Model Simulation of Altruistic Bequests*

James Sefton and Martin Weale
National Institute of Economic and Social Research,
2, Dean Trench Street,
London SW1P 3HE

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1 Introduction

The issue of inheritance and the motive for leaving bequests is one of the more perplexing issues associated with the study of household and individual behaviour. Study of this question is complicated by the fact that the relevant data are inevitably not in the form most suited to analysis. At the same time there has hitherto not been any satisfactory means of comparing what the various different explanations of bequests ought to imply. In this paper we present, for the first time, a study of bequests using a simulation model which we are able to set up to contrast two conflicting views of inheritance. We compare the idea that legacies are accidental, that parents leave money to their children simply because they indulge in precautionary saving to protect themselves from the risk of longevity, with the alternative view that parents leave bequests because they are explicitly concerned about the welfare of their children. We use the data generated by our simulation model to conduct regressions and compare these with an analysis of the data collected in the two General Household Surveys which asked specific questions about legacies.

Becker & Tomes (1979) were the first to construct an equilibrium theory of intergenerational mobility. In their model, parents care directly about the welfare of their children and consequently plan optimally how to transfer resources to them. They can invest in the education or human capital of their children or transfer capital directly to them. Their model makes some important predictions; firstly that inheritances are equalising if the parent's propensity to transfer resources to their children exceeds the 'inheritability' (the correlation coefficient between parent's human capital and their children) of human capita, secondly that the amount inherited should be inversely related to the recipient's income, and finally that there should be an inverse relation between inherited wealth and parental education given parental income.

There has since been considerable empirical work testing the predictions of their model. However the only empirical paper to 'strongly confirm the equalising role of inheritances' was Tomes's (1981) later study. He found in a random sample of probated estates in Ohio between 1964-65, that the size of inheritances received was inversely related to the recipients income and further this effect was strong enough to imply inheritances are equalising. Other empirical work on different samples from the US, such as Ioannides & Sato (1987), Altoniji, Hayashi & Kotlikoff (1992) and Wilhelm (1996) have found very little evidence for any altruistic bequest motive.

One possible reason that we explore in this paper, is that because the Becker & Tomes's (1979) model is so very stylised, so as to be tractable, it could ignore some important economic realities - such as wealth contraints, uncertainty concerning future income and life span - that may alter its conclusions. We therefore suggest an alternative and new methodology.The approach is to build a more complex model that captures some of these additional complexities, and solve the model numerically. A synthetic data sample can then be generated which can be tested for these various relationships to see if they are robust to these changes in the model. Further this synthetic sample can be generated in any desired way. Therefore it is always possible to generate it so to be comparable, or even identical, to any measured data set. The measured data set can then be tested against the underlying economic model by simply comparing the two data sets for any relevent differences.

In this paper, we pursue this approach. In section 2, we develop a model of intergenerational mobility along the lines of Becker & Tomes (1979), but generalised so as to include wealth contraints, income and life span uncertainty. We solve this model numerically using the approached described in section 3. In section 5, we test whether one can observe in a synthetic sample generated from this model, the relationships discussed in Becker & Tomes (1979). Further we compare our synthetic sample to a new UK data set on inheritances recorded in the 1990, 1991 General Household Survey. Finally in section 6 we conclude.

2 The Simulation Model

We assume that the population consists of a large number of independent dynasties. Each generation of the dynasty starts work at the age of 20 and has its children at 30 who leave home themselves at 20 when the parents are 50. All generations retire at the age of 65, and die anytime before the age of 80 and after the age of 50. These assumption are summarised in the timeline in figure 1. They are made to simplify the problem slightly because at any one time at most two generations of any dynasty are economically active. This has the implication that in making its economic decisions, any generation need consider only the circumstances of at most one other generation. Of course, there are times when three generations are alive, but at these instances the youngest generation is assumed to be living at home and dependent entirely on its parents. Clearly in this economy we have made some very strong assumptions about mating. One assumption consistent with the model is that each generation has one boy and one girl child, and that in this economy either the boy or girl always inherits. The key requirement in the model is that the transfer of wealth for every dynasty can be traced down through that dynasty alone.

Each generation starts its working life at age 20 with no assets or wealth. Given all knowledge about the stochastic process determining its labour income over their working lives, the only economic decision each generation needs to make is how much to consume, or how much to save, in each period. It makes this decision in full knowledge of both its parents' and children's income and assets and further in knowledge that these generations economic behaviour is identical to its own. Finally it

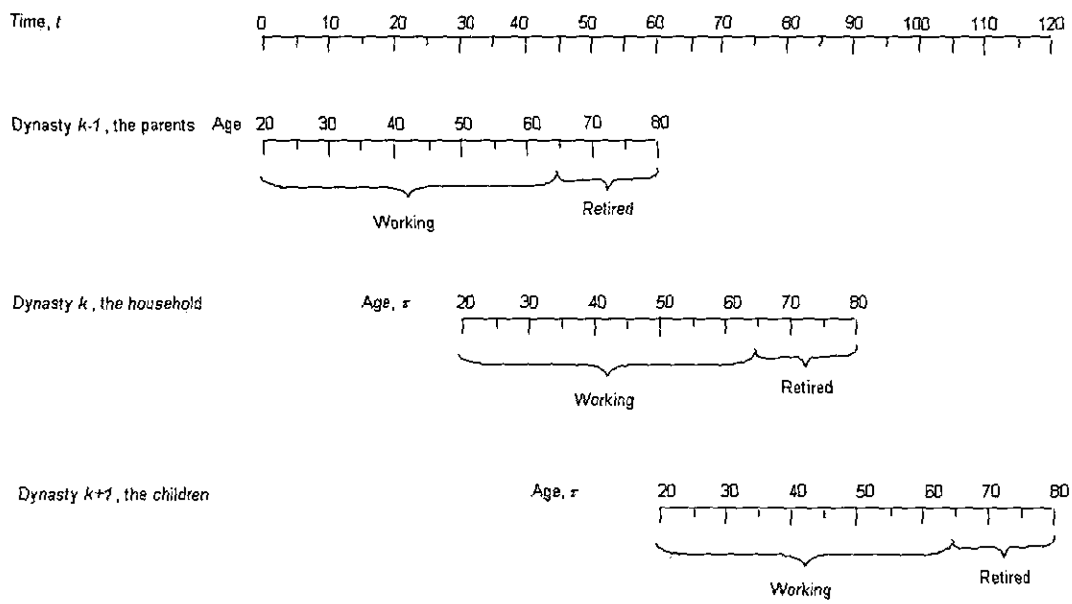

Figure 1: Diagram illustrating the timing of the working and retired lives of the different generations of a dynasty.

knows that on the death of its parents, it will inherit any of their remaing wealth and that on its death its wealth will be inherited by its children. It is assumed that debts cannot be left to children and that people are wealth-constrained so that they cannot be net debtors at any point in their lives[1]. We make one further assumption, to simplify the model further; we work with periods of five years rather than with individual years. Thus each household has a maximum life of twelve periods. There are three thousand households or generations who start working in each period, and, given that the next generation of each of these three thousand dynasties does not start working until thirty years or six periods later, our economy is made up of eighteen thousand dynasties.

Saving behaviour is described by the standard life-cycle model. People maximise their expected utilities taking account of the risk of death that they face. In the general case their uility functions also include the utility of their children. Utility of grandchildren does not enter directly into the

[1]If there is always a positive risk of death, then the assumption that people cannot leave insolvent estates is enough to prevent people becoming net debtors. Since we assume that there is no risk of death before the age of fifty, the constraint that we have is separate.

utility function but, because people know that their children's utility will depend on that of their children's children it is implicitly present (Barro 1974). There are two sources of non-property income. Households aged twenty to sixty-four go out to work and earn incomes generated by a stochastic process. People aged sixty-five and over receive fixed old-age pensions from the state. A tax is charged on labour income so as to fund the old-age pensions on a pay as you go basis.

Formally the model can be set out as follows. We describe it only for a single generation in one dynasty and omit the dynasty subscript so as to simplify the notation. If a generation is alive at time t we shall denote this as $m_{t,k} = 1$ and if dead as $m_{t,k} = 0$. Further let $c_{t,k}$, $y_{t,k}$ and $w_{t,k}$ denote the consumption, labour income and wealth at the beginning of the period of generation k in period t. To maintain the distinction between calendral time, t and the age of a typical household, τ, we write $\tau_{k,t} = 30k - t$ to represent the age of household k at time t. Often it will be useful to index this generation's consumption, income and wealth by its age rather than time t and in this case they will be denoted $c_{\tau,k}$, $y_{\tau,k}$ and $w_{\tau,k}$. For any generation its economic state is described by its income and wealth and the income and wealth of its parents and children. We shall denote the vector of these states of generation k at time t as $x_{\tau,k}$ where $x_{\tau,k} = [y_{t,k-1}, w_{t,k-1}, y_{t,k}, w_{t,k}, y_{t,k+1}, w_{t,k+1}]$, where the relevant state has a zero value if the parent has died or the child is yet to start working. Also let $\pi_{\tau,\tau+m}$ denote the probability that an adult aged τ is also alive m periods later, and $\omega_{\tau,\tau+m}$ be the probability that someone aged τ dies exactly m periods later. We shall first concern ourselves with the case where parents care about the utility of their children. In this case,the preferences of generation k can be represented by the infinite horizon utility function

$$U_{\tau,k} = \frac{1}{1-1/\alpha} E_\tau \left[\sum_{i=\tau}^{80} \left(\pi_{\tau,\tau+i} c_{i,k}^{1-1/\alpha} + \omega_{\tau,\tau+i} \theta U_{i-30,k+1} \right) \delta^{i-\tau} \right] \tag{1}$$

where θ is the extent to which a parent is concerned about a child's welfare relative to his own and δ is the discount rate. If we denote as V the value function derived from maximising this utility function, then the value functions satisfy the following recursive relationships

$$V_{\tau,k}(x_{\tau,k}) = \max_{c_{\tau,k}} \left[\frac{c_{\tau,k}^{1-1/\alpha}}{1-1/\alpha} + \delta \pi_{\tau,\tau+1} E_\tau \left(V_{\tau+1,k}(x_{\tau+1,k}) \middle| m_{\tau+1,k} = 1 \right) \right. \tag{2}$$

$$\left. + \delta \theta \omega_{\tau,\tau+1} E_\tau \left(V_{\tau-29,k+1}(x_{\tau-29,k+1}) \middle| m_{\tau+1,k} = 0 \right) \right] \tag{3}$$

where the maximisation is performed subject to the constraint that no household is ever in debt.

In this form the equations can describe the behaviour of the generations to changing economic conditions. However as we wish only to solve the problem for the steady state, we can reduce the complexity of the problem by using the steady state condition $V_{\tau,k}(x) = V_{\tau,k+1}(x) = V_\tau(x)$. In this case the recursive relationship simplifies to

$$
\begin{aligned}
V_\tau\left(x_{\tau,k}\right) &= \max_{c_{\tau,k}}\left[\frac{c_{\tau,k}^{1-1/\alpha}}{1-1/\alpha}+\delta\pi_{\tau,\tau+1}E_\tau\left(V_{\tau+1}\left(x_{\tau+1,k}\right)\right|m_{\tau+1,k}=1\right) \\
&\quad +\delta\theta\omega_{\tau,\tau+1}E_\tau\left(V_{\tau-29}\left(x_{\tau-29,k+1}\right)\right|m_{\tau+1,k}=0)]
\end{aligned}
\tag{4}
$$

where again the maximisation is subject to the wealth constraint. This is the steady state dynamic equation we shall solve later numerically. First, though, we need to detail the state evolution equations.

2.1 The Household Income Process

Households earn between the ages of 20 and 65 before retiring. During their working lives, their earnings are equal to their earning power in that period $h_{\tau,k}$, times the aggregate wage rate net of taxes, s, (given that they are alive)

$$y_{\tau,k} = m_{\tau,k} s h_{\tau,k}. \tag{5}$$

For the moment we shall assume that earning power of all households at the beginning of their working lives is distributed lognormally as

$$\log(h_{20,k}) \sim N(-\tilde{\sigma}_{20}^2/2, \tilde{\sigma}_{20}) \tag{6}$$

where we have normalised the distribution so that the mean earning power is 1[2]. Later we shall discuss this initial distribution in more detail. Now given the initial endowment, the evolution of household earning power during working life is described by the following first order autoregressive process

$$\left(\log h_{\tau+1,k} - \log \bar{h}_{\tau+1,k} + \tilde{\sigma}_{\tau+1}^2/2\right) = \rho\left(\log h_{\tau,k} - \log \bar{h}_{\tau,k} + \tilde{\sigma}_\tau^2/2\right) + \epsilon_\tau \tag{7}$$

where ϵ is an uncorrelated innovation processes drawn from the distribution $\epsilon_\tau \sim N(0,\sigma)$, and the parameters $\bar{h}_\tau$ and $\tilde{\sigma}_\tau^2$ are the average level of, and the variance of the log of, household earning power of households aged τ. The parameters $\bar{h}_\tau$ are calibrated from survey data on UK household income by age of head of household, and the parameters $\tilde{\sigma}_\tau^2$ can be derived recursively from the formula $\tilde{\sigma}_{\tau+1}^2 = \rho^2\tilde{\sigma}_\tau^2 + \sigma^2$. This is the dynamic income process studied in detail in Atkinson, Bourguignon & Morrisson (1992) and used by Huggett (1996) in his equilibrium model of the US economy. The variance adjustment in the dynamic equation is to ensure that the mean level of earning power is equal to $\bar{h}_\tau$, see footnote 2.1. As Atkinson *et al.* state, this autoregressive process has a number of

[2]If a random variable x is distributed lognormally as $\log x \sim N(\mu,\sigma)$ then the mean of of the distribution is $E(x) = \exp(\mu + \sigma^2/2)$.

desirable properties. As earning power is lognormally distributed for the youngest cohort, it remains so for every cohort thereafter. This is useful as the log normal distribution has for a long time be used as a reasonable fit of the earnings distribution. It can therefore be easily calibrated to fit the observed earnings distribution. Finally after retirement at age 65, households only non-property income is the universal basic state pension, p, which they receive until they die,

$$y_{\tau,k} = m_{\tau,k}p \text{ for all } \tau \geq 65 \tag{8}$$

Becker & Tomes (1979) were the first to construct an equilibrium theory of intergenerational mobility. In their theoretical model they stressed the interaction between bequests given in the form of human capital, and bequests given as capital. Even though in this paper we do not wish to model explicitly the process by which human capital is transfered from one generation to the next, we do wish to investigate the implications of such transfers on the distribution of bequests. We therefore model the correlation of earning power from one generation to the next using a simple mean reversion model. The initial level of earning power of the descendent household, $h_{20,k}$ is related to the earning power of its parent household, $h_{45,k-1}$ at age 45. We choose the age of 45 so as not to introduce any further states into the model. As the periods in the model are five years, the parents are aged 45 in the period before their child start working. Therefore their child's initial income next period is only a function of their income this period which is already a state variable. all information needed when it started work, h_{i0}. Again the process is a first order autoregressive,

$$\left(\log h_{20,k} + \tilde{\sigma}_{20}^2/2\right) = \lambda \left(\log h_{45,k-1} - \log \bar{h}_{45} + \tilde{\sigma}_{45}^2/2\right) + \eta \tag{9}$$

where η is independently distributed as $\eta \sim N(0, \sigma_\eta)$ and the parameter λ represents the degree of persistence across generations. In a steady state, the variance of the initial distribution of earning power $\tilde{\sigma}_{20}^2$ must be a function of the variance of the random variable η. Substituting in from equations (7) and (9) and rearranging gives the steady state relationship that

$$\tilde{\sigma}_{20}^2 = \frac{1}{1-\lambda^2\rho^{2n}}\left(\sigma_\eta^2 + \left(\frac{1-\rho^{2n}}{1-\rho^2}\right)\lambda^2\sigma^2\right) \tag{10}$$

where n is the number of periods between generations (in this model where periods are five years $n = 5$). In practise we calibrated $\tilde{\sigma}_{20}^2$ and σ^2 to the UK income distribution and calulated the implied σ_η^2 given an estimate for λ.

2.2 The Transmission of Wealth

Having described the evolution of income across generations, we now need to describe the transmission of wealth. Each household starts their working life with no capital assets, $w_{20,k} = 0$. During each following period they choose how much of their income to save, and receive a risk free return on this savings. Further some time in the first 30 years of their working lives, their parent household will die leaving them all their remaining assets. In turn, some time in the second or final 30 years of their life they will die leaving their remaining assets to their children. Thus the wealth equation can be written

$$w_{t+1,k} = m_{t+1,k} \left(Rw_{t,k} + y_{t,k} - c_{t,k} \right) + m_{t,k-1} (1 - m_{t+1,k-1}) \left(Rw_{t,k-1} + y_{t,k-1} - c_{t,k-1} \right) \tag{11}$$

where we have subscripted the variables here by time t rather than age of household. In these equation, the risk free rate of return has been denoted as R. It is worth reiterating again that all households are not allowed to borrow at any point in their lives. Thus the maximization in equation (4) is done subject to the condition that $c_{t,k} \leq Rw_{t,k} + y_{t,k}$.

The model is solved in a partial equilibrium. The rate of interest, and the aggregate wage rate is taken as exogenous and no attempt is made to show how this might adjust to the overall stock of wealth in the economy. Again this is in keeping with most models of this type. It speeds up the solution of what is, in any case, a complex programming problem.

3 Model Solution

3.1 Solution Method

The solution method is a development of the technique set out by Sefton (2000). It relies on optimal solutions being calculated on a multidimensional grid- with one dimension for each state variable plus a time dimension. Each state dimension has 50 points, and there are 12 time intervals so the full grid has $12 \times 50^{\text{Number of StateVariables}}$ points on it. However, though the state vector $x_{\tau,k}$ in equation (4) has 6 dimensions, only 4 are at most active in any period (as only either the parent or child household can be alive any one time). This enables us to reduce the number of states in any period to 4, and limits the number of points in our grid to fewer than 75 million[3]. For each of these points we solve the optimisation problem in equation (4). At present this is close to the maximum size of problem that our programme can solve in a reasonable length of time. It is this alone that explains the rather tight specification we have set out above, that has avoided more complex situations in which, for example, grandparents overlap directly with the working lives of their grandchildren.

There is one further issue, apart from its size, that makes this problem more complex than the problem studied in Sefton (2000); this concerns the fact that the value function equation to be max-

[3] In some periods it is only necessary to have three states, because either the household or the parent household has retired and so its income state can be dropped.

imised is a function itself of both parents' and childs' welfare. We adopted the following approach to solve this problem. We first solved the entire problem under the assumption that there was no bequest motive, $\theta = 0$. This is the solution to problem when all bequests are assumed to be accidental, and is a finite horizon problem that could be solved in an identical manner to the one in described in Sefton (2000). Then to solve the more complex problem when an altruistic bequest motive is introduced, the grid is initialised with the values from this first solution. It is then possible to recalculate all the values on grid in the typical manner by first solving for the last period, then the penultimate period and so on back in time. However, whenever it is necessary to have an estimate of the child's utility in value function equation (4), we can use values from the initial solution. In this manner we can estimate new values for all points in the grid. The grid is then initialised with these new values and the procedure repeated until it converges. For the parameter values we describe in the next section, this convergence was fairly rapid (6-9 iterations).

3.2 Parameter Values

The behavioural and macroeconomic parameter values are shown in table 1. The value for the discount factor at 4% a year, though greater than value used by Huggett (1996), is relatively uncontroversial. The the magnitude of the intertermporal elasticity of substitution is more controversial; Cooley and Prescott (1995) use unity for their simulations whereas Auerbach, Kotlikoff & Leibfritz (forthcoming) use a coefficient of relative risk aversion of only 0.25. Empirical work by Hansen & Singleton (1983) (1983) and Mankiw, Rotemberg & Summers (1985) suggest values a little over unity for the intertemporal elasticity of substitution while Grossman & Shiller (1981) and Mankiw (1985) found values between 0 and 0.4. Blundell, Browning & Meghir (1994) present evidence consistent with a choice of 0.75. Values of the coefficient of relative risk aversion (the inverse of the interetemporal elasticity of substitution) required to explain the equity premium puzzle first posed by Mehra & Prescott (1985) are very much higher than the values of 2, consistent with interetemporal elasticity of 0.5; but those very high values are implausible. Survey evidence on attitudes to risk suggest that coefficients of relative aversion greater than 5 are unlikely . (See Barsky, Kimball, Juster & Shapiro (1997)).

When $\theta = 0$ then the model is one in which bequests are accidental; with it set at 0.5 people give their children half of the importance of themselves in making their spending plans. Obviously any value between nought and one would be plausible. The real interest rate is set at 5% less a 20% capital tax rate, the gross wage rate is normalised to 2 with income taxes set at 15% and the basic pension was set at 30% of mean household net income.

We used data from the British Household Panel Survey (BHPS) data on household gross labour

Parameter	δ	α	θ	R	s	p
Value	0.96	0.5	0.5	1.045	1.7	0.6

Table 1: The Parameter Values for Preferences and Macroeconomic variables. All numbers are expressed at annual rates.

Parameter	ρ	σ^2	λ	$\tilde{\sigma}^2_{20}$
Value	0.993	0.013	0.5	0.20

Table 2: Parameter Values for the Income Process (all at annual rates)

income to calibrate the coefficients of our income process. The value for ρ is taken directly from analysis of the BHPS in (Dutta, Sefton & Weale 2001) while the estimates of variance of the initial incomes σ^2_{20} and the income innovation process σ^2 were estimated directly from the cross-sectional variance of household income in the BHPS. The coefficient of intergenerational mobility, λ, which summarises the link between parents' and children's incomes is approximately in the mid-range of the estimates given in Dearden, Machin & Reed (1997). These coefficients are detailed in the tables 2.

The mean estimates of household earning power are given in table 3, where they have been normalised so that the mean household's earning power in the first period of working life is 1. We have also included in the table, the variance of the distribution of each cohort's log of earning power and the Gini of the distribution of earning power.

4 Model Properties

In table 4 we show the two key macro-economic properties of the economy simulated by our model. While neither simulation shows enough wealth, it is plain that the model with the bequest motive is

Household age at start of period	20	25	30	35	40	45	50	55	60
Mean earning power ($\overline{h_\tau}$)	1.000	1.225	1.386	1.482	1.515	1.486	1.394	1.170	0.942
Var(h_τ)	0.203	0.251	0.296	0.338	0.378	0.414	0.448	0.480	0.481
Gini(h_τ)	0.250	0.277	0.299	0.319	0.335	0.349	0.361	0.371	0.372

Table 3: Parameter Values and Calculated Statistics of the Household Income Distribution.

Wealth/Net Income	Bequests/Net Income	
Accidental Bequests	3.23	3.2%
Bequest Motive	3.82	5.2%
UK	5.1	4.7%

Table 4: Macro-economic Ratios: Bequest Motive

closer to the facts for the United Kingdom. However, specifications which raise the level of wealth are also bound to raise the flow of bequests and, with movements *pari passu* the model without bequests might well turn out to be closer to the mark. Against this it has to be remembered that the published data on legacies understate the true extent to which parents give money to their children. The amount transferred by discretionary trusts is not particularly large, at about £300mn, as compared to the overall value of legacies in 1996/7, at £25bn. However gifts *inter vivos* must be substantial, particularly bearing in mind the tax benefits. It could therefore be argued that, even if wealth and bequests for the model with only accidental bequests, were brought into line with the UK data, the latter would still be too low and the model with a bequest motive would be preferred.

Perhaps a safer conclusion would be that the distinction between the two situations, with accidental bequests and with a bequest motive is relatively small. It would therefore be difficult to accept or reject a particular view of bequests from a study of macro-economic data. This simulation result contrasts with the calculations of Auerbach & Kotlikoff (1987) who argued that most wealth holdings in the United States were explained by the desire to leave bequests.

We proceed next to look at the distribution of labour income and wealth in our simulation economies. Table 5 shows the earned income quantiles in each age range. It also shows mean income by age. The table compares the distribution of labour income with the figures for the overall population taken from the *New Earnings Survey, 2001 (*Table A1). The UK data are scaled to have the same mean as our simulated data. It can be seen that, despite the fact that we use parameters fitted to the British Household Panel Survey, the distribution of income is more even in our simulation model than in the actual UK economy. The explanation of this is offered in the study by Dutta et al. (2001). They found that income dynamics were better represented by a mixed process than by the simple model we have used here. However despite this, we chose to remain with the more convential specification of the income process.

Tables 6 and 7 show the wealth quantiles and wealth holdings in the two cases. Comparison of the quantiles above the median with those of the income table shows that, for wealthy people the upper income and wealth quantiles are at roughly similar multiples of the mean. This is a consequence of the initial utility function; such people are not much affected by either the state pension or the prospect

	10%	25%	50%	75%	90%	Mean
20-24	3.76	4.94	6.69	9.08	11.89	7.42
25-29	4.19	5.72	8.01	11.17	15.22	9.10
30-34	4.42	6.14	8.85	12.77	17.89	10.31
35-39	4.41	6.25	9.25	13.73	19.61	11.02
40-44	4.26	6.13	9.29	14.06	20.48	11.25
45-49	3.93	5.84	8.96	13.85	20.47	11.05
50-54	3.73	5.47	8.26	12.58	18.34	10.04
55-59	3.36	4.86	7.24	10.86	15.63	8.68
60-64	2.81	4.01	5.90	8.74	12.43	6.99
65-69	3.26	3.26	3.26	3.26	3.26	3.26
70-74	3.26	3.26	3.26	3.26	3.26	3.26
75-79	3.26	3.26	3.26	3.26	3.26	3.26
All	3.77	5.38	7.94	11.83	17.13	9.56
UK 2001	1.76	3.25	6.60	13.69	27.93	9.56

Table 5: Income Quantiles

of wealth constraints. In the absence of such factors the allocation of life-time income between the different phases of one's life is relatively independent of the level. On the other hand, 10% of the population do not own any wealth in either case; at the lower end of the distribution wealth holdings rise faster than income.

It can be seen that average wealth holdings are 20% higher with the bequest motive than in its absence. However, it is apparent from looking at the figures for wealth holdings by age that the bequest motive generates an extra holding of about three units of wealth by the time people reach their sixties. As one would expect the bequest holding is relatively independent of age, while life-cycle holdings decline as people age. Thus the bequest motive almost doubles the holdings of wealth by the oldest group in the population.

Wealth data are also often presented as the proportion total wealth owned by particular quantiles and we therefore also present wealth distribution tables in this format. Tables 8 and 9 show the data in this format so as to allow comparision with UK data. Looking at the population as a whole it can be seen that the bequest motive makes little difference to the overall distribution of wealth. This is the counterpart of the observation about the earlier wealth distribution tables, that a bequest motive raises the wealth holdings at the various deciles in much the same proportions, as compared to a situation in which bequests are mainly accidental. Amongst young people it can be seen that a bequest motive does have the effect of making the distribution of wealth less equal; the main source of wealth held by young people is from bequests. Since bequests are larger when there is a bequest motive than in its absence, this observation comes as no great surprise.

The simulations show wealth in the model as being much less concentrated than wealth in practice

	10%	25%	50%	75%	90%	Mean
20-24	0.00	0.00	0.00	0.00	0.00	0.00
25-29	0.00	0.00	0.06	0.30	0.70	0.50
30-34	0.22	0.47	0.96	1.91	3.73	2.00
35-39	0.63	1.23	2.44	4.82	9.76	4.42
40-44	1.07	2.15	4.33	8.63	16.14	6.98
45-49	1.57	3.15	6.32	11.72	19.73	8.98
50-54	1.82	3.71	7.43	13.48	21.71	10.18
55-59	1.88	3.99	8.21	14.96	23.64	11.09
60-64	1.70	3.96	8.55	15.74	24.95	11.58
65-69	1.03	3.26	7.94	15.18	24.42	10.99
70-74	0.54	1.84	4.97	9.80	16.01	7.09
75-79	0.19	0.70	2.13	4.49	7.51	3.21
All	0.00	0.65	3.21	8.81	17.14	6.45

Table 6: Wealth Quantiles: Accidental Bequests Only

	10%	025%	50%	75%	90%	Mean
20-24	0.00	0.00	0.00	0.00	0.00	0.00
25-29	0.00	0.00	0.02	0.20	0.62	0.53
30-34	0.09	0.31	0.78	1.74	3.73	2.04
35-39	0.32	0.90	2.14	4.80	10.82	4.63
40-44	0.51	1.68	4.26	9.38	18.65	7.57
45-49	0.90	3.01	6.95	13.57	23.45	10.21
50-54	2.59	4.83	9.11	16.32	26.42	12.56
55-59	2.67	5.27	10.09	18.14	28.98	13.72
60-64	2.47	5.31	10.55	19.20	30.96	14.41
65-69	1.67	4.58	10.03	18.76	31.05	13.97
70-74	0.99	2.90	6.82	13.33	23.34	10.15
75-79	0.39	1.28	3.41	7.38	14.69	6.07
All	0.00	0.54	3.76	10.80	21.30	7.89

Table 7: Wealth Quantiles: Bequest Motive

(*Inland Revenue Statistics*, 2000, Table 13.5). There are two points to be made about this. The first is that the UK data cover marketable wealth only and therefore omit pension funds. These amount to about a quarter of total personal wealth and probably belong disproportionately to the upper middle classes rather than the extremely wealthy. It is nevertheless, the case that the failure to represent the full spread of income is likely to have, as a consequence, a failure to represent the extent of inequality in wealth distribution.

In table 10 we show the Gini coefficients for income and consumption. We can see that life becomes more unequal as people age. This reflects our stochastic model of income, both because disturbances decay only very slowly and from the interaction of proportionate errors with a mean wage which rises until people's forties. The mean income of people in their early sixties is lower than when they start

Proportion of Total Wealth Owned by Richest						
	50%	25%	10%	5%	2%	1%
20-24	0	0	0	0	0	0
25-29	0.99	0.92	0.78	0.69	0.59	0.44
30-34	0.88	0.71	0.52	0.40	0.25	0.16
35-39	0.86	0.67	0.44	0.30	0.17	0.10
40-44	0.84	0.62	0.37	0.24	0.13	0.07
45-49	0.82	0.58	0.33	0.20	0.10	0.06
50-54	0.81	0.57	0.32	0.20	0.10	0.06
55-59	0.82	0.57	0.31	0.19	0.10	0.06
60-64	0.82	0.57	0.32	0.19	0.10	0.06
65-69	0.84	0.59	0.33	0.20	0.10	0.06
70-74	0.86	0.61	0.34	0.21	0.11	0.06
75-79	0.87	0.63	0.36	0.22	0.11	0.07
All	0.93	0.71	0.42	0.27	0.14	0.08
UK	0.94	0.75	0.56	0.44	0.31	0.23

Table 8: The Concentration of Wealth: Accidental Bequests Only

their economic lives. But because income shocks decay only slowly, the distribution of labour incomes of people in their sixties is less even than that of people in their early twenties. Consumption is distributed more equally than income at almost all ages. The most striking aspect of this table is the fact that consumption is more equally distributed when people have a bequest motive than when inheritance is only accidental. Thus planned inheritance leads to a society more equal than one with only accidental inheritance.

The question whether a society with accidental bequests is more or less equal than one with no bequests at all was raised by Becker & Tomes (1979). The basic point is that, if inheritance is independent of the recipient's non-property income, then inheritance will reduce the overall variance of life-time resources and thus tend to reduce rather than increase inequality. The stronger is the correlation between inheritance and the life-time non-property income of the recipient, the more likely it is that inheritance raises rather than reduces inequality. Without substantial modification to our model it is difficult to see what consumption in individual years would be in the absence of bequests. However we are able to calculate Gini coefficients for life time consumption and life-time income. In the absence of bequests life-time income and life-time consumption are equal. Thus the Gini coefficient for life-time income shows the life-time consumption inequality which would be generated without bequests. This shows that, if bequests are accidental, then inheritance slightly increases life-time inequality. On the other hand if bequests are planned, then they reduce life-time inequality. The impacts are, of course very small, but nevertheless demonstrate that it is not possible to draw firm conclusions about the link between inheritance and inequality.

Proportion of Total Wealth Owned by Richest						
	50%	25%	10%	5%	2%	1%
20-24	0.00	0.00	0.00	0.00	0.00	0.00
25-29	1.00	0.96	0.86	0.78	0.67	0.51
30-34	0.92	0.78	0.59	0.47	0.30	0.20
35-39	0.90	0.73	0.50	0.35	0.19	0.12
40-44	0.88	0.67	0.41	0.26	0.14	0.08
45-49	0.85	0.61	0.35	0.22	0.11	0.06
50-54	0.80	0.56	0.31	0.19	0.10	0.06
55-59	0.81	0.56	0.31	0.19	0.10	0.06
60-64	0.81	0.56	0.31	0.19	0.10	0.06
65-69	0.83	0.58	0.33	0.20	0.10	0.06
70-74	0.85	0.61	0.35	0.22	0.11	0.06
75-79	0.88	0.67	0.42	0.27	0.15	0.09
All	0.94	0.72	0.43	0.27	0.14	0.08
UK	0.94	0.75	0.56	0.44	0.31	0.23

Table 9: Concentration of Wealth: Bequest Motive

The Gini coefficients are very similar to those for the UK as a whole. This criterion is frequently used for assessing models of this type. In this sense the model of income and consumption is satisfactory, although on the tougher test based on deciles which we discussed above it did not perform as well.

	Consumption		
	Accidental Bequests	Bequest Motive	Non-property Income
20-24	0.24	0.24	0.25
25-29	0.26	0.26	0.28
30-34	0.29	0.29	0.30
35-39	0.31	0.30	0.32
40-44	0.32	0.32	0.34
45-49	0.33	0.32	0.35
50-54	0.33	0.31	0.34
55-59	0.33	0.31	0.33
60-64	0.33	0.32	0.32
65-69	0.32	0.31	0.00
70-74	0.31	0.31	0.00
75-70	0.30	0.31	0.00
All	0.32	0.31	0.33
UK (1991 data)	0.3288		0.332
Life-time Values	0.2671	0.2713	0.2707

Table 10: Gini Coefficients for Consumption and Non-property Income

We now discuss the interrelations between the different variables in the model. These are shown in tables 11 and 12. They relate life-time income and consumption figures, calculated as the discounted value in the first period of economic activity, of the variables in question. The figures for the parents are calculated from the data for cohorts one to six, while those for the children are given by cohorts seven to twelve. The bequests received by parents and children are calculated at their actual values independently of the periods in which they are received. The correlation between parent's income and children's income is the value imposed in the simulation and of course present in the cross-section of results; the remaining figures are derived from the simulation results.

In each table the stochastic nature of the model is apparent. The correlation between parents' consumption and parents' income is the same as the correlation between children's consumption and children's income. However there is greater random variation in bequests than in incomes, and thus the correlations between parents' bequests and parents' incomes are therefore only approximately equal to the correlations between children's bequests and children's incomes. Similarly, the correlation between parental bequests and parental consumption is only approximately equal to the correlation between children's bequests and children's consumption.

The tables show that the presence of a bequest motive reduces the correlation between consumption and income only slightly. Without any bequests (and therefore with a fixed life-span or full annuitization) the two would be perfectly correlated. A flow of bequests reduces that correlation; it is striking that, even if parents are concerned about the welfare of their children, and therefore take action to protect their children's consumption from the effects of low income levels, that correlation is reduced only very slightly below the level generated by accidental bequests. Accidental bequests have the property of lifting the correlation between parental consumption and children's consumption above that of income, reflecting the point that parents with high incomes receive larger accidental bequests. However the presence of a bequest motive raises the correlation still further.

Even in the absence of a bequest motive there is a substantial correlation between the consumption of a parent and the bequest received by the child. But a bequest motive substantially increases that. It also substantially increases the correlation between the bequest received by the parent and the bequest received by the child. On the other hand the presence of a bequest motive reduces the correlations between bequests received by parents and children's incomes and consumption. When a bequest motive is present parents who receive a bequest will spend more of it on themselves when their children have high incomes than when they do not, while without such a motive their spending is independent of their children's incomes.

While these are the differences between an economy with a bequest motive and one without,

	YC	CP	CC	BP	BC
YP	0.50	0.98	0.55	0.28	0.46
YC		0.48	0.98	0.11	0.28
CP			0.53	0.44	0.44
CC				0.15	0.45
BP					0.23

Key

YP	Parents' Life-time Income
YC	Child's Life-time Income
CP	Parent's Life-time Consumption
CC	Child's Life-time Consumption
BP	Legacy left by Parent
BC	Legacy left by Child

Table 11: Correlations between Variables: Accidental Bequests only

	YC	CP	CC	BP	BC
YP	0.50	0.97	0.58	0.18	0.61
YC		0.48	0.97	0.05	0.20
CP			0.56	0.39	0.62
CC				0.12	0.40
BP					0.38

Key

YP	Parents' Life-time Income
YC	Child's Life-time Income
CP	Parent's Life-time Consumption
CC	Child's Life-time Consumption
BP	Legacy left by Parent
BC	Legacy left by Child

Table 12: Correlations between Variables: Bequest Motive

perhaps it is more striking that the presence of a bequest motive actually makes only a relatively small difference to the correlations between the variables. Certainly, without a bequest motive we observe a positive rather than zero correlation between parental income and the bequests they leave to children. With a bequest motive the correlation remains positive. Indeed of the various correlations in the tables, the only one which seems to be substantially affected by the bequest motive is the correlation between bequests received by parents and those received by children. This is considerably larger with a bequest motive than in its absence.

While the correlations provide us with information about the bivariate relationships, we need to complement them with an econometric analysis of the results similar to that which can be carried out on real data. We estimate regression equations to explain legacies received by children in terms of i) the life-time income of the parent, ii) the income of the child at the time the legacy is received and iii) the age of the child at the time of receipt. The last variable is, of course, perfectly correlated with the age of the parent at the time of death. The regression faces the problem resolved by Heckman (1978), that there are no negative bequests. If one includes the zero bequests, there is likely to be a discontinuity in the regression. If one looks only at positive bequests then there is an element of

	Probit Regression		Linear Regression	
	Coefficient	T-Ratio	Coefficient	T-Ratio
LPY	2.01	4.05	1.95	51.86
LCY	-0.03	0.09	0.15	5.77
Age	-4.97	7.77	-0.41	-29.96
Prob (B>0)			2.87	11.91
Constant	49.32	8.26	-4.61	-15.93
S.E / R^2			0.56	0.81

The dependent variable for the probit equation is one if a bequest is received and zero if it is not. The dependent variable for the linear regression is the log of the bequest received and the equation is fitted for all non-zero bequests.

Key
LPY Log Parent's Life-time Income
LCY Log Child's Life-time Income
Age Age of Child on Receipt of Legacy

Table 13: Probit and Regression Results: Accidental Bequest only

selection bias present. We therefore first estimate a probit equation which explains the probability of leaving a bequest. We then estimate a regression equation to explain the amount of the bequest and include, as an explanatory variable in this regression, the probability that the child receives a bequest.

Where there are only accidental bequests the probability of receiving a bequest is increasing in the income of the parent and decreasing with the age of both the parent and the child. The first term is explained by the fact that people with larger incomes save more for their retirement. But, since parents aim to have spent the whole of their resources by the time they reach the maximum life-span, the negative effect of age is also to be expected. Children's income has an insignificant coefficient. The positive correlation observed between children's income and bequests received of 0.28 is therefore shown as due to the link between parents' and children's incomes. Once this is controlled for the influence of children's incomes disappears.

In the regression explaining the log value of the bequests received age and parental income are strong influences. However, despite the presence of parental life-time income, the income of the child in the period in which the bequest is received is a positive determinant of the amount of the bequest.

The presence of a bequest motive makes a material difference to these regression equations. We find that child's income now enters negatively in the probit equation. Other things being equal, the higher the income of a child the lower is the chance of receiving a bequest. The same effect is visible in the regression equation itself. A high parental income increases the amount of a bequest while a high child's income reduces it. As in the case of accidental bequests, the value of inheritances declines with the age of the parent; the effect is, however, weaker than in the case where bequests were accidental.

	Probit Regression		Linear Regression	
	Coefficient	T-Ratio	Coefficient	T-Ratio
LPY	1.27	4.38	2.01	45.94
LCY	-1.12	4.45	-0.12	-3.49
Age	-2.03	6.79	-0.31	-15.39
Prob (B>0)			1.47	12.05
Constant	21.61	6.19	-3.49	-11.77
S.E / R^2			0.81	0.64

The dependent variable for the probit equation is one if a bequest is received and zero if it is not.
The dependent variable for the linear regression is the log of the bequest received and the equation is fitted for *all* non-zero bequests

Key
LPY Log Parent's Life-time Income
LCY Log Child's Life-time Income
Age Age of Child on Receipt of Legacy

Table 14: *Probit and Regression Results: Bequest Motive*

5 An Empirical Analysis of Factors Influencing Inheritance

There are two sources of information on inheritance in the United Kingdom. The National Child Development Survey is a study of a panel of children born in 1958; it also provides substantial information on their parents. The survey tells us whether respondents have received an inheritance and provides information on their incomes and their parents' incomes. It does not, however, say anything about the size of the inheritance. On two occasions the General Household Survey collected information about inheritances received in the previous ten years. But while amounts inherited are recorded (insofar as they are remembered correctly), the survey does not record the income of the respondent's parents. It does, however, collect data on their social classes.

The National Child development survey allows us to estimate the following probit equation explaining the probability of a son receiving an inheritance from his parents. We do not include an age term in the regression because all the children are of the same age. Out of the 1227 sons in the survey 260 had received an inheritance or *inter vivos* transfer. Unfortunately we have no information whether this transfer was received from their parents or another relative. We find that both father's permanent income and son's permanent income were significant positive influences on the probability of receiving an inheritance. The calculation of permanent income is described in the appendix. The coefficients of a probit equation are shown in table 15.

This equation is much closer to the situation in our simulation model when bequests are accidental than when they are motivated by a desire of the legator to take the legatee's circumstances into account.

	Coefficient	t-statistic
Log Father's Permanent Income	1.42	5.67
Log Son's Permanent Income	0.586	2.76
Constant	-5.67	-7.23

Table 15: Probit Equation: the Probability of Receiving an Inheritance in the National Child Development Survey

Variable	Coefficient	t-statistic	Coefficient	t-statistic
Log Father's Permanent Income	0.367	2.08	1.45	2.37
Log Son's Permanent Income	0.608	4.54	1.05	0.77
Prob(B>0)			-18.1	-1.5
Age of Son	0.041	7.87	0.06	1.5
Constant	-3.76	-17.5	6.5	4.41
R^2				0.04

Table 16: The Probability of Receiving a Bequest: Probit Estimates from the General Household Survey

The General Household Survey gives a similar picture. Out of 5962 households there are 188 who report receiving legacies from their parents. We use estimates of fathers' earnings in 1973 calculated from the General Household Survey at that time. We find, as with the National Child Development Survey, that the chance of receiving a legacy is increasing in both sons' and fathers' permanent earnings and that it increases with age. The calculation of permanent income is again described in the appendix; the father's permanent income is calculated only from information on social economic group because this is the only parental information provided in the General Household Survey. The parameter estimates are shown in table 16

6 Conclusions

We have developed a simulation model of bequests which allows us to compare accidental bequests with a situation in which bequests are altruistic. We find that altruism results in a substantially larger flow of bequests than does the alternative. The simulation model, based on distributional parameters observed in empirical studies of the United Kingdom, reproduces the Gini coefficients for the distribution of consumption and wealth reasonably well. It does less well at representing the upper deciles of the distribution. This is a fault common to most models of this type.Analysis of the correlations between income, consumption and bequests shows that these have the expected patterns and a two-step regression analysis finds that, if bequests are altruistic the incoem of potential beneficiaries has a negative influence on both the chance of receiving a bequest and on the amount received. If bequests are altruistic, then, relative to a situation in which there are no bequests, inheritance has the effect of slightly reducing life-time inequality. If, on the other hand, bequests are accidental, then inheritance has the effect of increasing life-time inequality.

The data for the United Kingdom fit the accidental model much better than the altruistic model. The income of the beneficiary is a positive influence on both the probability of receiving a bequest and on its magnitude. The income term tends to lose its statistical significance if education terms are also included. Nevertheless, it is a high (or unexpectedly high) level of education rather than a low or unexpectedly low level which is associated with both the chance of receiving a bequest and the amount of the bequest. This, too is quite at odds with the altruistic theory of inheritance. Thus, comparison of the results of a simulation model with findings for the United Kingdom suggests that bequests in the United Kingdom are accidental rather than altruistic.

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A Appendix: The Permanent Income Regressions and Educational Classification Scheme.

In this appendix we describe out approach to estimating father and son's permanent income. We assume that observable income, y_i, at any time is equal to permanent income, $y_{p,i}$, plus transitory income $y_{t,i}$. The dependence of observable and transitory income on time is understood and omitted from the notation. Both permanent income and transitory income are unobservable. However we posit that permanent income is linearly related to a set of observable constant characteristics, S_i such that $y_{p,i} = \gamma S_i$ and similarly transitory income is linearly related to a set of observable time-varying characteristics T_i such that $y_{t,i} = \lambda T_i$. We can therefore write

$$y_i = y_{p,i} + y_{t,i} + v_i \tag{12}$$

$$= \gamma S_i + \lambda T_i + v_i \tag{13}$$

where v_i is a transitory error term. Given this relationship, we can regress observable income on the set of observable permanent characteristics S_i and the time-varying characteristics T_i to estimate the parameters, γ and λ. We can then construct an estimate of permanent income as $y_{p,i} = \gamma S_i$ to use in the regressions. In Table 17 we report the results of the regressions to estimate father's permanent income. We use years in full-time education and dummy indicators of socio-economic group as the observable stable characteristic S_i; father's age, father's age^2 and a dummy indicators for region of domicile as the time-varying characteristics T_i. The regressions on the NCDS sample use Stewart's (1983) Grouped Dependent Variable estimator as in this survey father's earnings are only recorded as belonging to one of 12 earning groups. In the GHS, father's income level is recorded, and therefore these regression are estimated by OLS. Comparison of the results suggest that at low to mid income levels, very little information is lost from the grouping in the NCDS sample. However the estimates of the permanent income of the manager and professional classes in the NCDS sample are significantly lower than those from the GHS sample. A possible explanation is that on average the father's in the NCDS sample are younger than those in the GHS sample, and this effect is not completely corrected for by the age related variables in the regressions. Therefore as a test of this idea, we recalculated the regressions for the GHS sample after having narrowed the sample to include only fathers aged between 30 and 45. The results show that this factor does account for a considerable proportion of the discrepancy between the two samples. Finally comparison of the R^2 of the regressions using the different indicators for social class, suggest that using the more disaggregated scheme improves the fit by around 12%.

Tables 18 to 19 repeat this exercise for the sons. As we have more information on son's educational attainment, we experimented with different education classifications. The two samples agree relatively closely on the returns to different qualification levels, and on the permanent income levels of the lower to middle class groups. However, as with the regressions on the father's data, the two samples predict different levels of permanent income for the higher income classes. This is to be anticipated as the age of all the sons in the NCDS sample is 33. As earnings rise more steeply with age the higher the social income class, the recorded income of the sons in the NCDS sample almost surely underestimates their average lifetime or permanent income. Again comparison of the R^2 of the different regressions show that both the more disaggregated educational classification and social class schemes improve significantly the fit in both samples by as much as 40%.

	National Child Development Survey				General Hc		
					All those in Full Tir		
	F1(NCDS)		F2(NCDS)		F1(GHS)		F
	Coef.	Std Err	Coef.	Std Err	Coef.	Std Err	Coe
Years in Full-Time Education	0.04	(0.003)			0.037	(0.003)	
Employers - Large Firms	0.54	(0.035)	0.614	(0.035)	0.85	(0.139)	0.92
Managers- Large Firms					0.839	(0.034)	0.91
Employers - Small Firms	0.33	(0.033)	0.369	(0.033)	0.477	(0.076)	0.53
Managers- Small Firms					0.542	(0.036)	0.58
Professional - Employed	0.47	(0.036)	0.576	(0.036)	0.742	(0.036)	0.8
Professional - Self-Employed	0.72	(0.081)	0.872	(0.082)			
Ancillary Staff, Artesans	0.21	(0.034)	0.279	(0.034)	0.46	(0.035)	0.5
Foremen, Supervisors (Non-Man)					0.428	(0.046)	0.4
Junior Non-Manuel	0.13	(0.033)	0.152	(0.052)	0.317	(0.032)	0.3
Personal Services	0.03	(0.052)	0.027	(0.033)	0.151	(0.059)	0.15
Foremen, Supervisors (Man)	0.23	(0.032)	0.239	(0.032)	0.477	(0.034)	0.48
Skilled Manual	0.15	(0.031)	0.153	(0.033)	0.341	(0.031)	0.34
Semi skilled Manual	0.09	(0.032)	0.087	(0.035)	0.251	(0.032)	0.25
Unskilled Manual	0.02	(0.034)	0.015	(0.036)	0.157	(0.035)	0.15
Workers - own account	0.21	(0.035)	0.221	(0.052)	0.216	(0.059)	0.2
Farm Employers, Managers	0.11	(0.051)	0.149	(0.053)	0.206	(0.096)	0.23
Farm Workers - Own Account	-0.06	(0.052)	-0.052	(0.005)	-0.057	(0.216)	-0.05
Age	0.02	(0.005)	0.016	(0.007)	0.044	(0.002)	0.03
$Age^2/100$	-0.05	(0.007)	-0.036	(0.014)	-0.053	(0.003)	-0.04
	Plus an Intercept and 10 Regional Dummies						
Sample Size	7427		7427		5589		558
R^2					0.4		0.3

For the NCDS regressions, the dependent variable is the natural logarithm of father's weekly net pay; usual weekly take-home pay of any male head of household in full-time work in the sample. A Groupe estimate the statistics on the NCDS data, whereas an OLS estimator is used on the GHS data. Some gr and Managers of Large Firms, Employers and Managers of Small Firms, Ancillary staff and non-manu these merged groups are recorded in the row of the first group mentioned first. In the GHS there were on sample; they were therefore included in the professional employed group.

Table 17: Permanent Wage Regression of Fathers using Socio-Econ

	S9(NCDS)		S10(NCDS)		S11(NCI	
	Coef.	Std Err	Coef.	Std Err	Coef.	St
Years in Full-Time Education	0.040	(0.004)				
Higher Level Qual.					0.222	(0
Degree					0.299	(0
Preliminary Qual.						
Technical Qual.						
Advanced Technical Qual.						
O-levels						
A-levels						
Lower Tertiary Qual.						
Degree						
Managers- Large Firms	0.514	(0.088)	0.571	(0.089)	0.472	(0
Employers - Small Firms	0.046	(0.208)	0.156	(0.211)	0.078	(0
Managers- Small Firms	0.361	(0.101)	0.401	(0.102)	0.331	(0
Professional - Self-Employed	0.468	(0.182)	0.603	(0.184)	0.411	(0
Professional - Employed	0.496	(0.093)	0.593	(0.094)	0.418	(0
Ancillary Staff, Artesans	0.287	(0.089)	0.366	(0.090)	0.213	(0
Foremen, Supervisors (Non-Man)	0.341	(0.110)	0.362	(0.111)	0.351	(0
Junior Non-Manual	0.135	(0.088)	0.155	(0.089)	0.131	(0
Personal Services	-0.039	(0.099)	-0.026	(0.100)	-0.040	(0
Foremen, Supervisors (Man)	0.424	(0.098)	0.433	(0.100)	0.427	(0
Skilled Manual	0.304	(0.088)	0.296	(0.089)	0.317	(0
Semi skilled Manual	0.108	(0.089)	0.1	(0.090)	0.121	(0
Unskilled Manual	0.029	(0.101)	0.023	(0.103)	0.055	(0
Workers - own account	0.021	(0.130)	0.024	(0.132)	0.032	(0
Farm Employers, Managers	0.030	(0.229)	0.03	(0.232)	0.022	(0
	Plus an Intercept and 10 Regional Dummies					
Sample Size	3283		3283		3283	
R^2	0.226		0.205		0.253	

The dependent variable in all the regressions is the natural logarithm of observed net income of the son
social economic group dummy variables are based on the employment of the son in this 5th Wave. All re

Table 18: National Child Development Survey: Son's Permanent Wage Regressions u

	S9(GHS)		S10(GHS)		S11(GHS)	
	Coef.	Std Err	Coef.	Std Err	Coef.	Std
Years in Full-Time Education	0.010	(0.002)				
A-levels					0.098	(0.0
Degree					0.255	(0.0
Prelim Quals						
Tech Quals						
O-levels						
A-levels						
Lower Tertiary						
Degree						
Employers - Large Firms	1.904	(0.313)	1.908	(0.313)	1.863	(0.3
Managers- Large Firms	0.759	(0.076)	0.79	(0.075)	0.690	(0.0
Employers - Small Firms	0.393	(0.081)	0.406	(0.082)	0.370	(0.0
Managers- Small Firms	0.568	(0.077)	0.588	(0.077)	0.530	(0.0
Professional - Self-Employed	0.953	(0.090)	1.008	(0.089)	0.815	(0.0
Professional - Employed	0.697	(0.077)	0.747	(0.076)	0.571	(0.0
Ancillary Staff, Artesans	0.452	(0.077)	0.499	(0.076)	0.363	(0.0
Foremen, Supervisors (Non-Man)	0.441	(0.081)	0.455	(0.081)	0.408	(0.0
Junior Non-Manual	0.420	(0.077)	0.438	(0.077)	0.394	(0.0
Personal Services	0.106	(0.101)	0.116	(0.101)	0.078	(0.1
Foremen, Supervisors (Man)	0.431	(0.076)	0.436	(0.076)	0.410	(0.0
Skilled Manual	0.339	(0.074)	0.343	(0.075)	0.323	(0.0
Semi skilled Manual	0.201	(0.076)	0.204	(0.076)	0.200	(0.0
Unskilled Manual	0.162	(0.084)	0.161	(0.084)	0.162	(0.0
Workers - own account	0.044	(0.077)	0.053	(0.077)	0.032	(0.0
Farm Employers, Managers	-0.032	(0.113)	-0.008	(0.113)	-0.062	(0.1
Farm Workers - Own Account	-0.148	(0.144)	-0.14	(0.144)	-0.138	(0.1
Age	0.061	(0.013)	0.065	(0.013)	0.060	(0.0
Age^2	-0.074	(0.019)	-0.082	(0.019)	-0.073	(0.0
Married	0.110	(0.017)	0.107	(0.017)	0.106	(0.0
Children	0.031	(0.016)	0.029	(0.016)	0.035	(0.0
	Plus an Intercept and 10 Regional Dummies					
Sample Size	4455		4455		4455	
R^2	0.320		0.317		0.336	

The dependent variable in all the regressions is the natural logarithm of observed net income of any mal sample. All regressions are OLS

Table 19: General Household Survey: Son's Permanent Wage Regressions using