054		0.116		-		0.038
		(0.108)		(0.072)		(0.061)		0.228**		(0.075)
								(0.081)		
MDVPU	0.312	0.313	0.237	0.237	0.569	0.569	0.481	0.484	0.095	0.095

Notes: Dr: indicator of doctor visits, 65M: indicator of 65 years old or more to adjust for the doctor visit variable, it is in reality more than 65 only, A6364: to adjust for the doctor visit variable, this is in reality an indicator of 64 or 65 years old, A6263: to adjust for the doctor visit variable, this is in reality an indicator of 62 or 63 years old, MDVPU: Mean of dependent variable for previously uninsured. Stars convention: *** $p<0.01$, ** $p<0.05$ and * $p<0.1$.

Results for the binary dependent variables, based on *def1* and for the male sample only are presented in Table 62. In the case of vigorous physical activity, we see that the difference between the two groups already appears at the age 61/62 and increases gradually with age which suggests the presence of anticipatory behaviour. Uninsured individuals are less likely to smoke daily before 65, and become more likely to smoke daily after 65. This suggests the presence of EAMH although the coefficients are not significant. The uninsured however do not appear significantly less likely to quit smoking before or after 65. The uninsured are more likely to have ever drunk after 65 years old once we control for doctors visits and the estimate is even higher compared to the previous results. Although this pattern is similar to the one expected in case of EAMH, the rational that would explain why individuals start drinking when old is unclear. Finally, the uninsured appear to be more likely to drink daily independently of their age, which suggests the existence of positive selection. However, similarly to the previous results, these conclusions are very weak as the relevant coefficients are not significant.

Another issue is the construction of the number of cigarettes smoked per day variable and the model used to test the existence of EAMH. This variable only considers smokers and thus is truncated. The Poisson regression estimated on this sub-sample is not appropriate if all the zeros are missing. A selection model would be a better choice.

Finally, the rational for D&K sample selection is not clear. Including individual insured by Medicare before their 65 years old should not bias the results as Medicare at this age only covers specific disabilities such as end-stage renal diseases. The main issue is rather to determine whether these individuals should be considered as insured or not. Moreover, dropping the disabled on a wave-to-wave basis is questionable: it is likely that these individuals already encountered some difficulties before reporting officially a disability status (unless of a health shocks). At last, although they explain why they focus only on individuals with less then high school, it is necessary to explain what kind of policy recommendation could be made from their results, and an analysis that would compare their results to the ones using the whole sample would have been interesting.

To conclude, we believe that the D&K suggestion of an indirect effect created by Medicare at the age of 65 is very sensible, however their evidence for it is very weak as their results are relatively insignificant.

C Additional Results on Ex Ante Moral Hazard

In this section, we present the results for the "All Types" and "Private Only" definitions. The first Section presents the estimated propensity score, the second Section the results of the propensity score matching, Section C.3 the results of the DID propensity score matching, Section C.4 the results of the classical DID regression approaches, and Section C.5 has the results of the double-robust approach.

C.1 Estimated propensity score

Table 64: Propensity score regression estimates and balancedness tests of the covariates

	(1)		(2)	(3)	(4)	(5)
			Balancedness tests			
			Means			
	Estimates		Uninsured	Insured	% bias reduc.	P>|t|
SAH	-0.085	Unmatched	3.205	3.530		0.000
	(0.044)	Matched	3.205	3.221	95.2	0.755
Mobility index	-0.041	Unmatched	0.760	0.657		0.011
	(0.042)	Matched	0.760	0.805	56.5	0.426
Male	0.032	Unmatched	0.399	0.443		0.016
	(0.094)	Matched	0.399	0.397	94.8	0.923
White	-0.438*	Unmatched	0.729	0.855		0.000
	(0.205)	Matched	0.729	0.694	72.4	0.105
Black	-0.010	Unmatched	0.214	0.120		0.000
	(0.229)	Matched	0.214	0.237	74.7	0.234
Hispanic	0.752***	Unmatched	0.190	0.048		0.000
	(0.143)	Matched	0.190	0.206	88.9	0.405
Census West	-0.401**	Unmatched	0.169	0.166		0.854
	(0.125)	Matched	0.169	0.196	-982.6	0.141
Census mid-West	-0.536***	Unmatched	0.177	0.275		0.000
	(0.108)	Matched	0.177	0.197	79.4	0.274
Census North-East	-0.637***	Unmatched	0.117	0.167		0.000
	(0.125)	Matched	0.117	0.124	86.4	0.662
Married	-0.831***	Unmatched	0.616	0.780		0.000
	(0.220)	Matched	0.616	0.601	90.4	0.497
Partnered	-0.018	Unmatched	0.042	0.021		0.000
	(0.314)	Matched	0.042	0.039	89.0	0.810
Divorced	-0.206	Unmatched	0.178	0.109		0.000
	(0.233)	Matched	0.178	0.183	91.9	0.758
Widowed	-0.145	Unmatched	0.119	0.066		0.000
	(0.246)	Matched	0.119	0.109	81.0	0.502
Went to high school	-0.601***	Unmatched	0.349	0.392		0.015
	(0.101)	Matched	0.349	0.317	27.2	0.159
Went to college	-0.942***	Unmatched	0.144	0.224		0.000
	(0.130)	Matched	0.144	0.170	67.5	0.134
Finished college or more	-1.245***	Unmatched	0.085	0.224		0.000
	(0.151)	Matched	0.085	0.072	90.3	0.291
Works full-time	-0.472**	Unmatched	0.478	0.496		0.332
	(0.169)	Matched	0.478	0.493	17.2	0.538
Works part-time	-0.279	Unmatched	0.215	0.170		0.001
	(0.178)	Matched	0.215	0.205	77.6	0.600
Retired	-1.251***	Unmatched	0.105	0.235		0.000
	(0.187)	Matched	0.105	0.102	98.3	0.876
Unemployed	0.680*	Unmatched	0.044	0.011		0.000
	(0.304)	Matched	0.044	0.051	79.2	0.503
Self-employed	0.907***	Unmatched	0.191	0.119		0.000
	(0.127)	Matched	0.191	0.184	90.7	0.716
# years worked (log)	-0.058	Unmatched	3.133	3.345		0.000
	(0.059)	Matched	3.133	3.166	84.8	0.492
HH total assets	-1.067*	Unmatched	0.135	0.319		0.000
	(0.416)	Matched	0.135	0.193	68.1	0.087
HH total assets (squared)	0.052**	Unmatched	0.176	0.568		0.184
	(0.020)	Matched	0.176	0.916	-88.9	0.206
Has long-term care	-1.128***	Unmatched	0.020	0.089		0.000
insurance	(0.258)	Matched	0.020	0.024	95.1	0.627
Has life insurance	-0.676***	Unmatched	0.591	0.796		0.000
	(0.092)	Matched	0.591	0.600	95.6	0.699
Constant	1.603***					
	(0.369)					
N	5,912					

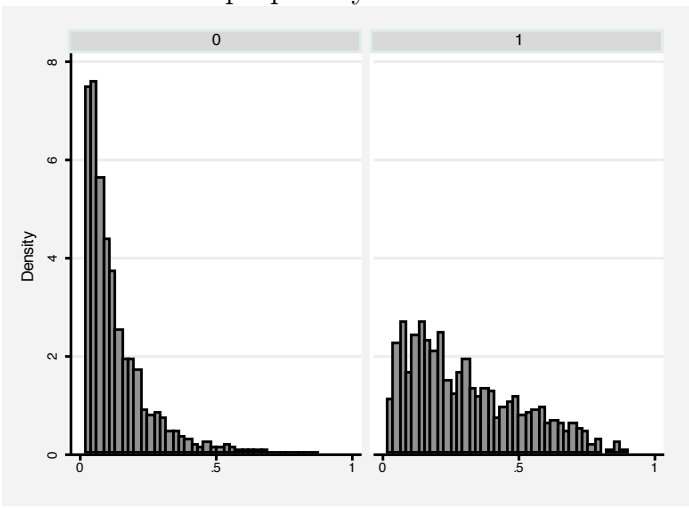
Notes: The uninsured definition is 'All Types'. SAH is self-assessed health. HH (Household) total assets are expressed in million. The propensity score is estimated using logit on individuals 59 or 60 years old and the coefficient estimates are reported in column 1. Matched sample is based on nearest neighbour matching with replacement. Column 2 and 3 report the means of the different covariates for the uninsured and insured respectively, for the unmatched and the matched sample. Column 4 reports the percentage bias reduction in the standardised bias before and after matching, and the last column presents the t-tests for the equality of means in the uninsured and insured groups, both before and after matching. Stars convention: * for $p<0.1$, ** for $p<0.05$, and *** for $p<0.01$.

Table 65: Propensity score regression estimates and balancedness tests of the covariates

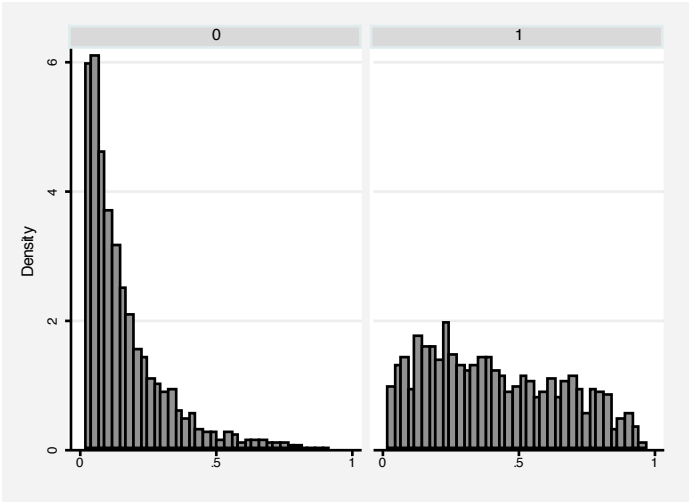
	(1)		(2)	(3)	(4)	(5)
			Balancedness tests			
			Means			
	Estimates		**Uninsured**	**Insured**	**% bias reduc.**	**P>|t|**
SAH	-0.168***	Unmatched	3.069	3.613		0.000
	(0.038)	Matched	3.069	3.077	98.5	0.842
Mobility index	0.111***	Unmatched	0.992	0.571		0.000
	(0.032)	Matched	0.992	0.993	99.8	0.989
Male	0.389***	Unmatched	0.419	0.442		0.136
	(0.080)	Matched	0.419	0.427	65.7	0.677
White	-0.429*	Unmatched	0.729	0.870		0.000
	(0.200)	Matched	0.729	0.698	77.6	0.062
Black	0.108	Unmatched	0.222	0.107		0.000
	(0.218)	Matched	0.222	0.255	72.1	0.043
Hispanic	0.631***	Unmatched	0.151	0.043		0.000
	(0.130)	Matched	0.151	0.148	96.8	0.793
Census West	-0.309**	Unmatched	0.173	0.165		0.443
	(0.104)	Matched	0.173	0.193	-125.7	0.175
Census mid-West	-0.657***	Unmatched	0.174	0.287		0.000
	(0.092)	Matched	0.174	0.154	82.7	0.157
Census North-East	-0.642***	Unmatched	0.128	0.169		0.000
	(0.102)	Matched	0.128	0.123	86.2	0.651
Married	-0.879***	Unmatched	0.615	0.800		0.000
	(0.180)	Matched	0.615	0.633	90.5	0.334
Partnered	0.161	Unmatched	0.042	0.019		0.000
	(0.257)	Matched	0.042	0.032	55.4	0.136
Divorced	-0.122	Unmatched	0.180	0.099		0.000
	(0.191)	Matched	0.180	0.172	89.6	0.555
Widowed	-0.029	Unmatched	0.120	0.059		0.000
	(0.206)	Matched	0.120	0.126	89.6	0.608
Went to high school	-0.451***	Unmatched	0.361	0.393		0.030
	(0.088)	Matched	0.361	0.328	-2.8	0.064
Went to college	-0.576***	Unmatched	0.175	0.223		0.000
	(0.108)	Matched	0.175	0.166	79.5	0.486
Finished college or more	-1.119***	Unmatched	0.087	0.240		0.000
	(0.130)	Matched	0.087	0.090	97.7	0.742
Works full-time	-0.651***	Unmatched	0.386	0.527		0.000
	(0.150)	Matched	0.386	0.389	98.5	0.908
Works part-time	-0.261	Unmatched	0.185	0.174		0.322
	(0.159)	Matched	0.185	0.187	81.7	0.885
Retired	-0.033	Unmatched	0.257	0.202		0.000
	(0.144)	Matched	0.257	0.224	41.0	0.044
Unemployed	0.615*	Unmatched	0.034	0.010		0.000
	(0.281)	Matched	0.034	0.054	17.8	0.011
Self-employed	0.864***	Unmatched	0.148	0.124		0.018
	(0.115)	Matched	0.148	0.136	50.8	0.362
# years worked (log)	-0.207***	Unmatched	3.113	3.376		0.000
	(0.051)	Matched	3.113	3.110	98.7	0.928
HH total assets	-1.477***	Unmatched	0.133	0.341		0.000
	(0.387)	Matched	0.133	0.207	64.5	0.011
HH total assets (squared)	0.073***	Unmatched	0.169	0.617		0.069
	(0.018)	Matched	0.169	1.094	-106.8	0.076
Has long-term care	-0.679***	Unmatched	0.034	0.092		0.000
insurance	(0.174)	Matched	0.034	0.046	80.6	0.126
Has life insurance	-0.625***	Unmatched	0.620	0.811		0.000
	(0.078)	Matched	0.620	0.623	98.5	0.877
Constant	2.538***					
	(0.329)					
N	5,912					

Notes: The uninsured definition is 'Private Only'. SAH is self-assessed health. HH (Household) total assets are expressed in million. The propensity score is estimated using logit on individuals 59 or 60 years old and the coefficient estimates are reported in column 1. Matched sample is based on nearest neighbour matching with replacement. Column 2 and 3 report the means of the different covariates for the uninsured and insured respectively, for the unmatched and the matched sample. Column 4 reports the percentage bias reduction in the standardised bias before and after matching, and the last column presents the t-tests for the equality of means in the uninsured and insured groups, both before and after matching. Stars convention: * for $p<0.1$, ** for $p<0.05$, and *** for $p<0.01$.

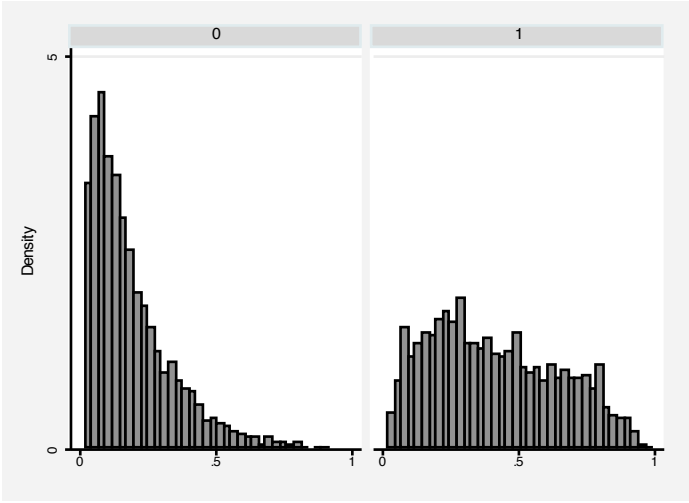
Figure 6: Distribution of the propensity score for each uninsured definition



Uninsured definition: "All Types"



Uninsured definition: "Private & Public"



Uninsured definition: "Public Only"

Notes: The insured (U=0) are on the left, and the uninsured (U=1) on the right.

C.2 PSM estimators

Table 66: Propensity score matching - "All Types" definition (binary variables)

		(1) ATT	(2) SE	(3) P-value	(4) uninsured obs. used	(5) insured obs. used	(6) uninsured obs. available	(7) insured obs. available
Vigorous physical activity								
Nearest Neighbour	**age 59/60**	0.053	0.029	0.072	776	564	776	4,170
	age 61/62	0.034	0.032	0.284	700	506	700	3,657
	age 63/64	-0.043	0.037	0.242	559	397	559	2,983
	age 65/66	-0.058	0.045	0.200	378	261	378	1,988
	age 67/68	-0.017	0.061	0.785	242	167	242	1,277
Kernel	**age 59/60**	0.020	0.023	0.388	765	4,168	776	4,170
	age 61/62	-0.003	0.025	0.900	684	3,653	700	3,657
	age 63/64	-0.053	0.028	0.058	543	2,977	559	2,983
	age 65/66	-0.026	0.034	0.439	357	1,983	378	1,988
	age 67/68	-0.001	0.044	0.978	223	1,269	242	1,277
Stratification	**age 59/60**	0.024	0.021	0.269	776	4,153	776	4,153
	age 61/62	0.000	0.021	0.998	700	3,643	700	3,643
	age 63/64	-0.058	0.023	0.010	559	2,974	559	2,974
	age 65/66	-0.058	0.038	0.121	378	1,982	378	1,982
	age 67/68	-0.036	0.042	0.396	242	1,273	242	1,273
Quit smoking								
Nearest Neighbour	**age 59/60**	-0.095	0.037	0.011	525	384	525	3,023
	age 61/62	-0.106	0.036	0.004	520	384	520	2,994
	age 63/64	-0.122	0.035	0.001	522	384	522	3,011
	age 65/66	-0.141	0.040	0.000	418	305	418	2,421
	age 67/68	-0.148	0.043	0.001	345	248	345	1,999
Kernel	**age 59/60**	-0.116	0.029	0.000	510	2,794	526	2,804
	age 61/62	-0.121	0.028	0.000	522	2,833	538	2,843
	age 63/64	-0.121	0.028	0.000	523	2,841	539	2,851
	age 65/66	-0.133	0.032	0.000	416	2,301	432	2,313
	age 67/68	-0.148	0.033	0.000	334	1,878	358	1,899
Stratification	**age 59/60**	-0.113	0.028	0.000	525	3,000	525	3,000
	age 61/62	-0.117	0.028	0.000	520	2,971	520	2,971
	age 63/64	-0.112	0.027	0.000	522	2,988	522	2,988
	age 65/66	-0.130	0.029	0.000	414	2,305	418	2,305
	age 67/68*	-0.149	0.038	0.000	343	1,874	345	1,874
Drink daily								
Nearest Neighbour	**age 59/60**	0.012	0.015	0.414	568	430	568	3,304
	age 61/62	0.020	0.016	0.205	730	543	730	4,105
	age 63/64	0.022	0.014	0.108	859	642	859	4,940
	age 65/66	0.033	0.015	0.029	675	507	675	3,979
	age 67/68	0.015	0.016	0.334	580	430	580	3,338
Kernel	**age 59/60**	-0.003	0.013	0.840	571	3,056	584	3,089
	age 61/62	0.023	0.013	0.066	747	3,890	762	3,906
	age 63/64	0.018	0.011	0.122	885	4,705	896	4,707
	age 65/66	0.024	0.013	0.076	683	3,775	694	3,780
	age 67/68	0.019	0.014	0.184	573	3,144	592	3,163
Stratification	**age 59/60***	-0.003	0.010	0.766	568	3,270	568	3,270
	age 61/62*	0.021	0.011	0.055	730	4,070	730	4,070
	age 63/64	0.016	0.010	0.113	859	4,904	859	4,904
	age 65/66	0.022	0.011	0.045	675	3,890	675	3,890
	age 67/68	0.016	0.011	0.159	580	3,273	580	3,273

Notes: The uninsured definition is 'All Types'. The nearest neighbour and kernel matching use Mahalanobis matching on race, working status, household assets and the estimated propensity score. Kernel matching is based on epanechnikov kernel. Stratification estimates are based on the common support only. * indicates that the bootstrapped variances are reported. The p-values are computed assuming independent observations asymptotically normally distributed.

Table 67: Propensity score matching - "All Types" definition (count variables)

		(1) ATT	(2) SE	(3) P-value	(4) uninsured obs. used	(5) insured obs. used	(6) uninsured obs. available	(7) insured obs. available
# cigarettes smoked per day								
Nearest Neighbour	**age 59/60**	1.193	0.628	0.057	586	431	586	3,095
	age 61/62	1.692	0.550	0.002	764	550	764	3,915
	age 63/64	1.728	0.466	0.000	896	633	896	4,711
	age 65/66	1.704	0.583	0.003	695	497	695	3,785
	age 67/68	2.064	0.545	0.000	591	412	591	3,162
Kernel	**age 59/60**	1.043	0.506	0.039	573	3,062	586	3,095
	age 61/62	1.658	0.459	0.000	749	3,899	764	3,915
	age 63/64	1.389	0.397	0.000	885	4,709	896	4,711
	age 65/66	1.834	0.436	0.000	684	3,780	695	3,785
	age 67/68	2.011	0.462	0.000	575	3,143	591	3,162
Stratification	**age 59/60***	0.979	0.429	0.022	586	2,906	586	2,906
	age 61/62*	1.587	0.452	0.000	764	3,701	764	3,701
	age 63/64	1.398	0.387	0.000	896	4,687	896	4,687
	age 65/66	1.779	0.406	0.000	695	3,771	695	3,771
	age 67/68	2.181	0.424	0.000	591	3,148	591	3,148
# alcoholic drinks per day								
Nearest Neighbour	**age 59/60**	0.893	0.423	0.035	581	427	581	3,087
	age 61/62	0.778	0.472	0.099	762	547	762	3,897
	age 63/64	0.690	0.370	0.062	891	630	891	4,699
	age 65/66	1.244	0.343	0.000	694	496	694	3,777
	age 67/68	0.186	0.395	0.637	591	412	591	3,157
Kernel	**age 59/60**	0.456	0.371	0.219	568	3,054	581	3,087
	age 61/62	0.706	0.360	0.050	747	3,881	762	3,897
	age 63/64	0.610	0.314	0.052	880	4,697	891	4,699
	age 65/66	0.799	0.341	0.019	683	3,772	694	3,777
	age 67/68	0.515	0.320	0.108	573	3,138	591	3,157
Stratification	**age 59/60***	0.478	0.397	0.228	581	2,898	581	2,898
	age 61/62*	0.758	0.393	0.054	762	3,684	762	3,684
	age 63/64	0.561	0.293	0.055	891	4,675	891	4,675
	age 65/66	0.690	0.318	0.030	694	3,763	694	3,763
	age 67/68	0.492	0.271	0.069	591	3,143	591	3,143

Notes: The uninsured definition is 'All Types'. The nearest neighbour and kernel matching use Mahalanobis matching on race, working status, household assets and the estimated propensity score. Kernel matching is based on epanechnikov kernel. Stratification estimates are based on the common support only. * indicates that the bootstrapped variances are reported. The p-values are computed assuming independent observations asymptotically normally distributed.

Table 68: Propensity score matching - "Private Only" definition (binary variables)

		(1) ATT	(2) SE	(3) P-value	(4) uninsured obs. used	(5) insured obs. used	(6) uninsured obs. available	(7) insured obs. available
Vigorous physical activity								
Nearest Neighbour	**age 59/60**	-0.018	0.029	0.542	1,248	769	1,248	3,890
	age 61/62	0.002	0.031	0.953	1,103	664	1,103	3,401
	age 63/64	-0.009	0.034	0.793	888	541	888	2,776
	age 65/66	-0.050	0.040	0.215	583	377	583	1,860
	age 67/68	-0.042	0.050	0.406	382	243	382	1,176
Kernel	**age 59/60**	0.003	0.021	0.893	1,212	3,888	1,248	3,890
	age 61/62	-0.028	0.023	0.235	1,071	3,399	1,103	3,401
	age 63/64	-0.017	0.026	0.513	860	2,760	888	2,776
	age 65/66	-0.038	0.031	0.224	562	1,851	583	1,860
	age 67/68	-0.017	0.041	0.675	362	1,169	382	1,176
Stratification	**age 59/60**	-0.006	0.022	0.770	1,248	3,890	1,248	3,890
	age 61/62	-0.024	0.024	0.319	1,103	3,401	1,103	3,401
	age 63/64	-0.032	0.026	0.227	888	2,770	888	2,770
	age 65/66	-0.053	0.031	0.081	583	1,857	583	1,857
	age 67/68	0.015	0.035	0.671	382	1,176	382	1,176
Quit smoking								
Nearest Neighbour	**age 59/60**	-0.133	0.036	0.000	892	525	892	2,577
	age 61/62	-0.139	0.035	0.000	913	523	913	2,609
	age 63/64	-0.109	0.034	0.001	914	523	914	2,618
	age 65/66	-0.122	0.035	0.000	711	427	711	2,146
	age 67/68	-0.145	0.038	0.000	578	339	578	1,766
Kernel	**age 59/60**	-0.113	0.025	0.000	850	2,559	892	2,577
	age 61/62	-0.107	0.024	0.000	869	2,591	913	2,609
	age 63/64	-0.100	0.023	0.000	870	2,600	914	2,618
	age 65/66	-0.095	0.026	0.000	675	2,130	711	2,146
	age 67/68	-0.120	0.028	0.000	538	1,755	578	1,766
Stratification	**age 59/60**	-0.108	0.032	0.001	892	2,576	892	2,576
	age 61/62	-0.101	0.032	0.001	913	2,608	913	2,608
	age 63/64	-0.096	0.031	0.002	914	2,617	914	2,617
	age 65/66	-0.091	0.024	0.000	711	2,146	711	2,146
	age 67/68	-0.106	0.028	0.000	544	1,783	578	1,749
Drink daily								
Nearest Neighbour	**age 59/60**	-0.006	0.016	0.691	953	588	953	2,905
	age 61/62	0.002	0.016	0.917	1,231	717	1,231	3,647
	age 63/64	0.012	0.013	0.365	1,446	858	1,446	4,387
	age 65/66	0.012	0.015	0.435	1,108	682	1,108	3,546
	age 67/68	0.006	0.017	0.699	926	554	926	2,961
Kernel	**age 59/60**	-0.004	0.012	0.747	909	2,899	953	2,905
	age 61/62	0.006	0.012	0.613	1,180	3,643	1,231	3,647
	age 63/64	0.006	0.010	0.599	1,404	4,383	1,446	4,387
	age 65/66	0.006	0.012	0.644	1,076	3,544	1,108	3,546
	age 67/68	0.007	0.014	0.584	897	2,959	926	2,961
Stratification	**age 59/60**	-0.002	0.009	0.808	953	2,904	953	2,904
	age 61/62	0.010	0.009	0.281	1,231	3,646	1,231	3,646
	age 63/64	0.011	0.008	0.187	1,446	4,386	1,446	4,386
	age 65/66	0.013	0.009	0.144	1,108	3,546	1,108	3,546
	age 67/68	0.009	0.009	0.308	926	2,952	926	2,952

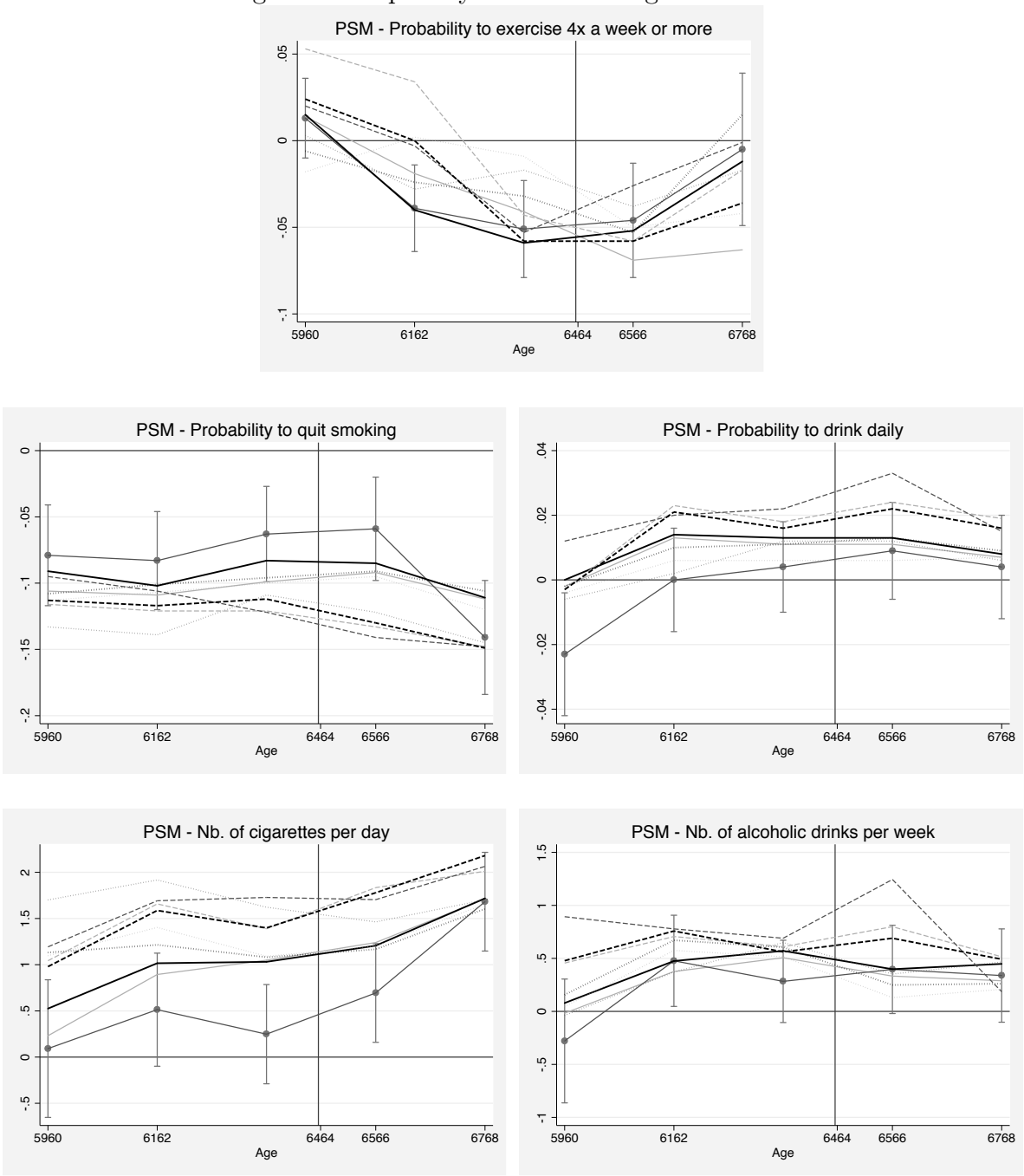
Notes: The uninsured definition is 'Private Only'. The nearest neighbour and kernel matching use Mahalanobis matching on race, working status, household assets and the estimated propensity score. Kernel matching is based on epanechnikov kernel. Stratification estimates are based on the common support only. The p-values are computed assuming independent observations asymptotically normally distributed.

Table 69: Propensity score matching - "Private Only" definition (count variables)

		(1) ATT	(2) SE	(3) P-value	(4) uninsured obs. used	(5) insured obs. used	(6) uninsured obs. available	(7) insured obs. available
# cigarettes smoked per day								
Nearest Neighbour	**age 59/60**	1.701	0.579	0.003	956	588	956	2,910
	age 61/62	1.917	0.532	0.000	1,233	719	1,233	3,655
	age 63/64	1.622	0.448	0.000	1,449	859	1,449	4,387
	age 65/66	1.463	0.460	0.001	1,109	682	1,109	3,549
	age 67/68	1.703	0.461	0.000	927	552	927	2,958
Kernel	**age 59/60**	1.098	0.452	0.015	912	2,904	956	2,910
	age 61/62	1.403	0.401	0.000	1,182	3,651	1,233	3,655
	age 63/64	1.091	0.341	0.001	1,407	4,383	1,449	4,387
	age 65/66	1.202	0.363	0.001	1,077	3,547	1,109	3,549
	age 67/68	1.657	0.391	0.000	898	2,956	927	2,958
Stratification	**age 59/60**	1.132	0.450	0.012	956	2,909	956	2,909
	age 61/62	1.215	0.517	0.019	1,233	3,654	1,233	3,654
	age 63/64	1.081	0.359	0.003	1,449	4,386	1,449	4,386
	age 65/66	1.167	0.342	0.001	1,109	3,549	1,109	3,549
	age 67/68	1.604	0.337	0.000	927	2,949	927	2,949
# alcoholic drinks per day								
Nearest Neighbour	**age 59/60**	-0.038	0.460	0.934	950	586	950	2,903
	age 61/62	0.371	0.436	0.395	1,228	717	1,228	3,641
	age 63/64	0.649	0.346	0.061	1,440	855	1,440	4,380
	age 65/66	0.352	0.335	0.294	1,108	682	1,108	3,543
	age 67/68	0.466	0.334	0.163	924	553	924	2,956
Kernel	**age 59/60**	0.046	0.314	0.884	906	2,897	950	2,903
	age 61/62	0.575	0.308	0.062	1,177	3,637	1,228	3,641
	age 63/64	0.515	0.268	0.054	1,398	4,376	1,440	4,380
	age 65/66	0.130	0.282	0.645	1,076	3,541	1,108	3,543
	age 67/68	0.208	0.303	0.493	895	2,954	924	2,956
Stratification	**age 59/60**	0.157	0.278	0.572	950	2,902	950	2,902
	age 61/62	0.671	0.269	0.012	1,228	3,640	1,228	3,640
	age 63/64	0.605	0.224	0.007	1,440	4,379	1,440	4,379
	age 65/66	0.249	0.246	0.311	1,108	3,543	1,108	3,543
	age 67/68	0.261	0.237	0.272	924	2,947	924	2,947

Notes: The uninsured definition is 'Private Only'. The nearest neighbour and kernel matching use Mahalanobis matching on race, working status, household assets and the estimated propensity score. Kernel matching is based on epanechnikov kernel. Stratification estimates are based on the common support only. The p-values are computed assuming independent observations asymptotically normally distributed.

Figure 7: Propensity score matching estimates



Notes: The graphs represent the PSM estimates. The plain lines are the results from the 'Private & Public' definition. The dotted lines are the results from the 'Private Only' defintion, and the dashed lines are the results from the 'All Types' definition. The light grey is based on NN matching, the medium grey one on the Kernel matching and the black one on the Stratification matching. The standard errors are only reported for the Kernel matching using the 'Private & Public' definition.

C.3 MDID estimators

Table 70: MDID estimators - "All Types" definition (binary variables)

		(1) ATT	(2) SE	(3) P-value	(4) uninsured obs. used	(5) insured obs. used	(6) uninsured obs. available	(7) insured obs. available
Vigorous physical activity								
Nearest Neighbour	**age 61/62 – 59/60**	0.067	0.039	0.088	685	488	685	3,579
	age 63/64 – 59/60	-0.021	0.045	0.648	533	371	533	2,839
	age 65/66 – 59/60	-0.092	0.055	0.093	360	265	360	1,885
	age 67/68 – 59/60	-0.082	0.071	0.252	220	162	220	1,183
	age 63/64 – 61/62	-0.134	0.044	0.002	543	374	543	2,882
	age 65/66 – 63/64	-0.016	0.051	0.753	371	273	371	1,958
	age 67/68 – 65/66	0.094	0.067	0.157	212	155	212	1,150
Kernel	**age 61/62 – 59/60**	0.033	0.035	0.337	494	2,381	685	3,579
	age 63/64 – 59/60	-0.021	0.044	0.631	362	1,651	533	2,839
	age 65/66 – 59/60	-0.093	0.061	0.125	200	844	360	1,885
	age 67/68 – 59/60	0.031	0.074	0.681	115	456	220	1,183
	age 63/64 – 61/62	-0.062	0.041	0.135	369	1,693	543	2,882
	age 65/66 – 63/64	-0.045	0.054	0.401	209	884	371	1,958
	age 67/68 – 65/66	0.080	0.071	0.259	108	426	212	1,150
Stratification	**age 61/62 – 59/60**	-0.016	0.028	0.562	685	3,565	685	3,565
	age 63/64 – 59/60	-0.053	0.034	0.119	533	2,830	533	2,830
	age 65/66 – 59/60	-0.075	0.042	0.072	360	1,879	360	1,879
	age 67/68 – 59/60	-0.041	0.053	0.443	220	1,179	220	1,179
	age 63/64 – 61/62	-0.053	0.032	0.099	543	2,873	543	2,873
	age 65/66 – 63/64	0.028	0.040	0.484	371	1,952	371	1,952
	age 67/68 – 65/66	0.033	0.050	0.502	212	1,146	212	1,146
Quit smoking								
Nearest Neighbour	**age 61/62 – 59/60**	0.021	0.024	0.373	522	373	522	2,774
	age 63/64 – 59/60	0.010	0.027	0.714	511	368	511	2,721
	age 65/66 – 59/60	-0.019	0.035	0.579	411	289	411	2,204
	age 67/68 – 59/60	-0.067	0.040	0.095	329	228	329	1,755
	age 63/64 – 61/62	0.004	0.024	0.871	523	372	523	2,761
	age 65/66 – 63/64	-0.014	0.027	0.599	418	296	418	2,249
	age 67/68 – 65/66	0.000	0.028	1.000	326	226	326	1,735
Kernel	**age 61/62 – 59/60**	0.029	0.022	0.179	339	1,497	522	2,774
	age 63/64 – 59/60	-0.002	0.024	0.940	331	1,436	511	2,721
	age 65/66 – 59/60	-0.024	0.031	0.448	240	1,059	411	2,204
	age 67/68 – 59/60	-0.018	0.036	0.621	169	804	329	1,755
	age 63/64 – 61/62	-0.027	0.022	0.220	343	1,489	523	2,761
	age 65/66 – 63/64	-0.007	0.023	0.778	248	1,081	418	2,249
	age 67/68 – 65/66	-0.019	0.021	0.364	167	761	326	1,735
Stratification	**age 61/62 – 59/60**	-0.003	0.018	0.874	522	2,763	522	2,763
	age 63/64 – 59/60	0.000	0.019	0.993	511	2,710	511	2,710
	age 65/66 – 59/60*	-0.025	0.028	0.374	411	2,197	411	2,197
	age 67/68 – 59/60	-0.042	0.033	0.209	327	1,751	329	1,749
	age 63/64 – 61/62	0.005	0.018	0.794	523	2,749	523	2,749
	age 65/66 – 63/64*	-0.015	0.019	0.424	418	2,241	418	2,241
	age 67/68 – 65/66	-0.011	0.017	0.535	324	1,730	326	1,728
Drink daily								
Nearest Neighbour	**age 61/62 – 59/60**	0.014	0.015	0.374	583	427	583	3,086
	age 63/64 – 59/60	0.034	0.015	0.026	581	425	581	3,059
	age 65/66 – 59/60	0.012	0.017	0.483	432	310	432	2,372
	age 67/68 – 59/60	0.025	0.022	0.264	325	223	325	1,764
	age 63/64 – 61/62	0.015	0.015	0.314	750	532	750	3,841
	age 65/66 – 63/64	-0.009	0.013	0.489	684	494	684	3,720
	age 67/68 – 65/66	-0.009	0.015	0.534	531	366	531	2,886
Kernel	**age 61/62 – 59/60**	0.030	0.015	0.047	417	1,985	583	3,086
	age 63/64 – 59/60	0.038	0.016	0.017	417	1,960	581	3,059
	age 65/66 – 59/60	0.019	0.018	0.294	294	1,406	432	2,372
	age 67/68 – 59/60	0.027	0.021	0.205	211	997	325	1,764
	age 63/64 – 61/62	0.006	0.013	0.679	548	2,617	750	3,841
	age 65/66 – 63/64	-0.008	0.013	0.564	502	2,489	684	3,720
	age 67/68 – 65/66	-0.007	0.016	0.652	375	1,809	531	2,886
Stratification	**age 61/62 – 59/60***	0.013	0.012	0.257	583	2,898	583	2,898
	age 63/64 – 59/60*	0.014	0.011	0.202	581	2,871	581	2,871
	age 65/66 – 59/60*	0.014	0.011	0.200	432	2,222	432	2,222
	age 67/68 – 59/60	0.011	0.014	0.441	323	1,651	325	1,649
	age 63/64 – 61/62*	-0.003	0.007	0.645	750	3,630	750	3,630
	age 65/66 – 63/64	-0.003	0.010	0.795	684	3,706	684	3,706
	age 67/68 – 65/66	-0.002	0.010	0.815	531	2,873	531	2,873

Notes: The uninsured definition is 'All Types'. The nearest neighbour and Kernel matching use Mahalanobis matching on race, working status, household assets and the estimated propensity score. Kernel matching is based on epanechnikov Kernel with a bandwidth of 0.08. Stratification estimates are based on the common support only. The p-values are computed assuming independent observations asymptotically normally distributed. * indicates that the error terms are estimated using bootstrapping.

Table 71: MDID Estimators - "All Types" definition (count variables)

		(1) ATT	(2) SE	(3) P-value	(4) uninsured obs. used	(5) insured obs. used	(6) uninsured obs. available	(7) insured obs. available
# cigarettes smokes per day								
Nearest Neighbour	**age 61/62 – 59/60**	0.259	0.504	0.607	586	429	586	3,095
	age 63/64 – 59/60	-0.151	0.571	0.792	583	426	583	3,065
	age 65/66 – 59/60	0.781	0.653	0.232	434	312	434	2,378
	age 67/68 – 59/60	0.865	0.834	0.300	325	225	325	1,763
	age 63/64 – 61/62	-0.278	0.467	0.552	752	535	752	3,850
	age 65/66 – 63/64	0.072	0.399	0.858	685	494	685	3,730
	age 67/68 – 65/66	0.173	0.454	0.703	531	368	531	2,887
Kernel	**age 61/62 – 59/60**	0.853	0.442	0.053	419	1,992	586	3,095
	age 63/64 – 59/60	-0.184	0.511	0.720	418	1,964	583	3,065
	age 65/66 – 59/60	0.830	0.560	0.138	296	1,409	434	2,378
	age 67/68 – 59/60	-0.260	0.714	0.715	211	996	325	1,763
	age 63/64 – 61/62	-0.801	0.351	0.023	550	2,620	752	3,850
	age 65/66 – 63/64	0.716	0.349	0.041	503	2,494	685	3,730
	age 67/68 – 65/66	-0.365	0.379	0.336	375	1,807	531	2,887
Stratification	**age 61/62 – 59/60***	0.420	0.307	0.172	586	2,906	586	2,906
	age 63/64 – 59/60*	-0.062	0.376	0.869	583	2,877	583	2,877
	age 65/66 – 59/60*	0.368	0.503	0.464	434	2,228	434	2,228
	age 67/68 – 59/60	0.371	0.558	0.506	323	1,650	325	1,648
	age 63/64 – 61/62*	-0.426	0.350	0.224	752	3,638	752	3,638
	age 65/66 – 63/64	0.005	0.311	0.987	685	3,716	685	3,716
	age 67/68 – 65/66	0.267	0.347	0.443	531	2,874	531	2,874
# alcoholic drinks per week								
Nearest Neighbour	**age 61/62 – 59/60**	0.253	0.332	0.445	580	424	580	3,077
	age 63/64 – 59/60	0.191	0.327	0.559	575	418	575	3,050
	age 65/66 – 59/60	-0.485	0.463	0.295	429	307	429	2,370
	age 67/68 – 59/60	-0.709	0.513	0.167	323	221	323	1,761
	age 63/64 – 61/62	0.122	0.325	0.708	747	530	747	3,826
	age 65/66 – 63/64	-0.544	0.327	0.096	682	493	682	3,714
	age 67/68 – 65/66	-0.122	0.404	0.762	531	366	531	2,879
Kernel	**age 61/62 – 59/60**	0.532	0.358	0.137	414	1,962	580	3,077
	age 63/64 – 59/60	0.457	0.359	0.203	411	1,932	575	3,050
	age 65/66 – 59/60	-0.050	0.485	0.918	291	1,387	429	2,370
	age 67/68 – 59/60	-0.800	0.563	0.156	209	988	323	1,761
	age 63/64 – 61/62	0.085	0.346	0.806	546	2,608	747	3,826
	age 65/66 – 63/64	-0.477	0.344	0.166	501	2,483	682	3,714
	age 67/68 – 65/66	-0.285	0.375	0.447	375	1,803	531	2,879
Stratification	**age 61/62 – 59/60***	-0.041	0.269	0.879	580	2,889	580	2,889
	age 63/64 – 59/60*	-0.260	0.287	0.366	575	2,862	575	2,862
	age 65/66 – 59/60*	-0.349	0.287	0.224	429	2,220	429	2,220
	age 67/68 – 59/60	-0.664	0.389	0.087	321	1,648	323	1,646
	age 63/64 – 61/62*	-0.153	0.220	0.487	747	3,615	747	3,615
	age 65/66 – 63/64	-0.341	0.270	0.206	682	3,700	682	3,700
	age 67/68 – 65/66	0.062	0.284	0.826	531	2,866	531	2,866

Notes: The uninsured definition is 'All Types'. The nearest neighbour and Kernel matching use Mahalanobis matching on race, working status, household assets and the estimated propensity score. Kernel matching is based on epanechnikov Kernel with a bandwidth of 0.08. Stratification estimates are based on the common support only. The p-values are computed assuming independent observations asymptotically normally distributed. * indicates that the error terms are estimated using bootstrapping.

Table 72: MDID estimators - "Private Only" definition (binary variables)

		(1) ATT	(2) SE	(3) P-value	(4) uninsured obs. used	(5) insured obs. used	(6) uninsured obs. available	(7) insured obs. available
Vigorous physical activity								
Nearest Neighbour	**age 61/62 – 59/60**	0.008	0.033	0.802	1,082	654	1,082	3,328
	age 63/64 – 59/60	-0.079	0.040	0.045	844	528	844	2,648
	age 65/66 – 59/60	-0.115	0.046	0.012	556	355	556	1,766
	age 67/68 – 59/60	-0.020	0.060	0.734	342	222	342	1,098
	age 63/64 – 61/62	-0.063	0.038	0.098	857	533	857	2,689
	age 65/66 – 63/64	-0.035	0.045	0.435	574	364	574	1,832
	age 67/68 – 65/66	0.131	0.056	0.019	327	213	327	1,070
Kernel	**age 61/62 – 59/60**	-0.003	0.030	0.931	785	2,442	1,082	3,328
	age 63/64 – 59/60	-0.056	0.037	0.133	584	1,777	844	2,648
	age 65/66 – 59/60	-0.077	0.048	0.105	304	931	556	1,766
	age 67/68 – 59/60	-0.042	0.060	0.476	161	465	342	1,098
	age 63/64 – 61/62	-0.053	0.035	0.131	594	1,799	857	2,689
	age 65/66 – 63/64	-0.007	0.043	0.863	313	967	574	1,832
	age 67/68 – 65/66	0.076	0.060	0.209	153	448	327	1,070
Stratification	**age 61/62 – 59/60**	-0.023	0.027	0.410	1,082	3,328	1,082	3,328
	age 63/64 – 59/60	-0.022	0.036	0.536	844	2,642	844	2,642
	age 65/66 – 59/60	-0.064	0.037	0.085	556	1,763	556	1,763
	age 67/68 – 59/60	-0.011	0.043	0.793	342	1,098	342	1,098
	age 63/64 – 61/62	-0.013	0.031	0.681	857	2,683	857	2,683
	age 65/66 – 63/66	0.007	0.035	0.845	574	1,829	574	1,829
	age 67/68 – 65/66	0.058	0.042	0.170	327	1,070	327	1,070
Quit smoking								
Nearest Neighbour	**age 61/62 – 59/60**	0.003	0.020	0.868	885	539	885	2,549
	age 63/64 – 59/60	0.007	0.022	0.756	863	524	863	2,506
	age 65/66 – 59/60	0.015	0.028	0.594	672	419	672	2,052
	age 67/68 – 59/60	0.035	0.032	0.271	519	332	519	1,647
	age 63/64 – 61/62	0.006	0.020	0.777	884	540	884	2,539
	age 65/66 – 63/64	0.001	0.020	0.942	688	427	688	2,089
	age 67/68 – 65/66	0.000	0.020	1.000	517	336	517	1,627
Kernel	**age 61/62 – 59/60**	0.028	0.017	0.109	536	1,521	885	2,549
	age 63/64 – 59/60	-0.001	0.020	0.974	526	1,476	863	2,506
	age 65/66 – 59/60	0.004	0.026	0.889	384	1,131	672	2,052
	age 67/68 – 59/60	0.017	0.029	0.553	277	822	519	1,647
	age 63/64 – 61/62	-0.032	0.018	0.070	537	1,518	884	2,539
	age 65/66 – 63/64	0.017	0.019	0.385	392	1,162	688	2,089
	age 67/68 – 65/66	-0.020	0.018	0.268	272	813	517	1,627
Stratification	**age 61/62 – 59/60**	0.007	0.015	0.649	885	2,548	885	2,548
	age 63/64 – 59/60	0.011	0.016	0.475	863	2,505	863	2,505
	age 65/66 – 59/60	0.006	0.030	0.834	672	2,052	672	2,052
	age 67/68 – 59/60	0.032	0.024	0.176	486	1,663	519	1,630
	age 63/64 – 61/62	0.005	0.016	0.742	884	2,538	884	2,538
	age 65/66 – 63/66	-0.011	0.027	0.684	688	2,089	688	2,089
	age 67/68 – 65/66	-0.002	0.017	0.887	485	1,642	517	1,610
Drink daily								
Nearest Neighbour	**age 61/62 – 59/60**	0.007	0.013	0.575	952	599	952	2,903
	age 63/64 – 59/60	0.021	0.013	0.104	942	595	942	2,883
	age 65/66 – 59/60	0.019	0.014	0.188	698	439	698	2,245
	age 67/68 – 59/60	0.004	0.019	0.833	505	324	505	1,673
	age 63/64 – 61/62	0.011	0.013	0.412	1,207	751	1,207	3,593
	age 65/66 – 63/64	0.000	0.012	1.000	1,090	675	1,090	3,493
	age 67/68 – 65/66	-0.010	0.014	0.477	824	515	824	2,717
Kernel	**age 61/62 – 59/60**	0.015	0.012	0.220	659	2,012	952	2,903
	age 63/64 – 59/60	0.024	0.013	0.073	651	1,984	942	2,883
	age 65/66 – 59/60	0.025	0.015	0.102	452	1,477	698	2,245
	age 67/68 – 59/60	0.014	0.017	0.418	314	1,038	505	1,673
	age 63/64 – 61/62	0.010	0.011	0.381	868	2,634	1,207	3,593
	age 65/66 – 63/64	-0.003	0.012	0.766	786	2,547	1,090	3,493
	age 67/68 – 65/66	-0.008	0.014	0.577	577	1,909	824	2,717
Stratification	**age 61/62 – 59/60**	0.005	0.009	0.604	952	2,902	952	2,902
	age 63/64 – 59/60	0.014	0.009	0.137	942	2,882	942	2,882
	age 65/66 – 59/60	0.009	0.010	0.348	698	2,245	698	2,245
	age 67/68 – 59/60*	0.012	0.012	0.332	505	1,644	505	1,644
	age 63/64 – 61/62	-0.002	0.009	0.865	1,207	3,592	1,207	3,592
	age 65/66 – 63/66	0.000	0.008	0.968	1,090	3,493	1,090	3,493
	age 67/68 – 65/66	-0.005	0.009	0.550	824	2,708	824	2,708

Notes: The uninsured definition is 'Private Only'. The nearest neighbour and Kernel matching use Mahalanobis matching on race, working status, household assets and the estimated propensity score. Kernel matching is based on epanechnikov Kernel with a bandwidth of 0.08. Stratification estimates are based on the common support only. The p-values are computed assuming independent observations asymptotically normally distributed. * indicates that the error terms are estimated using bootstrapping.

Table 73: MDID estimators - "Private Only" definition (count variables)

		(1) ATT	(2) SE	(3) P-value	(4) uninsured obs. used	(5) insured obs. used	(6) uninsured obs. available	(7) insured obs. available
# cigarettes smokes per day								
Nearest Neighbour	**age 61/62 – 59/60**	0.504	0.427	0.238	687	431	687	2,222
	age 63/64 – 59/60	-0.015	0.469	0.975	680	428	680	2,208
	age 65/66 – 59/60	-0.011	0.527	0.983	494	305	494	1,642
	age 67/68 – 59/60	-0.456	0.566	0.421	317	196	317	1,125
	age 63/64 – 61/62	-0.664	0.331	0.045	914	573	914	2,935
	age 65/66 – 63/64	0.346	0.392	0.378	885	562	885	2,904
	age 67/68 – 65/66	0.515	0.441	0.243	806	518	806	2,764
Kernel	**age 61/62 – 59/60**	-0.089	0.388	0.818	642	2,204	687	2,222
	age 63/64 – 59/60	-0.569	0.409	0.164	636	2,190	680	2,208
	age 65/66 – 59/60	-0.814	0.484	0.092	445	1,618	494	1,642
	age 67/68 – 59/60	-0.935	0.608	0.124	271	1,098	317	1,125
	age 63/64 – 61/62	-0.522	0.288	0.071	858	2,911	914	2,935
	age 65/66 – 63/64	0.167	0.296	0.573	836	2,892	885	2,904
	age 67/68 – 65/66	0.028	0.292	0.925	753	2,747	806	2,764
Stratification	**age 61/62 – 59/60**	0.386	0.311	0.214	687	2,169	687	2,169
	age 63/64 – 59/60	0.002	0.353	0.996	680	2,156	680	2,156
	age 65/66 – 59/60	-0.160	0.446	0.720	494	1,604	494	1,604
	age 67/68 – 59/60*	-0.269	0.486	0.580	317	1,104	317	1,104
	age 63/64 – 61/62	-0.244	0.270	0.367	914	2,890	914	2,890
	age 65/66 – 63/64	0.186	0.307	0.546	885	2,868	885	2,868
	age 67/68 – 65/66	0.204	0.269	0.448	806	2,736	806	2,736
# alcoholic drinks per week								
Nearest Neighbour	**age 61/62 – 59/60**	0.549	0.359	0.126	947	598	947	2,896
	age 63/64 – 59/60	0.287	0.376	0.446	935	592	935	2,875
	age 65/66 – 59/60	-0.229	0.387	0.554	695	439	695	2,243
	age 67/68 – 59/60	-0.453	0.399	0.256	503	323	503	1,670
	age 63/64 – 61/62	-0.191	0.309	0.537	1,200	747	1,200	3,582
	age 65/66 – 63/64	-0.508	0.261	0.052	1,088	675	1,088	3,487
	age 67/68 – 65/66	0.113	0.276	0.683	824	515	824	2,710
Kernel	**age 61/62 – 59/60**	0.544	0.292	0.063	655	2,007	947	2,896
	age 63/64 – 59/60	0.307	0.285	0.282	646	1,975	935	2,875
	age 65/66 – 59/60	-0.078	0.364	0.831	450	1,467	695	2,243
	age 67/68 – 59/60	-0.438	0.439	0.318	312	1,028	503	1,670
	age 63/64 – 61/62	-0.061	0.274	0.824	861	2,622	1,200	3,582
	age 65/66 – 63/64	-0.540	0.251	0.031	785	2,541	1,088	3,487
	age 67/68 – 65/66	0.216	0.291	0.458	577	1,904	824	2,710
Stratification	**age 61/62 – 59/60**	0.286	0.221	0.196	947	2,895	947	2,895
	age 63/64 – 59/60	0.261	0.226	0.247	935	2,874	935	2,874
	age 65/66 – 59/60	-0.317	0.253	0.211	695	2,243	695	2,243
	age 67/68 – 59/60*	-0.345	0.311	0.267	503	1,641	503	1,641
	age 63/64 – 61/62	-0.096	0.207	0.645	1,200	3,581	1,200	3,581
	age 65/66 – 63/64	-0.422	0.209	0.044	1,088	3,487	1,088	3,487
	age 67/68 – 65/66	0.034	0.228	0.883	824	2,701	824	2,701

Notes: The uninsured definition is 'Private Only'. The nearest neighbour and Kernel matching use Mahalanobis matching on race, working status, household assets and the estimated propensity score. Kernel matching is based on epanechnikov Kernel with a bandwidth of 0.08. Stratification estimates are based on the common support only. The p-values are computed assuming independent observations asymptotically normally distributed. * indicates that the error terms are estimated using bootstrapping.

C.4 Regression models

Table 74: Complete list of coefficients of Table 14

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Vigorous Physical Activity			Quit smoking			Drink daily		
	FE	Probit	FE Logit	FE	Probit	FE Logit	FE	Probit	FE Logit
SAH	0.030***	0.060***	0.003***	-0.011***	0.031***	-0.000	-0.001	0.005*	-0.000
	(0.006)	(0.005)	(0.004)	(0.004)	(0.006)	(0.000)	(0.002)	(0.003)	(0.000)
Mobility index	-0.034***	-0.080***	-0.004***	0.010***	0.003	0.000*	-0.000	-0.007***	-0.000
	(0.006)	(0.005)	(0.005)	(0.003)	(0.005)	(0.000)	(0.002)	(0.003)	(0.000)
male		0.074***			0.048***			0.045***	
		(0.011)			(0.016)			(0.007)	
White		-0.019			0.031			0.055**	
		(0.030)			(0.047)			(0.024)	
Black		-0.011			0.067			0.002	
		(0.033)			(0.050)			(0.026)	
Hispanic		-0.042**			0.107***			-0.034**	
		(0.020)			(0.032)			(0.013)	
married	0.021	0.018	0.000	-0.042	0.008	-0.001	0.018	-0.006	0.002
	(0.094)	(0.029)	(0.009)	(0.051)	(0.044)	(0.002)	(0.043)	(0.017)	(0.003)
partnered	0.039	0.006	0.002	-0.051	-0.097*	-0.001	0.056	0.036*	0.001
	(0.097)	(0.040)	(0.008)	(0.052)	(0.054)	(0.002)	(0.049)	(0.022)	(0.002)
divorced or	-0.011	0.009	-0.003	-0.058	-0.068	-0.001	-0.001	0.006	0.000
separated	(0.092)	(0.031)	(0.011)	(0.050)	(0.046)	(0.002)	(0.043)	(0.018)	(0.001)
widowed	-0.002	0.000	-0.002	-0.059	-0.102**	-0.002	0.022	-0.015	0.001
	(0.093)	(0.031)	(0.011)	(0.051)	(0.046)	(0.002)	(0.043)	(0.019)	(0.002)
went to high school		0.007			0.020			0.005	
		(0.014)			(0.019)			(0.009)	
went to college		0.001			0.026			0.017*	
		(0.016)			(0.022)			(0.010)	
has college degree		-0.020			0.121***			0.017*	
or more		(0.017)			(0.026)			(0.010)	
working full-time	-0.057**	-0.123***	-0.006	-0.012	0.073***	-0.001	0.005	-0.016	0.000
	(0.027)	(0.020)	(0.008)	(0.017)	(0.027)	(0.001)	(0.008)	(0.012)	(0.001)
working part-time	-0.027	-0.079***	-0.003	-0.007	0.072***	-0.000	0.001	-0.011	-0.000
	(0.026)	(0.021)	(0.004)	(0.017)	(0.027)	(0.001)	(0.008)	(0.012)	(0.001)
retired	-0.015	-0.033*	-0.001	0.001	0.047**	-0.000	-0.003	-0.005	-0.000
	(0.022)	(0.018)	(0.003)	(0.016)	(0.023)	(0.000)	(0.006)	(0.011)	(0.001)
unemployed	0.016	0.015	0.002	-0.051*	0.027	-0.001	0.024	0.009	0.001
	(0.045)	(0.043)	(0.005)	(0.030)	(0.045)	(0.002)	(0.023)	(0.024)	(0.002)
self-employed	0.028	0.052***	0.003	0.019	0.046**	0.001*	0.005	0.018**	0.000
	(0.024)	(0.016)	(0.005)	(0.015)	(0.021)	(0.002)	(0.009)	(0.008)	(0.001)
# years worked	0.108	0.012	0.012*	-0.148***	-0.026**	-0.004***	0.012	0.002	0.003
(log)	(0.068)	(0.008)	(0.011)	(0.051)	(0.012)	(0.008)	(0.015)	(0.005)	(0.005)
job requires some	0.097***	0.169***	0.009***	-0.013	-0.016	-0.000	0.005	0.005	0.000
physical activity	(0.017)	(0.013)	(0.012)	(0.010)	(0.016)	(0.000)	(0.006)	(0.007)	(0.001)
HH total assets	0.015***	0.010***	0.002***	-0.005	0.011***	-0.000	0.001	0.010***	0.000
(log)	(0.006)	(0.004)	(0.002)	(0.003)	(0.004)	(0.000)	(0.002)	(0.002)	(0.000)
HH total assets	0.111**	0.076*	0.015**	-0.042	0.104**	-0.001	0.015	0.089***	0.001
zero or below	(0.056)	(0.044)	(0.019)	(0.035)	(0.046)	(0.001)	(0.015)	(0.023)	(0.003)
has life insurance	0.006	-0.003	0.000	0.008	0.014	0.000	0.003	-0.019***	0.000
	(0.015)	(0.011)	(0.002)	(0.009)	(0.014)	(0.000)	(0.005)	(0.006)	(0.000)
has long-term	0.044***	0.038***	0.004**	-0.007	0.028	0.000	-0.009	0.005	-0.001**
insurance	(0.016)	(0.014)	(0.006)	(0.011)	(0.019)	(0.000)	(0.006)	(0.007)	(0.002)
# private insurance	-0.016	-0.007	-0.002*	0.012**	0.019*	0.001	-0.000	-0.004	0.000
	(0.010)	(0.009)	(0.003)	(0.005)	(0.011)	(0.001)	(0.003)	(0.004)	(0.000)
Census: West	-0.118	-0.712	-0.011	-0.006	0.063***	-0.001	0.013	0.026***	0.001
	(0.078)	(0.603)	(0.019)	(0.033)	(0.020)	(0.003)	(0.036)	(0.008)	(0.002)
Census: Midwest	-0.073	-0.650	-0.010	-0.008	0.022	-0.001	-0.027	-0.001	-0.002
	(0.072)	(0.451)	(0.016)	(0.043)	(0.017)	(0.002)	(0.026)	(0.007)	(0.004)
Census: Northeast	-0.085	-0.367	-0.006	-0.000	0.045**	-0.002	-0.034	0.029***	-0.001
	(0.065)	(0.383)	(0.010)	(0.027)	(0.020)	(0.004)	(0.038)	(0.008)	(0.002)
Nb. of individuals	5019	5,019	2,214	3,424	3,424	567	5,571	5,571	449
Nb. of observations	15205	15,205	8,009	13,004	13,004	2,275	19,766	19,766	1,703

Notes: The uninsured definition used here is 'Private & Public'. The reference age is 59/60. The coefficients for the probit and fixed effect (FE) logit regressions report the average marginal effects and the associated standard errors are obtained using the delta method. Standard errors given in parenthesis are clustered at the individual level and robust to heteroskedasticity and autocorrelation of unknown form. Stars convention: * for $p<0.1$, ** for $p<0.05$, and *** for $p<0.01$. The significance levels reported next to the marginal effects are based on the orginal coefficients.

Table 75: Complete list of coefficients of Table 16

	(1)	(2)	(3)	(4)	(5)	(6)
	# cigarettes smoked per day			# alcoholic drinks per week		
	FE	Nbreg	FE Nbreg	FE	Nbreg	FE Nbreg
SAH	0.147**	-0.490***	0.025	0.055	0.235***	0.127***
	(0.069)	(0.106)	(0.022)	(0.049)	(0.073)	(0.017)
Mobility index	-0.203***	0.176**	-0.085***	-0.031	-0.247***	-0.063***
	(0.065)	(0.081)	(0.018)	(0.043)	(0.070)	(0.018)
male		1.008***			2.856***	
		(0.253)			(0.215)	
White		0.421			1.533**	
		(0.789)			(0.615)	
Black		-2.022**			0.042	
		(0.854)			(0.657)	
Hispanic		-2.497***			-0.953***	
		(0.526)			(0.344)	
married	0.578	-0.238	0.037	-0.560	-0.459	-0.291*
	(0.869)	(0.793)	(0.187)	(0.650)	(0.450)	(0.162)
partnered	0.414	2.070**	0.432**	0.760	2.138***	-0.211
	(1.005)	(0.900)	(0.210)	(0.960)	(0.670)	(0.176)
divorced or	0.318	1.589*	0.342*	-0.710	-0.246	-0.296*
separated	(0.834)	(0.819)	(0.192)	(0.626)	(0.473)	(0.168)
widowed	0.638	1.162	0.335*	-0.245	-0.384	-0.311*
	(0.857)	(0.817)	(0.194)	(0.631)	(0.492)	(0.175)
went to high school		-0.170			0.071	
		(0.270)			(0.261)	
went to college		-0.540*			0.241	
		(0.320)			(0.276)	
has college degree		-1.906***			0.276	
or more		(0.430)			(0.285)	
working full-time	0.604**	-1.139***	0.089	0.201	-0.507	0.053
	(0.248)	(0.416)	(0.093)	(0.132)	(0.323)	(0.080)
working part-time	0.387	-1.033**	0.045	0.162	-0.271	0.075
	(0.251)	(0.434)	(0.094)	(0.133)	(0.333)	(0.080)
retired	0.271	-0.253	-0.008	-0.032	-0.244	-0.055
	(0.233)	(0.372)	(0.078)	(0.090)	(0.289)	(0.072)
unemployed	0.749	-0.606	0.397**	0.462	0.329	0.149
	(0.604)	(0.693)	(0.180)	(0.347)	(0.564)	(0.158)
self-employed	-0.446**	-0.445	-0.308***	0.074	0.173	0.089
	(0.225)	(0.392)	(0.088)	(0.177)	(0.220)	(0.055)
# years worked	1.074**	0.597***	-0.060	0.194	0.495***	0.001
(log)	(0.469)	(0.195)	(0.049)	(0.328)	(0.132)	(0.059)
job requires some	0.296*	0.014	0.076	0.042	0.047	-0.067
physical activity	(0.156)	(0.250)	(0.060)	(0.125)	(0.212)	(0.046)
HH total assets	0.106*	-0.296***	-0.026*	0.059	0.293***	0.102***
(log)	(0.054)	(0.073)	(0.015)	(0.040)	(0.054)	(0.015)
HH total assets	0.805	-2.436***	-0.217	0.391	2.463***	1.065***
zero or below	(0.570)	(0.787)	(0.152)	(0.412)	(0.611)	(0.171)
has life insurance	0.083	0.010	-0.010	0.118	-0.481***	-0.002
	(0.165)	(0.231)	(0.050)	(0.109)	(0.161)	(0.038)
has long-term	0.094	-1.147***	-0.067	-0.117	-0.023	-0.053
insurance	(0.147)	(0.321)	(0.073)	(0.096)	(0.187)	(0.045)
# private insurance	-0.183**	-0.168	-0.116***	-0.076	-0.131	0.017
	(0.091)	(0.182)	(0.042)	(0.068)	(0.114)	(0.025)
Census: West	-0.207	-0.889***	0.154	0.892	1.103***	0.296***
	(0.557)	(0.341)	(0.097)	(0.569)	(0.213)	(0.085)
Census: Midwest	0.478	-0.265	0.140*	0.177	0.184	0.326***
	(0.664)	(0.267)	(0.079)	(0.283)	(0.203)	(0.082)
Census: Northeast	-0.063	-0.382	0.336***	-0.232	1.109***	0.160*
	(0.429)	(0.338)	(0.100)	(0.401)	(0.225)	(0.083)
Nb. of individuals	5,571	5,571	1,181	5,569	5,569	2,458
Nb. of observations	19,795	19,795	4,265	19,735	19,735	8,993

Notes: The uninsured definition used here is 'Private & Public'. The reference age is 59/60. The coefficients for the negative binomial (nbreg) and fixed effect (FE) nbreg regressions report the average marginal effects and the associated standard errors are obtained using the delta method. Standard errors given in parenthesis are clustered at the individual level and robust to heteroskedasticity and autocorrelation of unknown form. Stars convention: * for $p<0.1$, ** for $p<0.05$, and *** for $p<0.01$. The significance levels reported next to the marginal effects are based on the orginal coefficients.

Table 76: DID - "All Types" definition (binary variables)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Vigorous physical activity				Quit smoking				Drink daily			
	FE	**FE**	**Probit**	**FE Logit**	**FE**	**FE**	**Probit**	**FE Logit**	**FE**	**FE**	**Probit**	**FE Logit**
age 61/62	0.039	0.038	0.009	0.003	-0.009	-0.009	0.036***	0.000	0.009	0.009	0.001	0.000
	(0.032)	(0.032)	(0.011)	(0.004)	(0.021)	(0.021)	(0.008)	(0.001)	(0.012)	(0.012)	(0.004)	(0.001)
age 63/64	0.072	0.071	0.009	0.005	-0.027	-0.027	0.068***	-0.000	0.016	0.016	0.002	0.001
	(0.060)	(0.060)	(0.012)	(0.006)	(0.040)	(0.040)	(0.011)	(0.001)	(0.024)	(0.024)	(0.005)	(0.001)
age 65/66	0.095	0.153	0.044	0.010	-0.030	-0.029	0.105***	-0.000	0.027	0.023	-0.011	0.001
	(0.090)	(0.098)	(0.041)	(0.012)	(0.059)	(0.063)	(0.040)	(0.001)	(0.036)	(0.040)	(0.019)	(0.001)
age 67/68	0.139	0.197	0.048	0.011	-0.050	-0.049	0.127***	-0.000	0.035	0.031	-0.013	0.001
	(0.117)	(0.123)	(0.042)	(0.013)	(0.078)	(0.081)	(0.041)	(0.001)	(0.048)	(0.051)	(0.020)	(0.001)
uninsured x age 59/60			0.034				-0.023				0.014	
			(0.036)				(0.040)				(0.020)	
uninsured x age 61/62	-0.008	-0.006	0.030	-0.001	0.006	0.006	-0.019	0.000	0.021**	0.021**	0.047***	0.001*
	(0.025)	(0.025)	(0.037)	(0.003)	(0.016)	(0.016)	(0.040)	(0.001)	(0.010)	(0.010)	(0.018)	(0.001)
uninsured x age 63/64	-0.059**	-0.059**	-0.024	-0.006	0.005	0.005	-0.025	0.000	0.019*	0.019*	0.045**	0.001*
	(0.028)	(0.028)	(0.037)	(0.008)	(0.017)	(0.017)	(0.041)	(0.000)	(0.011)	(0.011)	(0.017)	(0.001)
uninsured x age 65/66	-0.039	-0.142*	-0.083	-0.016	0.021	-0.009	-0.046	0.000	0.010	0.023	0.070***	0.001
	(0.033)	(0.077)	(0.064)	(0.023)	(0.020)	(0.036)	(0.056)	(0.001)	(0.011)	(0.030)	(0.024)	(0.002)
uninsured x age 67/68	-0.025	-0.128	-0.076	-0.015	-0.009	-0.040	-0.077	-0.000	-0.002	0.011	0.065**	0.000
	(0.038)	(0.080)	(0.070)	(0.022)	(0.022)	(0.037)	(0.060)	(0.001)	(0.012)	(0.032)	(0.026)	(0.001)
dr	0.035**	0.067***	0.048**	0.006	0.024**	0.032*	0.145***	0.000	-0.006	-0.004	-0.008	-0.000
	(0.018)	(0.022)	(0.020)	(0.008)	(0.011)	(0.017)	(0.022)	(0.000)	(0.007)	(0.009)	(0.010)	(0.001)
dr x 65 or more		-0.062	-0.043	-0.006		-0.003	0.020	0.000		0.004	0.012	0.000
		(0.045)	(0.041)	(0.008)		(0.025)	(0.039)	(0.001)		(0.017)	(0.019)	(0.001)
dr x before 65 x uninsured		-0.086**	-0.036	-0.008		-0.034	-0.063	-0.000		-0.006	-0.027	-0.000
		(0.044)	(0.035)	(0.011)		(0.025)	(0.039)	(0.001)		(0.019)	(0.017)	(0.001)
dr x 65 or more x uninsured		0.035	0.075	0.003		0.005	-0.034	-0.000		-0.020	-0.055**	-0.001
		(0.071)	(0.067)	(0.006)		(0.031)	(0.059)	(0.001)		(0.029)	(0.025)	(0.002)
individuals	4,935	4,935	4,935		3,345	3,345	3,345		5,463	5,463	5,463	449
observations	14,980	14,980	14,980	7,932	12,720	12,720	12,720	2,248	19,410	19,410	19,410	1,684

Notes: The uninsured definition used here is 'All Types'. The reference age is 59/60. The coefficients for the probit and fixed effect (FE) logit regressions report the average marginal effects and the associated standard errors are obtained using the delta method. Standard errors given in parenthesis are clustered at the individual level and robust to heteroskedasticity and autocorrelation of unknown form. Stars convention: * for p<0.1, ** for p<0.05, and *** for p<0.01. The significance levels reported next to the marginal effects are based on the orginal coefficients.

Table 77: DID - "All Types" definition (count variables)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	# cigarettes smoked per day				# alcoholic drinks per day			
	FE	**FE**	**Nbreg**	**FE Nbreg**	**FE**	**FE**	**Nbreg**	**FE Nbreg**
age 61/62	-0.126	-0.127	-0.663***	-0.168***	-0.069	-0.071	-0.038	-0.022
	(0.279)	(0.280)	(0.144)	(0.051)	(0.161)	(0.161)	(0.117)	(0.038)
age 63/64	-0.127	-0.129	-1.234***	-0.278***	-0.160	-0.164	-0.159	-0.018
	(0.532)	(0.533)	(0.201)	(0.064)	(0.298)	(0.299)	(0.137)	(0.053)
age 65/66	-0.123	0.034	-1.488***	-0.081	-0.283	-0.151	-0.281	0.155
	(0.781)	(0.826)	(0.548)	(0.151)	(0.433)	(0.497)	(0.437)	(0.119)
age 67/68	-0.096	0.061	-2.102***	-0.213	-0.399	-0.269	-0.416	0.135
	(1.030)	(1.064)	(0.571)	(0.163)	(0.565)	(0.617)	(0.459)	(0.132)
uninsured x age 59/60			-0.202				1.694***	
			(0.530)				(0.560)	
uninsured x age 61/62	0.439	0.440	0.349	0.182**	-0.096	-0.105	1.950***	-0.171*
	(0.308)	(0.308)	(0.507)	(0.090)	(0.233)	(0.234)	(0.584)	(0.090)
uninsured x age 63/64	0.191	0.193	0.595	0.196**	-0.187	-0.208	1.969***	-0.115
	(0.392)	(0.393)	(0.548)	(0.096)	(0.267)	(0.265)	(0.653)	(0.093)
uninsured x age 65/66	-0.029	-0.095	0.592	-0.022	-0.536*	-1.342	1.913***	-0.745***
	(0.359)	(0.810)	(0.685)	(0.183)	(0.315)	(0.852)	(0.587)	(0.175)
uninsured x age 67/68	0.315	0.253	1.144	0.222	-0.677**	-1.488*	1.859***	-0.651***
	(0.441)	(0.856)	(0.719)	(0.195)	(0.288)	(0.820)	(0.671)	(0.188)
dr	-0.271	-0.209	-1.410***	-0.087	-0.356**	-0.133	-0.102	-0.047
	(0.188)	(0.286)	(0.345)	(0.075)	(0.177)	(0.187)	(0.281)	(0.060)
dr x 65 or more		-0.168	-0.343	-0.444***		-0.145	-0.111	-0.193*
		(0.326)	(0.543)	(0.140)		(0.248)	(0.436)	(0.101)
dr x before 65 x uninsured		-0.052	0.331	-0.006		-0.853	-1.409**	-0.342***
		(0.498)	(0.517)	(0.096)		(0.577)	(0.564)	(0.096)
dr x 65 or more x uninsured		0.006	0.438	0.292		0.102	-1.878***	0.202
		(0.643)	(0.736)	(0.188)		(0.640)	(0.618)	(0.177)
individuals	5,463	5,463	5,463	1,160	5,461	5,461	5,461	2,400
observations	19,440	19,440	19,440	4,195	19,379	19,379	19,379	8,799

Notes: The uninsured definition used here is 'All Types'. 'dr' indicates whether the individual has visited the doctor in the last 2 years. The reference age is 59/60. All the regressions control for physical health, gender, race, education, Census regions, marital status, working status, number of years worked, an indicator of whether current job requires some physical activities, household assets in 1992$, whether the individual has a life or a long term care insurance, and dummies for the year of the interviews. The coefficients for the negative binomial (nbreg) and fixed effect (FE) nbreg regressions report the average marginal effects and the associated standard errors are obtained using the delta method. Standard errors given in parenthesis are clustered at the individual level and robust to heteroskedasticity and autocorrelation of unknown form. Stars convention: * for $p<0.1$, ** for $p<0.05$, and *** for $p<0.01$. The significance levels reported next to the marginal effects are based on the orginal coefficients.

Table 78: DID - "Private Only" definition (binary variables)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Vigorous physical activity				Quit smoking				Drink daily			
	FE	**FE**	**Probit**	**FE Logit**	**FE**	**FE**	**Probit**	**FE Logit**	**FE**	**FE**	**Probit**	**FE Logit**
age 61/62	0.040	0.040	0.008	0.005	-0.009	-0.009	0.031***	0.000	0.009	0.009	-0.000	0.000
	(0.031)	(0.031)	(0.011)	(0.006)	(0.020)	(0.021)	(0.008)	(0.001)	(0.012)	(0.012)	(0.004)	(0.001)
age 63/64	0.073	0.071	0.008	0.007	-0.020	-0.020	0.065***	0.000	0.019	0.019	0.001	0.001
	(0.060)	(0.059)	(0.012)	(0.009)	(0.039)	(0.040)	(0.011)	(0.002)	(0.024)	(0.024)	(0.005)	(0.001)
age 65/66	0.098	0.179*	0.046	0.016*	-0.025	-0.011	0.096**	0.001	0.033	0.021	-0.019	0.001
	(0.089)	(0.099)	(0.044)	(0.020)	(0.058)	(0.063)	(0.041)	(0.004)	(0.036)	(0.040)	(0.020)	(0.001)
age 67/68	0.141	0.222*	0.047	0.017*	-0.044	-0.030	0.120***	0.001	0.041	0.030	-0.021	0.001
	(0.116)	(0.124)	(0.046)	(0.021)	(0.077)	(0.081)	(0.043)	(0.005)	(0.047)	(0.051)	(0.021)	(0.001)
uninsured x age 59/60			0.006				-0.034				0.017	
			(0.034)				(0.037)				(0.019)	
uninsured x age 61/62	-0.013	-0.011	0.006	-0.002	0.016	0.016	-0.022	0.000	0.012	0.012	0.041**	0.000
	(0.021)	(0.021)	(0.035)	(0.004)	(0.013)	(0.013)	(0.038)	(0.001)	(0.008)	(0.008)	(0.017)	(0.001)
uninsured x age 63/64	-0.051**	-0.049**	-0.038	-0.006**	0.008	0.009	-0.038	-0.000	0.007	0.007	0.040**	0.000
	(0.023)	(0.023)	(0.035)	(0.009)	(0.015)	(0.014)	(0.039)	(0.001)	(0.009)	(0.009)	(0.017)	(0.001)
uninsured x age 65/66	-0.044	-0.183**	-0.099	-0.034***	0.036**	-0.007	-0.030	-0.001	-0.000	0.016	0.070***	0.001
	(0.027)	(0.072)	(0.061)	(0.047)	(0.017)	(0.036)	(0.055)	(0.002)	(0.009)	(0.028)	(0.024)	(0.001)
uninsured x age 67/68	-0.042	-0.182**	-0.089	-0.034***	0.024	-0.020	-0.059	-0.001	-0.012	0.005	0.064**	0.000
	(0.032)	(0.074)	(0.066)	(0.049)	(0.019)	(0.037)	(0.058)	(0.002)	(0.010)	(0.029)	(0.026)	(0.001)
dr	0.029*	0.064***	0.039*	0.008**	0.027**	0.033*	0.146***	0.000	-0.008	-0.007	-0.007	-0.000
	(0.018)	(0.024)	(0.021)	(0.011)	(0.011)	(0.017)	(0.024)	(0.001)	(0.007)	(0.010)	(0.011)	(0.001)
dr x 65 or more		-0.088*	-0.048	-0.012**		-0.015	0.018	-0.000		0.012	0.020	0.001
		(0.049)	(0.044)	(0.018)		(0.026)	(0.041)	(0.001)		(0.017)	(0.020)	(0.001)
dr x before 65 x uninsured		-0.075*	-0.022	-0.008*		-0.019	-0.031	-0.000		-0.005	-0.032*	-0.000
		(0.040)	(0.033)	(0.012)		(0.026)	(0.037)	(0.001)		(0.017)	(0.017)	(0.001)
dr x 65 or more x uninsured		0.082	0.074	0.009		0.031	-0.021	0.001		-0.023	-0.062**	-0.001
		(0.067)	(0.063)	(0.013)		(0.030)	(0.057)	(0.002)		(0.025)	(0.025)	(0.002)
individuals	5,126	5,126	5,126		3,486	3,486	3,486		5,691	5,691	5,691	
observations	15,515	15,515	15,515	8,140	13,252	13,252	13,252	2,298	20,227	20,227	20,227	1,778

Notes: The uninsured definition used here is 'Private Only'. 'dr' indicates whether the individual has visited the doctor in the last 2 years. The regressions are reduced to the common support of the PS. The reference age is 59/60. All the regressions control for physical health, gender, race, education, Census regions, marital status, working status, number of years worked, an indicator of whether current job requires some physical activities, household assets in 1992$, whether the individual has a life or a long term care insurance, and dummies for the year of the interviews. The coefficients for the probit and fixed effect (FE) logit regressions report the average marginal effects and the associated standard errors are obtained using the delta method. Standard errors given in parenthesis are clustered at the individual level and robust to heteroskedasticity and autocorrelation of unknown form. Stars convention: * for $p<0.1$, ** for $p<0.05$, and *** for $p<0.01$. The significance levels reported next to the marginal effects are based on the orginal coefficients.

Table 79: DID - "Private Only" definition (count variables)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	# cigarettes smoked per day				# alcoholic drinks per day			
	FE	**FE**	**Nbreg**	**FE Nbreg**	**FE**	**FE**	**Nbreg**	**FE Nbreg**
age 61/62	-0.093	-0.093	-0.614***	-0.152***	-0.173	-0.176	-0.128	-0.021
	(0.273)	(0.273)	(0.146)	(0.054)	(0.157)	(0.158)	(0.117)	(0.038)
age 63/64	-0.001	-0.001	-1.141***	-0.256***	-0.220	-0.227	-0.209	0.026
	(0.521)	(0.522)	(0.204)	(0.067)	(0.293)	(0.294)	(0.137)	(0.052)
age 65/66	0.006	0.090	-1.403**	-0.037	-0.323	-0.287	-0.246	0.199*
	(0.767)	(0.800)	(0.567)	(0.158)	(0.425)	(0.497)	(0.462)	(0.119)
age 67/68	0.037	0.122	-2.052***	-0.159	-0.471	-0.437	-0.423	0.184
	(1.011)	(1.034)	(0.590)	(0.169)	(0.556)	(0.614)	(0.483)	(0.132)
uninsured x age 59/60			0.134				1.390**	
			(0.515)				(0.544)	
uninsured x age 61/62	0.190	0.191	0.447	0.081	0.243	0.243	1.941***	-0.110
	(0.265)	(0.265)	(0.500)	(0.080)	(0.190)	(0.190)	(0.567)	(0.075)
uninsured x age 63/64	-0.383	-0.382	0.536	0.057	-0.041	-0.042	1.811***	-0.195**
	(0.309)	(0.309)	(0.539)	(0.087)	(0.211)	(0.211)	(0.615)	(0.078)
uninsured x age 65/66	-0.586*	-0.604	0.385	-0.151	-0.348	-0.895	1.536**	-0.727***
	(0.307)	(0.752)	(0.681)	(0.184)	(0.234)	(0.724)	(0.601)	(0.166)
uninsured x age 67/68	-0.333	-0.351	0.895	0.021	-0.426*	-0.978	1.760***	-0.649***
	(0.352)	(0.790)	(0.705)	(0.195)	(0.224)	(0.707)	(0.661)	(0.177)
dr	-0.381*	-0.371	-1.355***	-0.130*	-0.346**	-0.200	-0.020	-0.013
	(0.200)	(0.313)	(0.350)	(0.078)	(0.174)	(0.202)	(0.303)	(0.060)
dr x 65 or more		-0.088	-0.345	-0.450***		-0.047	-0.147	-0.166
		(0.309)	(0.570)	(0.150)		(0.262)	(0.458)	(0.102)
dr x before 65 x uninsured		0.040	-0.118	0.058		-0.528	-1.537***	-0.362***
		(0.515)	(0.489)	(0.086)		(0.491)	(0.549)	(0.083)
dr x 65 or more x uninsured		0.052	0.046	0.265		0.106	-1.790***	0.049
		(0.572)	(0.716)	(0.188)		(0.555)	(0.621)	(0.167)
individuals	5,691	5,691	5,691	1,192	5,689	5,689	5,689	2,546
observations	20,256	20,256	20,256	4,307	20,196	20,196	20,196	9,331

Notes: The uninsured definition used here is 'Private Only'. 'dr' indicates whether the individual has visited the doctor in the last 2 years. The regressions are reduced to the common support of the PS. The reference age is 59/60. All the regressions control for physical health, gender, race, education, Census regions, marital status, working status, number of years worked, an indicator of whether current job requires some physical activities, household assets in 1992$, whether the individual has a life or a long term care insurance, and dummies for the year of the interviews. The coefficients for the negative binomial (nbreg) and fixed effect (FE) nbreg regressions report the average marginal effects and the associated standard errors are obtained using the delta method. Standard errors given in parenthesis are clustered at the individual level and robust to heteroskedasticity and autocorrelation of unknown form. Stars convention: * for p<0.1, ** for p<0.05, and *** for p<0.01. The significance levels reported next to the marginal effects are based on the orginal coefficients.

C.5 Double-Robust approach

Table 80: DR estimates - "All Types" definition

	D(a)			DID(a,a')			DIDID(a,a'',a''')		
	est.	SE[1]	N		est.	SE[2]		est.	SE[2]
vigorous physical activity									
age 5960	0.012	0.001	4,307	**6162-5960**	-0.031	0.038	**(6364-6162)-(6162-5960)**	-0.034	0.061
age 6162	-0.019	0.001	3,593	**6364-6162**	-0.065 *	0.035	**(6566-6364)-(6162-5960)**	0.088 *	0.052
age 6364	-0.084 ***	0.001	3,368	**6566-6364**	0.057	0.037	**(6768-6566)-(6162-5960)**	0.039	0.066
age 6566	-0.028	0.001	2,256	**6768-6566**	0.008	0.049	**(6566-6364)-(6364-6162)**	0.122 **	0.059
age 6768	-0.019	0.002	1,456				**(6768-6566)-(6364-6162)**	0.074	0.056
							(6768-6566)-(6566-6364)	-0.048	0.068
quit smoking									
age 5960	-0.092 ***	0.029	2,924	**6162-5960**	0.029	0.027	**(6364-6162)-(6162-5960)**	-0.075	0.051
age 6162	-0.063 **	0.030	2,850	**6364-6162**	-0.046	0.030	**(6566-6364)-(6162-5960)**	-0.030	0.039
age 6364	-0.108 ***	0.029	2,928	**6566-6364**	-0.001	0.024	**(6768-6566)-(6162-5960)**	-0.074 **	0.038
age 6566	-0.110 ***	0.032	2,285	**6768-6566**	-0.045 *	0.025	**(6566-6364)-(6364-6162)**	0.044	0.040
age 6768	-0.155 ***	0.039	1,733				**(6768-6566)-(6364-6162)**	0.000	0.037
							(6768-6566)-(6566-6364)	-0.044	0.041
# cigarettes per day									
age 5960	1.200 **	0.498	3,552	**6162-5960**	-0.036	0.538	**(6364-6162)-(6162-5960)**	-0.053	0.957
age 6162	1.164 **	0.459	4,442	**6364-6162**	-0.089	0.557	**(6566-6364)-(6162-5960)**	0.212	0.787
age 6364	1.075 **	0.511	4,834	**6566-6364**	0.176	0.503	**(6768-6566)-(6162-5960)**	0.149	0.633
age 6566	1.251 **	0.500	3,727	**6768-6566**	0.112	0.445	**(6566-6364)-(6364-6162)**	0.265	0.875
age 6768	1.363 **	0.566	2,885				**(6768-6566)-(6364-6162)**	0.201	0.756
							(6768-6566)-(6566-6364)	-0.064	0.689
drink daily									
age 5960	0.000	0.015	3,543	**6162-5960**	-0.002	0.014	**(6364-6162)-(6162-5960)**	0.006	0.019
age 6162	-0.002	0.014	4,432	**6364-6162**	0.005	0.010	**(6566-6364)-(6162-5960)**	0.014	0.022
age 6364	0.003	0.015	4,829	**6566-6364**	0.012	0.014	**(6768-6566)-(6162-5960)**	-0.004	0.021
age 6566	0.015	0.016	3,721	**6768-6566**	-0.006	0.012	**(6566-6364)-(6364-6162)**	0.007	0.018
age 6768	0.009	0.017	2,883				**(6768-6566)-(6364-6162)**	-0.010	0.017
							(6768-6566)-(6566-6364)	-0.018	0.019
# alcohol drinks per week									
age 5960	0.992 **	0.397	3,539	**6162-5960**	-0.430	0.541	**(6364-6162)-(6162-5960)**	0.238	0.882
age 6162	0.561	0.482	4,425	**6364-6162**	-0.192	0.421	**(6566-6364)-(6162-5960)**	0.367	0.812
age 6364	0.369	0.380	4,817	**6566-6364**	-0.063	0.561	**(6768-6566)-(6162-5960)**	0.319	0.578
age 6566	0.305	0.336	3,719	**6768-6566**	-0.112	0.353	**(6566-6364)-(6364-6162)**	0.129	0.746
age 6768	0.194	0.298	2,879				**(6768-6566)-(6364-6162)**	0.081	0.595
							(6768-6566)-(6566-6364)	-0.048	0.796

Notes: The uninsured definition is 'All Types'. The double-robust estimates D(a) combine regression models, estimated using logit or negative-binomial if the dependent variable is binary or continuous respectively, and estimated propensity score. DID(a,a')=D(a')-D(a) and DIDID(a,a',a",a"')=DID(a",a"')-DID(a,a'). (1) indicates analytical standard errors (SE) and (2) bootstrapped standard errors (50 replications). Stars convention: *** p<0.01, ** p<0.05 and * p<0.1.

Table 81: DR estimates - "Private Only" definition

	D(a)			DID(a,a')			DIDID(a,a',a'',a''')		
	est.	SE[1]	N		est.	SE[2]		est.	SE[2]
vigorous physical activity									
age 5960	-0.010	0.021	4,482	**6162-5960**	0.014	0.031	**(6364-6162)-(6162-5960)**	-0.078	0.053
age 6162	0.004	0.026	3,720	**6364-6162**	-0.064 **	0.032	**(6566-6364)-(6162-5960)**	0.042	0.050
age 6364	-0.060 **	0.026	3,487	**6566-6364**	0.056	0.037	**(6768-6566)-(6162-5960)**	-0.012	0.065
age 6566	-0.004	0.033	2,333	**6768-6566**	0.002	0.048	**(6566-6364)-(6364-6162)**	0.120 **	0.056
age 6768	-0.002	0.043	1,493				**(6768-6566)-(6364-6162)**	0.066	0.058
							(6768-6566)-(6566-6364)	-0.055	0.067
quit smoking									
age 5960	-0.047 *	0.026	3,052	**6162-5960**	0.026	0.019	**(6364-6162)-(6162-5960)**	-0.056	0.038
age 6162	-0.021	0.028	2,973	**6364-6162**	-0.029	0.025	**(6566-6364)-(6162-5960)**	-0.030	0.031
age 6364	-0.050 **	0.024	3,044	**6566-6364**	-0.003	0.023	**(6768-6566)-(6162-5960)**	-0.037	0.027
age 6566	-0.054 **	0.027	2,375	**6768-6566**	-0.011	0.022	**(6566-6364)-(6364-6162)**	0.026	0.037
age 6768	-0.064 **	0.029	1,808				**(6768-6566)-(6364-6162)**	0.019	0.035
							(6768-6566)-(6566-6364)	-0.007	0.035
# cigarettes per day									
age 5960	0.604	0.470	3,736	**6162-5960**	0.061	0.407	**(6364-6162)-(6162-5960)**	-0.490	0.805
age 6162	0.665	0.539	4,642	**6364-6162**	-0.429	0.524	**(6566-6364)-(6162-5960)**	0.117	0.555
age 6364	0.235	0.346	5,021	**6566-6364**	0.178	0.377	**(6768-6566)-(6162-5960)**	-0.168	0.427
age 6566	0.413	0.333	3,863	**6768-6566**	-0.107	0.261	**(6566-6364)-(6364-6162)**	0.607	0.813
age 6768	0.306	0.320	2,994				**(6768-6566)-(6364-6162)**	0.322	0.587
							(6768-6566)-(6566-6364)	-0.285	0.519
drink daily									
age 5960	0.011	0.020	3,727	**6162-5960**	-0.024 *	0.012	**(6364-6162)-(6162-5960)**	0.028	0.019
age 6162	-0.013	0.015	4,633	**6364-6162**	0.004	0.009	**(6566-6364)-(6162-5960)**	0.040 **	0.017
age 6364	-0.009	0.015	5,016	**6566-6364**	0.016	0.011	**(6768-6566)-(6162-5960)**	0.021	0.020
age 6566	0.007	0.019	3,857	**6768-6566**	-0.003	0.018	**(6566-6364)-(6364-6162)**	0.012	0.015
age 6768	0.005	0.019	2,992				**(6768-6566)-(6364-6162)**	-0.007	0.021
							(6768-6566)-(6566-6364)	-0.019	0.023
# alcohol drinks per week									
age 5960	0.512	0.352	3,723	**6162-5960**	-0.525	0.456	**(6364-6162)-(6162-5960)**	0.150	0.698
age 6162	-0.013	0.434	4,626	**6364-6162**	-0.375	0.422	**(6566-6364)-(6162-5960)**	0.934	0.689
age 6364	-0.388	0.401	5,004	**6566-6364**	0.408	0.354	**(6768-6566)-(6162-5960)**	0.569	0.619
age 6566	0.020	0.425	3,855	**6768-6566**	0.043	0.486	**(6566-6364)-(6364-6162)**	0.784	0.576
age 6768	0.063	0.301	2,988				**(6768-6566)-(6364-6162)**	0.418	0.850
							(6768-6566)-(6566-6364)	-0.365	0.643

Notes: The uninsured definition is 'Private Only'. The double-robust estimates D(a) combine regression models, estimated using logit or negative-binomial if the dependent variable is binary or continuous respectively, and estimated propensity score. DID(a,a')=D(a')-D(a) and DIDID(a,a',a",a"')=DID(a",a"')-DID(a,a'). (1) indicates analytical standard errors (SE) and (2) bootstrapped standard errors (50 replications). Stars convention: *** p<0.01, ** p<0.05 and * p<0.1.

Part 6

Appendix: Parenting Style and Children's Health

A Cluster and Factor Analysis

The literature review in Section 3.2.1.1 presents the main definitions of types of parenting style that have been considered in the literature, and in Section 3.3.1.2, we reviewed how different groups of parents have been identified. In this section, we conduct cluster and factor analysis in order to investigate possible patterns of parenting style and to see if it is possible to select representative measures of parenting style (factor analysis) or simple categorisations of mother's parenting style (cluster analysis). We use parenting style reported at sweep 3.

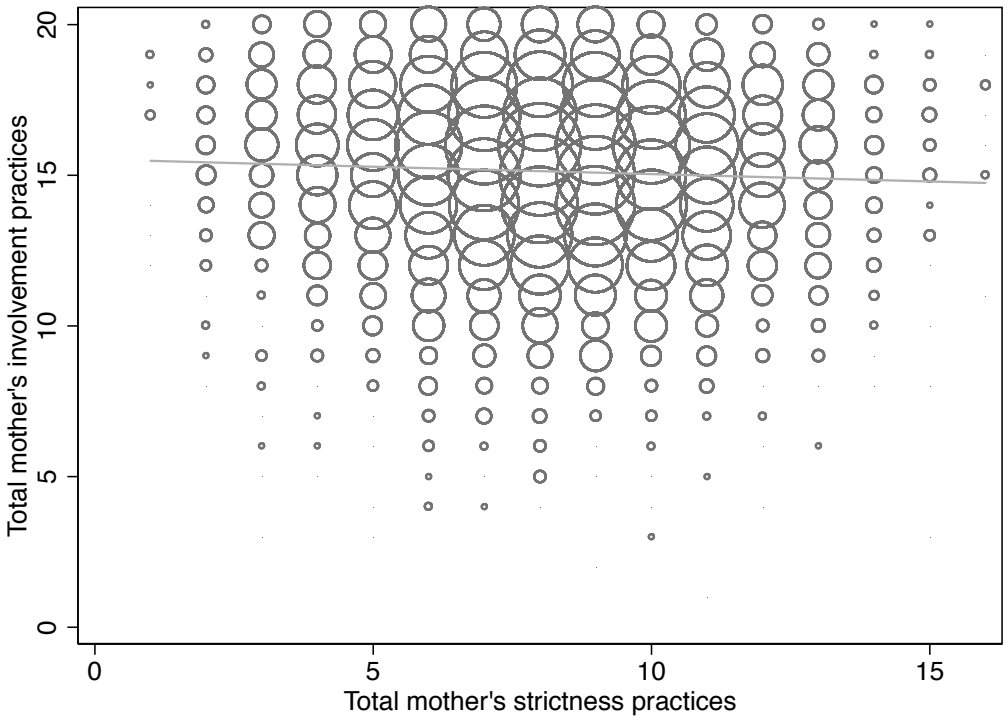
The literature has predominantly focused on the intensity of parents' involvement and strictness. Figure 8 plots mother's total involvement and strictness practices. The size of the circles is proportional to the number of observations. We see that the majority of mother are highly involved, whereas the distribution of strictness practices is more normally distributed. The correlation between mother's involvement and strictness is slightly negative implying that mothers who are highly involved in the education of their child are less likely to impose numerous strictness methods. The observations are grouped in the higher centre of the graph without clearly representing specific types of parenting style.

A.1 Cluster analysis

Cluster analysis attempts to identify natural groups or types of observations based on individual's characteristics. The greater the similarities between groups and the dissimilarities across, the better the clustering. As we are interested in classifying mother's parenting style into different groups similar to those in the psychology literature, we apply partitional clustering.[98] This method breaks the observations into a pre-set number of non-overlapping groups. We apply the commonly used *k-means* algorithm (MacQueen, 1967) defined as the set $S = \{S_1, S_k, ...S_k\}$ that minimises the

[98]This is by opposition to hierarchical clustering which would not make sense in our case.

Figure 8: Correlations between total involvement and strictness



function F defined as

$$F = \sum_{i=1}^{k} \sum_{p_j \epsilon S_k} ||p_j - \mu_i||^2 \tag{55}$$

where μ_i is the centre (mean) of the parenting style type S_k and p_j the parenting style of the parent belonging to type S_k. The objective is to minimise the difference between each observation and its group mean.[99]

We investigate possible groups for the 8 different measures of mother's parenting methods, as well as for the mother's involvement and strictness indices which are more similar to what has been done to the literature. As an alternative to the *k-means* algorithm, we also implement *k-medians* algorithm as the variables are not continuous. To evaluate the distance between each observation and the group's mean or median, we compare the results using Euclidean distance, absolute-value distance, and maximum-value distance. Cluster analysis requires users to specify the number of clusters to create and we investigate the possibility of 3, 4 and 5 groups. Each time, we impose the groups to be non-overlapping, so that a mother does not belong to more than one group, and complete which forces each observation to belong to one group.

[99]We have performed the same analysis using the median to accommodate the count nature of our data, but the results remain unchanged.

These various options give very different results. Focusing first on the results using just the indices of mother's involvement and strictness practices, we are able to identify four groups in line with the authoritative, authoritarian, permissive and neglectful groups used in the literature. The results are presented in Figure 9.

The first graph of each line illustrates that, depending on the chosen specification for the cluster analysis, we can obtain groups in line with the literature. The first grouping obtained in the first graph can be associated to Baumrind's initial classification, with the diamond shape group representing the permissive parents who exert almost no authority, but are attentive to their child's needs. Authoritative mothers can be represented by the squares, that is mothers who are involved as well as strict. And finally, the triangles could be a large authoritarian group, with mothers generally strict but not involved. When imposing four groups, the four categories in last graph of the second line can unequivocally be associated to the four classical parenting style, authoritarian, authoritative, permissive and neglectful. The first graph in the case of five groups additionally identifies a moderate group in terms of involvement and strictness that is represented by the crosses in the middle of the parenting style distribution

However, when considering now the other graphs of each line, the new groups created cannot be related to the ones discussed, suggesting that clustering does not identifies clear parenting style groups.

Table 10 shows the average specific parenting style by groups obtained when doing cluster analysis using the specific parenting style measures. In the example reported, we used the k-means algorithm, imposing 4 groups, and using Euclidean distance. If one tries to identifies one or more categories of mothers similar to the classical four categories in the literature, it is impossible no matter the clustering method used. Here, groups 2 and 4 are the less involved on average, and group 4 is also the most strict in average which suggests it represents the authoritative mothers. However, among groups 1, 2, 3, it is not clear which one is the most strict so that we cannot distinguish between authoritarian, neglectful and permissive.

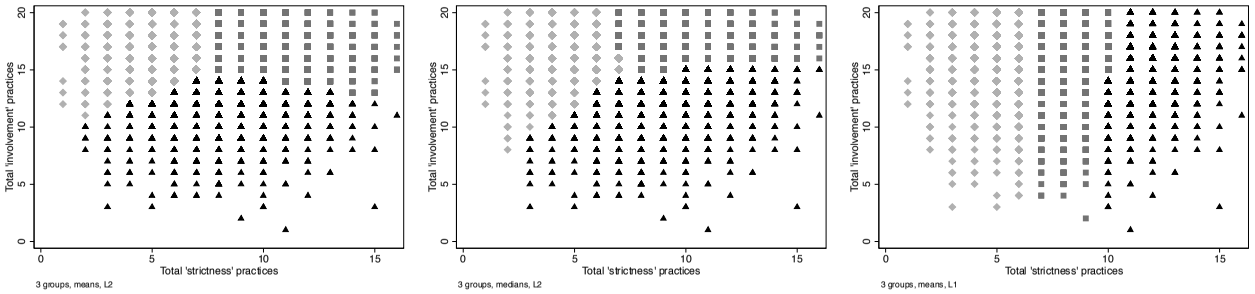
We have tried to represent the different groups on the same axis as in Figure 9 but the groups overlap each other. Therefore, we conclude that clustering is not a robust approach to identify parenting groups. We now turn to factor analysis to investigate the possibility to reduce the numerous dimensions of parenting style.

A.2 Factor analysis

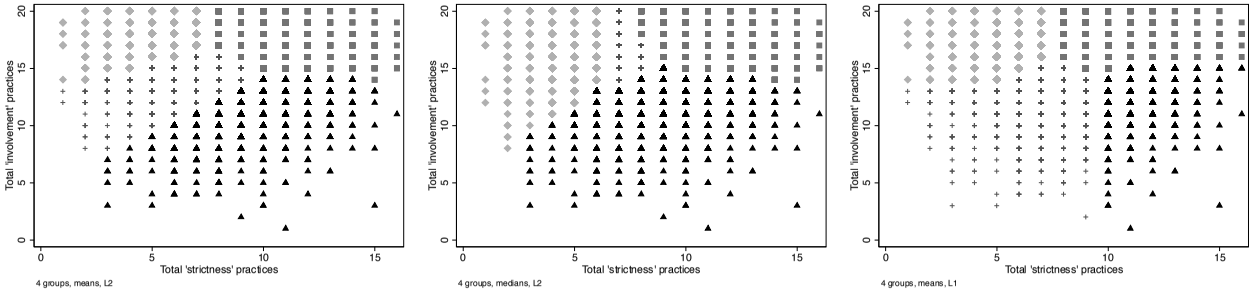
We use factor analysis as an exploratory approach in order to combine correlated variables in order to reduce the number of dimensions to analyse.

Figure 9: Parenting groups identified by cluster analysis

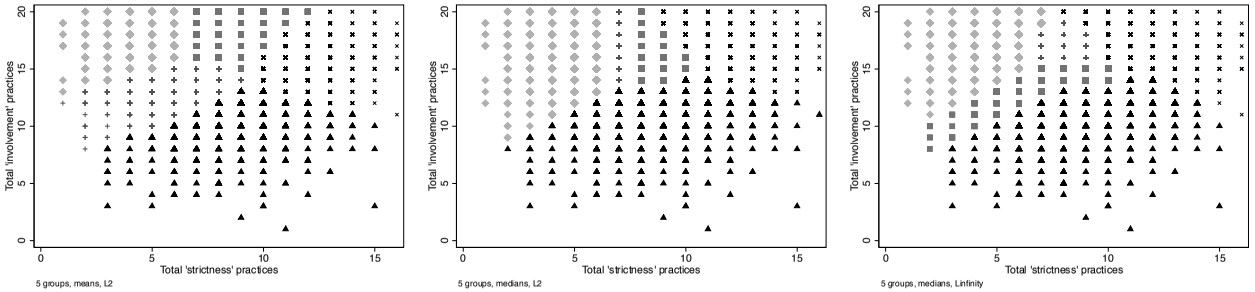
3 groups:



4 groups:



5 groups:



Notes: The graphs report the results from cluster analysis. The horizontal axes represent the total strictness practices, whereas the vertical axes represent the total involvement practices. The first line imposes 3 groups, the second line 4 groups, and the last line 5 groups. For each line, the first graph is the result of a k-means algorithm using Euclidean distance, the second one is based on k-medians algorithm using Euclidean distance, and the last one on k-medians using maximum-value distance.

Figure 10: Correlations between total involvement and strictness

	Group 1	Group 2	Group 3	Group 4
Prop. to read with child	0.946	0.923	0.941	0.931
Prop. to do art with child	0.860	0.854	0.872	0.854
Prop. to do physical act. with child	0.690	0.666	0.698	0.677
Prop. to play with child	0.778	0.741	0.789	0.747
Prop. to reason naughty child	0.940	0.885	0.942	0.904
Prop. to shout at child	0.460	0.879	0.576	0.856
Prop. to take away treats from naughty child	0.357	0.357	0.775	0.796
Prop. to ignore naughty child	0.705	0.278	0.175	0.817
Observations	1,817	2,327	2,446	3,558

Notes: Parenting style at sweep 3. Cluster is based on the k-means algorithm, imposing 4 groups, and using Euclidean distance.

In table 11, we present the results for a factor analysis on the whole set of specific parenting style variables. Three factors are retained (based on the Kaiser (1958) criterion that suggests to retain factors with eigenvalue above one). The first factor is overall positively associated with all the involvement measures, including reasoning with the naughty child, and negatively with the other punitive measures. The second factor is negatively associated with mother's reading activity and reasoning with the child, but positively associated with all the other measures. The last factor is negatively associated with the artistic activities, and positively with the other parenting style variables. Whilst the first factor can be assumed to capture the propensity to be involved with children, it is difficult to understand which underlying propensity is captured by the last two factors.

The proportion of the total variance is the percentage explained by each factor, and here, the main factor only explains 17.94% of the total variance. The first three retained factors only explain 48.70% of the total variance. Uniqueness, that is the proportion of the common variance of the variable that is not associated with the factor, is relatively small for the involvement measures compared to the strictness measures. The rule of thumb is that, when variables have a uniqueness above 0.6, the factors are assumed not to explain these variables very well, which is the case for all the strictness variables except the propensity to shout at the naughty child.

We also applied a principal components analysis to produce a set of uncorrelated linear combination of the variables that capture most of the variance. The objective is to find a combination that has the greatest variance, and the principal component is the one with the maximal overall variance. We could not identify sensible components with this approach.

We repeated this analysis separately for the involvement and strictness measures, but it did not provide a meaningful combination of factors.

As cluster analysis and principal component analysis fail to identify specific types

Figure 11: Factor analysis

	Eigenvalue	Proportion	Factor loadings	Factor 1	Factor 2	Factor 3	Uniqueness
Factor1	1.435	0.179	Prop. to read	0.173	-0.200	0.777	0.327
Factor2	1.302	0.163	Prop. to do art	0.397	0.381	-0.551	0.394
Factor3	1.158	0.145	Prop. to do physical act.	0.585	0.415	0.130	0.470
Factor4	0.961	0.120	Prop. to play	0.651	0.338	0.192	0.425
Factor5	0.861	0.108	Prop. to reason	0.294	-0.414	0.138	0.724
Factor6	0.810	0.101	Prop. to shout	-0.518	0.436	0.034	0.541
Factor7	0.759	0.095	Prop. to take away treats	-0.168	0.500	0.325	0.616
Factor8	0.713	0.089	Prop. to ignore	-0.315	0.469	0.268	0.609
N	10148						
N parameters	21						

Notes: Parenting style at sweep 3. Results from principal component-factor analysis.

of parenting style,[100] we pursue our analysis by investigating separately the role of mother's total involvement and total strictness, as well as the different specific parenting style practices.

[100]Stewart-Brown et al. (2005) undertook a principal component analysis with UK British cohorts and were as well unable to derive scores.

B Additional Results on Parenting Style and Children's Outcomes

We present here additional results for the parenting style and children's outcome analysis. Section B.1 presents the descriptive statistics for the additional variables used in the estimation of the parenting style equations. Section B.2 reports the full list of coefficients of all the control variables for the main regressions, and the results for the additional children's outcomes.

B.1 Additional descriptive statistics

Table 82: Additional covariates in the parenting style regressions

	Mean	Std. dev.
M. works as self-employed	0.057	(0.233)
M. is manager/supervisor at work	0.180	(0.384)
M. works from home	0.061	(0.239)
M. nb days works/week	2.268	(2.268)
M. works at night	0.877	(1.065)
M.'s own parents div/separate	0.291	(0.454)
M.'s own parents never lived together	0.025	(0.155)
M. left home before 17	0.141	(0.348)
M. disagrees w. partner on child's issues	1.542	(1.062)
M. spends time with friends (1-5)	3.210	(0.910)
M. has no religion	0.392	(0.488)
M. attendes religious meeting (0-3)	0.594	(1.061)
P. works as self-employed	0.128	(0.334)
P. is manager/supervisor at work	0.311	(0.463)
Observations	10281	

Notes: M: mother, P: partner. The table reports the descriptive statistics for the additional covariates included in the parenting style equations. The variables are measured at age 5 (sweep 3).

B.2 Mother's parenting style and children's outcomes

Table 83: Full list of coefficients of selected regressions from Table 32 - Probability to be in good health

	(1)	(2)	(3)
	No PS	Pooled probit	
		Just total PS	Specific PS
Child's age	-0.000	-0.001	-0.000
	(0.003)	(0.003)	(0.003)
Child is a boy	-0.002	-0.002	-0.002
	(0.002)	(0.002)	(0.002)
Weight at birth (kg)	0.003*	0.003*	0.003*
	(0.002)	(0.002)	(0.002)
Child has longstanding illness	-0.092***	-0.092***	-0.090***
	(0.007)	(0.006)	(0.006)
Mother tried breastfeeding	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)
Aged stopped breastfeeding (w)	0.003	0.002	0.002
	(0.002)	(0.002)	(0.002)
M.'s age (year)	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)
M.'s age (squared)	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)
M. is in good health	0.031***	0.031***	0.030***
	(0.005)	(0.005)	(0.005)
M: currently pregnant	-0.001	-0.002	-0.002
	(0.004)	(0.004)	(0.004)
M. has longstanding illness	0.002	0.002	0.002
	(0.002)	(0.002)	(0.002)
M.'s depression index	-0.001**	-0.001**	-0.001**
	(0.000)	(0.000)	(0.000)
M. didn't smoke pregnant	0.001	0.002	0.002
	(0.004)	(0.004)	(0.004)
M.'s nb of cigarettes during preg. (log)	-0.001	-0.001	-0.001
	(0.002)	(0.002)	(0.002)
M. does not smoke	0.001	0.000	0.000
	(0.002)	(0.002)	(0.002)
M. smokes other tobacco products	0.009*	0.009**	0.009**
	(0.005)	(0.004)	(0.004)
M.'s alcohol cons. (scale 0-6)	0.001**	0.001**	0.001**
	(0.001)	(0.001)	(0.001)
Both parents are in HH	0.005	0.005	0.004
	(0.005)	(0.005)	(0.005)
M.'s partner is child's father	0.006	0.006	0.007
	(0.006)	(0.006)	(0.006)
Partner interviewed	-0.003	-0.003	-0.003
	(0.005)	(0.004)	(0.004)
M. became single	0.004	0.004	0.005
	(0.005)	(0.005)	(0.005)
M. is married	-0.001	-0.001	-0.001
	(0.003)	(0.002)	(0.002)
M. became married	-0.003	-0.003	-0.003
	(0.004)	(0.004)	(0.004)
M. is separated	-0.009	-0.008	-0.008
	(0.010)	(0.009)	(0.009)
M. became separated	0.004	0.004	0.004
	(0.005)	(0.005)	(0.005)
M. is divorced	-0.002	-0.003	-0.002
	(0.006)	(0.006)	(0.005)
M. became divorced	0.008**	0.008**	0.008***
	(0.003)	(0.003)	(0.003)
M. is widowed	-0.013	-0.009	-0.010
	(0.025)	(0.023)	(0.022)

Notes: M: mother. The first column reports the socio-economic factors' effects when parenting style is not taken into account. Columns 2 and 3 correspond to the probit specifications where we control for the total parenting indices or the specific parenting style practices, respectively. Stars convention: * for $p<0.1$, ** for $p<0.05$, and *** for $p<0.01$.

Table 84: Full list of coefficients of selected regressions from Table 32 (continued) - Probability to be in good health

	(1)	(2)	(3)
	No PS	Pooled probit	
		Just total PS	Specific PS
Annual income [£1600-£3100]	-0.003	-0.002	-0.001
	(0.007)	(0.007)	(0.006)
Annual income [£3100-£10400]	-0.001	-0.001	-0.001
	(0.007)	(0.006)	(0.006)
Annual income [£10400-£20800]	0.002	0.002	0.003
	(0.006)	(0.006)	(0.006)
Annual income [£20800-£52000]	0.002	0.002	0.003
	(0.006)	(0.006)	(0.006)
Annual income >£52600	0.008*	0.008*	0.008*
	(0.004)	(0.004)	(0.004)
Whether own the house	-0.005**	-0.005**	-0.005**
	(0.002)	(0.002)	(0.002)
M. has A level	0.001	0.001	0.001
	(0.003)	(0.003)	(0.003)
M. has diploma in higher educ.	0.006***	0.006***	0.006***
	(0.002)	(0.002)	(0.002)
M. has first degree	0.007***	0.007***	0.007***
	(0.002)	(0.002)	(0.002)
M. has higher degree	0.008***	0.008***	0.008***
	(0.003)	(0.003)	(0.003)
M. has job	0.006**	0.007**	0.006**
	(0.003)	(0.003)	(0.003)
M. hours works per week	-0.000*	-0.000*	-0.000*
	(0.000)	(0.000)	(0.000)
Nb. people in HH	-0.001	-0.000	-0.000
	(0.002)	(0.002)	(0.002)
Nb. siblings in HH	-0.000	-0.000	-0.000
	(0.002)	(0.002)	(0.002)
Nb. natural siblings	0.004*	0.004*	0.004*
	(0.002)	(0.002)	(0.002)
Grand-parents in the HH	0.004	0.004	0.004
	(0.004)	(0.004)	(0.004)
Freq. sees grand-parents (0-5)	-0.000	-0.000	-0.000
	(0.001)	(0.001)	(0.001)
M.'s life satisfaction (1-10)	0.001**	0.001**	0.001**
	(0.000)	(0.000)	(0.000)
P. currently has a job	-0.002	-0.001	-0.002
	(0.005)	(0.005)	(0.005)
P. hours works (week)	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)
White	0.010*	0.009*	0.010*
	(0.006)	(0.006)	(0.006)
Asian	-0.001	-0.001	-0.000
	(0.005)	(0.005)	(0.005)
Black	0.005	0.005	0.005
	(0.005)	(0.004)	(0.004)
Wales	0.000	0.001	0.000
	(0.002)	(0.002)	(0.002)
Scotland	0.004	0.004*	0.004*
	(0.002)	(0.002)	(0.002)
Northern Ireland	-0.003	-0.002	-0.003
	(0.003)	(0.003)	(0.003)
Sweep 4	0.006	0.006	0.005
	(0.007)	(0.007)	(0.006)
N	14,944	14,944	14,944
N_clust	9,038	9,038	9,038

Notes: The first column reports the socio-economic factors' effects when parenting style is not taken into account. Columns 2 and 3 correspond to the probit specifications where we control for the total parenting indices or the specific parenting style practices, respectively. Stars convention: * for $p<0.1$, ** for $p<0.05$, and *** for $p<0.01$.

Table 85: Body mass index

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Pooled OLS		FE		Lagged OLS		Recursive specifications		
	PS S3,4		PS S3,4		Health S4, PS S3		Health S4, PS S3		
Total 'involvement' practices	0.011		0.005		0.028***		0.077**		
	(0.007)		(0.007)		(0.011)		(0.034)		
Prop. to read with child		0.202*		-0.002		0.194		0.047	0.068
		(0.116)		(0.101)		(0.206)		(0.566)	(0.572)
Prop. to do art with child		0.031		0.163*		-0.085		0.771	0.766
		(0.090)		(0.091)		(0.155)		(0.528)	(0.525)
Prop. to do physical act. with child		-0.037		0.001		0.152		-0.374	-0.337
		(0.090)		(0.080)		(0.149)		(0.477)	(0.478)
Prop. to play with child		-0.025		-0.008		-0.046		0.643	0.611
		(0.080)		(0.069)		(0.137)		(0.492)	(0.485)
Total 'rules' actions	0.010		0.014		0.003		0.022		
	(0.008)		(0.009)		(0.012)		(0.036)		
Prop. to reason naughty child		-0.057		-0.093		-0.074		-0.171	-0.176
		(0.088)		(0.069)		(0.144)		(0.465)	(0.458)
Prop. to shout at child		0.051		-0.002		0.120		-0.064	-0.039
		(0.069)		(0.064)		(0.106)		(0.396)	(0.391)
Prop. to take away treats from naughty child		0.032		0.102		-0.009		0.397	0.379
		(0.062)		(0.064)		(0.098)		(0.346)	(0.343)
Prop. to ignore naughty child		-0.114**		0.043		-0.252***		-0.310	-0.324
		(0.054)		(0.059)		(0.084)		(0.319)	(0.317)
Goes to bed regularily (0-3)	-0.045*	-0.045*	-0.007	-0.007	-0.103**	-0.099**	-0.103**	-0.102**	0.019
	(0.027)	(0.027)	(0.024)	(0.024)	(0.041)	(0.041)	(0.041)	(0.041)	(0.123)
Nb. days has breakfast	-0.071***	-0.072***	0.027	0.027	-0.116***	-0.118***	-0.116***	-0.118***	-0.245**
	(0.023)	(0.023)	(0.019)	(0.019)	(0.036)	(0.036)	(0.036)	(0.036)	(0.113)
N_clust	8,987	8,987	9,456	9,456					
N	14,813	14,813	15,282	15,282	6,537	6,537	10,268	10,268	10,268
r2	0.065	0.065	0.040	0.041	0.074	0.075			

Notes: S: sweep, PS: parenting style. Columns 1 and 2 are pooled OLS over sweeps 3 and 4. Columns 3 and 4 report results from fixed effect (FE) regressions of child's health measured in sweeps 3 and 4. Columns 5 and 6 regress child's BMI in sweep 4 on controls in sweep 4 and parenting style in sweep 3. The recursive specifications estimate the child health production function for health measured at age 4 and the reduced form of parenting style measured in sweep 3. Colum 7 and 8 assumes that the overall parenting style indices and the specific measures of parenting style, respectively, are endogenous but not the lifestyle measures. Column 9 considers the parenting style variables as well as the lifestyle variables to be endogenous. Robust standard errors clustered at the family level are given in parenthesis. Stars convention: * for $p<0.1$, ** for $p<0.05$, and *** for $p<0.01$.

Table 86: Correlation of the residuals across the equations (BMI)

	1	2	3	4	5	6	7	8	9	10	11
1 Child BMI	1.000	0.056***	-0.020***	0.002	-0.002	0.095	-0.019	-0.052	-0.068*	0.060	0.017
2 Prop. to read with child	0.056***	1.000	-0.146	0.087**	0.051	0.035***	-0.053***	0.032***	0.012***	0.062***	0.037***
3 Prop. to do art with child	-0.020***	-0.146	1.000	0.145	0.133***	0.008***	-0.054***	-0.008***	-0.023	0.007***	-0.003
4 Prop. to do physical act. with child	0.002	0.087**	0.145	1.000	0.261**	0.030	-0.081	0.020***	-0.025***	0.030***	0.020*
5 Prop. to play with child	-0.002	0.051	0.133***	0.261**	1.000	-0.006**	-0.064***	0.021*	0.001	0.000	0.011*
6 Prop. to reason naughty child	0.095	0.035***	0.008***	0.030	-0.006**	1.000	-0.150	-0.029	-0.059	-0.003***	0.010**
7 Prop. to shout at child	-0.019	-0.053***	-0.054***	-0.081	-0.064***	-0.150	1.000	0.109***	0.124	-0.014	-0.007***
8 Prop. to take away treats from naughty child	-0.052	0.032***	-0.008***	0.020***	0.021*	-0.029	0.109***	1.000	0.121***	0.030	0.031
9 Prop. to ignore naughty child	-0.068*	0.012***	-0.023	-0.025***	0.001	-0.059	0.124	0.121***	1.000	-0.024***	-0.016***
10 Goes to bed regularly (0-3)	0.060	0.062***	0.007***	0.030***	0.000	-0.003***	-0.014	0.030	-0.024***	1.000	0.128***
11 Nb. days has breakfast	0.017	0.037***	-0.003	0.020*	0.011*	0.010**	-0.007***	0.031	-0.016***	0.128***	1.000

Notes: The table reports the correlations between the unobserved error terms of each equation. We report the correlation matrix for the last specification where all the specific parenting style measures as well as the lifestyle measures are assumed to be endogenous. Stars convention: * for p<0.1, ** for p<0.05, and *** for p<0.01.

Table 87: Correlation of the residuals across the equations (hyperactivity)

	1	2	3	4	5	6	7	8	9	10	11
1 Child hyperactivity	1.000	0.045***	-0.022***	-0.045	0.017	-0.012	-0.032	0.005	-0.069	0.081	-0.001
2 Prop. to read with child	0.045***	1.000	-0.146	0.087**	0.051	0.035***	-0.053***	0.032***	0.012***	0.062***	0.037***
3 Prop. to do art with child	-0.022***	-0.146	1.000	0.145	0.133***	0.008***	-0.054***	-0.008***	-0.023	0.007***	-0.003
4 Prop. to do physical act. with child	-0.045	0.087**	0.145	1.000	0.261**	0.030	-0.081	0.020***	-0.025***	0.030***	0.020*
5 Prop. to play with child	0.017	0.051	0.133***	0.261**	1.000	-0.006**	-0.064***	0.021*	0.001	0.000	0.011*
6 Prop. to reason naughty child	-0.012	0.035***	0.008***	0.030	-0.006**	1.000	-0.150	-0.029	-0.059	-0.003***	0.010**
7 Prop. to shout at child	-0.032	-0.053***	-0.054***	-0.081	-0.064***	-0.150	1.000	0.109***	0.124	-0.014	-0.007***
8 Prop. to take away treats from naughty child	0.005	0.032***	-0.008***	0.020***	0.021*	-0.029	0.109***	1.000	0.121***	0.030	0.031
9 Prop. to ignore naughty child	-0.069	0.012***	-0.023	-0.025***	0.001	-0.059	0.124	0.121***	1.000	-0.024***	-0.016***
10 Goes to bed regularly (0-3)	0.081	0.062***	0.007***	0.030***	0.000	-0.003***	-0.014	0.030	-0.024***	1.000	0.128***
11 Nb. days has breakfast	-0.001	0.037***	-0.003	0.020*	0.011*	0.010**	-0.007***	0.031	-0.016***	0.128***	1.000

Notes: The table reports the correlations between the unobserved error terms of each equation. We report the correlation matrix for the last specification where all the specific parenting style measures as well as the lifestyle measures are assumed to be endogenous. Stars convention: * for p<0.1, ** for p<0.05, and *** for p<0.01.

Table 88: Hyperactivity reported by the teacher

	(1)	(2)	(3)	(4)	(5)
	Lagged probit		Recursive specifications (probit)		
	Health S4, PS S3		Health S4, PS S3		
Total 'involvement' practices	-0.001		-0.069		
	(0.005)		(0.064)		
Prop. to read with child		0.073		0.897	0.846
		(0.099)		(2.087)	(0.981)
Prop. to do art with child		0.134*		1.717	1.023
		(0.072)		(2.728)	(0.862)
Prop. to do physical act. with child		-0.067		-1.456	-1.275
		(0.075)		(2.868)	(1.152)
Prop. to play with child		0.043		0.553	0.615
		(0.074)		(2.011)	(1.023)
Total 'rules' actions	0.020***		0.168***		
	(0.005)		(0.048)		
Prop. to reason naughty child		0.017		0.382	0.043
		(0.066)		(2.352)	(0.865)
Prop. to shout at child		-0.013		0.795	0.302
		(0.052)		(0.810)	(0.576)
Prop. to take away treats from naughty child		0.014		0.885	0.584
		(0.049)		(0.770)	(0.515)
Prop. to ignore naughty child		0.031		-0.528	-0.120
		(0.042)		(0.820)	(0.477)
Goes to bed regularily (0-3)	0.010	0.011	0.048	0.042	-0.170
	(0.018)	(0.018)	(0.075)	(0.071)	(0.202)
Nb. days has breakfast	0.000	0.002	-0.010	-0.017	0.592***
	(0.013)	(0.014)	(0.057)	(0.051)	(0.161)
N	667	667	667	667	667

Notes: S: sweep, PS: parenting style. Columns 1 and 2 report the results from regressions of child's mental health measured in sweep 4 on controls in sweep 4 and parenting style in sweep 3. The recursive specifications estimate the child health production function for hyperactivity measured at age 7 (sweep 4) and the reduced form of parenting style measured at age 5 (sweep 3). Colums 3 and 4 assume that the overall parenting style indices or the specific measures are endogenous, but not the lifestyle measures. Column 9 allows the parenting style variables as well as the lifestyle variables to be endogenous. The average marginal effects are reported. Stars convention: * for $p<0.1$, ** for $p<0.05$, and *** for $p<0.01$.

Table 89: Emotional symptoms reported by the child

	(1)	(2)	(3)	(4)	(5)
	Lagged OLS		Recursive specifications (cont)		
	Health S4, PS S3		Health S4, PS S3		
Total 'involvement' practices	-0.033***		-0.010		
	(0.008)		(0.020)		
Prop. to read with child		-0.131		-0.612*	-0.635*
		(0.156)		(0.352)	(0.344)
Prop. to do art with child		-0.126		-0.205	-0.206
		(0.119)		(0.367)	(0.361)
Prop. to do physical act. with child		-0.193*		-0.205	-0.182
		(0.111)		(0.304)	(0.297)
Prop. to play with child		-0.142		0.110	0.081
		(0.101)		(0.268)	(0.264)
Total 'rules' actions	0.030***		0.017		
	(0.009)		(0.020)		
Prop. to reason naughty child		0.128		-0.238	-0.233
		(0.114)		(0.300)	(0.294)
Prop. to shout at child		0.024		-0.077	-0.055
		(0.079)		(0.222)	(0.221)
Prop. to take away treats from naughty child		-0.038		0.125	0.081
		(0.072)		(0.206)	(0.205)
Prop. to ignore naughty child		0.091		-0.125	-0.108
		(0.062)		(0.179)	(0.177)
Goes to bed regularily (0-3)	0.038	0.032		0.030	0.176**
	(0.029)	(0.029)		(0.029)	(0.075)
Nb. days has breakfast	-0.014	-0.012		-0.013	-0.029
	(0.021)	(0.021)		(0.021)	(0.050)
N	6,070	6,070	10,204	10,204	10,204
r2	0.036	0.033			

Notes: S: sweep, PS: parenting style. Internalising behavioural probems reported by the child are only available in sweep 4. Columns 1 and 2 regress child's emotional symptoms in sweep 4 on the controls in sweep 4 and parenting style in sweep 3. The recursive specifications estimate the child's mental health function for emotional symptoms measured at age 7 (sweep 4) and the reduced form of parenting style measured at age 5 (sweep 3). Colum 3 and 4 assume that the overall parenting style indices and the specific measures of parenting style, respectively, are endogenous but not the lifestyle measures. Column 5 considers the parenting style variables as well as the lifestyle variables to be endogenous. Robust standard errors clustered at the family level are given in parenthesis. Stars convention: * for $p<0.1$, ** for $p<0.05$, and *** for $p<0.01$.

Table 90: Full list of coefficients of selected regressions from Table 32 - Externalising behavioural problems

	(1)	(2)	(3)
	No PS	Pooled probit	
		Just total PS	Specific PS
Child's age	-0.270***	-0.215***	-0.258***
	(0.066)	(0.060)	(0.064)
Child is a boy	0.374***	0.257***	0.339***
	(0.033)	(0.030)	(0.032)
Weight at birth (kg)	-0.040	-0.028	-0.040
	(0.033)	(0.030)	(0.032)
Child has longstanding illness	0.227***	0.218***	0.239***
	(0.041)	(0.038)	(0.040)
Mother tried breastfeeding	-0.067*	-0.125***	-0.062
	(0.041)	(0.037)	(0.039)
Aged stopped breastfeeding (w)	-0.001	-0.001	-0.000
	(0.001)	(0.001)	(0.001)
M.'s age (year)	-0.043	-0.056**	-0.052*
	(0.030)	(0.027)	(0.029)
M.'s age (squared)	0.000	0.001**	0.001
	(0.000)	(0.000)	(0.000)
M. is in good health	-0.060	-0.057	-0.064
	(0.054)	(0.049)	(0.053)
M: currently pregnant	-0.067	-0.070	-0.070
	(0.069)	(0.065)	(0.068)
M. has longstanding illness	-0.010	-0.010	0.001
	(0.039)	(0.035)	(0.037)
M.'s depression index	0.127***	0.077***	0.112***
	(0.010)	(0.009)	(0.010)
M. didn't smoke pregnant	0.106	0.139	0.095
	(0.097)	(0.087)	(0.093)
M.'s nb of cigarettes during preg. (log)	0.181***	0.164***	0.160***
	(0.046)	(0.042)	(0.045)
M. does not smoke	-0.081*	-0.069	-0.080*
	(0.049)	(0.045)	(0.048)
M. smokes other tobacco products	-0.276	-0.337	-0.282
	(0.234)	(0.211)	(0.226)
M.'s alcohol cons. (scale 0-6)	0.016	-0.008	0.010
	(0.012)	(0.011)	(0.011)
Both parents are in HH	-0.141	-0.089	-0.162*
	(0.092)	(0.084)	(0.090)
M.'s partner is child's father	-0.214*	-0.204*	-0.168
	(0.126)	(0.115)	(0.123)
Partner interviewed	0.308**	0.270**	0.268**
	(0.129)	(0.116)	(0.125)
M. became single	-0.200	-0.149	-0.173
	(0.165)	(0.157)	(0.161)
M. is married	-0.109**	-0.083*	-0.083
	(0.055)	(0.050)	(0.053)
M. became married	0.075	0.090	0.086
	(0.077)	(0.071)	(0.075)
M. is separated	-0.084	-0.066	-0.030
	(0.159)	(0.155)	(0.159)
M. became separated	-0.013	0.022	-0.025
	(0.170)	(0.164)	(0.169)
M. is divorced	-0.008	0.032	0.030
	(0.102)	(0.095)	(0.098)
M. became divorced	-0.104	-0.078	-0.079
	(0.124)	(0.117)	(0.121)
M. is widowed	-0.828***	-0.689**	-0.768***
	(0.290)	(0.280)	(0.279)
M. became widowed	-0.381	-0.095	-0.405
	(0.452)	(0.451)	(0.473)

Notes: The first column reports the socio-economic factors' effects when parenting style is not taken into account. Columns 2 and 3 correspond to the OLS specifications where we control for the total parenting indices or the specific parenting style practices, respectively. Stars convention: * for $p<0.1$, ** for $p<0.05$, and *** for $p<0.01$.

Table 91: Full list of coefficients of selected regressions from Table 32 (continued) - Externalising behavioural problems

	(1)	(2)	(3)
	No PS	Pooled probit	
		Just total PS	Specific PS
Annual income [£1600-£3100]	0.042	0.104	0.028
	(0.153)	(0.140)	(0.144)
Annual income [£3100-£10400]	0.094	0.110	0.097
	(0.150)	(0.137)	(0.141)
Annual income [£10400-£20800]	0.104	0.081	0.097
	(0.152)	(0.139)	(0.143)
Annual income [£20800-£52000]	0.073	0.040	0.072
	(0.154)	(0.141)	(0.145)
Annual income >£52600	0.094	0.039	0.106
	(0.158)	(0.144)	(0.149)
Whether own the house	-0.149***	-0.171***	-0.153***
	(0.050)	(0.046)	(0.049)
M. has A level	-0.177***	-0.230***	-0.148***
	(0.056)	(0.051)	(0.055)
M. has diploma in higher educ.	-0.149***	-0.184***	-0.123**
	(0.057)	(0.050)	(0.055)
M. has first degree	-0.331***	-0.387***	-0.279***
	(0.050)	(0.045)	(0.048)
M. has higher degree	-0.179**	-0.256***	-0.135*
	(0.076)	(0.070)	(0.074)
M. has job	-0.061	-0.095**	-0.099*
	(0.052)	(0.048)	(0.051)
M. hours works per week	0.001	0.002	0.001
	(0.002)	(0.002)	(0.002)
Nb. people in HH	0.096*	0.069	0.094*
	(0.054)	(0.049)	(0.053)
Nb. siblings in HH	-0.034	0.008	-0.033
	(0.057)	(0.052)	(0.056)
Nb. natural siblings	-0.090*	0.030	-0.052
	(0.048)	(0.043)	(0.046)
Grand-parents in the HH	-0.177	-0.090	-0.163
	(0.127)	(0.119)	(0.124)
Freq. sees grand-parents (0-5)	-0.007	0.001	-0.004
	(0.013)	(0.012)	(0.013)
M.'s life satisfaction (1-10)	-0.092***	-0.051***	-0.076***
	(0.010)	(0.009)	(0.010)
P. currently has a job	-0.013	-0.047	-0.029
	(0.108)	(0.097)	(0.104)
P. hours works (week)	-0.004**	-0.002	-0.003*
	(0.002)	(0.002)	(0.002)
White	0.207**	0.153**	0.175**
	(0.081)	(0.073)	(0.078)
Asian	0.120	0.228**	0.114
	(0.106)	(0.097)	(0.102)
Black	-0.209	-0.236*	-0.312**
	(0.147)	(0.136)	(0.140)
Wales	-0.084*	-0.068*	-0.086*
	(0.046)	(0.041)	(0.045)
Scotland	0.085	0.105**	0.092*
	(0.052)	(0.047)	(0.051)
Northern Ireland	-0.059	-0.061	-0.045
	(0.058)	(0.053)	(0.056)
Sweep 4	0.337**	0.272**	0.288**
	(0.135)	(0.122)	(0.130)
N	14,582	14,582	14,582
N_clust	8,918	8,918	8,918

Notes: The first column reports the socio-economic factors' effects when parenting style is not taken into account. Columns 2 and 3 correspond to the OLS specifications where we control for the total parenting indices or the specific parenting style practices, respectively. Stars convention: * for $p<0.1$, ** for $p<0.05$, and *** for $p<0.01$.

Table 92: Full list of coefficients of selected regressions from Table 32 - Emotional problems

	(1)	(2)	(3)
	No PS	Pooled probit	
		Just total PS	Specific PS
Child's age	-0.061	-0.039	-0.061
	(0.057)	(0.057)	(0.057)
Child is a boy	-0.089***	-0.114***	-0.079***
	(0.029)	(0.029)	(0.030)
Weight at birth (kg)	-0.036	-0.029	-0.036
	(0.030)	(0.030)	(0.030)
Child has longstanding illness	0.315***	0.308***	0.311***
	(0.039)	(0.039)	(0.039)
Mother tried breastfeeding	0.005	-0.009	0.009
	(0.036)	(0.036)	(0.036)
Aged stopped breastfeeding (w)	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)
M.'s age (year)	0.029	0.025	0.027
	(0.025)	(0.025)	(0.025)
M.'s age (squared)	-0.001*	-0.001	-0.001*
	(0.000)	(0.000)	(0.000)
M. is in good health	-0.087	-0.086	-0.086
	(0.053)	(0.053)	(0.053)
M: currently pregnant	-0.080	-0.067	-0.073
	(0.070)	(0.069)	(0.070)
M. has longstanding illness	0.094***	0.092**	0.094***
	(0.036)	(0.036)	(0.036)
M.'s depression index	0.167***	0.154***	0.162***
	(0.010)	(0.010)	(0.010)
M. didn't smoke pregnant	0.055	0.060	0.045
	(0.084)	(0.083)	(0.084)
M.'s nb of cigarettes during preg. (log)	0.024	0.018	0.011
	(0.040)	(0.039)	(0.040)
M. does not smoke	0.072*	0.084**	0.077*
	(0.043)	(0.042)	(0.043)
M. smokes other tobacco products	0.001	-0.022	-0.015
	(0.209)	(0.206)	(0.206)
M.'s alcohol cons. (scale 0-6)	-0.045***	-0.049***	-0.045***
	(0.010)	(0.010)	(0.010)
Both parents are in HH	-0.048	-0.038	-0.046
	(0.086)	(0.085)	(0.085)
M.'s partner is child's father	-0.121	-0.123	-0.127
	(0.113)	(0.112)	(0.112)
Partner interviewed	0.042	0.044	0.051
	(0.116)	(0.114)	(0.115)
M. became single	0.009	0.005	0.001
	(0.140)	(0.138)	(0.140)
M. is married	0.033	0.044	0.044
	(0.048)	(0.048)	(0.048)
M. became married	-0.083	-0.084	-0.083
	(0.068)	(0.068)	(0.068)
M. is separated	0.132	0.132	0.146
	(0.181)	(0.180)	(0.181)
M. became separated	-0.338*	-0.323*	-0.338*
	(0.189)	(0.188)	(0.189)
M. is divorced	0.007	0.024	0.016
	(0.095)	(0.095)	(0.095)
M. became divorced	-0.101	-0.089	-0.086
	(0.115)	(0.115)	(0.115)
M. is widowed	-0.204	-0.131	-0.162
	(0.349)	(0.346)	(0.341)
M. became widowed	0.084	0.129	0.062
	(0.544)	(0.523)	(0.530)

Notes: The first column reports the socio-economic factors' effects when parenting style is not taken into account. Columns 2 and 3 correspond to the OLS specifications where we control for the total parenting indices or the specific parenting style practices, respectively. Stars convention: * for $p<0.1$, ** for $p<0.05$, and *** for $p<0.01$.

Table 93: Full list of coefficients of selected regressions from Table 32 (continued) - Emotional problems

	(1)	(2)	(3)
	No PS	Pooled probit	
		Just total PS	Specific PS
Annual income [£1600-£3100]	-0.164	-0.163	-0.178
	(0.154)	(0.154)	(0.153)
Annual income [£3100-£10400]	-0.155	-0.157	-0.159
	(0.152)	(0.151)	(0.151)
Annual income [£10400-£20800]	-0.180	-0.188	-0.182
	(0.154)	(0.153)	(0.153)
Annual income [£20800-£52000]	-0.267*	-0.277*	-0.267*
	(0.156)	(0.155)	(0.154)
Annual income >£52600	-0.305*	-0.323**	-0.305*
	(0.159)	(0.158)	(0.158)
Whether own the house	-0.006	-0.006	-0.007
	(0.046)	(0.045)	(0.046)
M. has A level	-0.108**	-0.117**	-0.092*
	(0.048)	(0.048)	(0.048)
M. has diploma in higher educ.	0.058	0.045	0.061
	(0.053)	(0.052)	(0.052)
M. has first degree	-0.027	-0.040	-0.017
	(0.043)	(0.043)	(0.043)
M. has higher degree	0.056	0.034	0.067
	(0.071)	(0.070)	(0.071)
M. has job	-0.133***	-0.143***	-0.141***
	(0.050)	(0.050)	(0.050)
M. hours works per week	-0.001	-0.000	-0.001
	(0.002)	(0.002)	(0.002)
Nb. people in HH	0.046	0.037	0.042
	(0.053)	(0.052)	(0.052)
Nb. siblings in HH	-0.057	-0.039	-0.053
	(0.057)	(0.056)	(0.056)
Nb. natural siblings	-0.050	-0.028	-0.046
	(0.042)	(0.042)	(0.042)
Grand-parents in the HH	-0.052	-0.041	-0.051
	(0.125)	(0.123)	(0.124)
Freq. sees grand-parents (0-5)	-0.001	-0.002	-0.003
	(0.012)	(0.012)	(0.012)
M.'s life satisfaction (1-10)	-0.052***	-0.043***	-0.048***
	(0.009)	(0.009)	(0.009)
P. currently has a job	0.109	0.100	0.106
	(0.098)	(0.098)	(0.098)
P. hours works (week)	-0.003	-0.002	-0.003
	(0.002)	(0.002)	(0.002)
White	0.072	0.054	0.069
	(0.079)	(0.078)	(0.079)
Asian	0.005	0.039	-0.018
	(0.109)	(0.108)	(0.108)
Black	-0.019	-0.012	-0.054
	(0.131)	(0.129)	(0.131)
Wales	-0.046	-0.051	-0.051
	(0.043)	(0.043)	(0.043)
Scotland	-0.043	-0.044	-0.043
	(0.044)	(0.043)	(0.044)
Northern Ireland	-0.037	-0.052	-0.042
	(0.051)	(0.051)	(0.051)
Sweep 4	0.359***	0.355***	0.366***
	(0.117)	(0.116)	(0.117)
N	14,364	14,364	14,364
N_clust	8,829	8,829	8,829

Notes: The first column reports the socio-economic factors' effects when parenting style is not taken into account. Columns 2 and 3 correspond to the OLS specifications where we control for the total parenting indices or the specific parenting style practices, respectively. Stars convention: * for $p<0.1$, ** for $p<0.05$, and *** for $p<0.01$.

Table 94: Full list of coefficients of selected regressions from Table 32 - Cognitive ability

	(1)	(2)	(3)
	No PS	Pooled probit	
		Just total PS	Specific PS
Child's age	3.078***	3.027***	3.078***
	(0.316)	(0.316)	(0.316)
Child is a boy	-1.086***	-1.042***	-1.086***
	(0.149)	(0.150)	(0.149)
Weight at birth (kg)	0.627***	0.587***	0.627***
	(0.154)	(0.153)	(0.154)
Child has longstanding illness	-0.983***	-0.970***	-0.983***
	(0.209)	(0.208)	(0.209)
Mother tried breastfeeding	0.413**	0.424**	0.413**
	(0.187)	(0.186)	(0.187)
Aged stopped breastfeeding (w)	0.008	0.008	0.008
	(0.006)	(0.006)	(0.006)
M.'s age (year)	0.319**	0.333**	0.319**
	(0.143)	(0.143)	(0.143)
M.'s age (squared)	-0.004**	-0.004**	-0.004**
	(0.002)	(0.002)	(0.002)
M. is in good health	0.345	0.307	0.345
	(0.280)	(0.280)	(0.280)
M: currently pregnant	1.265**	1.213**	1.265**
	(0.517)	(0.519)	(0.517)
M. has longstanding illness	-0.102	-0.091	-0.102
	(0.187)	(0.187)	(0.187)
M.'s depression index	-0.111**	-0.090**	-0.111**
	(0.045)	(0.045)	(0.045)
M. didn't smoke pregnant	-0.610	-0.592	-0.610
	(0.438)	(0.435)	(0.438)
M.'s nb of cigarettes during preg. (log)	-0.346*	-0.329*	-0.346*
	(0.200)	(0.199)	(0.200)
M. does not smoke	0.016	-0.025	0.016
	(0.247)	(0.245)	(0.247)
M. smokes other tobacco products	-1.272	-1.094	-1.272
	(1.221)	(1.153)	(1.221)
M.'s alcohol cons. (scale 0-6)	0.086	0.091*	0.086
	(0.055)	(0.055)	(0.055)
Both parents are in HH	-0.184	-0.188	-0.184
	(0.451)	(0.450)	(0.451)
M.'s partner is child's father	0.503	0.539	0.503
	(0.583)	(0.579)	(0.583)
Partner interviewed	-0.382	-0.463	-0.382
	(0.577)	(0.573)	(0.577)
M. became single	1.146	1.221	1.146
	(1.120)	(1.075)	(1.120)
M. is married	0.412	0.363	0.412
	(0.258)	(0.256)	(0.258)
M. became married	-0.832**	-0.809*	-0.832**
	(0.418)	(0.417)	(0.418)
M. is separated	0.570	0.521	0.570
	(0.650)	(0.663)	(0.650)
M. became separated	-0.254	-0.187	-0.254
	(0.756)	(0.762)	(0.756)
M. is divorced	-0.740*	-0.858*	-0.740*
	(0.448)	(0.445)	(0.448)
M. became divorced	0.506	0.567	0.506
	(0.634)	(0.625)	(0.634)
M. is widowed	-1.203	-1.322	-1.203
	(1.308)	(1.199)	(1.308)
M. became widowed	-0.648	-0.240	-0.648
	(1.877)	(1.586)	(1.877)

Notes: The first column reports the socio-economic factors' effects when parenting style is not taken into account. Columns 2 and 3 correspond to the OLS specifications where we control for the total parenting indices or the specific parenting style practices, respectively. Stars convention: * for $p<0.1$, ** for $p<0.05$, and *** for $p<0.01$.

Table 95: Full list of coefficients of selected regressions from Table 32 (continued) - Cognitive ability

	(1)	(2)	(3)
	No PS	Pooled probit	
		Just total PS	Specific PS
Annual income [£1600-£3100]	0.025	0.141	0.025
	(0.944)	(0.945)	(0.944)
Annual income [£3100-£10400]	0.353	0.433	0.353
	(0.919)	(0.919)	(0.919)
Annual income [£10400-£20800]	0.999	1.103	0.999
	(0.926)	(0.926)	(0.926)
Annual income [£20800-£52000]	1.403	1.505	1.403
	(0.930)	(0.931)	(0.930)
Annual income >£52600	1.555	1.663*	1.555
	(0.950)	(0.951)	(0.950)
Whether own the house	0.625***	0.604**	0.625***
	(0.237)	(0.236)	(0.237)
M. has A level	1.059***	1.074***	1.059***
	(0.250)	(0.248)	(0.250)
M. has diploma in higher educ.	0.845***	0.853***	0.845***
	(0.236)	(0.234)	(0.236)
M. has first degree	2.260***	2.271***	2.260***
	(0.242)	(0.243)	(0.242)
M. has higher degree	1.679***	1.735***	1.679***
	(0.372)	(0.373)	(0.372)
M. has job	0.354	0.381	0.354
	(0.265)	(0.266)	(0.265)
M. hours works per week	-0.010	-0.011	-0.010
	(0.008)	(0.008)	(0.008)
Nb. people in HH	-0.471	-0.425	-0.471
	(0.289)	(0.289)	(0.289)
Nb. siblings in HH	0.138	0.060	0.138
	(0.307)	(0.306)	(0.307)
Nb. natural siblings	-0.351	-0.340	-0.351
	(0.226)	(0.226)	(0.226)
Grand-parents in the HH	1.236*	1.199*	1.236*
	(0.659)	(0.655)	(0.659)
Freq. sees grand-parents (0-5)	0.002	0.009	0.002
	(0.061)	(0.061)	(0.061)
M.'s life satisfaction (1-10)	0.068	0.058	0.068
	(0.050)	(0.050)	(0.050)
P. currently has a job	0.728	0.806	0.728
	(0.539)	(0.535)	(0.539)
P. hours works (week)	-0.002	-0.004	-0.002
	(0.009)	(0.009)	(0.009)
White	-0.946**	-0.906**	-0.946**
	(0.412)	(0.409)	(0.412)
Asian	-1.395**	-1.506***	-1.395**
	(0.579)	(0.575)	(0.579)
Black	-1.553**	-1.667**	-1.553**
	(0.770)	(0.769)	(0.770)
Wales	-0.314	-0.293	-0.314
	(0.216)	(0.215)	(0.216)
Scotland	-0.698***	-0.725***	-0.698***
	(0.218)	(0.219)	(0.218)
Northern Ireland	0.625**	0.643**	0.625**
	(0.276)	(0.277)	(0.276)
N	4,478	4,478	4,478

Notes: The first column reports the socio-economic factors' effects when parenting style is not taken into account. Columns 2 and 3 correspond to the OLS specifications where we control for the total parenting indices or the specific parenting style practices, respectively. Stars convention: * for p<0.1, ** for p<0.05, and *** for p<0.01.

Part 7

Appendix: List of Acronyms

ATE	Average Treatment Effect
ATT	Average Treatment Effect on the Treated
BRFSS	Behavioural Risk Factor Surveillance System (a telephone survey)
CSA	Common Support Assumption
DID	Difference-in-Differences
DR	Double-Robust
D&K	Dave and Kaestner
EAMH	Ex Ante Moral Hazard
EPMH	Ex Post Moral Hazard
FE	Fixed Effect
HIE	Health Insurance Experiment
HMO	Health Maintenance Organisation
HRS	Health and Retirement Study
IPW	Inverse Probability Weight
IV	Instrumental Variable(s)
LHS	Left Hand Side
MB	Marginal Benefit
MC	Marginal Cost
NHS	National Health Service (UK)
OLS	Ordinary Least Squares
PA	Physical Activity
PSID	Panel Study of Income Dynamics

PSM	Propensity Score Matching
RAND	Research ANd Development Coporation
RHS	Right Hand Side

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