Life-Cycle Learning, Earning, Income and Wealth

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November 2000

1 Introduction

Individuals who invest heavily in human capital tend to experience a higher level of earnings and income throughout most of their life-cycle. Most of their higher earnings are in the form of higher wages, but a significant fraction is accounted for by a greater work effort. In addition, such individuals tend to consume more and accumulate financial assets at a faster rate. What accounts for these differences? While one might be inclined to attribute such differences largely to luck, much of the heterogeneity we observe could also be due to personal choices that are made on the basis of an intrinsic set of tastes and abilities that happen to differ across people. Our paper is about exploring the plausibility of this latter hypothesis.

One obvious measure of past human capital investments is the level of educational attainment. Among adults in Canada and the United States, roughly 25% are high-school dropouts, 50% have a high-school diploma, and 25% have a college degree. Unlike demographic variables such as age, sex, and race, educational attainment (or human capital accumulation in general) is largely a choice variable. It seems reasonable to suppose that individuals are from an early age generally aware of the benefits associated with higher levels of human capital investment; and yet, people clearly make different choices. What drives these different decisions?

One way to understand the human capital choice is in terms of an optimal investment decision; see Ben-Porath (1967). In the Ben-Porath model, individuals seek to maximize the present value of their lifetime earnings by allocating their time between work and learning activities, and by choosing an appropriate expenditure path for educational goods and services. A key parameter in this model is the 'ability to learn', modelled as the technological efficiency with which learning effort and resources augment the value of human capital.[1] Not surprisingly, the model predicts that more able individuals choose to undertake greater human capital investments, especially early on in the life-cycle, and that learning effort declines over time. During youth, less able individuals tend to earn more (as they devote more time to work rather than learning), but more able individuals have rapidly rising earning profiles that soon overtake those of the less able. In addition, dispersion in earnings across educational groups tends to grow over time. These predictions are broadly consistent with the evidence; e.g., see Lillard (1977).

While the basic Ben-Porath model provides a plausible explanation for why earnings profiles might differ, before one can be confident that ability differences are at the root of inequality it would be prudent to examine whether the model is consistent with other facts, for example, on labour supply, consumption, and asset accumulation behaviour. In order to examine this issue, the basic model must be extended to incorporate a labour-leisure choice and a consumption-saving decision. Such an extension has been provided by Blinder and Weiss (1976), Heckman (1976), and Ryder, Stafford and Stephan (1976). Judging by what is reported in the recent survey by Neal and Rosen (1998), these versions of the Ben-Porath human capital model represent the extent to which this theoretical set-up has currently progressed.

Blinder and Weiss (1976) and Ryder, Stafford and Stephan (1976) are primarily concerned with exploring what sort of life-cycle dynamics might emerge in such an environment for a 'representative' individual.[2] Heckman (1976) reports the results of several comparative dynamics exercises, but does not always provide a full description of joint behaviour. For example, he finds that individuals with greater learning ability have peaks in their hours of work profiles at older ages, but we are not told how these profiles are positioned relative to each other. As well, he does not ask how differences in ability affect financial asset accumulation.

The purpose of our paper is explore what this environment has to say about how life-cycle patterns of consumption, learning, labour supply, earnings, income and asset accumulation should be shaped as a function of parameters describing tastes and abilities. In this paper, we focus on three sources of parameter heterogeneity: (1) the ability to learn; (2) the subjective rate of time-preference; and (3) the taste for leisure. We wish to discover first of all whether any single source of parameter heterogeneity might be able to account for the qualitative differences that we observe in the data. Our preliminary findings suggest that no single source of parameter heterogeneity can account for the facts. Next, we ask whether there are plausible combinations of parameters that might be able to explain the data. Our preliminary findings suggest that the model is broadly consistent with the evidence if we assume that people differ in their rate of time-preference and their taste for leisure; and if these parameters are

[1] Another way to model learning ability is in terms of initial endowments of human capital.

[2] Evidently, a very rich and complex set of dynamics is possible.

positively correlated among individuals.

1.1 Some Facts

In this section, we describe what 'typical' (median) life-cycle profiles look like across three educational groups: dropouts; highschool; and college. The data is from the Canadian 1992 Family Expenditure Survey Public Use File (FAMEX) and is described in a little more detail in Appendix I. We also review evidence from Attanasio (1994) who reports similar measurements from the 1990 Consumer Expenditure Survey for the United States.

1.2 Income, Consumption and Saving

Figure 1 plots measures of after-tax income, consumption expenditures, and saving for each educational group over ten periods of a life-cycle beginning at age 21 and ending at age 70. Not surprisingly, more highly educated individuals have significantly more income at every age except for very early in the life-cycle. The age-income profile for dropouts displays a modest hump-shaped pattern, with income peaking age 52 at a level that is 1.65 times higher than at age 21. The age-income profile for college graduates, on the other hand, displays a significant hump-shaped pattern, with income peaking at age 52 at a level that is 2.88 times higher than at age 21. According to this data, college graduates generate roughly twice the income of dropouts around the peak income years. Attanasio (1994) reports similar findings for the United States. In particular, median income peaks in the 51–55 year-old cohort, with college graduates generating 2.84 times more income than dropouts.

Qualitatively, it appears that consumption tracks disposable income fairly closely in the sense of sharing the same hump-shaped pattern. This fact that has been referred to as the 'consumption-income parallel' (see Carroll and Summers, 1991) and is sometimes used as an argument to reject the basic life-cycle model, which predicts a flat age-consumption profile. Attanasio and Browning (1995) argue that the consumption-income parallel largely reflects family-size effects. Using several years of U.K. FES data to follow cohorts through time, they reproduce the finding that consumption and income move together over the life-cycle. However, deflating consumption by an adult-equivalent scale renders a completely flat life-cycle path for adjusted consumption. On the other hand, Gourinchas and Parker (1999) argue that with their adjustments, consumption continues to display a hump-shape.

The bottom panel of Figure 1 displays household saving, defined here as the difference between household after-tax income and household consumption. According to this measure of saving, the median household of each education group are net savers over the life-cycle (at least, up to age 70). Higher education groups tend to save more, both in total and as a ratio of their disposable income.

In fact, the propensity to save remains fairly constant from age 32 onward in this data. Over the entire life-cycle, saving rates average 8.8% for dropouts, 10.6% for highschool graduates, and 19.6% for college graduates.

The FAMEX data set provides a series called 'net change in assets' which differs (empirically, not conceptually) somewhat from the saving measure reported above. Qualitatively, the net-change-in-assets series is similar in that higher education groups tend to save more over the entire life-cycle. But according to this measure, the median saving for dropouts is pretty close to zero over the entire life-cycle and the median saving for highschool graduates is not very much larger. In addition, the level of saving by college graduates is about half of what is recorded by the earlier definition of saving.

The saving behaviour reported in Figure 1 is broadly consistent with SCF and PSID data on wealth accumulation patterns across educational groups. According to Cagetti (1999), median net worth positions (including housing but abstracting from pension entitlements) are very low and similar across individuals at age 30. While all three educational groups tend to save over the entire life-cycle, the rate of asset accumulation is much higher for well-educated individuals. By age 60, the median dropout has accumulated roughly between $60,000–90,000; the median high-school graduate has between $125,000–180,000; and the median college graduate has between $250,000–300,000.[3] In other words, to a first approximation, each level of education is associated with a doubling of net worth in old age.

1.3 Earnings, Labour Supply and Wages

Figure 2 plots measures of earnings, labour supply, and wages for each educational group over ten periods of a life-cycle beginning at age 21 and ending at age 70. Again, it is not surprising to discover that better educated individuals tend to have higher life-cycle earnings. Age-earning profiles tend to display a more pronounced hump-shaped pattern relative to income, partly because earnings drop significantly as people approach old age.

The next two panels in Figure 2 reveal that better educated individuals have higher earnings early on in the life-cycle because they allocate more time the market sector; i.e., not because the pecuniary return to labour is higher. Wage rates tend to grow over time for all education groups, but grow more quickly for the better educated. Labour supply profiles rise early on in the life-cycle and then flatten out, showing a modest decline as the household ages; this pattern holds for all education groups. The main difference in labour supply across education groups is simply in terms of levels: college graduates work on average about twice as hard a dropouts.

[3] The figures are in 1992 dollars. The lower bound is from the SCF; the upper bound is from the PSID.

1.3.1 The Return on Education

There is a large empirical literature concerned with measuring the 'return' to education; this literature has recently been surveyed by Card (1998). The standard econometric model taken to the data is usually some variant of Mincer's (1974) 'human capital earnings function' that relates some measure of log earnings ($\log y$) to some measures of educational attainment (S) and work experience (X); together with a statistical residual (ε); e.g.,

$$\log y = a + bS + g(X) + \varepsilon. \quad (1)$$

Apparently, it is now conventional to refer to the estimated parameter b as the 'return to education'. Typically, the return to education is found to vary with certain characteristics of individuals, such as 'ability' and 'family background'. Card argues that the empirical specification above, with g modelled as a third or fourth degree polynomial, provides a reasonably good fit with the data, although, contrary to the specification in (1), there does appear to be some evidence of an interaction between education and experience.

When log annual earnings are regressed on education and other controls, the estimated return to education is the sum of the b coefficients for parallel models fit to the log of wages ($\log w$) and the log of annual hours ($\log h$). Here, we reproduce Card's (1998) Table 1, which reports the estimated returns to education using (1) fit to the 1994–96 CPS.

	Dependent Variable		
	$\log w$	$\log h$	$\log y$
Men			
b	0.100	0.042	0.142
R^2	0.328	0.222	0.403
Women			
b	0.109	0.056	0.165
R^2	0.247	0.105	0.247

Thus, Card concludes that in the U.S. labour market in the mid-1990s, about two-thirds of the measured return to education in annual earnings data is attributable to the effect of education on the wage rate, with the remainder attributable to the effect on annual hours worked.

1.4 Data Summary

The reader should keep in mind that there are several practical and (unresolved) conceptual issues relating to the measurement of these variables; see Browning and Lusardi (1996) for details. But despite the quantitative differences that emerge depending on how variables are defined or measured, a number of qualitative features appear to be robust across different data sets and different definitions/measurements. The important qualitative differences are as follows:

1. Individuals of a given age differ in terms of accumulated human capital (e.g., as measured by educational attainment).
2. Individuals who invest heavily in human capital (better educated individuals) tend to have higher incomes, earnings, consumption, and savings;
   (a) Higher earnings are attributable to both higher wage rates (2/3) and greater work effort (1/3);
   (b) Higher savings attributable to higher incomes and a greater propensity to save.
3. The dispersion in income, earnings, consumption, and saving across educational groups peaks sometime in the middle of the life-cycle; the dispersion in labour supply and saving rates remains relatively constant; and the dispersion in wage rates is (weakly) increasing with age.

We wish to focus on these qualitative features of the data and ask whether a sensibly parameterized life-cycle model (that endogenizes human capital and labour supply) can account for these qualitative patterns.

2 The Model

Consider an economy populated by overlapping generations of individuals who live for J periods, indexed by $j = 1, 2, ..., J$. The population is assumed to grow at a constant rate n per period, and we denote the share of age-j individuals in the population by μ_j, which is time-invariant and satisfies $\mu_j = (1+n)^{-1}\mu_{j-1}$ for $j = 2, ..., J$ and $\sum_{j=1}^{J} \mu_j = 1$.

There is an issue as to whether idiosyncratic risks play an important role in the evolution of life-cycle variables. Our feeling on this matter is that, while idiosyncratic risks may be important, they are not dominant. This view is supported by the empirical work of Venti and Wise (2000), who investigate the question of why the dispersion of wealth at retirement ages is so great. These authors argue that 90% of the variation observed in retirement wealth is due to the different choices that people make and not to idiosyncratic luck. In the analysis below, we abstract from uncertainty.

Individuals have preferences defined over deterministic time-profiles of consumption c_j, leisure l_j, as well as a final net worth position a_{J+1} (bequeathed to the future generation); let preferences be represented by the utility function:

$$\sum_{j=1}^{J} \delta^{j-1}[U(c_j) + \lambda V(l_j)] + \phi B(a_{J+1}).$$

Assume that the functions U, V and B are all strictly concave and that they satisfy standard Inada conditions; we will treat these functions as common across individuals. Preferences are parameterized by the discount factor δ; the taste for leisure λ; and the strength of the bequest motive χ; individuals may or may not differ along these dimensions. Note: in this version of the paper, we set $\chi = 0$.

There are three uses for time: market work n; learning effort e; and leisure l; where $n + e + l = 1$ (and the usual non-negativity constraints). Let h denote human capital. People might differ in their initial endowment of human capital (one measure of differences in ability). A person's human capital is assumed to augment time-use in working and learning; measured in 'efficiency units', work effort equals hn and learning effort equals he.

Following Heckman (1976), the human capital accumulation technology is given by:[4]

$$h_{j+1} = (1 - \sigma)h_j + \alpha G(h_j e_j);$$

where G is strictly increasing and concave, σ is the depreciation rate on human capital, and α is a parameter that indexes 'learning ability'. We will assume that G and σ are common across households; however, α may differ. Let v denote the vector of parameters describing a particular individual; i.e. $v = (\alpha, \delta, \lambda)$.

There are two prices in the model. Let ω denote the price of an efficiency unit of labor and let R denote the (gross) real rate of interest paid on financial assets. Both of these prices will be determined by market clearing conditions in the general equilibrium. Note that labor earnings are given by ωhn, so that $w = \omega h$ can be interpreted as the real wage.

Individuals can save or borrow freely at the going interest rate R (there are no debt constraints beyond the end-period restriction $a_{J+1} \geq 0$). The asset accumulation equation is given as follows:

$$a_{j+1} = Ra_j + w_j n_j - c_j;$$

Optimal decision-making results in a desired profile $\{c_j, n_j, e_j, l_j, a_{j+1}, h_{j+1} \mid \omega, R, v\}_{j=1}^{J}$.

What remains now is the determination of prices. In a steady-state, the per capita capital stock is given by:

$$K = (1 + n)^{-1} \sum_{j=1}^{J} \mu_j \sum_{v} a_j(v)\mu(v);$$

[4] Note that we are not modelling the schooling choice per se. What we are assuming is that individuals in the data who attend school longer are likely to invest more heavily in human capital at all stages of the life-cycle. To the extent that this is true, we can then associate people in the model with higher levels of human capital with people in the data who have higher education.

where $\Lambda(v)$ represents the fraction of the population with parameter vector v. The per capita level of hours (measured in efficiency units) is given by:

$$H = \sum_{j=1}^{J} \mu_j \sum_{v} h_j(v) n_j(v) \Lambda(v)$$

Output is produced by a constant returns to scale production technology $Q = F(K, H)$. Equilibrium prices are determined by the usual marginal conditions:

$$\begin{aligned} \omega &= F_H(K, H) \\ R &= F_K(K, H) + 1 - \phi; \end{aligned}$$

where ϕ is the depreciation rate of physical capital. Finally, goods-market clearing requires:

$$C + (n + \phi)K = Q;$$

where,

$$C = \sum_{j=1}^{J} \mu_j \sum_{v} c_j(v) \Lambda(v).$$

2.1 Parameterization

Functional forms are required for U, V, G and F.

$$\begin{aligned} U(c) &= (1 - \gamma)^{-1}[c^{1-\gamma} - 1] \\ V(z) &= (1 - \eta)^{-1}[z^{1-\eta} - 1] \\ G(x) &= x^{\zeta} \\ F(K, H) &= K^{\theta} H^{1-\theta}. \end{aligned}$$

3 Calibration

At this stage, we do not have the time to calibrate or estimate the model as precisely as we would like. So, we will content ourselves with a rough calibration. We calibrate first to a 'representative' individual; the parameters are chosen as follows.

3.1 Demographics

Let the number of periods be $J = 11$; the length of a period is five years (think of people beginning their economic life at age 20 and living to 70). The population growth rate is set to $n = 0$; so that $\mu_j = 1/J$ for all j.

3.2 Preferences

The curvature parameter on U is chosen to be $\gamma = 1.5$ (a standard choice). The curvature for V is also chosen to be $\eta = 1.5$. The weighting factor for leisure is chosen to be $\lambda = 1.752$; this generates the result that roughly $1/3$ of available time is devoted to the labour market. The discount factor is chosen to be $\delta = 0.86$; which implies an annual discount rate of 3%.

3.3 Technology

The learning ability parameter is set to $\alpha = 0.40$; this implies that young people spend around 10% of their available time in learning activities. The curvature of the learning technology is taken from Heckman (1976); $\zeta = 0.70$. The share of physical capital in total output is set to $\theta = 0.35$. Physical capital depreciates at an annual rate of 12%; set $\phi = 0.48$. Assume that human capital does not depreciate; $\sigma = 0$.

3.4 Endowments

The human capital endowment is normalized to $h_1 = 1$.

4 Representative Individual

In Figure 3 we plot the life-cycle behaviour of the representative individual; i.e., the equilibrium based on the parameterization above. As Figure 3 reveals, the model does a very nice job of replicating 'typical' life-cycle behaviour, with the possible exception of the very aged. In particular, the model predicts that consumption continues to rise throughout the life-cycle; the data suggests otherwise. As well, in the model, individuals dissave in old age much more rapidly than in the data (we only plot the first 10 periods of the 13 period life-cycle). This last feature could presumably be rectified by incorporating the bequest motive.

5 Single Sources of Heterogeneity

In this section, we shall consider three separate sources of heterogeneity and evaluate how each, in isolation, is predicted to affect life-cycle behaviour. The three parameters we consider are: (1) the ability to learn, α; (2) the discount factor, δ; and (3) the taste for leisure, λ. For each case, we will model three types, representing high, medium, and low values, with 50% of the population taking on the medium value, and the other 50% evenly divided across the two extreme values. In equilibrium, each type of person will choose a different life-time learning profile; we label the group with the greatest life-time learning effort 'college graduates' and those with the lowest 'dropouts'.

5.1 The Different-Ability Hypothesis

Suppose that individuals differ only in their ability to learn; e.g., $\alpha = 0.32, 0.40, 0.48.$ The results are plotted in Figure 4. Not surprisingly, those with the highest learning ability become 'college graduates'.

Observe that the earnings profiles take the expected shape in the sense that those with low learning ability have higher earnings when young (relative to high learning ability types), and relatively lower earnings when old. This basic qualitative pattern is also highlighted in Neal and Rosen (1998, Figure 4.2), who remark that this U-shaped relationship between cohort earnings variance and cohort age is an important theme in the literature on human capital. However, this U-shaped pattern is not present in our data, possibly because by age 21 (the youngest age in our sample) we are already beyond the minimum dispersion point. Ability differences seem to generate the right type of life-cycle wage patterns, but labour supply profiles are qualitatively similar only after period 3 (age 32).[5]

The most glaring deficiency in the "Different-Ability Hypothesis" is what it implies for asset accumulation behaviour. According to the model, individuals with low learning ability (dropouts) will accumulate financial assets rapidly, while those with high learning ability (college) are predicted to hold negative net-worth positions for most of their life.

The model's logic is perfectly clear. Wealth takes two forms in this model: human wealth and financial wealth. Low ability individuals naturally wish to substitute into the accumulation of financial wealth, while high ability individuals allocate their resources toward accumulating human capital. Later on in the life-cycle, those who are rich in human capital work harder to exploit their relatively high skill levels, while those who are rich in financial wealth can afford to consume more leisure.

5.2 The Different-Discount-Rate Hypothesis

The idea that people differ in their degree of 'patience', and that this might explain much of the heterogeneity observed in economic behaviour, is an old one (e.g., see Rae, 1834). Here, we consider three rates of time-preference (annualized) equal to: $0.0275, 0.030$; and 0.0325; the results are displayed in Figure 5.

[5] Measured hours of work here is total hours worked plus time spent learning, except for those aged 21 and in college. The idea here is that training is undertaken while on the job.

In a model without leisure, different discount rates would have no effect on the level of human capital investment (assuming perfect capital markets). However, when leisure is endogenous and when personal time is a necessary input to learning, differences in the subjective rate of time-preference will induce different levels of learning effort. Because learning is a form of investment, one might naturally expect that relatively patient individuals would end up accumulating more human capital. Somewhat surprisingly, the model predicts that the least patient individuals will accumulate the most human capital; i.e., impatience here is positively correlated with the level of education, although the differences in time devoted to learning are small. One possible explanation for this result might lie in the fact that human capital cannot be consumed or sold as death approaches, unlike financial capital. Consequently, more patient individuals (who when young place a greater weight on end-of-life consumption) might prefer to accumulate wealth through a vehicle that is better suited to providing for old age consumption. In addition, the more patient place a greater weight on future leisure; and financial asset accumulation rather than human capital can better provide for future leisure.

In the model, patient individuals (associated here with dropouts) prefer to postpone consumption and leisure to a later age; hence, they consume little and work hard when young, so that net worth grows rapidly (although they remain relatively unskilled). According to the model, the reason why labour supply is relatively low for dropouts in latter stages of the life-cycle is because they are so wealthy. Needless to say, the model's explanation hardly seems plausible.

5.3 The Different-Taste-for-Leisure Hypothesis

Suppose now that people differ only in the relative weight they place on consumption and leisure at any point in time; here, we consider the following three values for the leisure parameter: $\lambda = 1.54; 1.74;$ and $1.94.$ According to the model, those who place relatively low weight on leisure are the ones who accumulate more human capital.

Out of the three hypotheses considered so far, the taste-for-leisure hypothesis seems to hold the most promise. In particular, the profiles for earnings, hours worked and real wages are qualitatively similar to observation. But once again, the most glaring deficiency of this hypothesis is what it predicts for asset accumulation behaviour: lower education groups display a greater propensity to save. Apparently, those who do not find work or schooling effort so painful prefer to accumulate wealth through human capital, rather than through financial assets.

6 Multiple Sources of Heterogeneity

The main source of tension in the model is that which seems to exist between human capital and financial capital; i.e., these two forms of capital represent alternative mechanisms by which to accumulate purchasing power. Consequently, if one is relatively good at accumulating human capital (whether it is because of higher ability, less patience, or a greater taste for consumption), then one tends to substitute into human capital at the expense of financial capital. In the data, however, the propensity to accumulate human capital is positively correlated with the propensity to accumulate financial assets.

The only way to generate this positive correlation between human and financial capital investment is to consider multiple sources of heterogeneity. In this section, we consider two economies: one in which people differ in their learning ability and their discount rate; and one in which people differ in their taste for leisure and their discount rate. For simplicity, we assume a perfect correlation between the two parameters (so that there will continue to be only three types of individuals).

6.1 Learning Ability and Discount Rate

Assume that people differ both in their ability to learn and in their discount rate; and that the discount rate (discount factor) is negatively (positively) related with learning ability. The three types of individuals are described by the following parameter configuration:

	α	δ
Type 1	0.30	0.84
Type 2	0.40	0.86
Type 3	0.50	0.88

In the model, individuals who have a high ability to learn and a low discount rate (Type 3 individuals) end up accumulating greater levels of human capital. The hope here is that the high learning ability will result in high human capital investments and that the low discount rate will result in a high rate of saving. The results are displayed in Figure 7. As the figure reveals, this hypothesis holds some promise. However, high-ability people still tend to be net debtors early on in the life-cycle (they wish to finance their human capital investments). Increasing the dispersion in the time-preference parameter may help along this margin; however, doing so would exacerbate the tilts in the consumption profiles (something we do not see in the data).

6.2 Taste for Leisure and Discount Rate

Assume now that people differ in their taste for leisure and in their discount rate; and that discounting is positively related to the taste for leisure. The three types of individuals are described by the following parameter configuration:

	λ	δ
Type 1	1.25	0.88
Type 2	1.75	0.86
Type 3	2.25	0.84

In the model, individuals who have a low taste for leisure and a low discount rate (high discount factor) end up accumulating greater levels of human capital. As with the earlier experiment, the hope here is that the low taste for leisure will result in high levels of human capital investments while the low discount rate will result in a high rate of saving. Figure 8 demonstrates that this hypothesis has a great deal of promise; this figure fits the data better than any of the explanations proposed so far.

The implications of this hypothesis are potentially profound. It argues that, while people may appear to differ in their ability to learn, this difference arises not from intrinsic differences in learning ability (α); but from the human capital investments that people have chosen to make in the past (remember that it is the efficiency unit of learning effort he that enters into the learning production function). Ability here is to be interpreted as the manifestation of hard work and frugal (forward-looking) tendencies.

7 Discussion

We believe that it is interesting to discover what sort of intrinsic differences in people might cause them to make very different economic decisions. Knowledge of the intrinsic structure of heterogeneity (i.e., the distribution of deep parameter values) can play an important role in the design of social policy. For example, if heterogeneous discounting is found to be important, then any redistributive policy should likely include provisions to make entitlements legally inalienable; see Andolfatto (2000). If it is found that the taste for leisure matters more than the ability to learn in explaining the data, then we can conclude that people differ in their skills not because of intrinsic ability differences but because of how they chose to allocate their time in the past. If mitigating skill differences (earnings differentials) is a policy goal, then such a result might point to education subsidies. On the other hand, if observed heterogeneity is attributable to differences in endowments (financial bequests or initial human capital levels), then lump-sum transfers may be the suitable instrument to implement a redistribution policy.

FIGURE 1
Canada 1992 FAMEX Data

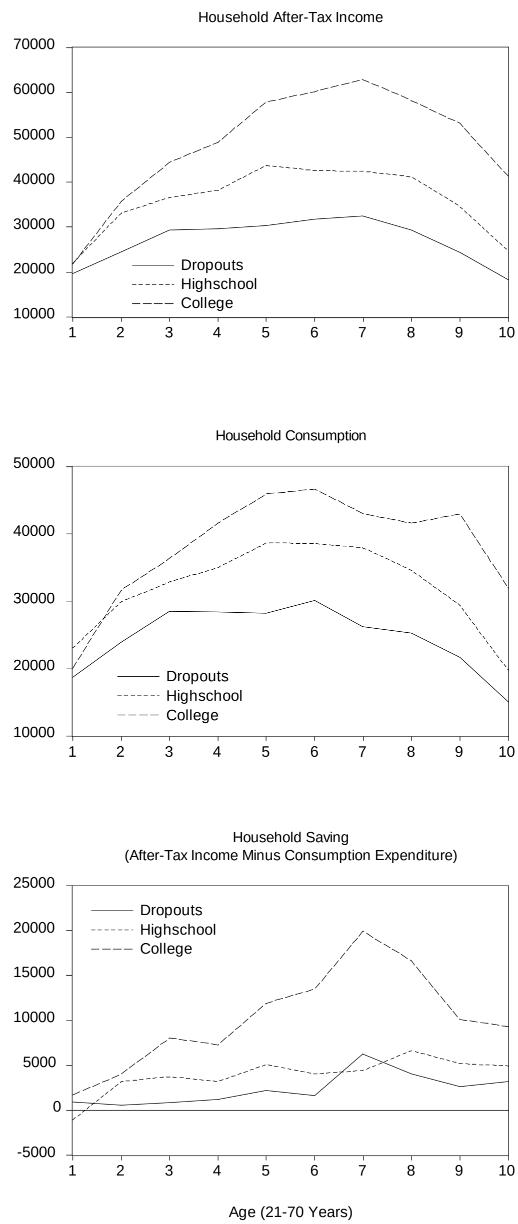


FIGURE 2
Canada 1992 FAMEX Data

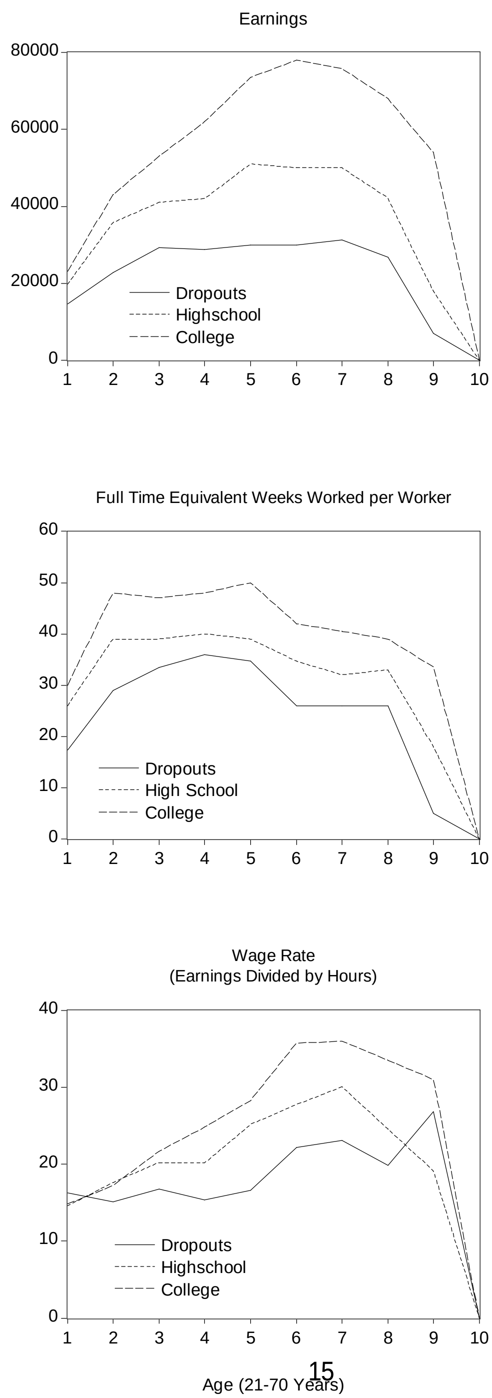


FIGURE 3
Representative Agent

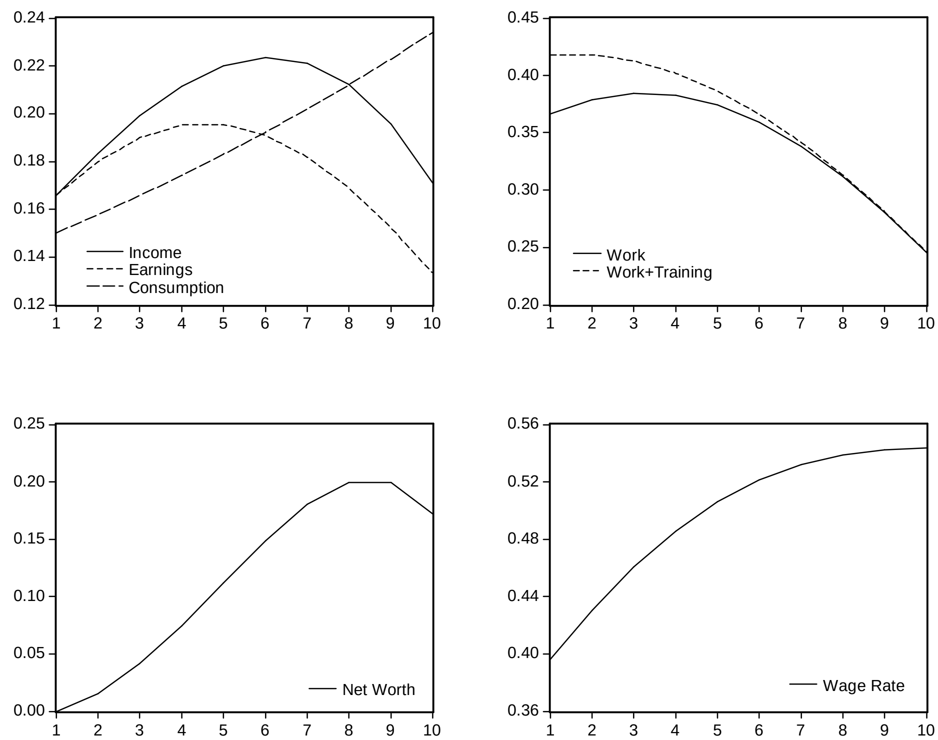


FIGURE 4
Differences in Learning Ability

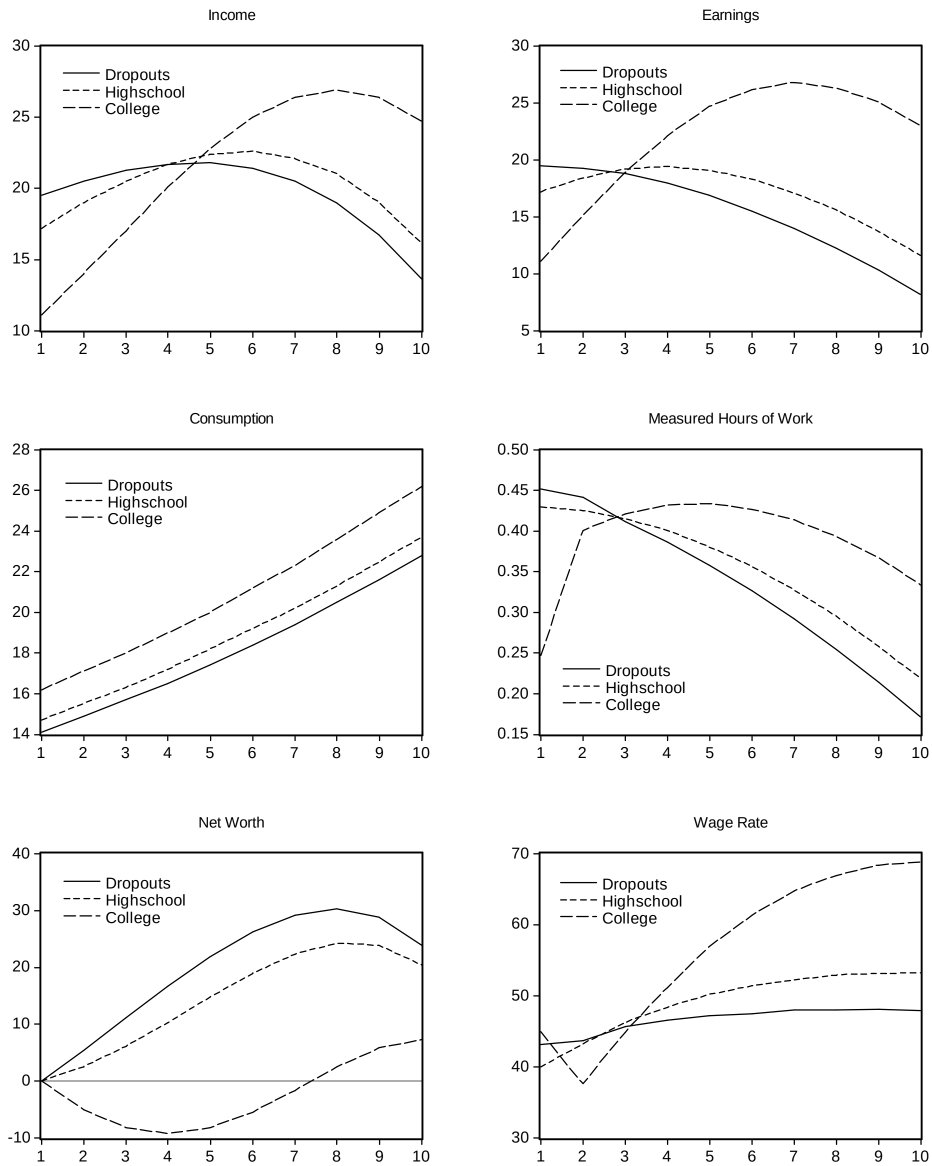


FIGURE 5
Differences in Time-Preference

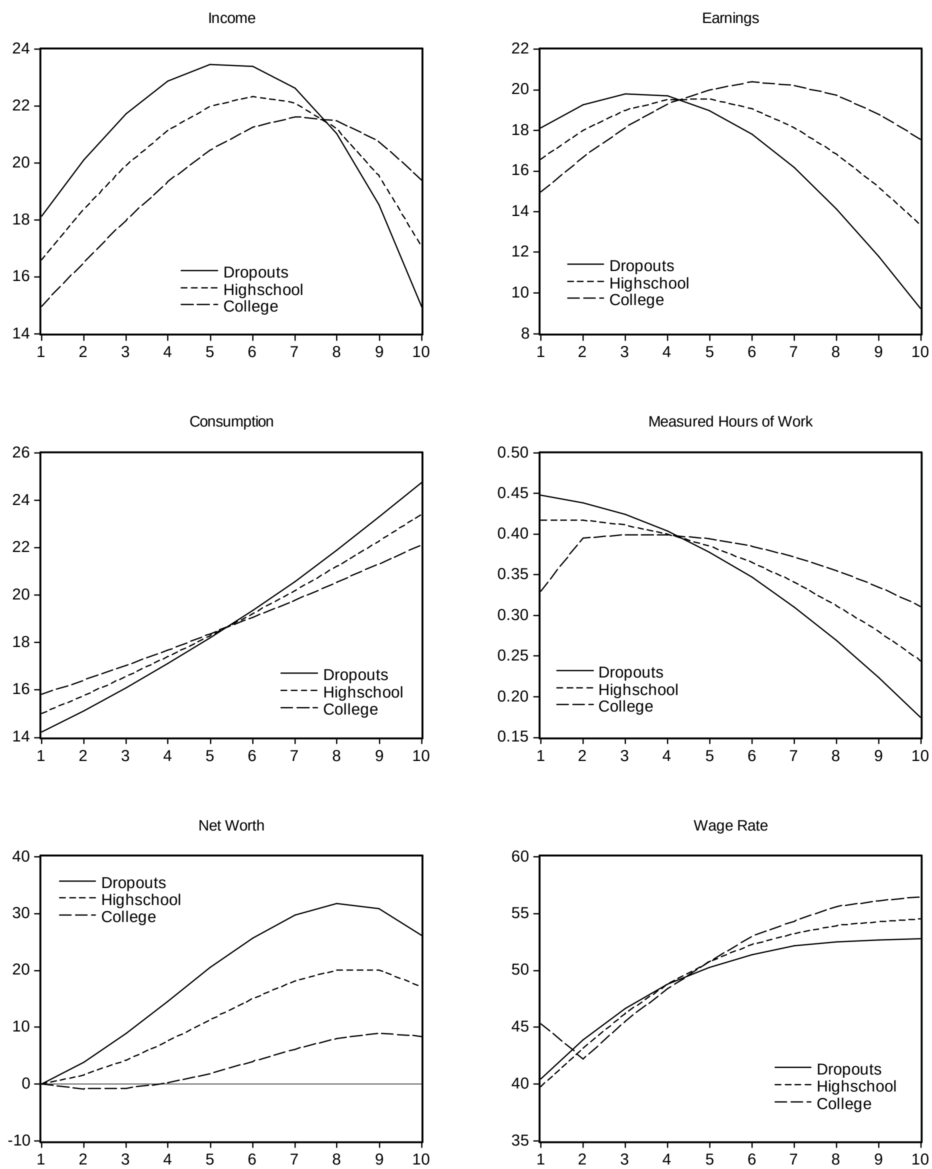


FIGURE 7
Negative Correlation Between the Rate of Time-Preference
and the Ability to Learn

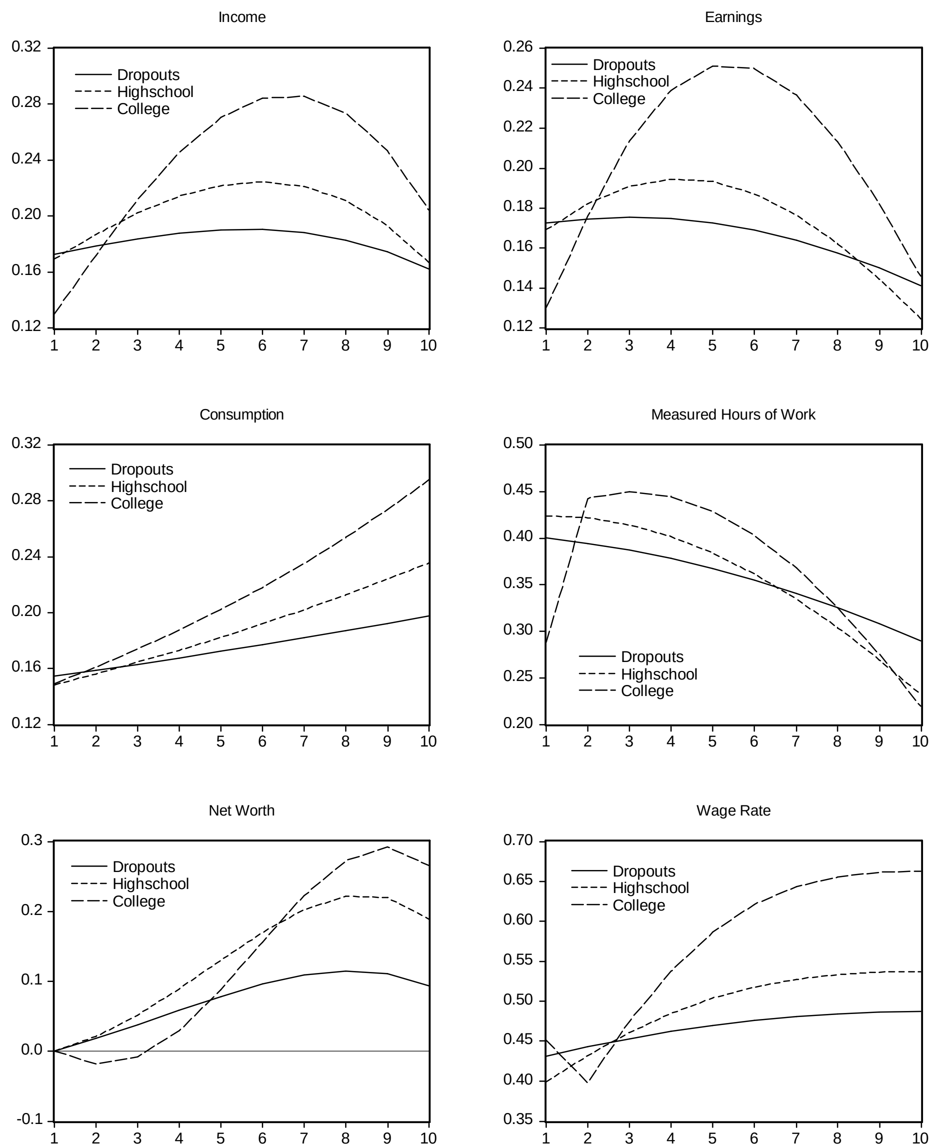


FIGURE 6
Differences in the Taste for Leisure

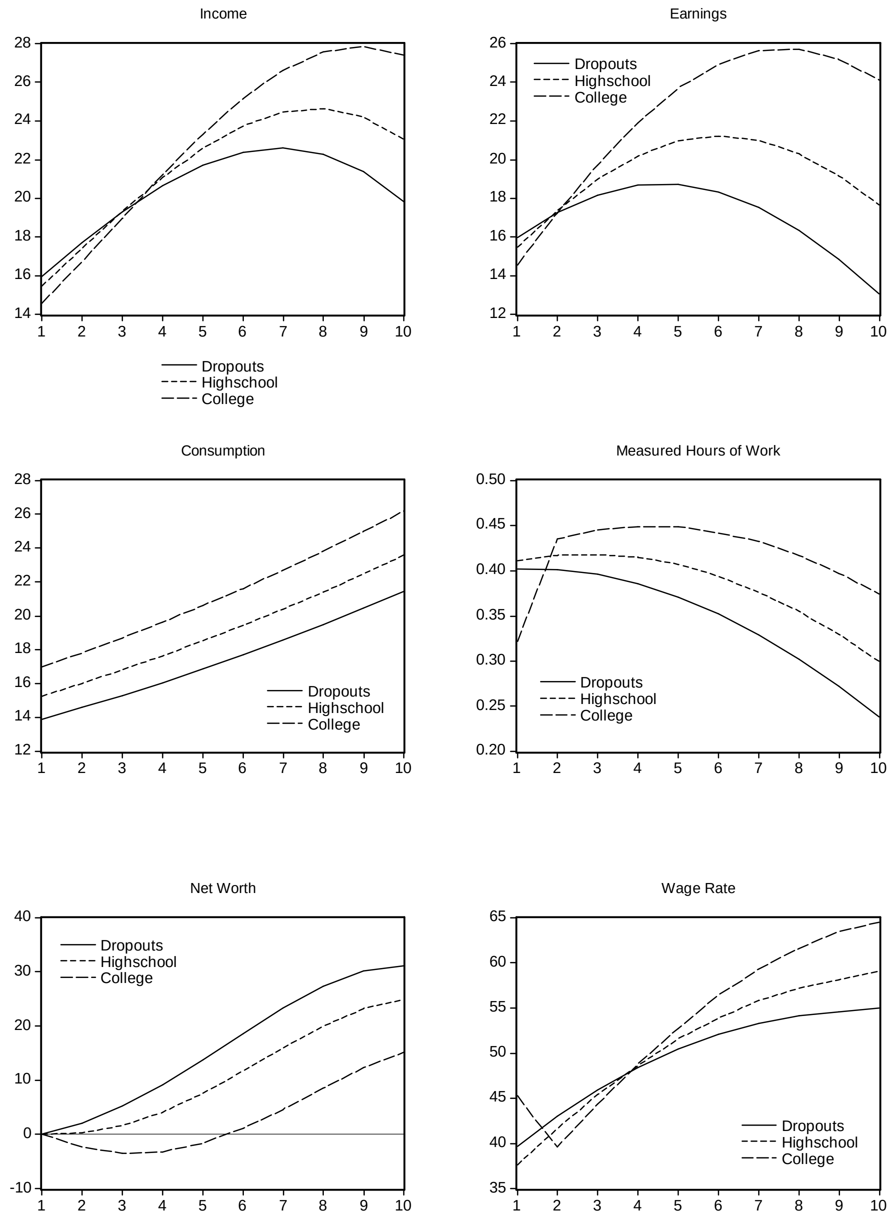
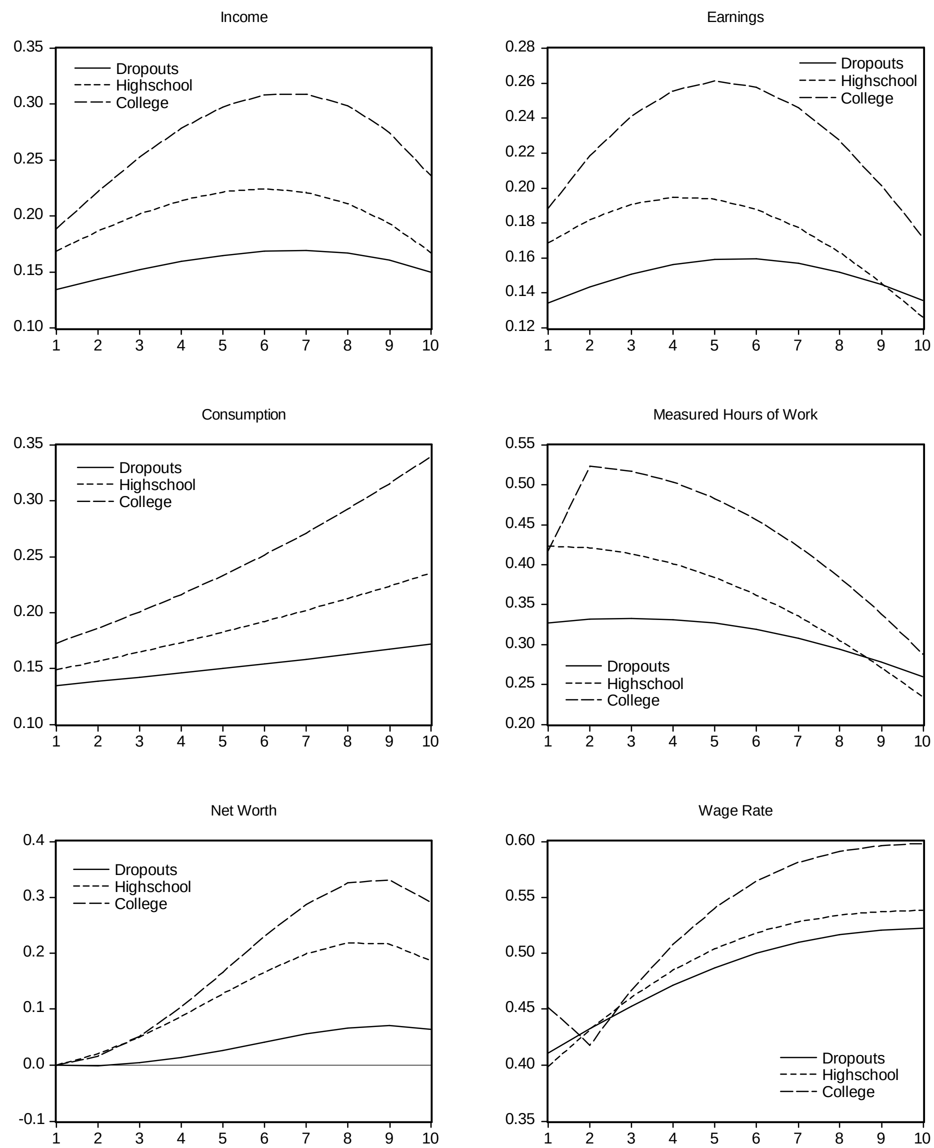


Figure 1:

FIGURE 8
Positive Correlation Between the Rate of Time-Preference
and the Taste for Leisure



Appendix I: Data Description

The data come from the 1992 Family Expenditure Survey Public Use File (FAMEX). We selected those households with no more than 2 wage earners and with the reference person reporting some education. All statistics are weighted by the FAMEX weight variable.

Households were grouped into five-year age categories and three education categories. Married households were grouped according to the greater level of education and age of the spouses. That is, the age category of the household is the maximum of the two spouses ages, and the education category is the maximum of the two spouses education levels. The education categories, as dictated in part by the public use file, are less than a high-school degree, high school degree and some college or university, and a university degree or more.

The FAMEX contains a variable equal to the total number of person-weeks within the household taking into account the exit and entry of persons during the year. Consumption and expenditure are converted to "per person-week" units using this variable.

The documentation for the Family Expenditure Survey 1992 can be found at: http://130.15.161.74/webdoc/ssdc/cdbksnew/famex/famex92guide.txt

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