# Estimates of the asset-effect: the search for a causal effect of assets on adult health and employment outcomes

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## Abstract

In this paper we seek to determine the effect of assets held in early adult life on later outcomes. We specifically look at wages, employment prospects, general health and Malaise. The identification of an asset-effect throws up a number of statistical challenges as asset holding is not random. We employ a number of statistical techniques in our search for the causal effect of assets on adult health and employment outcomes. We find that simple Ordinary Least Squares and probit estimates of the asset effect are indeed biased in many cases. However, after applying a battery of techniques to remove such biases, the conclusion is that within the cohort examined (born in 1958), early asset holding does have positive effects on later wages, employment prospects, excellent general health and in reducing malaise.

Keywords: asset effect, wealth, asset-based welfare
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## Abbreviations and Acronyms

| | |
|---|---|
| BHPS | British Household Panel Study |
| CTF | Child Trust Fund |
| IDA | Individual Development Accounts |
| ISA | Individual Savings Accounts |
| IV | Instrumental variables |
| LCH | Life Cycle Hypothesis |
| NCDS | National Child Development Survey |
| OLF | Out of the Labour Force |
| PAYE | Pay As You Earn |
| PI | Permanent Income |
| SG | Saving Gateway |
| 2SLS | Two stage least squares |

# 1. Introduction

In the United Kingdom much attention has focused on growing inequalities in individual earnings and household income over the last 25 years. Much less attention has been paid to inequalities in assets and wealth. It would seem inevitable that inequalities in income and earnings feed through to inequalities in wealth; as richer individuals/families have an excess of income over consumption needs leading to asset accumulation; and, poorer individuals/families often experience periods where consumption needs exceed income, leading them to either draw down on assets or go into debt. In this way, inequalities in flows (income and earnings) manifest into inequalities in stocks (assets). From a welfare policy perspective it is perhaps understandable that the focus has been on flows rather than on stocks as income is concerned with meeting present needs, but it is a narrow perspective which appears to be changing. There were some policy developments under the previous Labour Government which were designed around asset-based welfare and could be seen as a sign of a mature welfare state concerned with long term inequalities between individuals and families. The value of assets which an individual or a family holds is both an indication of their standard of living in the past as well as their future prospects. And it is the relationship between asset-holding and future prospects which we are particularly interested in.

Given increases in earnings and income inequality it is not surprising that inequality in wealth increased in the UK over the last two decades. In 2000 the top 1% of the population held 23% of all personal wealth, an increase from 18% in 1990 but this fell back to 21% in 2005 (figures from HMRC, table 13.5 (Series C)). Not only do the wealthiest hold disproportionate shares of personal wealth but this is coupled with a significant proportion of the population holding no wealth at all. Evidence from the Wealth and Asset Survey (WAS) suggests that over 25% of all households had zero or negative financial assets in 2006-08 (Daffin, 2009).

A further cause for concern arises from the possibility that assets play an important role in shaping individuals' life chances, both in economic and non-economic ways. If lack of access to assets means young people are unable to: invest in human capital, secure decent living conditions, start-up business ventures, instil a sense of well-being and security leading to 'better' long term outcomes, then inequalities will widen further. This can lead to re-enforcing cycles of deprivation among the more vulnerable groups in societies; especially, households on low incomes with children, single parents, or workless households, see (Piachaud and Sutherland 2000; Piachaud and Sutherland 2002) and (Gregg and Wadsworth 2000; Dickens, Wadsworth et al. 2001; Dickens, Gregg et al. 2003). If young people are restricted in the choices they make in life at an early age, this can lead to sub-optimal outcomes during adult life.

The growing acceptance of the importance of assets above and beyond their pure monetary value has led to innovative policies, both in the UK and elsewhere. Asset-based welfare, as it has become known, represents a small but radical shift from traditional forms of welfare provision which have typically taken the form of income-transfers and service provision. Advocates of asset-based approaches to welfare typically do not call for wholesale redistribution of assets but instead put forward policies which create the right environment for individuals (normally asset-poor) to accumulate assets. These have taken the form of small asset-transfers providing a base for individuals to build on or through matched saving schemes. One of the main promoters of this idea advocates asset accumulation, particularly amongst the more vulnerable income groups, purporting a broad range of attributes that constitute as assets including human, physical and social capital, see Sherraden (1991). This theme saw some support in the UK, with an emphasis on having access to financial assets that would enable the individual to pursue a wider choice of opportunities in life (Regan, 2001; Paxton, 2001; Paxton, 2003). The previous Labour Government, in its 1998 Budget report, advocated redressing inequalities in wealth and set an agenda focused on trying to provide equal opportunity for all (H.M. Treasury 1998). There is some echo of this in the Coalition Government's agenda.

If it can be shown that assets play an important role in shaping individuals' opportunities then inequalities in asset-holding will clearly come under the spotlight. Traditionally policies designed to encourage asset accumulation have tended to benefit better off families and individuals through, potentially increasing asset inequality. Recent policy initiatives have attempted to redress this imbalance by targeting lower income households. Various policies encouraging savings have been pursued with the intention of ensuring that all individuals have access to a sufficient minimum level of financial resources to enable a greater range of opportunities to be pursued, leading to better outcomes later in life.

Although policy development can move at quite a pace there is very little hard statistical evidence to support asset-based welfare policies. The objective of the research undertaken in this study is to contribute to the knowledge base in this important area. More specifically, the empirical analysis presented in this paper is designed to examine the relationship between holding a financial asset in young adult life on outcomes in later life. We attempt to establish the causal effect of holding financial assets on various outcomes. We do not attempt to explain how financial assets should be spent to ensure better outcomes as this is beyond the scope of our data. This study does provide some evidence on whether there exist positive effects from holding an asset, over and above other individual and family circumstances and characteristics. We shall refer to this as the asset-effect.

Most of the empirical research on the effects of holding assets on adult outcomes has been conducted in the US, much of which is descriptive or

examines different objectives, such as participation in civil society, impact on smoking, etc. Our analysis goes beyond existing work already undertaken on the asset-effect in the UK; there is one particularly influential study for which the findings are reported in Bynner (2000), Bynner and Paxton (2001) and Bynner and Despotidou (2000). This previous study used data from a British birth cohort study (the National Child Development Study) and examines the impact of holding an asset at age 23 years on a range of outcomes at age 33 years, after controlling for a number of differences between individuals. The findings suggest that there is a positive correlation between asset-holding and outcomes in later life. These outcomes include socio-economic outcomes, such as health, employment and marital status; as well as social and civic involvement, such as political interest and voting. Another UK study uses the British Household Panel Study (McKay and Kempson 2003). These authors attempted to replicate the work by Bynner and Paxton (2001) and find evidence that holding assets have an effect on later outcomes; however, when they apply their own methodology, they report that no reliable effects of asset holdings on life outcomes were found. The problem with this study is that data in the BHPS do not allow them to estimate a true asset-effect. All they are able to do is to examine whether the presence of assets is associated with a change in behaviour. For example, they look at whether individuals with assets are more likely to stop smoking to a greater extent than individuals without assets. This greatly weakens the value of this study as the initial presence of assets may already have influenced the characteristics of interest, for example, whether or not individuals smoke in the first place, raising problems related to endogeneity. The result is that the two groups are unlikely to be random samples. In addition, if asset-rich individuals who smoke (for example) are different from asset-poor individuals who smoke, then whether or not they stop smoking may be completely unrelated to whether or not they hold an asset. Overall this means that the fact that they did not find a significant difference in the change in an outcome, that they could attribute to asset-holding, does not indicate a lack of an asset-effect.

While existing research does provide some insight into the correlations between holding an asset and later outcomes, in the analysis presented here we employ more rigorous econometric regression techniques than previously applied to account for differences in individual and family circumstances and characteristics. The main difficulty with estimating the asset-effect is that individuals with assets can differ from individuals without assets in a number of important ways. For example, asset-rich individuals could be ‘better-off’ in a whole range of ways compared with asset-poor individuals and these other characteristics and attributes could also be correlated with, or indeed contribute directly to, the outcomes we are interested in exploring. We employ a number of econometric techniques to try and disentangle these different influences with the objective of identifying a pure asset-effect.

### *1.1 Objectives*

In this study we set out to provide more accurate estimates of the importance, or otherwise, of asset-holding on a range of economic and non-economic outcomes than have been available to date. We estimate whether there are any benefits in later life from having financial assets in early adulthood, after controlling for individuals' characteristics and circumstances and whether or not asset-holders are a select group of individuals. If after controlling for individual and family characteristics there still exist significant positive effects on outcomes from holding an asset then there is an argument for policy interventions which encourage individual asset accumulation at some level. We also provide estimates on how long lasting any effects may be and provide some information on how large an asset needs to be to have a significant impact. We are not able to say how important the process of accumulation of assets is, nor how an asset is spent, as these are beyond the scope of the data we have available. As we only have snapshots of asset holding some individuals without assets may have had assets prior to these snapshots and others may have accumulated assets after the snapshots were taken and prior to the measured outcome. We are only able to address the question – did asset-holding observed at these snapshots lead to improved outcomes?

The data set used here, the National Child Development Study (NCDS), was originally conceived as a nationally representative sample of individuals all born in a week in March 1958. These individuals have been followed from birth, and interviews have been conducted at varying intervals through their childhood and their adult lives. This work builds on an earlier empirical study led by John Bynner (2000), which examined the impact of holding assets at age 23 on a range of outcomes at age 33. We attempt to employ more sophisticated econometric techniques to control for individual characteristics and circumstances which may have an independent impact on the outcomes we are interested in. We also make use of the availability of another round of interviews which allows us to examine the impact of assets at age 23 on outcomes at age 42; and assets at 33 years on outcomes at age 42.

### *1.2 Economic background*

In economics it has long been noted that there are disparities between the levels of current income and current expenditure over the lifecycle (see Modigliani and Brumberg, 1954 and Friedman, 1957 on the life cycle hypothesis (LCH) and the permanent income (PI) theories). The LCH model assumes that early in adult life, a typical person is likely to have expenditure above his/her current income, leading to dis-saving or debt. This is largely driven by the need to undertake costly investment in human capital before entering the labour market. Over the working life, individuals typically consume less than their income; thereby saving some of their current income for future consumption. These models predict several motives for savings: to provide resources to draw upon during retirement, precautionary savings for unexpected expenditure, deposits for assets such as consumer durables or property, and altruism through

intergenerational transfers both during the lifetime (intra vivos) and bequests. There are vast numbers of studies examining the importance of these different motivations and their significance across the population, which are not covered here (see Kotlikoff and Summers, 1981; Kotlikoff, 1988; and Bernheim, Schleifer et al., 1985, for intergenerational transfers and bequests).

While perfect capital markets allow individuals to smooth expenditure against changes in income, through borrowing from financial institutions, the reality for many individuals or families on low incomes is that they are unable to obtain credit and are thus liquidity-constrained[1]. Empirical studies in the US provide evidence that a significant fraction of the US population is liquidity-constrained. Transfers from family and friends are particularly important in easing the borrowing constraints of those liquidity constrained (Cox 1990; Cox and Japelli 1990). Young people required to make costly investments before entering the labour market lack the means to fund these investments from self-generated income. To fund these investments they either have to borrow (against a future income stream) or rely on transfers from other family members (or in some cases non-family members). In some situations governments and/or employers fund or subsidize the investments (education and training). Low income families are themselves credit constrained and therefore this can lead to under-investment in human capital and lower lifetime earnings. There is much evidence that those who most need financial assistance have restricted access to funds available from financial institutions or credit facilities, and instead have to resort to moneylenders and credit institutions with unfavourable conditions associated with the risk of repayment, thereby reinforcing their financial disadvantage[2]. This is because loans made on this basis are both risky (higher future income is not guaranteed and risks may be higher for disadvantaged individuals) and these individuals are not able to provide any security for the loan (such as property or parental wealth). In addition, some studies have shown that those at the very bottom of the income distribution may be debt-averse and will not borrow to overcome their current liquidity constraints (Kempson and Whyley 1999; Kempson 2002).

The emphasis on asset accumulation as a policy objective is not a new phenomenon and has appeared in various forms through the welfare state. Welfare policy is commonly understood to seek to remedy the failures of the market (Goodin, Headey et al. 1999). These failures include: ensuring assistance to those who fall below a minimum standard of living, providing assistance for those who face an unexpected large drop in living standards, and to assist in income-smoothing across the life-time. This latter objective

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1 No liquid assets or borrowing facilities to fund current expenditure.

2 There is significant literature on this issue, particularly pertinent to developing countries, and the role for micro-credit institutions and rural micro-finance schemes with successful programmes such as the well-documented Grameen Bank in Bangladesh, which is not covered here.

involves the reallocation of individuals' income (consumption) over their lifetime and includes redistribution from themselves at one point in their life-cycle to themselves at another point, as in actuarial private pension schemes, or notional redistribution as an unfunded state pension scheme which embodies an intergenerational social contract (Glennerster, 2003; Barr 1998). Another welfare objective is to reduce inequality in living standards in two forms: vertical equity issues, which redistribute resources towards individuals or families on lower incomes; or, horizontal equity, where benefits take into account differences across individuals and equivalise the benefits (Boadway and Wildasin, 1996). In the UK during the 1980s, roughly three-quarters of all the redistribution of welfare spending achieved was of horizontal redistribution; only one-quarter was concerned with redistributing income to the lifetime poor, vertical redistribution (Falkingham and Hills, 1995).

Financial assets in the form of savings are affected by many policies, including; taxation, system of social insurance especially pensions, health and disability insurance, welfare services and education, transfers of various sorts and debt policy (Boadway and Wildasin 1996). There are a variety of instruments for converting present consumption into future consumption: financial assets (debt, shares in firms, pension funds, annuities, mutual funds, insurance policies), real estate, unincorporated business assets, consumer durables (and housing), and even investment in human capital formation. The distinctions between the different savings instruments are relevant since they have different tax implications. Some studies have shown that in determining their life-time plans, individuals take into account the plan of the state. The state has a role in income-smoothing, whether through collecting taxes through PAYE system allocating resources through pensions. Since individuals determine their savings according to the State's role, it has important considerations for the economy in general; aggregate savings affect aggregate investment in the economy, affecting economic activity and hence overall economic growth in the economy. Individuals' and households' saving behaviour also has implications for the well-being of future generations in terms of debt liabilities, for example (Barro, 1979; Kotlikoff, 1989; Boadway and Wildasin, 1996). Policies affecting savings amongst individuals can not only affect the life course of the individual but aggregate savings in the economy can have macroeconomic effects that carry over into the future, and hence it is important that such policies have the correct incentives.

### *1.3 Policy Context*

As noted earlier, traditional forms of welfare policy have been income-based policies (transfers) or service provision and delivery. In an attempt to try and ensure more people can benefit from having savings (for the reasons outlined above) the previous Labour Government introduced incentives designed to encourage people, particularly those on a low income, to save (H.M. Treasury, 2000; H.M. Treasury, 2001a; H.M. Treasury, 2001b). These have included a

variety of policies such as: the introduction of stakeholder pension schemes[3] and Individual Savings Account (ISAs) and making savings products more accessible and transparent. However, most of the policies which are designed to encourage people to save and hold assets tend to favour those on higher incomes because they most often take the form of tax relief. The very poor do not benefit from tax relief policies since their gross income is often below the threshold at which income tax is levied. It is generally felt that the very poorest are unlikely to be able to create sufficient levels of savings to be able to escape poverty, whatever the level of tax relief, and that encouraging expenditure switching from essential subsistence-level expenditure into savings could be detrimental to the individual. Notwithstanding this, the absence of savings is in itself not a reflection of an individual's lack of future planning or risk aversion but, as implied in the life cycle hypothesis, could be the optimal solution given the individual's present circumstances or may be due to imperfections in the capital market or disincentives in the social security system.

What is concerning is the inability of some individuals to be able to save for future expenditure or borrow when necessary which may lead to individuals being unable to maximize their income and utility over their lifecycle, and thus lead to sub-optimal outcomes in later life for both the individual and society. As well at the direct gains from what savings can acquire, it is claimed that there are benefits from the process of accumulating an asset, in terms of the financial discipline and long term planning process, as well as benefits from having a financial asset which provides security and empowerment from being able to draw on these reserves (Paxton 2001). The previous government asserted that holding financial assets has an 'independent effect on young peoples' chances in life' (H.M. Treasury 2001c; p12), irrespective of what assets can acquire, above and beyond such factors as their social class, background or educational achievement, and that having assets and engaging in the process of saving could be associated with a range of beneficial effects.

The act of saving reflects an individual's ability/desire to plan for the future and provides them with a degree of security which can allow them to choose riskier options which can ultimately lead to greater benefits in the long run. Some argue that if improving the welfare of individuals is the objective, then providing assets or financial incentives to save for those who are not currently saving is not necessarily the most efficient way of tackling this issue. An alternative would be to provide those on low incomes with a greater current income to allow them to decide how much to consume today and how much to save for the future. On the other hand if young peoples' access to an asset is one of the transmission mechanisms of intergenerational mobility, welfare packages that provided assets to young adults could increase intergenerational mobility without going through the long drawn out process of saving and

[3] To be superseded by the low-cost National Employment Savings Trust (NEST) being introduced from 2012 under the 2008 Pensions Act.

accumulation of an asset after the time when it would be most effective (Emmerson and Wakefield 2001).

There have been various targeted saving schemes, introduced in a number of countries, designed to assist low income families or individuals. Most of these schemes are means-tested in some way and involve the Government making a contribution to the individual's saving account. The amount is usually proportionate to the value the individuals have saved themselves; often called matched savings. Many of the schemes also provide compulsory classes on financial advice and education, and many have restrictions as to what the savings can be used for when they are withdrawn. In most cases the savings can be put towards either educational programmes, housing or small businesses. These schemes include: the well-documented Individual Development Accounts (IDA) in the US (Sherraden, 2000; Sherraden, 2001; Silva, 2002); in Canada the learn$ave, introduced in 2000; in Ireland in 2001 local banks teamed up with the Government to increase national savings rate through matched savings at a rate of £1 for every £4 saved per month; in Puerto Rico, a limited scheme open to residents of the public housing system were offered 1:1 matched savings though with uses of the fund limited to housing and education; and, in Taiwan in 2000 a limited number of participants were offered for a limited period deposits in their Family Development Accounts with a 1:1 matched savings rate. Until now the information relating to the progress of each of the schemes has largely focused on the amount of savings or what the savings have been used for. There is little evaluation evidence on how savings have changed the lives of the beneficiaries.

In many countries the beneficiaries of these programmes are children. The savings account is in the name of the child, and although others can make deposits into the account, savings can only be withdrawn by the account holder when they reach maturity or be used for specific items to benefit the child. In Singapore a Baby Bonus scheme was introduced in 2001 (enhanced in 2004 and 2008). The scheme offers 1:1 matched savings when parents contribute to a Children's Development Account (CDA); up to various caps depending on the birth order. The savings in the accounts can be used for educational or medical-related expenses for the child (or another child in the family) up to the age of 6. In addition, in an attempt to boost fertility rates, the scheme provides a cash payment of S$4,000 each for the first and second child, and S$6,000 each for the third and fourth child.

In the UK, governments have promoted the need to save throughout the life time through the development of a series of savings products suitable for various stages of the life cycle, to both increase the incentives to save and to empower individuals to make informed and responsible saving choices. Other than pension schemes, which are designed for long-term saving for use during retirement and the already established Individual Savings Accounts (ISAs), the previous Labour Government developed two tax-advantaged savings schemes:

the Saving Gateway (SG) and the Child Trust Fund (CTF) (H.M. Treasury 2003). The former was aimed at providing incentives for lower-income earners to save by offering to match savings with additional contributions paid by the Government. It was announced in the 2003 Budget that the Child Trust Fund would provide every child born from September 2002 with an initial endowment at birth of £250, with £500 for children in the poorest third of families, who also qualify for the full Child Tax Credit[4]. At the age of 7 the Government made a further contribution to the fund for lower income households claiming Child Tax Credit. Additional contributions can be made by other family and non-family members, up to an annual limit of £1,200. In contrast with most other schemes of this type, there are no restrictions on the use of the asset when the child reaches maturity, but only the child can access the fund at age 18, including the additional contributions (H.M. Treasury 2003). The Child Trust Fund was abolished by the Conservative-Liberal Democrat coalition government and phased-out from August 2010 A new tax-exempt, but not endowed, Junior ISA was announced in the Coalition Government's 2011 budget and is due to be introduced in November 2011. Money invested in the Junior ISA will be locked in and only available to the child when they reach 18.

In August 2002 a pilot of the Savings Gateway began in five regions around the country. As well as the, then, Department for Education and Skill, the pilots were run in partnership with the Community Finance and Learning Initiative. Administered through Halifax plc, the accounts lasted for 18 months and, within certain limits, each pound saved by participants were matched by a pound from the Government. Participants were able to save a maximum of £25 per month up to an overall account limit of £375 of savings, £750 with matching funds. Tailored financial information and education was provided along with the accounts to enable individuals to make informed savings decisions. The results from the evaluation of the pilot schemes were used to design the Savings Gateway scheme on a national basis[5]. The scheme was due to be rolled out nationally in July 2010 but was scrapped by the Coalition Government.

These savings programmes in the UK and elsewhere illustrate the variety of tools that have been designed to try and encourage the saving habit as well as providing financial incentives to increase the size of savings for those on lower incomes. The purpose of the accumulated assets are usually not prescribed but

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4 Child Tax Credit was introduced in 2002 and is an income-related support for families with children, replacing the child element of: the Working Families Tax Credit, the Disabled Person's Tax Credit, Income Support or Jobseeker's Allowance, and the Children's Tax Credit.

5 See (http://www.hmtreasury.gov.uk/topics/topics_savings/topics_savings_savgateway.cfm).

it is hoped that they will put individuals on a more secure financial footing, provide something to fall back on in times of need, and to make investments which can have long lasting effects for the individuals and their families.

## 2. Data

In this study we make use of the rich information available in the National Child Development Study (NCDS). This is an on-going study which follows a nationally representative sample of individuals who were born during one week in March 1958. The survey consists of a series of interviews, and in some cases questionnaires, administered to the selected individuals themselves as well as to their parents and teachers, even from the midwife, during the early years. In addition a number of medical and educational tests have been administered over the years. From the interviews information is collected on a range of aspects: socio-economic characteristics, income, education, health, housing and employment. For details of the NCDS see Shepherd (1995).

The main surveys were carried out at birth in 1958, and then at age 7 (1965), age 11 (1969), age 16 (1974), age 23 (1981), age 33 (1991), age 42 (2000) and two further surveys have been conducted, which we do not include in this study, age 46 (2004) and age 50 (2008). As is the case with all surveys which attempt to track the same individuals over a period of time, some of the individuals do not take part in all of the surveys and some leave the study all together. The loss of individuals is commonly known as attrition, and can result from the inability of the survey team to keep in touch with individuals (for example when they move house) or when individuals choose to stop participating in the study. Of the 17,416 individuals first surveyed in 1958, 12,537 were interviewed at age 23; 11,407 were interviewed at age 33; and 11,419 were interviewed at age 42. The loss of individuals is not necessarily a problem if attrition is random. In cases where there is a greater propensity for certain types of individual to drop out of the study the sample then becomes a select group of the original random sample and no longer a representative sample. We consider this possibility in the analysis presented below. Although in total a larger number of individuals were interviewed in each year, we have to restrict the sample to individuals from the original sample[6] who responded at age 23 and 33; or age 23 and 42; or age 33 and 42, and who provided key information on asset-holding and the outcome variables of interest (see below).

One of the main difficulties when estimating the types of models we are interested in estimating here is the lack of information in a particular dataset. Finding sufficient variables to separately identify the selection equation is one of the greatest challenges. We are very fortunate with the NCDS as individuals

[6] Some individuals in the survey do not appear in the original sample because they were born outside the United Kingdom.

have been followed over many years we are able to draw on information from previous surveys. For example, we have attitudinal information when respondents were young which we can use to ascertain their attitude to risk and autonomy well before we observe their asset-holding and we are able to use this information to identify the asset equation.

### *2.1 Financial Savings Information*

This study explores the impact of holding assets (financial savings and investments) at age 23 and age 33 on later outcomes. The main reason for examining financial savings at age 23 is that this is the first year that detailed information on individuals' finances was collected. Age 23 is a point in an individual's life by which time he/she may have accumulated some savings, as well as being early enough in the start of their adult life in which choices about the future are being made. Although age 23 may initially appear a completely arbitrary age for which to focus on savings, and data alone constrains us to using this year, there is little evidence to suggest this is an atypical point to be examining savings of young adults (Banks and Rohwedder, 2001). We extend this to look at asset holding at age 33 and the impact of asset holding at age 33 on age 42 outcomes.

We also make use of important information available on individuals' work and economic activity histories which are clearly important as they are likely to provide an indication of resources available to individuals and could also have a direct impact on the outcome variables. Much work has been done in forming a monthly account of the labour market status of individuals (Galindo-Rueda, 2002), and we exploit this information in our analysis[7]. Since employment income is likely to be highly correlated with financial assets, individuals' activity history provides a useful contribution to the missing information.

The information on assets at age 23 and 33 has been collected in two ways. Firstly, according to the type of account in which the money is held in and, secondly, by who the account holder is. Initial examination of the data by account type revealed that there are many accounts with very small amounts of money deposited in them.

Savings were defined in the survey as money held in:

- Building Society
- National Savings Certificates
- Post Office Savings Bank
- Bank Deposit or Savings Account
- Trustee Savings Bank/Savings Account
- Government Save as you Earn (SAYE)

[7] We are indebted to Fernando Galindo-Rueda for making these data available to us.

- Premium Bonds
- Any other savings

Investments were defined in the survey as money held in:

- Company Shares or Securities
- Unit Trusts or Investment Trusts
- Government Stocks and Securities
- Local Authority Bonds and Securities
- Property (Bricks and Mortar) other than main residence
- Any other investments

It is important to distinguish between savings that individuals keep in accounts that they have ready access to (liquid), or whether savings are kept in accounts designed as longer-term savings vehicles (illiquid). In this analysis, we are also interested in money that is kept aside to cover more than small, one-off, expenditures. For this reason we have utilised the information available by account type and imposed a minimum cut off below which we have deemed an insufficient amount to be classified as assets for this study, although in some of the analysis we consider total financial assets with no minimum restriction. For liquid savings we apply a cut-off of £200[8] or more (at age 23 in 1981). We considered a number of different cut-offs and concluded that this amount was a reasonable amount for an average 23 year old, in 1981, to hold to cover fairly small out-goings[9]. Further support for this cut-off comes from previous research which suggests that assets above a minimum cut-off in the region of £100-£200 (in 1981) were associated with a boost in the positive outcomes and a reduction in negative outcomes (Bynner and Despotidou, 2000). Across all investment accounts (illiquid savings), an aggregate amount of £100[10] or more (at age 23 in 1981) has been classified as active savings. We have chosen a lower threshold for illiquid savings to reflect the fact that these savings are more likely to represent saving for expenditures in the future since they have been placed in savings vehicles designed for longer term investment. Savings by account holder (definition 2) have also been calculated and are provided in the summary tables below to illustrate that there has been no loss of generality by choosing information by account type. For comparability with the account type information, information from account holder has been explored by aggregating the amount in the accounts that the individual has access to. This includes savings and investment accounts that are in the individual's name, individual and spouse's name and individual and other. Again accounts that are

8 £357 in 1991, £456 in 2000 and £598 in 2010 (RPI all items index).

9 Average net monthly pay for employees in this birth cohort at age 23 was £312 in 1981.

10 £179 in 1991, £228 in 2000 and £299 in 2010 (RPI all items index).

considered inactive have been excluded by imposing a minimum cut-off; this is less than £200 for savings accounts and less than £100 for investment accounts in 1981.

In all of the analysis we concentrate on gross financial assets. This means that we do not consider debt. Clearly individuals with debts may be required to use some or all of their financial assets to pay off these debts but to some extent they have a choice and it is very common for individuals to simultaneously hold financial assets and debts. We choose to analyse gross financial assets because this will give us the best guide to the potential impact of asset-based welfare policies designed to increase financial assets (eg as the Child Trust Fund and the Saving Gateway were designed to do) as these policies increase gross financial assets.

## 3. Descriptive Statistics

In this section we present some of the descriptive statistics relating to the complete cohort and for the samples used in this study.

Table A1 in the Appendix provides an overview of the features of the NCDS data. The sample size is quite large; covering over 11,400 individuals in each year, with equal participation of men and women. Attrition is a significant problem with 28% of individuals surveyed in 1974 not present in the 1991 or 2000 surveys; attrition is higher among men. However, the problem of attrition for those for whom we have asset information in 1981 and for outcomes in 1991 and 2000 is relatively small: 14% of those with outcome information have no corresponding information on assets for the 1991 data, and 15% for 2000 data.

In the 1981 dataset when the cohort was aged 23, about three-quarters of the respondents came from a social class background of skilled manual or with lower levels of skill (based on father's occupation at birth of respondent). A little over one-third of individuals have little or no qualifications at age 23 years, though the figure is slightly higher for men, at 41%. Around 10% of men and women have a higher education qualification. About half the sample is single at 23 years old. The figure for men is lower at 41%, while as many as 54% of women are married at age 23. Over three-quarters of the sample have no children, though around 9% have two or more children at age 23.

The 1991 sample (aged 33) is spread across the whole of Great Britain, with around 30% living in London and South East regions. The percentage of cohort members who are single at age 33 fell to 17%, with, on average, 68% of the sample now married and 10% divorced. Interestingly, of the sample who responded to the survey at age 33, a greater proportion of respondents has no or low qualifications. This suggests that there have been differential rates of

attrition, maybe because the more highly qualified are more mobile and therefore harder to trace. As you would expect, the share of the sample with further education qualifications and above has increased. Looking at social class of individuals at age 33, it can be seen that only around half belong to skilled manual or lower categories. However, the percentage of observations with information missing for social class category is as high as 10%, with the percentage of missing for men as high as 13%.

Table 1 summarises the main outcome variables examined in this study. The types of outcomes that we are interested in examining in later adult life capture both monetary and non-monetary aspects to reflect a broad concept of well-being. Through examining outcomes in the labour market; wage rate and employment status, we capture some aspect of material well-being, while by examining health outcomes; malaise scores and self-reported general health, we capture a more general concept of physical and psychological well-being. The samples are restricted to those individuals who answered the asset question at age 23.

For economic outcomes we look at employment status and hourly wages. Due to data limitations we have to limit our analysis of wages to employees, and even among employees there are a significant number of observations with missing wage information; a problem that is not unique to the NCDS.

For non-economic outcomes we examine two different health measures. Firstly, we explore a measure of malaise. This is the aggregation of 24 specified questions covering physical and psychological ailments (see Appendix C for the list of questions asked). This indicator, commonly known as the Malaise Inventory, has been used extensively in both medical and social science fields (Rutter, Tizard et al., 1970; Rutter, Tizard et al., 1976; Richman, 1978; Rodgers, Pickles et al., 1999). It has been shown that a score of 1 to 7 indicates that an individual is suffering from some type of malaise, while a score of 8 is indicative of non-clinical depression (a high risk of psychiatric morbidity). This variable contrasts with the question on general health, which reflects the individual's subjective assessment of their own general health.

**Table 1: Overview of Outcomes at age 33 and 42**

| **Outcomes** | **Total** | **Male** | **Female** |
|---|---|---|---|
| **At 33 years old** | %/£ | %/£ | %/£ |
| *Economic Status* | | | |
| Full-Time employment | 53.0 | 74.3 | 33.0 |
| Part-time employment | 15.4 | 0.7 | 29.2 |
| Self-employment | 11.4 | 16.3 | 6.9 |
| Unemployment | 3.7 | 5.6 | 2.0 |
| Full-time education | 0.6 | 0.3 | 0.8 |
| Out of the Labour Force | 15.3 | 2.3 | 27.6 |
| Other | 0.6 | 0.5 | 0.7 |
| *Wage* | | | |
| Average wage (actual) | £6.28 | £7.39 | £5.23 |
| *Malaise score* | | | |
| Malaise (score=0) | 31.3 | 36.3 | 26.7 |
| Malaise (score <8) | 62.0 | 59.3 | 64.6 |
| Non-clinical depression score (8-24) | 6.6 | 4.4 | 8.7 |
| *General Health* | | | |
| Excellent | 34.9 | 36.6 | 33.3 |
| Good | 52.0 | 50.8 | 53.5 |
| Fair | 11.3 | 11.1 | 11.5 |
| Poor | 1.6 | 1.5 | 1.8 |
| **At 42 years old** | No. | (%) | (%) |
| *Economic Status* | | | |
| Full-time Employment | 55.8 | 71.8 | 40.8 |
| Part-time employment | 17.0 | 1.4 | 31.5 |
| Self-employment | 12.7 | 18.1 | 7.7 |
| Unemployment | 2.1 | 2.8 | 1.5 |
| Full-time education | 0.5 | 0.2 | 0.7 |
| Out of the Labour Force | 11.1 | 5.1 | 16.8 |
| Other | 0.8 | 0.6 | 1.0 |
| *Wage* | | | |
| Average wage (actual) | £10.47 | £12.61 | £8.36 |
| *Malaise score* | | | |
| No malaise (score=0) | 19.6 | 23.6 | 15.9 |
| Malaise (score <8) | 67.7 | 66.5 | 68.9 |
| Non-clinical depression score (8-24) | 12.7 | 10.0 | 15.2 |
| *General Health* | | | |
| Excellent | 30.3 | 30.9 | 29.7 |
| Good | 52.1 | 51.5 | 52.7 |
| Fair | 14.2 | 14.4 | 14.1 |
| Poor | 3.4 | 3.2 | 3.5 |

**Source:** NCDS 1991, 2000

Looking at economic outcomes, the percentage of the sample engaged in full-time employment at age 33 is 53%, rising to 56% at age 42. However there is quite a disparity between men and women, with 74% of men in full-time employment at age 33, falling to 72% of the sample in 2000 at age 42. For women, 41% of the sample is engaged in full-time employment at age 42, which is an increase from 33% at age 33. Women have a higher rate of part-time employment; 29% at age 33 compared to less than 1% for men; and 32% at age 42 for women while for men part-time employment share remains unchanged. However, men have around double the unemployment rate than women at age 33 and 42. There is also great disparity in the out of the labour force (OLF) rates across gender; 28% for women at age 33 compared to 2% for men; while at age 42 it has fallen slightly for women, to 17% (part-time employment however increased between 33 and 42 years) and increases to 5% for men. Average actual wages increased between 1991 and 2000, average wages of women are 70% and 66% of men's, respectively.

Interestingly, in both years, on average, around two-thirds of the sample experience some sort of malaise age 33, though by age 42 the percentage showing signs of non-clinical depression has approximately doubled to 13%. This increase in malaise could be a function of ageing. At both ages the percentage showing signs of non-clinical depression is higher for women than for men. However, again in both years the percentage claiming to have good or even better health is over three-quarters of the respective samples. Unlike the malaise scores, there is little variation across men and women in general health outcomes.

Table 2 contains the descriptive statistics relating to asset holdings among the age 23 sample. Aggregating liquid and illiquid savings together, it can be seen that around 74% of the population have some form of savings. This is consistent with findings from other studies which suggest that 32-37% of adults aged over 16 have no formal savings, see Kempson (1998). Approximately 7% of the population (1.5m households) in Britain were found not to have a current account, nor any savings, credit or insurance (Kempson and Whyley, 1999).

However, if we impose a cut off of £100 for liquid assets and £200 for illiquid assets below which savings are not counted and assumed to be either idle balances or used for current expenditure, it can be seen that less than half this age 23 cohort, 47%, have a significant amount of savings, which we refer to as 'active' financial assets. Around one-fifth of this age 23 cohort had financial assets worth over £1,000 in 1981. Approximately 18% of the sample had assets between £1,000 and £10,000, while around 2% have over £10,000. Women have less savings and investments then men but the differences between men and women are marginal.

**Table 2: Asset holdings at age 23 (1981 values)**

| 23 yrs old | Assets Holdings | Total %/£ | Male %/£ | Female %/£ |
|---|---|---|---|---|
| Savings | All with asset | 73.7 | 73.6 | 72.4 |
| | Asset (£200+) | 44.2 | 45.1 | 43.3 |
| | Average +ve Amt | £869 | £928 | £810 |
| | Avg. Amt (£200+) | £1,399 | £1,479 | £1,316 |
| Investments | All with assets | 6.9 | 8.4 | 5.4 |
| | Asset (£100) | 6.2 | 7.5 | 4.9 |
| | Average +ve Amt | £6,379 | £5,916 | £7,095 |
| | Avg. Amt (£100+) | £7,104 | £6,624 | £7,836 |
| Mortgage or housing loan | All | 26.7 | 20.6 | 32.9 |
| Mortgage/loan & Sav+Inv | All with active assets | 62.1 | 60.8 | 63.3 |
| Inheritance | With Asset >£500 | 11.1 | 10.2 | 12.0 |
| | Avg. Value >£500 | £2,816 | £2,899 | £2,746 |
| Savings | £0 | 27.0 | 26.4 | 27.6 |
| | Less than £200 | 28.8 | 28.6 | 29.1 |
| | £200-£1,000 | 26.5 | 26.2 | 26.7 |
| | £1,000 - £3,000 | 13.5 | 14.0 | 13.0 |
| | £3,000+ | 4.1 | 4.9 | 3.6 |
| Investments | £0 | 93.1 | 91.7 | 94.6 |
| | Less than £100 | 1.3 | 1.6 | 1.1 |
| | £100-£1,000 | 2.0 | 2.6 | 1.4 |
| | £1,000 - £3,000 | 1.2 | 1.4 | 1.0 |
| | £3,000+ | 2.4 | 2.8 | 1.9 |
| Combined (Sav. +Inv.) | With Asset | 73.6 | 74.2 | 73.0 |
| | Asset (active) | 46.5 | 47.8 | 45.1 |
| | Avg. +ve Amt | £1,452 | £1,579 | £1,325 |
| | Avg. +ve Amt (active) | £2,273 | £2,427 | £2,110 |
| Grouped | £0 | 26.1 | 25.5 | 26.8 |
| | Less than £100 | 19.8 | 19.2 | 20.4 |
| | £100-£500 | 22.1 | 21.7 | 22.6 |
| | £500-£1,000 | 11.6 | 11.7 | 11.4 |
| | £1,000 - £3,000 | 13.8 | 14.3 | 13.2 |
| | £3,000 - £10,000 | 4.5 | 5.2 | 3.7 |
| | £10,000 + | 2.1 | 2.4 | 1.9 |

**Source:** NCDS 1981
**Note:** £100 in 1981 was worth approximately £300 in 2010

Around 27% of individuals in the survey have a mortgage or housing loan at age 23: higher for women at 33%. This difference is no doubt related to the fact that a higher percentage of women than men are married and have children at age 23 in this cohort. Not surprisingly it is those individuals who have savings or an investment above the minimum cut-offs who are more likely (much more likely) to be buying a house through a mortgage or loan: 62% on average.

The percentage of the age 23 sample that had received an inheritance or a gift from another person to the value of £500 or more was 11%. The average value of the largest inheritance or gift received by these individuals was £2,816.

These figures are consistent with the findings in McKay and Kempson (2003) who found, using the BHPS, a nationally representative dataset over all age groups 1991-2000; that on average 39-43% of respondents were saving at any given time.

## 4. Methodology

Without having the advantage of results from a randomized experiment, where one group of individuals is randomly assigned assets and another group is not, which would allow us to identify the impact of asset-holding independent from the influence of other factors, we have to employ statistical techniques to try to identify the 'asset-effect'. The main challenge is to compute an estimate of the counterfactual. A simple comparison of the outcomes between asset-holders and those without assets could be very misleading. If individuals with assets have other favourable attributes (e.g. more advantaged backgrounds or higher levels of education) then a positive association between assets and outcomes could be spurious. Where such attributes are observable a regression model can be estimated controlling for these differences and isolating the asset-effect. If such characteristics are unobservable regression estimates will suffer from omitted variable bias. Similarly estimates would be biased and inconsistent if individuals accumulated assets for the purpose of improving outcomes. In this case we say that the individual decision to accumulate and hold an asset is endogenous by which we mean that in some sense asset-holding and the outcome of interest are jointly determined. It is also possible that those individuals most likely to benefit from having an asset are those individuals who accumulate assets.

To estimate the pure asset-effect we would like to know what the counterfactuals are; that is we would like to know what the outcomes *would have been* for individuals with assets had they not had assets, thereby allowing us to calculate the difference the asset made. Likewise for individuals without assets, we would like to know what their outcomes would have been had they had an asset, thereby allowing us to calculate the difference an asset would have had.

There are many reasons why we think that financial asset holding is not random. Individuals differ in both their desire and ability to accumulate and/or acquire assets. This is a problem when estimating the impact of asset holding on outcomes to the extent to which individuals' desire to hold assets is influenced by the extent to which they (correctly) believe they will benefit from the asset (to the extent that individuals have a choice, they self-select) and these individuals systematically have other unobserved attributes which affect the likelihood that they will hold assets and the outcome of interest (asset holding is endogenous).

Previous research has estimated simple regression outcome equations including as many relevant control variables as possible. The problem is that not all the factors which are likely to affect the outcomes of interest are observable or available in the data and the issue of endogeneity is not addressed. We approach this problem in a slightly different way drawing on techniques used in other areas of economics. We begin by thinking about the estimation problem being one where there is a choice variable (asset-holding) and where the choice is both directly and indirectly correlated with the outcome of interest (i.e. it is endogenous) – there is self-selection and it is endogenous. The technique we employ has previously been used to estimate the impact of active labour market programmes on future employment, where participation in the programme is voluntary and those most likely to benefit from the programme (in the knowledge of this or otherwise) are more likely to volunteer to participate (i.e. participation is non-random and endogenous). This is often referred to as the treatment effects model (see Greene, 1997, for details) and is a form of control function estimation[11]. The control function method directly models what is technically known as the assignment rule to control for self-selection. This method directly analyses the choice problem facing individuals deciding on asset-holding.

This method uses the specification of the decision function (choice) together with an excluded 'instrument' (or set of instruments from the outcome equation) to derive a control function, which fully controls for endogenous selection. The assumption is that any impact of the variables predicting the decision to hold assets on potential outcomes arises through the unobservable component in the participation equation together with the observable decision status. The challenge is to find a suitable 'instrument'.

The rationale for using this technique is two-fold. Firstly, it is hypothesised that factors affecting the decision or ability to acquire and hold assets also affect the outcome variable under analysis[12]. This means that those individuals who have

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11 The term treatment effect comes from the use of this and similar statistical techniques to evaluate medical trials where treatment denotes to medical treatment.

12 This assumption is in fact tested in the empirical analysis, described later, but the initial hypothesis of a positive (negative) correlation between earnings and general

the choice and/or the ability to acquire or accumulate assets in early adulthood are either more or less likely to benefit from holding an asset.

Without controlling for endogenous self-selection bias, Ordinary Least Squares regression estimates will over- or under-estimate the effect on the outcome variable (Maddala, 1983; Dolton and Makepeace, 1987; Greene, 1997; Heckman, Tobias et al., 2000).

We compare the results we obtain from the treatment effects model with those obtained from instrumental variable models. The instrumental variable method is the standard econometric approach to endogeneity, where an explanatory variable is correlated with the error term. Explanatory variables can be correlated with the error term in a number of circumstances: where there exists reverse causation (the outcome (dependent variable) causes individuals to hold assets (the independent variable) in this case); where there are important omitted variables, and where there exists measurement error. In these cases OLS generally produces biased and inconsistent results. This method relies on exclusion restrictions to achieve identification. To achieve identification it is necessary to find at least one variable (instrument) that is correlated with the endogenous explanatory variable *and* is not correlated with the error term in the explanatory equation – i.e. the 'instrument' only affects the outcome of interest through its effect on the endogenous explanatory variable. Some analysts rely on the non-linearity introduced in models through the selection correction term to achieve identification but in many cases this can be very weak and lacks theoretical validity. Identification through the assumption of non-linearity from the selection correction term is even more problematic when the choice function extends beyond the binary decision to a multiple selection model. Where the cut-offs are finite (most notably in the interior range) the selection correction term can be linear and identification is not achieved (Chiburis and Lokshin, 2007). The challenge is to find appropriate variables which predict asset-holding but do not directly affect the outcomes of interest.

In a simple linear constant parameter model the IV estimator identifies the treatment effect (technically the Local Average Treatment Effect), i.e. where the treatment effect is homogeneous. In a heterogeneous treatment effect model the IV estimator will only identify the average treatment effect under strong assumptions and ones that are unlikely to hold in practice (Blundell and Costa-Dias, 2008).

We contrast the findings from simple regression models with models that attempt to control for endogeneity and self-selection and with the simple summary statistics in the raw data and discuss the methodological challenges involved in this type of estimation.

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health (malaise) outcomes and assets follows from the work of Bynner (2000).

### *4.1 Estimation Models*

TREATMENT EFFECTS MODEL

For the reasons outlined above we choose to estimate the asset-effect using what is known as the treatment effects model (Greene 1997).

The treatment effects model consists of two parts:

i) modelling the probability of holding an asset (this can be extended to different levels of assets); and,

ii) estimating the impact of asset-holding on outcomes while correcting for differences across individuals in the probability of holding an asset.

The relationship between assets and outcomes can be described as follows:

$$Y_i = \mathbf{x}_i\beta + \delta z_i + \varepsilon_i \tag{1}$$

where $Y_i$ is the outcome variable of interest, $\mathbf{x}_i$, is a vector of exogenous explanatory variables and $z_i$ indicates the presence of assets, where

$z_i$ =1 if individual i has an asset and 0 otherwise

The probability of holding an asset can be expressed as:

$$z_i^* = \mathbf{w}_i\gamma + u_i \tag{2}$$

$$z_i = \begin{cases} 1, & if\ z_i^* > 0 \\ 0, & otherwise \end{cases}$$

The binary decision to acquire assets $z_i$ is modelled as the outcome of an unobserved latent variable, $z_i$*. It is assumed that $z_i$* is a linear function of the exogenous covariates $w_i$ and a random component $u_i$,
where ε and u are bivariate normal with mean zero and covariance matrix:

$$\begin{bmatrix} \sigma & \rho \\ \rho & 1 \end{bmatrix} \tag{3}$$

Since the error $\varepsilon_i$ in (1) is believed to be correlated with the outcome variable, we need to correct for this bias by finding variables that are associated with holding an asset at one age, but are not associated with the outcomes of interest at a later age.

The expected value of ε varies between individuals with and without assets and is not equal to zero.

$$E(\varepsilon_i \mid z_i = 1) \neq E(\varepsilon_i \mid z_i = 0) \neq 0 \tag{4}$$

Due to the conditions just specified, the coefficient on the asset variable in the outcome equation, δ, does not capture the impact of assets-holding on the outcome variable.

Rather the expected outcome for individuals with assets can be expressed as:

$$E[Y_i \mid z_i = 1] = \mathbf{x}_i\beta + \delta + E[\varepsilon_i \mid z_i = 1]$$

$$= \mathbf{x}_i\beta + \delta + \rho\sigma\left[\frac{\phi(\mathbf{w}_i\gamma)}{\Phi(\mathbf{w}_i\gamma)}\right] \tag{5}$$

where $\phi$ and Φ are the standard normal density and distribution functions respectively.

The expected outcome for individuals without assets can be expressed as:

$$E[Y_i \mid z_i = 0] = \mathbf{x}_i\beta + \rho\sigma\left[\frac{-\phi(\mathbf{w}_i\gamma)}{1-\Phi(\mathbf{w}_i\gamma)}\right] \tag{6}$$

The result we are interested in is the difference in expected outcomes between individuals with and without assets:

$$E[Y_i \mid z_i = 1] - E[Y_i \mid z_i = 0] = \delta + \rho\sigma\left[\frac{\phi(w_i\gamma)}{\Phi(w_i\gamma)(1-\Phi(w_i\gamma)}\right] \tag{7}$$

This can also be re-written as:

$$Y_i = \mathbf{x}_i\beta + \delta z_i + \rho\sigma\lambda_i + \varepsilon_i \tag{8}$$

$$E[\varepsilon|zi=1] = E[\varepsilon|zi=0] = 0 \tag{9}$$

If $z_i$ is exogenous then cov($\varepsilon$, $u$) = 0 (i.e. $\rho=0$), where there is no correlation between holding an asset in stage 1 and outcomes in stage 2, then OLS estimation would be the appropriate estimation method to use. Where $z_i$ is endogenous in the case where cov($\varepsilon$, $u$) ≠ 0 and $\rho \neq 0$ the sign of $\rho$ determines the sign of the bias. In this case $\rho\sigma\lambda$ represents the bias and the omission of this correction term in an OLS regression will lead to omitted-variable bias and the results will generally be inconsistent.

These equations outline the basic treatment effects model. Our asset variables and outcome variables take a number of different forms. The simplest model involves estimating a binary selection model and a continuous outcome

variable. This is the case when we consider the impact of holding an asset on hourly wages. As we are interested in looking at different levels of asset-holding and binary and ordered outcome variables (employment, malaise, general health) we have had to program the likelihood functions for these different models as they are not routine programmes found in standard statistical estimation software packages. Appendix A details the different models we have made use of in this study.

INSTRUMENTAL VARIABLE MODEL

The method of Instrumental Variables deals directly with the case where an explanatory variable is endogenous (correlated with the error term). The IV approach requires the existence of at least one regressor exclusive to the decision rule. This is known as the instrument, w. It affects the decision to hold assets only and so is not one of the observable regressors in the outcome equation (X). This is known as the exclusion restriction. Under various conditions the instrument w is the source of exogenous variation used to approximate randomisation. The IV estimator is:

$$\delta^{IV}=(Z'X)^{-1}Z'y$$

While the IV model successfully deals directly with endogeneity, in practice it is very difficult to find suitable instruments that meet the conditions of the model. As the variance-covariance matrix of the IV estimator is larger than that of the OLS estimator, by an amount that is inversely related to the correlation between the instrument and the regressor (the endogenous variable), the strength of the instrument(s) is crucial in minimizing the variance of the IV estimator (Kennedy, 1998).

There are clearly similarities between the IV model and the treatment effects model. The treatment effects model gains identification through exclusion restrictions in the selection equation (sometimes known as the treatment or participation equation) and the joint distribution of the error term (bivariate normal) while the IV model relies on the validity of the instruments.

### *4.2 Identification and model diagnostics*

Before estimating the models, we need to ensure they are correctly specified. The two-stage approach used in the treatment effects model is similar to a two-stage instrumental variable model (two stage least squares 2SLS) and all of our models require the separate identification of the 'asset equation'. While technically selection models like the treatment effects model can achieve identification through the joint distributional assumption relating to the error term a valid exclusion restriction provides a sound theoretical base for the model and strengthens the model.

We can interpret the first stage of the regression, which in this case is the probability of an individual holding an asset at age 23/33, to be similar to

estimating the exogenous variables that are used to determine the instrument. Without interpreting either the significant variables or the efficiency of the estimation, we can test whether the first stage estimation is a robust model of holding an asset by testing whether the variables chosen for the instruments over-identify the model. The C statistic, or difference-in-Sargan statistic, allows a test of a subset of the orthogonality conditions, i.e. it is a test of the exogeneity of one or more instruments. It is defined as the difference of the Hansen-Sargan statistics of the unrestricted and restricted equations. The C statistic is distributed as chi-squared in the number of restrictions tested. In the case of 2SLS, the Mean Squared Error (MSE) (with no finite-sample adjustment) from the unrestricted (more efficient) equation is used to calculate both Sargan statistics. For further discussion, see Hayashi (2000: 218-22 and 232-34). The test is of the joint null hypothesis that the excluded instruments are valid instruments, i.e. uncorrelated with the error term and correctly excluded from the estimated equation. A rejection of the null hypothesis casts doubt on the validity of the instruments. Therefore when testing over-identification, we wish to fail to reject the null hypothesis.

Although we have theoretically suggested there is self-selection as to who holds an asset at age 23/33, we test this using the Hausman Test. This procedure tests if the two- stage estimation produces significantly different results from an OLS estimation, which does not allow for self-selection, i.e. testing our assumption that the error term is correlated with the regressor. This validates the approach for treating asset-holding as a form of endogenous selection. The null hypothesis for this test states that an ordinary least squares (OLS) estimator of the same equation would yield consistent estimates: that is, any endogeneity among the regressors would not have deleterious effects on OLS estimates and therefore as OLS is the more efficient estimator OLS should be used above the alternative model. A rejection of the null hypothesis indicates that endogenous regressor effects on the estimates are meaningful, and an alternative modelling strategy is required.

Rho also provides an estimate of the correlation between the error terms and its sign and statistical significance can provide a useful test of the validity of the selection model and the expected bias if selection is ignored.

Finally, the F-test is a way of assessing if the explanatory power of a model (residual sum of squares) is sufficiently improved through the inclusion of additional explanatory variables. In the context of IV it can be used to test whether the instrument(s) effectively belong in the outcome equation in the sense that their inclusion sufficiently increases the explanatory power of the model.

## 5. Asset holding

We begin by looking at asset-holding in our sample using the variable definitions we use in our statistical models. Table 3 shows the shares of men and women with financial assets at age 23 and 33 using the minimum cut-off defined in Section 2.1. The binary indicator variables for assets at age 23 and 33 show the share of men and women with assets above the minimum cut-offs. The grouped asset variables group the sum of total financial assets valued in 1981 prices.

We find increases in the share of the cohort who hold assets above the minimum cut-offs between age 23 and age 33, small increases in the share with no savings or investments and falls in the share of men and women with low value financial assets. We also find increases in the share with larger assets (>£1,000) and large increases in the average value of assets (positive amounts) – nearly three times greater.

**Table 3: Shares of men and women with assets at age 23 and 33 (%/£)**

| | **Men** | **Women** |
|---|---|---|
| Assets 23 (active) | 47.8 | 45.1 |
| Grouped assets | | |
| asset=0 | 25.5 | 26.8 |
| 0>asset<£200 | 26.8 | 28.2 |
| £200>=asset<£1,000 | 25.8 | 26.1 |
| asset>=£1,000 | 21.9 | 18.8 |
| Av value (£) if >0 | 1,579 | 1,325 |
| Assets 33 (active) | 57.3 | 47.28 |
| Grouped assets | | |
| asset=0 | 26.6 | 30.3 |
| 0>asset<£200 | 16.9 | 18.0 |
| £200>=asset<£1,000 | 18.7 | 19.0 |
| asset>=£1,000 | 37.8 | 32.8 |
| Av value (£) if >0 | 6,282 | 5,211 |

**Note:** Asset values in 1981 prices

As the estimation of the asset equation is critical to much of our analysis we begin by presenting some model estimates for this equation. We are seeking to find a set of variables that predict asset-holding at age 23/33 but do not directly impact on the outcome variables of interest (earnings, employment, general health, malaise): the exclusion restrictions. They can be thought of as the 'instruments' (or linear combination) that will be used in the statistical modelling ,although we experiment with the precise selection of variables such as the exclusion of absence from school due to illness in the general health and malaise outcome models. A great deal of analysis was conducted before the final selection of variables. The underlying rationale was that the set of variables should provide a theoretical basis for separate identification of the asset equation and should pass identification tests and model diagnostics as outlined in Section 4.2.

The results for the asset equation estimates can be found in Table 4. We find a social class gradient with individuals from more privileged social class backgrounds more likely to have an asset at age 23/33. Social class may not just influence individuals' ability to accumulate or inherit an asset but may influence individuals' attitudes to asset holding. Higher maths (arithmetic) tests scores at age 7 are associated with an increased probability of having an asset at age 23/33 (not statistically significant for women). Conversely the relationship between reading test scores at age 7 and the probability of having an asset at age 23/33 is stronger and more likely to be statistically significant for women.

We were unable to find a general health question at age 16 so we used the variable which reported the amount of time absent from school in the last 12 months. Being absent from school for over one month due to illness during the last 12 months at age 16 was associated with a lower probability of having an asset at age 23/33 (not statistically significant for asset-holding among men age 33).

We included two attitudinal questions which we thought would reflect attitudes towards accumulating and holding financial assets. At age 16 respondents were asked to respond to the statement 'no point planning for the future' and 'never take work seriously' We found a positive relationship between respondents who disagreed with the statement 'no point planning for the future' and the probability of holding an asset at age 33, relative to those who agreed with the statement. Respondents who agreed responded 'true' to the statement 'never take work seriously' were the least likely to be holding an asset at age 23/33.

Parental financial problems when cohort member was age 11 were associated with a lower probability of having an asset at age 23, but this relationship was not statistically significant by age 33. Similarly being in receipt of Free School Meals (an indicator of low household income) at age 11 was associated with a lower probability of holding an asset at age 23/33 (not statistically significant

for women age 33). Relative to other forms of housing, owner occupation at age 7 was associated with a higher probability of holding an asset at age 23/33. The presence of siblings was associated with a lower probability of later asset holding; although more important for age 23 assets than age 33 assets.

The presence of dependent children at age 23 was associated with a lower probability of asset holding and the effect was bigger the more children there were.

**Table 4: Coefficients estimates from the probit model of the probability of holding an active asset age 23 and age 33**

| | Males 23 β | Females 23 β | Males 33 β | Females 33 β |
|---|---|---|---|---|
| **Social class (birth)** | | | | |
| Intermediate | -0.030 | -0.051 | **-0.230** | -0.147 |
| Skilled N-Man | -0.102 | -0.183 | **-0.359** | **-0.279** |
| Skilled Man | -0.162 | **-0.224** | **-0.401** | **-0.240** |
| Semi-skilled | **-0.241** | -0.180 | **-0.369** | **-0.257** |
| Unskilled | **-0.457** | **-0.348** | **-0.544** | **-0.250** |
| missing | -0.205 | -0.143 | **-0.370** | **-0.245** |
| **Maths test age 7** | | | | |
| 3rd quartile | 0.077 | 0.040 | **0.119** | 0.065 |
| 2nd quartile | **0.168** | 0.077 | **0.284** | 0.057 |
| 1st quartile | **0.201** | 0.089 | **0.306** | 0.097 |
| missing | 0.006 | 0.067 | -0.146 | 0.227 |
| **Reading test age 7** | | | | |
| 3rd quartile | 0.098 | 0.073 | 0.075 | **0.202** |
| 2nd quartile | 0.086 | **0.190** | 0.117 | **0.191** |
| 1st quartile | 0.059 | **0.184** | -0.070 | 0.220 |
| missing | 0.225 | 0.040 | **0.416** | -0.064 |
| **School absence (illness) 16** | | | | |
| 1 wk - 1 mth | 0.022 | **-0.135** | -0.075 | -0.085 |
| over 1 mth | -0.159 | **-0.180** | -0.073 | **-0.222** |
| absent dk length | -0.260 | -0.168 | -0.342 | -0.099 |
| does not attend | -0.310 | **-0.911** | -0.127 | -0.226 |
| don't know | 0.038 | -0.097 | -0.147 | 0.095 |
| ***No point planning for future 16*** | | | | |
| cannot say | 0.032 | 0.088 | 0.135 | **0.252** |
| not/not usually true | 0.088 | 0.085 | **0.156** | **0.187** |
| missing | 0.255 | -0.019 | 0.254 | 0.193 |

| | Males 23 β | Females 23 β | Males 33 β | Females 33 β |
|---|---|---|---|---|
| **Never take work seriously 16** | | | | |
| usually true | 0.248 | 0.265 | **0.286** | 0.134 |
| cannot say | **0.358** | 0.281 | **0.331** | 0.005 |
| usually not true | **0.333** | **0.276** | **0.335** | 0.216 |
| not true | **0.380** | **0.374** | **0.349** | **0.274** |
| missing | 0.136 | 0.404 | 0.216 | 0.133 |
| ***Parental financial problems 11*** | | | | |
| financial problems | **-0.188** | **-0.153** | -0.078 | -0.106 |
| missing | -0.030 | **0.150** | 0.023 | 0.001 |
| **Free school meals 11** | | | | |
| yes | **-0.184** | **-0.321** | **-0.199** | -0.016 |
| missing | 0.102 | **-0.169** | -0.068 | -0.071 |
| **Owner occupation 7** | | | | |
| owner occupied | **0.178** | **0.150** | **0.127** | **0.159** |
| missing | -0.020 | 0.113 | 0.039 | 0.092 |
| **Siblings** | | | | |
| 1 sibling | -0.007 | -0.094 | -0.011 | -0.077 |
| 2 siblings | **-0.148** | **-0.144** | 0.043 | -0.109 |
| 3 siblings | **-0.295** | -0.105 | **-0.176** | -0.115 |
| 4+ siblings | -0.287 | -0.227 | -0.092 | -0.189 |
| missing | **-0.236** | **-0.082** | 0.080 | **-0.258** |
| **Dependent children age 23** | | | | |
| 1 child | **-0.363** | **-0.523** | **-0.230** | **-0.279** |
| 2+ children | **-0.846** | **-0.747** | **-0.425** | **-0.502** |
| **Months in FT work 16-23** | | | | |
| less than 2yrs | 0.043 | **0.262** | -0.064 | 0.028 |
| over 2 < 5yrs | 0.107 | **0.397** | **-0.254** | -0.031 |
| 5+ yrs | **0.256** | **0.347** | **-0.388** | -0.048 |
| incomplete record | -0.022 | 0.181 | **-0.589** | **-0.381** |
| **Months in FT work 23-33** | | | | |
| none | | | **-0.942** | **-0.341** |
| less than 8yrs | | | **-0.589** | **-0.230** |
| incomplete record | | | **-0.377** | **-0.314** |
| constant | -0.410 | -0.447 | 0.442 | 0.201 |

**Notes:** Probit model estimates. Reference categories: Professional social class, 1st quantile maths test 7, 1st quantile reading test 7, less than 1 week absence from school in year 16, 'no point planning for the future' very/usually true 16, 'never take work seriously' very true 16, no parental financial problems 11, no free school meals 11, not in owner occupation 7, no siblings, no dependent children 23, no months in FT work 16-23yrs, 8 years or more FT work 23-33yrs. Coefficients that are statistically significant above the 5% level are highlighted in bold.

There is an interesting relationship between work histories and asset-holding. We initially included these variables because we felt that fuller work histories would be indicative of higher earnings and therefore income up to age 23 or 33 and this would affect individuals' ability to accumulate an asset. For men aged 23 we found an increase in the probability of having an asset if they had worked full-time for 5 years or more (relative to those with no work experience). For women aged 23 we found that any full-time work experience between 16 and 23 was associated with a higher probability of having an asset at age 23 relative to those with no work experience. However by age 33 quite a different picture emerges. Full time work experience between ages 23 and 33 was associated with a higher probability of having an asset and the longer the work experience the higher the probability of having an asset. Work experience 16-23 years does not have a statistically significant effect on asset holding at age 33 for women, but for men it is those individuals who had no full-time work experience during these years who are more likely to have an asset at age 33 and the longer work experience is the greater the negative relationship. This is likely to be picking up the fact that men with longer work experience are likely to have left education earlier with fewer qualifications and subsequently to have lower income and a reduced ability to accumulate an asset.

## 6. Estimating the impact of assets on later adult outcomes

Overall we have four different outcomes and a simple asset specification and a more complex asset specification where we look at different levels of assets-holding. We examine assets at age 23 and age 33 and outcomes at age 33 and age 42. This amounts to a large number of estimations; for the sake of brevity we report only the coefficient of interest[13]. We provide model estimates for the simple binary asset model and for levels of assets (ordered model) and for more complex models which take into account selection and endogeneity related to asset-holding and contrast these findings with differences observed in raw means. The outcome equations contain a core set of independent control variables covering: social class background, ethnicity, educational attainment, marital status, presence of dependent children. Additional control variables are included where relevant to the specific outcome being estimated, such as job characteristics in the wage equation. The asset equations contain controls for social class background, presence of financial problems at age 11, free school meals at age 11, if parents were owner occupiers, ability test scores, attitudinal data, absence from school due to ill health, number of siblings, work experience, number of dependent children (see Section 4). These are the exclusion restrictions or (linear combination of) instruments.

Table 5 shows the actual hourly gross wage at age 33 and age 42 by asset-holding status at age 23 and 33. It is clear from the differences in the raw data

[13] The full results are available from the author on request.

that individuals with assets earn, on average, more than individuals without assets. With one exception (men with assets at age 23 and wages at age 42), higher levels of assets are associated with higher average wages.

A comparison between age 42 wages and asset-holding at age 23 and age 33 shows that individuals with no assets at age 33 (or assets of low value) are relatively worse-off in terms of average wages than individuals in similar positions at age 23. This suggests, as you would expect, that some individuals with no/low level assets at age 23 improved their position over time. In terms of age 42 wages it appears, in the raw data at least, that 'asset-poverty' is associated with poorer wage outcomes when it occurs later in adult life.

**Table 5: Actual average gross wages and asset-holding (£)**

| | Age 23 assets | | Age 33 assets |
|---|---|---|---|
| | Age 33 Wage | Age 42 Wage | Age 42 Wage |
| Males | | | |
| no 'active' asset | 7.10 | 11.51 | 10.45 |
| asset | 7.97 | 13.57 | 13.89 |
| Females | | | |
| no 'active' asset | 5.11 | 7.95 | 7.40 |
| asset | 6.10 | 8.91 | 9.12 |
| Males | | | |
| 0 | 7.08 | 12.02 | 10.31 |
| 0<£200 | 7.11 | 11.23 | 10.56 |
| £200<£1,000 | 7.78 | 12.95 | 12.04 |
| £1,000+ | 8.20 | 14.25 | 14.93 |
| Females | | | |
| 0 | 4.87 | 7.41 | 7.13 |
| 0<£200 | 5.29 | 8.16 | 7.82 |
| £200<£1,000 | 5.92 | 8.78 | 8.42 |
| £1,000+ | 6.38 | 9.09 | 9.58 |

**Note:** 'active' assets denote asset holdings above the minimum cut-offs defined in Section 3. Assets are valued in 1981 prices.

### *6.1 The impact of assets on earnings*

In this section we focus on estimates of the impact of holding assets at age 23 on age 33 and age 42 hourly wages for men and women for all those in employment (due to data limitations we are not able to analyse the employment income of self-employed workers). We also look at the impact of asset-holding at age 33 on age 42 wages.

Table 6 contains the asset-effect estimates in the raw data, ordinary least squares regression, and the predicted marginal effects from the 'treatment effect' models. In addition estimates are included from IV models.

The results show positive differences in hourly wages of men and women at age 33 between those with and without assets at age 23: wage premiums of 5% for men and 7% for women at age 33 in the simple OLS models. In the raw data the wage premiums are 12% for men and 19%, so the OLS results suggest that over half of these differences are due to asset holders having other characteristics that predict higher wages (such as higher education, privileged social class background, etc). The predicted marginal effects from the treatment effects (TE) model suggests that the OLS estimates are biased upwards due to problems associated with endogeneity (see Methodology section) but remain positive and statistically significant: these results suggest an asset-effect on wages of 4% for men and 5% for women at age 33.

When different levels of assets are identified it is found for men that assets under £200 (in 1981 prices) have no statistically significant effect on wages; supporting our decision to impose a minimum cut-off for the binary asset variable. Assets greater than £200 but less than £1,000 have a 3% effect on wages (but this result is only marginally significant) and a larger 7% effect for assets £1,000 or more, showing a positive relationship between assets levels and later wages. We don't have the marginal effects estimates for the treatment effects models with grouped assets but it is clear from the coefficients that a similar pattern remains after controlling for endogeneity. However rho is not statistically significant which suggests that for this model the errors in the two models are not correlated and the OLS estimates are unbiased.

For women, the OLS estimates show a positive gradient between wages at age 33 and the value of assets held at age 23, with the effects on wages larger than those observed for men (a finding that is reflected in the raw data). Relative to women with zero assets at age 23 the OLS estimates suggest that, on average, women who had assets up to £200 (in 1981) were earning 6% more at age 33, women with assets worth more than £200 but less than £1,000 were earnings 10% more and women with assets worth more than £1,000 at age 23 were earning, on average, 11% more at age 33. While we don't have comparative marginal effects for the TE model with asset levels the coefficient estimates show a significant positive gradient between the value of assets held at age 23 and wages at age 33. The estimate of rho is statistically significant showing a correlation between the residuals in the asset selection equation and the wage equation.

**Table 6: Asset effect wage estimates at age 33: raw, OLS, treatment effects and IV model estimates**

| | Raw diff | OLS | TE | | | IV |
|---|---|---|---|---|---|---|
| | | β/ME | β | ME | rho | β/ME |
| **Males** | | | | | | |
| 'Active' asset 23 | 0.123 | **0.053** | **0.280** | **0.042** | **-0.425** | **0.187** |
| | | (0.000) | (0.000) | | (0.001) | (0.002) |
| Grouped 23 | | | | | | |
| 0<£200 | 0.000 | -0.011 | -0.001 | | -0.166 | |
| | | (0.525) | (0.948) | | (0.231) | |
| £200<£1,000 | 0.099 | 0.030 | **0.042** | | | |
| | | (0.096) | (0.040) | | | |
| £1,000+ | 0.139 | **0.066** | 0.210 | | | |
| | | (0.000) | (0.086) | | | |
| **Females** | | | | | | |
| 'Active' asset 23 | 0.194 | **0.074** | **0.427** | **0.052** | **-0.624** | **0.429** |
| | | (0.000) | (0.000) | | (0.000) | (0.000) |
| Grouped 23 | | | | | | |
| 0<£200 | 0.086 | **0.057** | **0.077** | | **-0.431** | |
| | | (0.001) | (0.000) | | (0.009) | |
| £200<£1,000 | 0.215 | **0.104** | **0.122** | | | |
| | | (0.000) | (0.000) | | | |
| £1,000+ | 0.310 | **0.110** | **0.506** | | | |
| | | (0.000) | (0.001) | | | |

**Notes:** p-values are shown in parenthesis. Model estimates statistically significant at the 5% level shown in bold. Assets are valued in 1981 prices. 'Active' assets denote asset holdings above the minimum cut-offs defined in Section 3.

At age 42 (Table 7) assets held at age 23 still have a positive effect on wages. For men, we find a 6% wage premium in the simple OLS regression, the effect for women is not statistically significant. The wage premium for men with assets is reduced to 3% when endogeneity is taken into account in the treatment effects model. Looking at the different levels of assets in the OLS model we find that for men it is assets valued at £1,000 or more (in 1981) that have a 5% effect on wages but this is only marginally significant at the 7% level. The TE model estimates are not statistically significant, nor is rho. For women, we find statistically significant wage effects at the three levels of assets identified, although assets at least as great as £1,000 (in 1981) is only marginally significant at the 9% level. The positive and significant wage premium for women with assets less than £200 of 7% is likely to explain why the binary variable which has a minimum cut-off is not statistically significant. This is the

same as the age 42 wage premium for women with assets worth £200 or more but less than £1,000 at age 23. While marginal effect estimates are not available, coefficient estimates from the TE model show a significant and positive relationship between the value of assets held at age 23 and wages at age 42. Rho is insignificant which suggests that the OLS estimates are unbiased.

Assets at age 33 have strong positive effects on wages at age 42, ceteris paribus. This can be seen in the OLS and treatment effects models. For men, we find a 33% premium in the raw data, this is reduced to 10% in the OLS model and to 8% in the TE model. The asset effect is very similar for women: 23% in the raw data, 10% in the OLS model and 8% in the TE model. In the models that distinguish between different levels of assets, for men it is assets greater than £1,000 at age 33 (in 1981 prices) that have a statistically significant effect on wages at age 42: 45% premium in the raw data, 16% in the OLS model and although we don't have marginal effects for the TE model the coefficient is large, positive and significant. Rho is significant. For women, the wage effects are higher and there exists a clear positive gradient with higher assets held at age 33 associated with higher relative wages at age 42.

The instrumental variable model estimates show a much higher (in fact implausibly high) asset-effect on wages than that observed in the raw data. However, although tests of the model estimates using the Durbin (score) and Wu-Hausman suggest that the asset variable is endogenous in the wage equation, and tests of the overidentifying restrictions using the Sargan (score) and Basmann test statistics suggest that the instruments are valid, the model F-test suggests that the instruments are weak. This is likely to explain the inflated coefficient in the IV models. We conducted a considerable amount of work searching for better instruments. While there are similarities between the IV and TE models theoretically the TE model fits better than the IV model and therefore our preferred model is the TE model.

**Table 7: Asset effect wage estimates at age 42: raw, OLS, treatment effects and IV model estimates**

| | Raw diff | OLS β/ME | β | TE ME | rho | IV β/ME |
|---|---|---|---|---|---|---|
| **Males** | | | | | | |
| 'Active' asset 23 | 0.179 | **0.061** | **0.726** | **0.032** | **-0.686** | **0.187** |
| | | (0.002) | (0.000) | | (0.000) | (0.047) |
| 'Active' asset 33 | 0.329 | **0.103** | **0.817** | **0.078** | **-0.715** | **0.519** |
| | | (0.000) | (0.000) | | (0.000) | (0.002) |
| Grouped 23 | | | | | | |
| 0<£200 | -0.066 | -0.031 | -0.022 | | -0.102 | |
| | | (0.284) | (0.478) | | (0.386) | |
| £200<£1,000 | 0.077 | 0.031 | 0.043 | | | |
| | | (0.282) | (0.177) | | | |
| £1,000+ | 0.186 | 0.054 | 0.199 | | | |
| | | (0.074) | (0.236) | | | |
| Grouped 33 | | | | | | |
| 0<£200 | 0.024 | 0.002 | **-0.075** | | **-0.735** | |
| | | (0.937) | (0.025) | | (0.000) | |
| £200<£1,000 | 0.168 | 0.040 | 0.015 | | | |
| | | (0.172) | (0.650) | | | |
| £1,000+ | 0.448 | **0.156** | **1.280** | | | |
| | | (0.000) | (0.000) | | | |
| **Females** | | | | | | |
| 'Active' asset 23 | 0.121 | 0.022 | **0.656** | **-0.012** | **-0.725** | **0.291** |
| | | (0.226) | (0.000) | | (0.000) | (0.001) |
| 'Active' asset 33 | 0.232 | **0.097** | **0.643** | **0.076** | **-0.644** | **0.625** |
| | | (0.000) | (0.000) | | (0.000) | (0.000) |
| Grouped 23 | | | | | | |
| 0<£200 | 0.101 | **0.068** | **0.059** | | **-0.024** | |
| | | (0.005) | (0.030) | | (0.182) | |
| £200<£1,000 | 0.185 | **0.074** | **0.115** | | | |
| | | (0.004) | (0.000) | | | |
| £1,000+ | 0.227 | 0.046 | **0.121** | | | |
| | | (0.091) | (0.000) | | | |
| Grouped 33 | | | | | | |
| 0<£200 | 0.097 | **0.062** | -0.055 | | **-0.771** | |
| | | (0.017) | (0.062) | | (0.000) | |
| £200<£1,000 | 0.181 | **0.117** | **0.061** | | | |
| | | (0.000) | (0.030) | | | |
| £1,000+ | 0.344 | **0.126** | **1.206** | | | |
| | | (0.000) | (0.000) | | | |

**Notes:** p-values are shown in parenthesis. Model estimates statistically significant at the 5% level shown in bold. Assets are valued in 1981 prices. 'Active' assets denote asset holdings above the minimum cut-offs defined in Section 3.

### *6.2 The impact of assets on employment probabilities*

The relationship between assets and employment status observed in the raw data shows a correlation between asset holding at age 23 and employment outcomes at age 33 and 42, and asset holding at age 33 and employment outcomes at age 42. Table 8 shows the distribution of employment status at age 33 and 42 for asset and non-asset holders at age 23 and 33, separately for men and women.

A higher proportion of men with active assets at age 23 are observed in full time employment or self-employment at age 33 and 42, compared with men without assets at age 23. A lower proportion of men with assets are unemployed or out of the labour force than men without assets. An interesting picture emerges from the analysis of assets by grouped asset values. In general self-employment is more common among men with either zero active assets at age 23 or with assets over £1,000 in value than for men with assets between these two values (the one exception being that a very slightly higher proportion of men without active assets at age 33 are self-employed at age 42 than men with assets greater than or equal to £200 and less than £1,000). The consequence of which is that while there is a clear positive gradient between the value of assets held and later proportions in full time employment up to asset holdings of £1,000, it tends to fall slightly after £1,000. It is possible that this finding illustrates two types of self-employment: (1) own account workers for those with low skills and poor employment prospects, (2) highly successful businesses. It is also possible that the lack of assets among this group is due to the fact that their financial assets have been invested in a business enterprise.

Mirroring the positive relationship between asset holding and later employment probabilities, lower proportions of men with assets at age 23 and 33 are out of the labour force (OLF) or unemployed at age 33 or 42. The results from the analysis of grouped assets show a clear gradient: the higher the value of the asset held (age 23 and 33) the lower the proportion found OLF or unemployed (age 33 and 42).

For women, the picture is more mixed. Women are more likely than men to be working part time and out of the labour force at age 33 and 42, and lower shares in full-time and self-employment. Holding assets at age 23 is associated with higher proportions in full time employment and lower proportions in unemployment or out of the labour force at age 33; there is no significant difference in the proportion of women working part time or in self-employment between women with and without assets. The positive relationship between assets at age 23 and full time employment at age 42 does not hold. Instead a higher proportion of women with assets at age 23 are employed part-time or are self-employed at age 42 than those without asset at age 23 and fewer of these women are out of the labour force. A similar relationship exists between asset holding at age 33 and outcomes at age 42. The analysis of assets by grouped

asset values and employment outcomes shows a positive gradient between asset values at age 23 and the proportion of women in full time employment at age 33. There is a negative gradient between the value of assets held at age 23 and unemployment at age 33. Unlike for men, there is not a clear negative gradient between asset values and the proportion of women out of the labour force at age 33. The much higher proportions of women OLF is due to childcare responsibilities and the bipolar distribution (with higher shares of women OLF either with no assets at age 23 or assets of £1,000+) is likely to be an illustration of the contrasting position of women with limited employment prospects and those who were able to choose to stay at home full-time with their children. However, this relationship is not evident between asset holding at age 23 and OLF status at age 42. The much lower proportions of women OLF at age 42 is likely to be due to the fact many of these women returned to work after taking some time out of the labour force to raise children (This cohort was born in 1958 when average age of family formation was younger than it is today).

In Table 9 we show the results when the employment outcome information is summarised into a simple binary categorisation where the proportions of individuals working either in full-time, part-time or self-employed are summed. This is the variable we shall use for the statistical modelling exercise.

This summary information shows the overall positive relationship between asset holding at age 23 and employment at age 33 and 42, with a stronger relationship observed for men than for women. Looking at the value of the asset held at age 23 and 33 for men there is a clear positive gradient between assets and employment probabilities. For women, there are similar findings to those noted in the more detailed breakdown of employment status.

**Table 8: The relationship between asset-holding and employment outcomes (%)**

| | Males | | Females | | Males | Asset value | | | Females | Asset value | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Age 23 assets | no asset | asset | no asset | asset | 0 | 0<£200 | £200<£1000 | £1000+ | 0 | 0<£200 | £200<£1000 | £1000+ |
| Age 33 | | | | | | | | | | | | |
| Full time | 70.5 | 78.1 | 31.5 | 34.6 | 65.6 | 74.4 | 78.6 | 77.6 | 29.1 | 33.3 | 34.4 | 35.0 |
| Part time | 0.9 | 0.5 | 29.3 | 29.0 | 0.9 | 0.9 | 0.7 | 0.4 | 28.3 | 30.3 | 31.3 | 25.7 |
| Self employed | 15.7 | 16.9 | 6.8 | 7.0 | 17.7 | 14.0 | 15.6 | 18.3 | 6.2 | 7.2 | 5.8 | 8.7 |
| Unemployed | 8.5 | 2.8 | 2.7 | 1.2 | 9.4 | 7.8 | 3.4 | 2.1 | 3.3 | 2.2 | 1.2 | 1.1 |
| OLF | 3.4 | 1.2 | 28.3 | 26.8 | 5.0 | 2.0 | 1.3 | 1.1 | 31.9 | 25.3 | 25.9 | 28.1 |
| Other | 1.1 | 0.5 | 1.5 | 1.4 | 1.4 | 0.9 | 0.5 | 0.6 | 1.3 | 1.7 | 1.3 | 1.4 |
| Age 42 | | | | | | | | | | | | |
| Full time | 68.8 | 74.7 | 41.5 | 40.1 | 63.2 | 73.2 | 75.9 | 73.5 | 39.2 | 43.3 | 40.1 | 40.1 |
| Part time | 1.8 | 1.1 | 29.8 | 34.7 | 1.9 | 1.9 | 1.0 | 1.3 | 26.9 | 30.2 | 35.1 | 34.3 |
| Self employed | 17.4 | 18.7 | 6.8 | 8.7 | 19.2 | 16.1 | 17.1 | 20.5 | 6.6 | 7.0 | 8.0 | 9.7 |
| Unemployed | 3.8 | 1.9 | 1.9 | 1.0 | 4.6 | 3.1 | 2.4 | 1.4 | 2.2 | 1.7 | 1.4 | 0.6 |
| OLF | 7.3 | 3.0 | 19.4 | 13.7 | 9.8 | 5.2 | 3.2 | 2.7 | 23.5 | 16.1 | 13.8 | 13.7 |
| Other | 1.0 | 0.6 | 1.6 | 1.8 | 1.3 | 0.8 | 0.5 | 0.6 | 1.6 | 1.7 | 1.7 | 1.7 |
| Age 33 assets Age 42 | | | | | | | | | | | | |
| Full time | 69.5 | 75.2 | 39.4 | 41.2 | 66.9 | 74.0 | 77.2 | 74.2 | 36.9 | 43.4 | 43.2 | 40.2 |
| Part time | 1.7 | 1.1 | 30.4 | 33.2 | 2.0 | 1.3 | 1.5 | 0.9 | 30.3 | 30.6 | 36.0 | 31.6 |
| Self employed | 15.7 | 18.9 | 6.8 | 8.1 | 16.2 | 14.8 | 17.0 | 20.0 | 7.1 | 6.1 | 6.0 | 9.4 |
| Unemployed | 4.5 | 1.4 | 2.3 | 0.9 | 5.1 | 3.7 | 1.1 | 1.6 | 2.6 | 1.8 | 0.8 | 0.9 |
| OLF | 7.8 | 2.4 | 19.5 | 14.6 | 9.0 | 5.7 | 2.6 | 2.4 | 21.3 | 16.6 | 12.5 | 15.7 |
| Other | 0.7 | 0.9 | 1.7 | 2.0 | 0.8 | 0.6 | 0.7 | 1.0 | 1.9 | 1.6 | 1.5 | 2.2 |

**Note:** 'No asset'/'asset' refers to assets below and above the minimum cut-offs defined in Section 3. All assets valued in 1981 prices.

**Table 9: Employment (full-time, part-time and self-employment): percent within asset group**

| | Age 23 assets | | Age 33 assets |
|---|---|---|---|
| | Age 33 | Age 42 | Age 42 |
| | Emp | Emp | Emp |
| **Males** | | | |
| no 'active' asset | 87.0 | 88.0 | 87.0 |
| asset | 95.5 | 94.6 | 95.3 |
| | | | |
| **Females** | | | |
| no 'active' asset | 67.6 | 78.0 | 76.6 |
| asset | 70.7 | 83.5 | 82.6 |
| | | | |
| **Males** | | | |
| 0 | 84.2 | 84.4 | 85.1 |
| 0<£200 | 89.3 | 90.9 | 90.0 |
| £200<£1000 | 94.9 | 94.0 | 95.6 |
| £1000+ | 96.2 | 95.3 | 95.1 |
| | | | |
| **Females** | | | |
| 0 | 63.6 | 72.6 | 74.3 |
| 0<£200 | 70.8 | 80.5 | 80.1 |
| £200<£1000 | 71.6 | 83.1 | 85.2 |
| £1000+ | 69.4 | 84.0 | 81.2 |

**Note:** no 'active' assets denote asset holdings below the minimum cut-offs defined in Section 3. Assets are valued in 1981 prices.

MODELLING THE IMPACT OF ASSET-HOLDINGS ON EMPLOYMENT PROBABILITIES

Modelling the potential impact of assets on the probability of being in employment raises some statistical challenges because the outcome variable is binary (or possibly multinomial). This means that standard instrumental variable models cannot be estimated and it is necessary to program maximum likelihood models to estimate treatment effects models. To estimate the impact of asset holding on employment probabilities we estimate simple probit models where we ignore the potential endogeneity of the asset variable. Then to address the endogeneity issue we estimate treatment effects models (bivariate probit models; where the joint distribution is estimated).

Most of the control variables we use and the variables used to identify the asset model are the same as those used in the earnings models in Section 6.1. The exceptions are that in the employment equation we exclude variables relating to

the type of employment which were important in estimating the level of earnings but are inappropriate in the model of employment probability (sector of employment, full/part-time employment).

The estimates from the statistical models for the probability of being in work at age 33 are in Table 10 and age 42 in Table 11. The results from the simple probit models suggest that overall asset holding at age 23 has a positive effect (association) with employment at age 33 for men. The marginal effect (evaluated at sample means) suggest that this amounts to a 5% increase in the probability of working for men with similar education, family circumstances, ethnicity and social class background characteristics. The can be interpreted as follows: if the probability of being in employment at age 33 was 87% for individuals without an asset (as for men in Table 9) the positive effect of the asset would, on average, increase this probability to 91%. The positive relationship between assets and employment outcomes increases with the size of the asset held.

For women, overall we do not find a statistically significant asset effect, but the more detailed breakdown of asset levels reveals that compared with women with no assets at age 23, women with assets up to £200 and between £200 and £1,000 have a 5-6% increased probability of working at age 33. Reflecting the findings in the raw data, women with higher value assets (>£1,000 in 1981) are no more likely to be in employment at age 33 than women with no assets.

Estimates from the treatment effects model for the binary model of assets suggests a significant positive effect for men. Rho is an estimate of the correlation between the residuals in the two equations (assets, employment). Here rho is negative and statistically significant which suggests that there is a variable not included in the model that increases the probability of holding an asset but reduced the probability of being in employment. It suggests that the probit model estimates will be biased downwards. The marginal effect estimate suggests an asset-effect of 27% which looks high and may indicate problems with the model specification. The effect for women is not statistically significant.

The treatment effects model estimates where different levels of assets at age 23 are identified shows that once potential endogeneity in the asset variable is explicitly modelled there are no significant differences between women with no assets and women with the three levels of assets identified, in terms of their employment probability at age 33. Rho is negative and statistically insignificant which suggests that the probit model underestimates the true asset-effect. For men higher levels of assets are found to have a positive effect on the probability of being in employment at age 33.

**Table 10: Asset effect employment estimates age 33: Raw, probit and treatment effects model estimates**

| | Raw diff | probit | | TE | | |
|---|---|---|---|---|---|---|
| | | β | ME | β | ME | rho |
| **Males** | | | | | | |
| 'Active' asset 23 | 0.098 | **0.406** | **0.051** | **1.486** | **0.271** | **-0.696** |
| | | (0.000) | | (0.000) | | (0.000) |
| Grouped 23 | | | | | | |
| 0<£200 | 0.061 | 0.135 | 0.016 | **0.660** | | **-0.677** |
| | | (0.057) | | (0.000) | | (0.000) |
| £200<£1,000 | 0.127 | **0.439** | **0.047** | **1.132** | | |
| | | (0.000) | | (0.000) | | |
| £1,000+ | 0.143 | **0.524** | **0.057** | **2.057** | | |
| | | (0.000) | | (0.000) | | |
| **Female**s | | | | | | |
| 'Active' asset 23 | 0.046 | 0.012 | 0.004 | 0.131 | 0.046 | -0.074 |
| | | (0.760) | | (0.730) | | (0.682) |
| Grouped 23 | | | | | | |
| 0<£200 | 0.113 | **0.168** | **0.057** | 0.146 | | 0.021 |
| | | (0.001) | | (0.396) | | (0.895) |
| £200<£1,000 | 0.125 | **0.146** | **0.050** | 0.108 | | |
| | | (0.008) | | (0.707) | | |
| £1,000+ | 0.091 | 0.059 | 0.021 | 0.002 | | |
| | | (0.326) | | (0.997) | | |

**Notes:** p-values are shown in parenthesis. Marginal effects (ME) are evaluated at sample means. Assets are valued in 1981 prices. 'Active' assets denote asset holdings above the minimum cut-offs defined in Section 3.

We also find significant positive effects of assets held at age 23 and 33 on employment probabilities at age 42 (Table 11). The treatment effects model estimates are positive and significant. However the marginal effects estimates seem implausibly high for women, age 23 and age 33 assets, and for men with assets at age 33 and further analysis of these results is warranted. These asset effects are generally greater for higher asset values. Rho is negative and statistically insignificant which suggests that the probit model estimates underestimate the true asset-effect

For men, the treatment effect model estimates show that the relationship between assets held at age 33 and employment at age 42 is greater than that between assets held at age 23 and employment at age 42, in the raw data and in

the three models estimated. This is not the case for women in the simple probit model estimates. Overall there appears to be a clear gradient between the level of assets held and later employment probabilities that is stronger for men. Although for assets greater than £1,000 at age 33 are not associated with the highest asset-effect.

**Table 11: Asset effect employment estimates age 42: Raw, probit and treatment effects model estimates**

| | Raw | probit | | TE | | |
|---|---|---|---|---|---|---|
| | diff | β | ME | β | ME | rho |
| **Males** | | | | | | |
| 'Active' asset 23 | 0.075 | **0.203** | **0.025** | **0.921** | **0.138** | **-0.459** |
| | | (0.001) | | (0.041) | | (0.039) |
| 'Active' asset 33 | 0.095 | **0.319** | **0.039** | **1.505** | **0.306** | **-0.724** |
| | | (0.000) | | (0.000) | | (0.000) |
| Grouped 23 | | | | | | |
| 0<£200 | 0.078 | **0.217** | **0.025** | **0.440** | | -0.242 |
| | | (0.003) | | (0.021) | | (0.245) |
| £200<£1,000 | 0.114 | **0.292** | **0.033** | **0.678** | | |
| | | (0.000) | | (0.033) | | |
| £1,000+ | 0.129 | **0.346** | **0.037** | **0.973** | | |
| | | (0.000) | | (0.063) | | |
| Grouped 33 | | | | | | |
| 0<£200 | 0.058 | 0.108 | 0.012 | **0.509** | | **-0.577** |
| | | (0.186) | | (0.000) | | (0.004) |
| £200<£1,000 | 0.124 | **0.438** | **0.042** | **1.031** | | |
| | | (0.000) | | (0.000) | | |
| £1,000+ | 0.117 | **0.317** | **0.035** | **1.491** | | |
| | | (0.000) | | (0.000) | | |
| **Females** | | | | | | |
| 'Active' asset 23 | 0.069 | **0.106** | **0.029** | **1.276** | **0.371** | **-0.747** |
| | | (0.017) | | (0.000) | | (0.000) |
| 'Active' asset 33 | 0.079 | 0.078 | 0.021 | **1.528** | **0.489** | **-0.908** |
| | | (0.075) | | (0.000) | | (0.000) |
| Grouped 23 | | | | | | |
| 0<£200 | 0.108 | **0.162** | **0.043** | **0.606** | | **-0.485** |
| | | (0.004) | | (0.000) | | (0.001) |
| £200<£1,000 | 0.145 | **0.196** | **0.051** | **0.978** | | |
| | | (0.001) | | (0.000) | | |
| £1,000+ | 0.156 | **0.217** | **0.056** | **1.464** | | |
| | | (0.001) | | (0.000) | | |
| Grouped 33 | | | | | | |
| 0<£200 | 0.078 | **0.156** | **0.041** | **0.578** | | **-0.589** |
| | | (0.011) | | (0.000) | | (0.001) |
| £200<£1,000 | 0.148 | **0.276** | **0.070** | **0.944** | | |
| | | (0.000) | | (0.000) | | |
| £1,000+ | 0.093 | 0.063 | 0.017 | **1.289** | | |
| | | (0.253) | | (0.000) | | |

**Notes:** p-values are shown in parenthesis. Marginal effects (ME) are evaluated at sample means. Assets are valued in 1981 prices. 'Active' assets denote asset holdings above the minimum cut-offs defined in Section 3.

### *6.3 General health and asset holding*

Assets may also have an impact on general health through allowing an individual to pursue a healthier lifestyle in terms living environment, diet (although more likely to be linked to income), access to sports facilities, holidays and medical services, etc., and the extent to which a sense of well-being associated with a more favourable asset position influences self-reported general health. In this section we examine the relationship between asset holding and individuals' self-reported general health. NCDS respondents were asked at age 33 and 42 about their general health. '*How would you describe your health generally? Would you say it is: excellent, good, fair or poor?*' We have chosen to focus on the probability of respondents reporting excellent general health. In the raw statistics shown in Table 12 it is clear to see that asset holding is always associated with a greater probability of reporting excellent general health relative to the lack of assets. In addition, higher assets are almost always associated with higher probabilities of reporting excellent general health.

**Table 12: Self-reported 'excellent' general health: percent within asset groups**

| | **Age 23 assets** | | **Age 33 assets** |
|---|---|---|---|
| | **Age 33 Excellent** | **Age 42 Excellent** | **Age 42 Excellent** |
| **Males** | | | |
| no 'active' asset | 34.0 | 27.4 | 26.3 |
| asset | 39.2 | 34.3 | 34.3 |
| | | | |
| **Females** | | | |
| no 'active' asset | 28.4 | 25.0 | 25.1 |
| asset | 38.8 | 35.0 | 34.0 |
| | | | |
| **Males** | | | |
| 0 | 34.9 | 27.2 | 25.4 |
| 0<£200 | 33.1 | 27.8 | 28.6 |
| £200<£1000 | 36.6 | 31.6 | 28.9 |
| £1000+ | 42.4 | 37.3 | 36.7 |
| | | | |
| **Females** | | | |
| 0 | 26.9 | 23.8 | 23.8 |
| 0<£200 | 29.4 | 26.1 | 27.0 |
| £200<£1000 | 35.5 | 34.0 | 31.4 |
| £1000+ | 43.5 | 36.3 | 35.7 |

**Notes:** no 'active' assets denote asset holdings below the minimum cut-offs defined in Section 3. Assets are valued in 1981 prices.

As with earnings and employment it is certainly possible that what looks like a relative advantage among asset-holders could be due to other individual characteristics that both increase the likelihood that an individual is holding an asset at age 23 or age 33 and the probability of reporting excellent general health. To try and isolate the asset-effect, as above, we employ a number of modelling strategies.

Modelling the probability of reporting excellent general health at 33 or 42 using a probit specification allows us to control for a range of variables that may directly affect general health and which are also correlated with asset holding. Table 13 shows the results from this model for general health at age 33.

The probit model and the treatment effects model estimates suggest that for men, when other characteristics have been controlled for, asset-holding at age 23 is weakly associated with an increase in self-reported excellent general health at age 33 of 2.4%; this is only significant at the 10% level (Table 13). The results from the treatment effects model which takes into account endogenous selection, while greater than the probit model estimates, are also only weakly significant (at the 7% level). Rho ($\rho$) measures the correlation between the residuals in the two equations (asset-holding, excellent general health). The negative sign of rho suggests that there is a variable not included in the model that increases the probability of asset-holding and reduces the probability of excellent general health. This leads to a downward bias in the simple probit equation. Assuming that the marginal effect from the TE model is significant, this can be interpreted as: if the probability of excellent general health was 34% (as in the raw data for this group, see Table 12) at age 33 among those without assets at age 23 this would increase to 41% should these individuals have had assets at age 23, holding everything else constant. The results for women can be interpreted in a similar way. The marginal effect of asset-holding are higher (as in the raw data) for women than men. Results from the treatment effects model suggest that asset-holding at age 23 increases excellent general health by 27%.

When we examine the different levels of assets we see find no statistically significant effects for men at the 5% level of significance. Assets £1,000 or more at age 23 are significant only at the 10% level for men – 21% higher than no assets in the raw data, 3.7% higher in the simple probit model. The estimated effects from the TE model are not statistically significant. For women assets over £200 are associated with higher excellent general health in the raw data, the simple probit model and the treatment effects model. The sign and significance of rho indicates that the probit model estimates are biased towards zero.

Overall at age 33 there is little evidence of an asset-effect on self-reported excellent general health for men in contrast to a positive asset-effect for women.

**Table 13: Asset effect general health (excellent) estimates age 33: Raw, probit and treatment effects model estimates**

| | raw | probit | | TE | | |
|---|---|---|---|---|---|---|
| | diff | β | ME | β | ME | rho |
| **Males** | | | | | | |
| 'Active' asset 23 | 0.153 | 0.064 | 0.024 | 0.591 | 0.220 | **-0.335** |
| | | (0.099) | | (0.071) | | (0.045) |
| Grouped 23 | | | | | | |
| 0<£200 | -0.052 | -0.064 | -0.024 | 0.138 | | -0.207 |
| | | (0.247) | | (0.413) | | (0.209) |
| £200<£1,000 | 0.048 | -0.019 | -0.007 | 0.328 | | |
| | | (0.732) | | (0.236) | | |
| £1,000+ | 0.214 | 0.097 | 0.037 | 0.643 | | |
| | | (0.092) | | (0.132) | | |
| **Females** | | | | | | |
| 'Active' asset 23 | 0.365 | **0.166** | **0.060** | **0.744** | **0.268** | **-0.366** |
| | | (0.000) | | (0.008) | | (0.023) |
| Grouped 23 | | | | | | |
| 0<£200 | 0.092 | 0.014 | 0.005 | **0.349** | | **-0.329** |
| | | (0.800) | | (0.033) | | (0.040) |
| £200<£1,000 | 0.318 | **0.112** | **0.041** | **0.688** | | |
| | | (0.043) | | (0.010) | | |
| £1,000+ | 0.614 | **0.276** | **0.103** | **1.157** | | |
| | | (0.002) | | (0.004) | | |

**Notes:** p-values are shown in parenthesis. Marginal effects (ME) are evaluated at sample means. Assets are valued in 1981 prices. 'Active' assets denote asset holdings above the minimum cut-offs defined in Section 3.

Interestingly by age 42 we find that holding an asset at age 23 does have a positive effect on men reporting excellent general health (around 4%) in the simple probit model (see Table 14) and a similar effect between asset holding at age 33 and general health at age 42. However, the treatment effects model results suggest that there are no statistically significant effects and the estimates of rho suggest that there is not a statistically significant correlation in the residuals of the two equations (asset holding, excellent general health). This suggests that the simple probit model estimates are unbiased. This is in contrast to the results for women where we find positive and statistically significant

asset effects on general health at age 42 in relation to assets held at age 23 and age 33. 40% in the raw data, 6% in the simple probit model and 20% in the treatment effects model for age 23 assets and 36%, 5% and 33% respectively for age 33 assets.

The results from the grouped asset models show that for men assets below £1,000 (in 1981 prices) do not have a statistically significant effect on self-reported excellent general health. Assets over £1,000 have a positive and statistically significant effect (around 6%). For women, assets over £200 have a positive and statistically significant effect and the effects are larger for those with over £1,000. Even assets up to £200 (in 1981 prices) at age 23 and 33 have positive and significant effects on women's self-reported excellent general health at age 42 in the treatment effects models.

**Table 14: Asset effect general health (excellent) estimates age 42: Raw, probit and treatment effects model estimates**

| | raw | probit | | TE | | |
|---|---|---|---|---|---|---|
| | | β | ME | β | ME | rho |
| **Males** | | | | | | |
| 'Active' asset 23 | 0.249 | **0.105** | **0.037** | 0.332 | 0.116 | -0.144 |
| | | (0.010) | | (0.273) | | (0.345) |
| 'Active' asset 33 | 0.305 | **0.116** | **0.041** | 0.463 | 0.158 | -0.221 |
| | | (0.005) | | (0.314) | | (0.280) |
| Grouped 23 | | | | | | |
| 0<£200 | 0.022 | -0.008 | -0.003 | 0.089 | | -0.099 |
| | | (0.895) | | (0.556) | | (0.488) |
| £200<£1,000 | 0.163 | 0.043 | 0.015 | 0.210 | | |
| | | (0.458) | | (0.396) | | |
| £1,000+ | 0.373 | **0.160** | **0.057** | 0.424 | | |
| | | (0.007) | | (0.269) | | |
| Grouped 33 | | | | | | |
| 0<£200 | 0.127 | 0.046 | 0.017 | 0.260 | | -0.250 |
| | | (0.451) | | (0.134) | | (0.194) |
| £200<£1,000 | 0.140 | 0.024 | 0.009 | 0.355 | | |
| | | (0.691) | | (0.168) | | |
| £1,000+ | 0.445 | **0.170** | **0.060** | 0.732 | | |
| | | (0.001) | | (0.080) | | |
| | | | | | | |
| Females | | | | | | |
| 'Active' assets 23 | 0.400 | **0.166** | **0.057** | **0.572** | **0.197** | -0.256 |
| | | (0.000) | | (0.022) | | (0.079) |
| 'Active' asset 33 | 0.358 | **0.139** | **0.048** | **0.991** | **0.332** | **-0.545** |
| | | (0.000) | | (0.000) | | (0.000) |
| Grouped 23 | | | | | | |
| 0<£200 | 0.095 | -0.007 | -0.002 | **0.272** | | **-0.271** |
| | | (0.898) | | (0.073) | | (0.054) |
| £200<£1,000 | 0.427 | **0.152** | **0.053** | **0.629** | | |
| | | (0.007) | | (0.010) | | |
| £1,000+ | 0.527 | **0.169** | **0.059** | **0.907** | | |
| | | (0.006) | | (0.014) | | |
| Grouped 33 | | | | | | |
| 0<£200 | 0.135 | 0.061 | 0.021 | **0.397** | | **-0.389** |
| | | (0.297) | | (0.001) | | (0.003) |
| £200<£1,000 | 0.320 | **0.142** | **0.050** | **0.658** | | |
| | | (0.013) | | (0.000) | | |
| £1,000+ | 0.500 | **0.185** | **0.064** | **1.040** | | |
| | | (0.000) | | (0.000) | | |

**Notes:** p-values are shown in parenthesis. Model estimates statistically significant at the 5% level shown in bold. Marginal effects (ME) are evaluated at sample means. Assets are valued in 1981 prices. 'Active' assets denote asset holdings above the minimum cut-offs defined in Section 3.

### *6.4 The relationship between Malaise and asset holding*

The Malaise Inventory (Rutter et al, 1970), as explained in Section 4 above, is a set of self-completion questions asked at various ages in the NCDS (age 23, 33 and 42). These questions combine to measure levels of psychological distress, or depression. There are 24 questions to which the respondent is required to answer 'yes-no' (Appendix C). The inventory covers emotional disturbance and associated physical symptoms. By simply summing the 'yes' answers (where yes=1 and no=0) the total scores range from 0 to 24. Individuals responding 'yes' to eight or more of the 24 items are considered to be at risk of depression (Rodgers et al., 1999); here we shall simply refer to this as Malaise. A considerable amount of validation has been undertaken and it is now widely used in social and medical sciences (Rodgers et al., 1999).

The raw correlations between Malaise and asset holdings shown in Table 15 show that a lower proportion of men and women who held an asset at age 23 reported Malaise age 33 or 42 compared to those without assets. At age 33 the proportion reporting Malaise was around half for those with an asset at age 23. Similarly asset holding at age 33 was associated with a lower proportion of men and women reporting Malaise at age 42 compared with those without assets. When we look at the size of the asset held, Malaise declines monotonically, across the four asset groups considered, as the size of the asset held increases.

**Table 15: Malaise (8-24): percent within asset group**

| | Age 23 assets | | Age 33 assets |
|---|---|---|---|
| | Age 33 Malaise | Age 42 Malaise | Age 42 Malaise |
| **Males** | | | |
| no 'active' asset | 6.2 | 12.3 | 12.0 |
| 'active' asset | 2.8 | 7.8 | 8.1 |
| **Females** | | | |
| no 'active' asset | 11.6 | 18.3 | 19.2 |
| 'active' asset | 5.5 | 11.6 | 11.7 |
| **Males** | | | |
| 0 | 7.3 | 14.9 | 13.4 |
| 0<£200 | 5.3 | 10.1 | 10.4 |
| £200<£1000 | 2.9 | 7.9 | 9.2 |
| £1000+ | 2.6 | 7.7 | 7.4 |
| **Females** | | | |
| 0 | 13.5 | 21.5 | 20.9 |
| 0<£200 | 10.0 | 15.8 | 17.3 |
| £200<£1000 | 6.1 | 12.6 | 12.2 |
| £1000+ | 4.6 | 10.3 | 10.9 |

**Notes:** 'active' assets denote asset holdings above the minimum cut-offs defined in Section 3. Assets are valued in 1981 prices.

The regression results shown in Table 16 show that the negative association between asset-holding and Malaise (individuals with assets are less likely to suffer from Malaise) at age 33 remains after a range of control variables have been included in a simple probit regression modelling the probability of reporting Malaise at age 33. The results from the grouped asset values supports our decision to exclude small levels of assets from our binary asset variable as assets less than £200 have no significant effect on Malaise. The marginal effect estimates from the simple probits (evaluated at sample means) suggest that overall assets are associated with 1.4% lower probability of reported Malaise for men and 1.7% for women. The treatment effect model estimates are not statistically significant for men (nor is rho) but is for women. The estimate for women suggests that asset-holding at 23 reduces the probability of Malaise by 23%. Rho, which measures the correlation between the residuals in the two equations (asset-holding, Malaise), is positive and significant, which suggests that there is a variable not included in the model that is positively related to

asset-holding and Malaise. This leads to a bias towards zero in the probit coefficient estimate and therefore leads to an underestimate of the negative effect of asset-holding on Malaise.

**Table 16: Asset effect Malaise (8-24) estimates age 33: Raw, probit and treatment effects model estimates**

| | Raw | probit | | TE | | |
|---|---|---|---|---|---|---|
| | | β | ME | β | ME | rho |
| **Males** | | | | | | |
| 'Active' asset 23 | -0.553 | **-0.200** | **-0.014** | -0.393 | -0.028 | 0.122 |
| | | (0.008) | | (0.352) | | (0.646) |
| Grouped 23 | | | | | | |
| 0<£200 | -0.276 | -0.091 | -0.006 | -0.214 | | 0.128 |
| | | (0.317) | | (0.384) | | (0.590) |
| £200<£1,000 | -0.600 | **-0.240** | **-0.015** | -0.453 | | |
| | | (0.019) | | (0.256) | | |
| £1,000+ | -0.640 | **-0.260** | **-0.016** | -0.600 | | |
| | | (0.020) | | (0.347) | | |
| **Females** | | | | | | |
| 'Active' asset 23 | -0.527 | **-0.132** | **-0.017** | **-1.308** | **-0.231** | **0.918** |
| | | (0.028) | | (0.000) | | (0.000) |
| Grouped 23 | | | | | | |
| 0<£200 | -0.257 | -0.055 | -0.007 | **-0.591** | | **0.606** |
| | | (0.429) | | (0.000) | | (0.004) |
| £200<£1,000 | -0.550 | -0.152 | -0.018 | **-1.084** | | |
| | | (0.057) | | (0.000) | | |
| £1,000+ | -0.656 | **-0.182** | **-0.021** | **-1.700** | | |
| | | (0.053) | | (0.000) | | |

**Notes:** p-values are shown in parenthesis. Model estimates statistically significant at the 5% level shown in bold. Marginal effects (ME) are evaluated at sample means. Assets are valued in 1981 prices. 'Active' assets denote asset holdings above the minimum cut-offs defined in Section 3.

For women, higher asset values at age 23 are associated with lower probabilities of reported Malaise at age 33. Assets with a value less than £200 (in 1981) have no statistically significant effect on Malaise at age 33.

The treatment effects model estimates suggest that when endogeneity is taken into account, the level of asset-holding is not statistically significantly related to variation in Malaise at age 33 for men. In contrast, a clear significant negative gradient is evident for women (higher levels of assets are associated with lower probabilities of Malaise). In the treatment effects model rho is

insignificant for men but positive and significant in the model estimate for women.

The relationship between asset holding at age 23 and Malaise age 42 is lower in the raw data for men but the marginal effect estimates from the simple probit model and the treatment effects model show larger statistically significant effects (Table 17). The estimate of rho is positive and statistically significant demonstrating a positive correlation between the residuals in the two equations (asset-holding, Malaise). For women, the simple probit model estimates a non-significant relationship between asset holding and Malaise but the treatment effects model estimate shows a strong significant negative effect.

For men the results from the grouped asset variable show some variation between the size of the asset held at age 23 and Malaise at age 42 although it is not monotonic. Despite higher recorded levels of Malaise among women and higher Malaise at age 42 compared with age 33, asset holding at age 23 is not associated with lower Malaise at age 42 in the simple probit model at any of the asset levels. However, the treatment effects model estimates which correct for endogeneity show a significant negative influence of assets on Malaise and a clear gradient with higher levels of assets leading to greater reductions in the probability of Malaise at age 42. The model estimate of rho is positive and significant.

The relationship between asset holding at age 33 and Malaise at age 42 is not significant for men in the probit model but the treatment effects model estimates a negative relationship between assets and Malaise. The marginal effect is estimated to be a reduction of 17%. This can be interpreted as follows: if the probability of Malaise at 42 among men without an asset is 12% (as in Table 15) an asset at age 33, above the minimum cut-off, would, on average, reduce this probability to 10%. There is also a statistically significant negative effect of assets at age 33 on Malaise at age 42 for women in the treatment effects model but not in the simple probit model. For women the effect is greater with a marginal effect estimate of 32%.

There is no statistically significance effect of assets on Malaise at age 42 for the different levels of assets at age 33 for men in the simple probit model estimates but the treatment effect model estimates a significant negative gradient, with high levels of assets having a stronger negative influence on Malaise. For women, the simple probit model estimates a negative effect of assets over £200 (in 1981 prices) at age 33. The treatment effect model estimates a statistically significant negative relationship between asset levels and Malaise.

**Table 17: Asset effect Malaise (8-24) estimates age 42: Raw, probit and treatment effects model estimates**

| | Raw | probit | | TE | | |
|---|---|---|---|---|---|---|
| | | β | ME | β | ME | rho |
| **Males** | | | | | | |
| 'Active' asset 23 | -0.364 | -0.104 | -0.016 | -0.641 | -0.108 | **0.340** |
| | | (0.066) | | (0.075) | | (0.070) |
| 'Active' asset 33 | -0.324 | -0.035 | -0.005 | **-0.850** | **-0.166** | **0.493** |
| | | (0.576) | | (0.000) | | (0.002) |
| Grouped 23 | | | | | | |
| 0<£200 | -0.324 | **-0.152** | **-0.022** | -0.393 | | 0.273 |
| | | (0.039) | | (0.097) | | (0.306) |
| £200<£1,000 | -0.471 | **-0.203** | **-0.029** | -0.671 | | |
| | | (0.009) | | (0.101) | | |
| £1,000+ | -0.487 | **-0.165** | **-0.024** | -0.911 | | |
| | | (0.044) | | (0.178) | | |
| Grouped 33 | | | | | | |
| 0<£200 | -0.227 | -0.074 | -0.011 | **-0.452** | | **0.510** |
| | | (0.404) | | (0.000) | | (0.002) |
| £200<£1,000 | -0.317 | -0.041 | -0.006 | **-0.649** | | |
| | | (0.639) | | (0.000) | | |
| £1,000+ | -0.448 | -0.127 | -0.019 | **-1.235** | | |
| | | (0.110) | | (0.000) | | |
| | | | | | | |
| Females | | | | | | |
| 'Active' asset 23 | -0.365 | -0.055 | -0.012 | **-0.962** | **-0.225** | **0.646** |
| | | (0.266) | | (0.010) | | (0.005) |
| 'Active' asset 33 | -0.394 | -0.085 | -0.018 | **-1.219** | **-0.321** | **0.862** |
| | | (0.103) | | (0.000) | | (0.000) |
| Grouped 23 | | | | | | |
| 0<£200 | -0.263 | -0.065 | -0.014 | **-0.468** | | **0.421** |
| | | (0.292) | | (0.008) | | (0.039) |
| £200<£1,000 | -0.415 | -0.083 | -0.017 | **-0.791** | | |
| | | (0.214) | | (0.010) | | |
| £1,000+ | -0.522 | -0.112 | -0.023 | **-1.264** | | |
| | | (0.141) | | (0.010) | | |
| Grouped 33 | | | | | | |
| 0<£200 | -0.170 | -0.072 | -0.015 | **-0.456** | | **0.499** |
| | | (0.312) | | (0.001) | | (0.010) |
| £200<£1,000 | -0.416 | **-0.141** | **-0.028** | **-0.748** | | |
| | | (0.052) | | (0.000) | | |
| £1,000+ | -0.479 | **-0.130** | **-0.027** | **-1.214** | | |
| | | (0.049) | | (0.001) | | |

**Notes:** p-values are shown in parenthesis. Model estimates statistically significant at the 5% level shown in bold. Marginal effects (ME) are evaluated at sample means. Assets are valued in 1981 prices. 'Active' assets denote asset holdings above the minimum cut-offs defined in Section 3.

# 7. Conclusions

There is a strong incentive for individuals to accumulate financial assets as they play a number of important functions in terms of financial well-being. Assets allow individuals to smooth income by drawing down on savings during times when income falls; which might be due to the loss of employment or when expenditure rises such as following the birth of a baby. Assets allow individuals to pay for large items of expenditure without turning to the credit market such as the purchase of a car, to fund training schemes and education, covering the cost of home improvements or to pay for a holiday. Savings can also provide a deposit for the purchase of a house or to cover the start-up costs of a business. Asset-holding provides individuals with a sense of security that during times of need they would have an asset to draw upon and this has a positive effect on emotional well-being.

The benefits of saving and asset-holding for these purposes are obvious and have long been recognised. In more recent times claims have been made that there is a wider 'asset-effect' which leads to a positive impact on a range of outcomes. This means that asset-poor individuals are doubly disadvantaged. This has been used to support a range of policy initiatives that have collectively become known as 'asset-based welfare' which is seen by some as an expanded vision of poverty alleviation. These policies have primarily focused on addressing asset poverty through matched savings schemes and savings vehicles designed to encourage savings among those on a low income. The other main policy has focused on schemes that encourage parents to save on behalf of their children. Some of these schemes include contributions made by government (such was the case with the Child Trust Fund) and some have matched savings and all allow for tax-free savings (usually with a cap) on the behalf of children. Once children reach maturity they can access these accounts and start adult life with an asset.

However, beyond simple correlations which suggest that individuals with assets have better outcomes compared with individuals without assets there is very little hard statistical evidence of an asset-effect. In this study we have tried to go further than previous research in identifying an asset-effect. We have used a very rich longitudinal data source, the National Child Development Study, which allows us to look at the asset position of individuals at one point in time and map these individuals to various outcomes in later life. As the individuals in this survey have been tracked since birth we are able to control for important differences between individuals in terms of their ability and desire to accumulate assets in the first place, characteristics which it is fair to assume are also related to the outcomes of interest, to try and isolate a pure asset-effect. We have used various statistical techniques to control for differences between individuals with and without assets as well as between individuals with higher and lower asset accumulations, particularly those

characteristics which could lead to a bias in any measured asset-effect. For example, individuals with more privileged family backgrounds may be more likely to have a financial asset and have improved outcomes. Without controlling for differences in family background it would appear that it is the asset that is leading to the improved outcome but this may not be the case. We go one step further than this through considering the possibility that individuals' choice to accumulate an asset is influenced by what benefits they believe an asset would provide them with and these benefits may include the outcome variables we are interested in. In this sense individuals self-select and this selection provides a number of analytical problems when it comes to identifying an asset-effect, particularly where the presence of assets is endogenous. To make this more of a challenge, individuals most likely to benefit from asset-holding, in terms of our outcome variables, may be those who choose to accumulate financial assets.

Four different outcomes have been assessed: wages, employment, general health and Malaise. We find evidence of a significant asset-effect in all four domains (although limited effects on general health and Malaise for men). We also find evidence that individuals self-select and that the decision to hold assets is endogenous in many cases. This leads to bias in simple OLS and probit estimates of the asset effect. However, there is some evidence that the identification required to estimate the causal effect of assets on these four outcomes is challenging and clearly more work can and should be done. However, bearing all of this in mind the conclusion is that assets have positive effects on wages, employment prospects, excellent general health and in reducing Malaise. These assets do not need to be large in size although higher assets are generally associated with improved outcomes. The evidence supports the basis for asset-based welfare policies, but it is not possible to assess whether improvements in these four domains could be more efficiently achieved through other policies or if the route through which an individual accumulates an asset is important.

While we don't yet have a complete table of marginal effects (treatment effects) for all outcomes and asset levels the final table (Table 18) summarises our preferred estimates of asset-effects across the four domains (wages, employment, general health, Malaise). These estimates are drawn from the treatments effects models where asset-holding was found to be endogenous or from the simple OLS/probit models where endogeneity was insignificant.

The key findings are:

- Asset holding at age 23 improves employment and wage prospects of women at age 33 and age 42. Assets do not need to be large to have a positive significant effect but higher value assets generally lead to better outcomes. Assets under £200 in 1981 (equivalent to £600 in 2010) put

women in a more favourable position compared to women with no savings or investments.

- There is some evidence for this cohort of women that higher value assets at age 23 were associated with a decision not to work at age 33.
- Asset holding at age 33 for women also lead to statistically significant improvements in wages and employment at age 42.
- For men, assets held above the minimum defined thresholds at age 23 led to positive wage effects at age 33 and age 42. For men assets needed to be as high as £1,000 in 1981 (£3,000 in 2010) to have a statistically significant effects on wages.
- Assets improve the employment prospects for men at age 33 and age 42. The asset effects appear stronger at age 33 than age 42 for assets held at age 23 but assets held at age 33 have strong positive effects on employment probabilities at age 42.
- We find significant asset effects on self-reported general health and Malaise at age 33 (for assets held at age 23) and age 42 (for assets held at age 23 and age 33) for women. Assets increase the probabilities of women reporting excellent general health and decrease the probability of Malaise. There is evidence that assets needed to be greater than £200 in 1981 (£600 in 2010) for the asset to have an effect on women's health outcomes.
- For men, asset holding (greater than £1,000 in 1981; £3,000 in 2010) at age 23 increases the probability of reporting excellent general health at age 33 and age 42, and age 33 assets on age 42 general health. However, lower levels of assets have the effect of reducing Malaise probabilities at age 33 and age 42. It appears overall that the effect of assets on general health and Malaise is stronger for women than for men.

**Table 18: Estimated asset-effects – preferred estimates**

| | Employment outcomes | | | | Health outcomes | | | |
|---|---|---|---|---|---|---|---|---|
| | Wages/33 | Wages/42 | Emp/33 | Emp/42 | GH/33 | GH/42 | Mal/33 | Mal/42 |
| MEN | | | | | | | | |
| **Age 23 assets** | | | | | | | | |
| Active asset | 4.2% | 3.2% | 27.1% | 13.8% | NS(2.4%) | NS(3.7%) | -1.4% | NS(-10.8%) |
| 0<£200 | NS | NS | NS | 2.5% | NS | NS | NS | -2.2% |
| £200<£1000 | NS(3.0%) | NS | 4.7%** | 3.3% | NS | NS | -1.5% | -2.9% |
| £1000+ | 6.6% | NS(5.4%) | 5.7%** | 3.7% | NS(3.7%) | NS(5.7%) | -1.6% | -2.4% |
| **Age 33 assets** | | | | | | | | |
| Active asset | N/A | 7.8% | N/A | 30.6% | N/A | NS(4.1%) | N/A | -16.6% |
| 0<£200 | N/A | -ve | N/A | +ve | N/A | NS | N/A | -ve |
| £200<£1000 | N/A | NS | N/A | 4.2%** | N/A | NS | N/A | -ve |
| £1000+ | N/A | 15.6%* | N/A | 3.5%** | N/A | 6.0% | N/A | -ve |
| WOMEN | | | | | | | | |
| **Age 23 assets** | | | | | | | | |
| Active asset | 5.2% | -1.2% | NS | 37.1% | 26.8% | 19.7% | -23.1% | -22.5% |
| 0<£200 | 5.7%* | 6.8% | 5.7% | 4.3%** | +ve | +ve | -ve | -ve |
| £200<£1000 | 10.4%* | 7.4% | 5.0% | 5.1%** | 4.1%** | 5.3%** | -ve | -ve |
| £1000+ | 11.0%* | NS(4.6%) | NS | 5.6%** | 10.3%** | 5.9%** | -2.1%** | -ve |
| **Age 33 assets** | | | | | | | | |
| Active asset | N/A | 7.6% | N/A | 48.9% | N/A | 33.2% | N/A | -32.1% |
| 0<£200 | N/A | NS | N/A | 4.1%** | N/A | +ve | N/A | -ve |
| £200<£1000 | N/A | 11.7%* | N/A | 7.0%** | N/A | 5.0%** | N/A | -2.8%** |
| £1000+ | N/A | 12.6%* | N/A | +ve | N/A | 6.4%** | N/A | -2.7%** |

**Notes:** N/A not applicable. NS not statistically significant at the 5% level. Percentages shown in parenthesis are significant at the 10% level.
** indicates estimates from the simple OLS/probit models where marginal effects are not available from the treatment effects models which we believe under-estimate the true asset-effect.
* indicates estimates from the simple OLS/probit models where marginal effects are not available from the treatment effects models which we believe over-estimate the true asset-effect.
+ve/-ve are used to denote positive/negative statistically significant effects where marginal effects are not available.

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## Appendix A: Description of the data

| | Survey Information | Total No. | Male (%) | Female (%) |
|---|---|---|---|---|
| Respondents | 1981 Survey | 12,537 | 50.0 | 50.0 |
| | 1991 Survey | 11,405 | 49.2 | 50.8 |
| | 2000 Survey | 11,417 | 49.3 | 50.7 |
| Attrition | In 1974 & not in 1991 | 3,401 | 31.4 | 24.6 |
| | In 1974 & not in 2000 | 3,417 | 31.5 | 24.9 |
| Missing assets | In 1991 missing 1981 assets* | 1,660 | 15.8 | 13.3 |
| | In 2000 missing 1981 assets* | 1,786 | 17.1 | 14.2 |
| **23 yrs old** | **Demographic Profile** | (%) | (%) | (%) |
| Ethnicity (1981) | White | 75.8 | 73.3 | 78.4 |
| | Non-White | 1.5 | 1.6 | 1.4 |
| | Missing | 22.7 | 25.1 | 20.2 |
| Ethnicity (1991) | White | 97 | 96.8 | 97.2 |
| | Non-White | 2.2 | 2.3 | 2.1 |
| | Missing | 0.8 | 0.9 | 0.7 |
| Social Background (Father's Social class in 1958) | Professional | 4.1 | 4.2 | 4.1 |
| | Intermediate | 12.1 | 12.1 | 12.1 |
| | Skilled Non-Manual | 9.2 | 9.4 | 9.0 |
| | Skilled Manual | 45.6 | 45.0 | 46.1 |
| | Semi-skilled | 11.1 | 10.9 | 11.3 |
| | Unskilled | 8.2 | 8.5 | 7.9 |
| | Missing | 9.8 | 9.9 | 9.6 |
| Education | None, CSE 2-5 | 37.5 | 41.2 | 33.8 |
| | O Levels | 35.3 | 33.2 | 37.5 |
| | A Levels | 12.1 | 11.1 | 13.0 |
| | Further Education | 5.1 | 3.7 | 6.5 |
| | Higher Education | 9.9 | 10.6 | 9.1 |
| | Missing | 0.1 | 0.2 | 0.1 |
| Marital Status | Single | 51.7 | 62.8 | 40.6 |
| | Married | 44.6 | 34.8 | 54.4 |
| | Separated | 2.2 | 1.6 | 2.7 |
| | Divorced | 1.4 | 0.7 | 2.1 |
| | Widowed | 0.1 | 0.0 | 0.2 |
| | Missing | 0.0 | 0.1 | 0.0 |
| No of Dependent Children | 0 | 75.4 | 83.4 | 67.4 |
| | 1 | 15.5 | 11.4 | 19.5 |
| | 2+ | 9.2 | 5.2 | 13.1 |

| **33 yrs old** | **Demographic Profile** | (%) | (%) | (%) |
|---|---|---|---|---|
| Region | North | 5.2 | 5.1 | 5.2 |
| | North West | 11.2 | 11 | 11.5 |
| | Yorks. & Humberside | 10.4 | 10.5 | 10.4 |
| | West Midlands | 9.4 | 9.9 | 9.0 |
| | East Midlands | 6.2 | 6.8 | 5.6 |
| | East Anglia | 3.9 | 3.7 | 4.2 |
| | South West | 8.9 | 8.7 | 9.1 |
| | South East | 24.1 | 24.0 | 24.2 |
| | London | 7.2 | 7.2 | 7.2 |
| | Wales | 5.0 | 5.1 | 4.8 |
| | Scotland | 8.5 | 8.1 | 8.9 |
| Marital Status | Single | 17.3 | 20.5 | 14.2 |
| | Married | 6.08 | 66.0 | 70.0 |
| | Separated | 2.7 | 2.7 | 2.7 |
| | Divorced | 8.1 | 6.5 | 9.8 |
| | Widowed | 0.2 | 0.1 | 0.4 |
| | Missing | 3.6 | 4.3 | 3 |
| Education | None, CSE 2-5 | 40.6 | 43.9 | 37.5 |
| | O Levels | 29.0 | 26.6 | 31.3 |
| | A Levels | 10.4 | 9.4 | 11.3 |
| | Further Education | 9.1 | 8.2 | 9.9 |
| | Higher Education | 10.9 | 12.0 | 9.9 |
| | Missing | 0.1 | 0.1 | 0.0 |
| Social Class | Professional | 3.4 | 4.8 | 2.0 |
| | Intermediate | 12.6 | 11.3 | 13.9 |
| | Skilled Non-Manual | 31.8 | 15.9 | 47.2 |
| | Skilled Manual | 13.9 | 21.9 | 6.2 |
| | Semi-skilled | 21.7 | 26.4 | 17.3 |
| | Unskilled | 4.7 | 6.7 | 2.8 |
| | Missing | 11.9 | 13.0 | 10.8 |

* This is the share of individuals for whom we have information on their outcomes but information on their assets is missing in the base year.

## Appendix B: Treatment effects models

### 1. Binary treatment, continuous outcome

$$y_i = x_i\beta + \delta z_i + \varepsilon_i$$

$$z_i^* = w_i\gamma + u_i$$

where the errors have a bivariate normal distribution (u, ε) ~ N2[0, 0, 1, σ, ρ]

Assuming that:

$$f(\varepsilon,u) = f(\varepsilon \mid u) f(u) = f(u \mid \varepsilon) f(\varepsilon)$$

which in this case the likelihood function equals:

$$l_i = \Phi(u \mid \varepsilon)\phi(\varepsilon)$$

and the standardized Prob $$(u \mid \varepsilon) = \left( \frac{u - \mu_{u|\varepsilon}}{\sigma_{u|\varepsilon}} \right)$$

where: $$\mu_{u|\varepsilon} = \mu_u - \rho\frac{\sigma_u}{\sigma_\varepsilon}\mu_\varepsilon + \rho\frac{\sigma_u}{\sigma_\varepsilon}\varepsilon$$ and $$\sigma_{u|\varepsilon}^2 = \sigma_u^2\left(1-\rho^2\right)$$

Based on the treatment effects model, the log likelihood function is defined for observation i, where the latent variable is a binary probit:

$$l_i = \ln\left( \Phi\left\{ \frac{\left(-\gamma' w_i\right) - \left[ \left(y_i - x_i\beta\right)\frac{\rho}{\sigma} \right]}{\sqrt{1-\rho^2}} \right\} \right) - \frac{1}{2}\left( \frac{y_i - x_i\beta}{\sigma} \right)^2 - \ln\left(\sqrt{2\pi}\sigma\right)$$

$z_i=0$

$$l_i = \ln\left( \Phi\left\{ \frac{\left(\gamma' w_i\right) + \left[ \left(y_i - x_i\beta - \delta\right)\frac{\rho}{\sigma} \right]}{\sqrt{1-\rho^2}} \right\} \right) - \frac{1}{2}\left( \frac{y_i - x_i\beta - \delta}{\sigma} \right)^2 - \ln\left(\sqrt{2\pi}\sigma\right)$$

$z_i=1$

## 2. Ordered treatment (3 levels), continuous outcome

$$y_i = x_i\beta + \sum_{j=1}^{2}\delta_j z_{ij} + \varepsilon_i$$

$$z_i^* = w_i\gamma + u_i$$

where the errors have a bivariate normal distribution (u, ε) ~ N2[0, 0, 1, σ, ρ]

In the case where z is ordinal and modelled via an ordered probit (for example with three values):

$$\begin{array}{lll} z_i = 0 & z^* \le \mu_1 & prob(z=0) = \Phi(\mu_1 - \gamma' w) \\ z_i = 1 & \mu_1 < z^* \le \mu_2 & prob(z=1) = \Phi(\mu_2 - \gamma' w) - \Phi(\mu_1 - \gamma' w) \\ z_i = 2 & \mu_2 \le z^* & prob(z=2) = 1 - \Phi(\mu_2 - \gamma' w) = \Phi(-(\mu_2 - \gamma' w)) \end{array}$$

$$l_i = \ln\left(\Phi\left\{\frac{(\mu_1 - \gamma' w_i) - \left[(y_i - x_i\beta)\frac{\rho}{\sigma}\right]}{\sqrt{1-\rho^2}}\right\}\right) - \frac{1}{2}\left(\frac{y_i - x_i\beta}{\sigma}\right)^2 - \ln\left(\sqrt{2\pi}\sigma\right) \qquad z_i=0$$

$$l_i = \ln\left(\Phi\left\{\frac{\Phi^{-1}\left[\Phi(\mu_2 - \gamma' w_i) - \Phi(\mu_1 - \gamma' w_i)\right] - \left[(y_i - x_i\beta - \delta_1)\frac{\rho}{\sigma}\right]}{\sqrt{1-\rho^2}}\right\}\right) - \frac{1}{2}\left(\frac{y_i - x_i\beta - \delta_1}{\sigma}\right)^2 - \ln\left(\sqrt{2\pi}\sigma\right)$$

$z_i=1$

$$l_i = \ln\left(\Phi\left\{\frac{(-(\mu_2 - \gamma' w_i)) + \left[(y_i - x_i\beta - \delta_2)\frac{\rho}{\sigma}\right]}{\sqrt{1-\rho^2}}\right\}\right) - \frac{1}{2}\left(\frac{y_i - x_i\beta - \delta_2}{\sigma}\right)^2 - \ln\left(\sqrt{2\pi}\sigma\right)$$

$z_i=2$

## 3. Binary treatment, binary outcome

$$y^*_i = x_i\beta + \delta\ z_i + \varepsilon_i$$

$$z_i^* = w_i\gamma + u_i$$

where the errors have a bivariate normal distribution (u, ε) ~ N2[0, 0, 1, 1, ρ]

let $\alpha = 2y_i - 1$

$$l_i = \ln\left[\Phi_2\left(\alpha\left(x_i\beta\right), -w_i\gamma, -\alpha(\rho)\right)\right] \qquad z_i=0$$

$$l_i = \ln\left[\Phi_2\left(\alpha\left(x_i\beta + \delta\right), w_i\gamma, \alpha(\rho)\right)\right] \qquad z_i=1$$

## 4. Ordered treatment (3 levels), binary outcome

$$y^*_i = x_i\beta + \sum_{j=1}^{2}\delta_j z_{ij} + \varepsilon_i$$

$$z_i^* = w_i\gamma + u_i$$

where the errors have a bivariate normal distribution (u, ε) ~ N2[0, 0, 1, 1, ρ]

In the case where z is ordinal and modelled via an ordered probit (for example with three values):

$$\begin{array}{lll} z_i = 0 & z^* \le \mu_1 & prob\left(z=0\right) = \Phi\left(\mu_1 - \gamma' w\right) \\ z_i = 1 & \mu_1 < z^* \le \mu_2 & prob\left(z=1\right) = \Phi(\mu_2 - \gamma' w) - \Phi\left(\mu_1 - \gamma' w\right) \\ z_i = 2 & \mu_2 \le z^* & prob\left(z=2\right) = 1 - \Phi(\mu_2 - \gamma' w) = \Phi(-\left(\mu_2 - \gamma' w\right)) \end{array}$$

let $\alpha = 2y_i - 1$

$$l_i = \ln\left[\Phi_2\left(\alpha\left(x_i\beta\right), \mu_1 - w_i\gamma, -\alpha(\rho)\right)\right] \qquad z_i=0$$

$$l_i = \ln\left[\Phi_2\left(\alpha\left(x_i\beta + \delta_1\right), \mu_{21} - w_i\gamma, -\alpha(\rho)\right) - \Phi_2\left(\alpha\left(x_i\beta + \delta_1\right), \mu_1 - w_i\gamma, -\alpha\left(\rho\right)\right)\right] \qquad z_i=1$$

$$l_i = \ln\left[\Phi_2\left(\alpha\left(x_i\beta + \delta_2\right), -(\mu_2 - w_i\gamma), \alpha(\rho)\right)\right] \qquad z_i=2$$

## Appendix C: Malaise Inventory

'These questions are concerned with how you are feeling generally. Please answer them by ticking either the 'Yes' or 'No' box for each on. It is important that you try to answer ALL the questions.'

1. Do you often have back-ache?
2. Do you feel tired most of the time?
3. Do you often feel miserable or depressed?
4. Do you often have bad head-aches?
5. Do you often get worried about things?
6. Do you usually have great difficulty in falling asleep?
7. Do you usually wake unnecessarily early in the morning?
8. Do you wear yourself out worrying about your health?
9. Do you often get into a violent rage?
10. Do people often annoy and irritate you?
11. Have you at times had a twitching of the face, head or shoulders?
12. Do you often suddenly become scared for no good reason?
13. Are you scared to be alone when there are not friends near you?
14. Are you easily upset or irritated?
15. Are you frightened of going out alone or of meeting people?
16. Are you constantly keyed up and jittery?
17. Do you suffer from indigestion?
18. Do you suffer from an upset stomach?
19. Is your appetite poor?
20. Does every little thing get on your nerves and wear you out?
21. Does your heart often race like mad?
22. Do you often have bad pains in your eyes?
23. Are you troubled with rheumatism or fibrosis?
24. Have you ever had a nervous breakdown?