Intergenerational transfer of health: the role of time and risk preferences

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Evidence suggests that maternal and offspring health is correlated. This may partly explain why health inequalities are so persistent over time. Little is known about the mechanisms through which intergenerational transfer occurs. This paper explores the role of risk and time preferences. In economic models, risk and time preferences are key parameters which determine investment behaviour. Limited evidence suggests that these preferences are formed during early childhood and remain relatively stable after adolescence. Given that they are formed during childhood, parents are likely to have an influence on their children's preferences. This can therefore partly explain the correlation in health investments and ultimately health between maternal and offspring. This hypothesis is tested using eight waves of data (2001-2008) from the (HILDA) survey data. The HILDA survey contains information on health behaviours including smoking as well as proxies for time and risk preferences. The data include 7,490 adult offspring (aged 16-34) living in the same household as their mothers. The estimated models decompose the variance to estimate the percentage of the correlation in maternal and offspring health behaviours explained by risk and time preferences. The results show that risk and time preference explain a significant part of the correlation in smoking outcomes between mother and daughters but not between mothers and sons.

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1. Introduction

Health inequalities are of major policy concern in the UK and many other countries. Numerous policy initiatives have been developed to address health inequalities but these have had no or limited success. Part of the reason why health inequalities are so persistent over time is that intergenerational transmission of both wealth and health. The intergenerational transmission of economic status has been well researched and there is substantial evidence that economic status of parents and children are correlated (Bowles and Gintis, 2002). There is also some evidence that health and health behaviours are transferred from parents to their children (Ahlburg, 1998, Wickrama etal., 1999, Shenassa et al., 2003, Fawzy et al., 1983, DiLorenzo et al., 1998, Rimal and Flora, 1998). The mechanisms behind intergenerational transmission are still unclear. Genetics, shared environment and transmission of personality traits have all been identified as potential mechanisms. This paper investigates whether the transmission of preference parameters, which could be argued to be related to personality traits, is one of the mechanisms through which intergenerational transfer of health occurs.

The preference parameters central to investment decisions are time and risk preferences. Time and risk preferences influence investment decisions such as education and savings but also health investments such as exercise, cigarette consumption and health insurance. These investments represent a trade-off between current costs and future benefits. Investments in health such as giving up smoking involve a trade-off between current costs, such as withdrawal symptoms, and future benefits, such as increased life expectancy. It can therefore be argued that individuals who are more present oriented, that is, exhibit higher time preference rates, are less likely to invest in their health. A growing body of evidence within both the psychology and economics literature shows that individuals who smoke, drink alcohol, use drugs tend to have higher implied time preference rates (see Fuchs, 1991 and Bretteville-Jensen, 1999 for examples of empirical evidence). Fuchs (1982) highlights that investment behaviour is also likely to be influenced by risk attitude. Future outcomes of investments are inherently uncertain and an individual's attitude towards uncertainty (or risk) is therefore likely to influence investment decisions. There is some evidence that more risk averse individuals are less likely to engage in unhealthy behaviour such as smoking and drug use (see for example Barsky *et al.*, 1997).

Little is known about how time and risk preferences are formed. Economists generally assume that risk and time preferences are exogenous and stable. In one of the early works on time preference, Rae (1905) suggested that time preferences are formed early in childhood and remain stable. However, empirical evidence has shown that both time and risk preferences are a function of age. For example, Green *et al*. (1999) compared time preference rates across three age groups (children, young adults and older adults) and found that rates decrease as a function of age. Becker and Mulligan (1997) developed a model of endogenous time preference where the latter is influenced by wealth, addictions and other variables. They also specifically mention how parents may influence their children's rate of time preference. There are different ways in which parents may influence their children's time and risk preferences. Parents act as role models and children may therefore become more future oriented and more risk averse if their parents are. Parents who are more future oriented may have more resources available to teach their children to be more future oriented and less risk seeking. There is very limited empirical evidence of intergenerational transfer of time and risk preferences. Webley and Nyhus (2006) used data from the DNB household survey to examine whether parents and children's' future orientation is correlated. Future orientation could be argued to be related to the concept of time preference. Evidence was found of a correlation. Knowles and Postlewaite (2004) investigated whether correlations in time preference between parents and their children can explain why children learn to save from their parents. Reynolds et al. (2000) estimated correlations in time preference between mothers and their offspring in a small sample (N=30). They found a modest but not significant correlation in time preferences. Dohmen *et al*. (2006) investigated the intergenerational transmission of risk attitude using data from the German Socio-Economic Panel. The results show that risk attitude of parents and their children are correlated.

There are two aims to this paper. Firstly, we investigate the permanent correlation in smoking resulting from the family. This identifies how the family contributes to health inequalities. The second part of this study examines how much of the correlation in health behaviours between parents and their offspring is explained by the correlation in individual characteristics and risk and time preferences. To our knowledge this is the first study to examine this. Whist Reynolds et al. (2000) elicited data on both time preference and smoking status of mothers and their offspring, they did not explore how much of the correlation in smoking status is explained by the correlation in time preference.

This paper is organised as follows. Section 2 outlines the theoretical framework that informs the empirical analysis. The econometric model is discussed in Section 3. The data is described in Section 4. Section 5 presents the results. Section 6 is the discussion. Finally, Section 7 concludes.

2. Theoretical Framework

We combine two models, the Grossman model and the Becker and Tomes model, to explain why parents and their offspring may have correlated health behaviour outcomes that are influenced by time and risk preferences.

The seminal paper by Grossman (1972) developed a health production function. In this model, health is treated as a component of human capital. Analogous to human capital, the health stock can be augmented or maintained by investing in health. One aspect of this investment is health related behaviours such as smoking status. These behaviours will affect the current health stock and the depreciation rate of the total health stock. Time and risk preferences may directly or indirectly influence the current health stock and the depreciation rate of the total health stock. For example, time preference or future orientation will influence the resources dedicated to the production of health. Less future orientated individuals will invest less resources in future health. More myopic individuals may invest in less education which will indirectly affect health production. Less education may affect health knowledge impacting on health production. The original Grossman model is formulated under conditions of certainty and risk preferences were therefore not considered. Risk preferences may affect the likelihood of engaging in risky behaviours directly affecting health. The indirect effect of risk preferences on health can be measured by the impact of risk preference on the budget constraint.. Risky individuals may take more financial risks impacting on their budget constraint, A reduced budget will impact on the health production function.

Becker and Tomes (1986) developed a model to explain inequalities in families over time. In this framework parents are utility maximisers concerned with their children's welfare and invest in children's education, health, (observed characteristics) motivation, and creativity of their children (unobserved and immeasurable characteristics). This investment by parents will lead to parents and children sharing similar observed behaviours such as smoking status as well as preferences such as time and risk preferences contributing to inequality.

These two models are combined to explain why parents and their offspring may have correlated health behaviour outcomes that are influenced by time and risk preferences. Parental time preferences will affect educational attainment and health investment. For example, women with high discount rates tend to invest less in education and tend to be less 'careful' mothers (Currie and Moretti 2003). Lower levels of education of mothers may affect health knowledge causing mothers to engage in risky health behaviours or not provide adequate health inputs for children such as healthy meals and regular doctor visits. Parental risk preferences may affect the household budget constraint. Parental risk preference may lead to risky behaviours such as smoking that will directly affect their children's health outcomes and influence children's health related behaviour. Parents may also directly transmit their risk and time preferences to their children as inputs into their children's growth and development.

To test this framework we investigate the permanent correlation in maternal and young adult smoking behaviour measured by correlated individual effects. The econometric model controls for the effect of individual characteristics and risk and time preferences on the correlation in maternal and young adult smoking. . The analysis focuses on mothers initially and will be extended to consider fathers.

3. Econometric Framework

A simple statistical framework based on the methods used in the wage literature (Solon et al. 1991, Altonji and Dunn 2000, Beenstock 2008, and Mazumder 2008) is utilised to investigate the permanent correlation in maternal and young adult smoking status. This methodology uses the variance in smoking outcomes 'within' families and the variance of the general population to calculate the permanent correlation from the family. This permanent correlation can be categorised as the intergenerational transmission of smoking status which contributes to health inequalities.

We start with a constant only:

$$Y_{it}^{M} = \pi + \varepsilon_{it}^{M} \qquad (1A)$$

$$Y_{it}^{C} = \pi + \varepsilon_{it}^{C} \qquad (1B)$$

$$Y_{it} = \pi + \varepsilon_{it} \qquad (1C)$$

The superscripts M and C represent mothers and their children respectively. Y is a binary outcome variable which equals one if individual (i) in period (t) is observed to smoke and is zero otherwise. π is a constant term. Equations (1A) and (1B) are estimated simultaneously using a bivariate probit. This allows the error term to be correlated between the mother and children. Equation (1C) is estimated for the whole population using a univariate probit model[1]. The error term is decomposed into two parts[2]:

$$\varepsilon_{it}^{M,C} = \alpha_{i}^{M,C} + u_{it}^{M,C} \qquad (2A,B)$$

$$\varepsilon_{it} = \alpha_{i} + u_{it} \qquad (2C)$$

Equations (1A) and (1B) are estimated simultaneously allowing the error terms to be correlated, this implies a correlated individual effects (α_i) and correlated random error component (u_{it}) for mothers and children. The error term for the general population sample in equation (2C) is comprised of an individual effect (α_i) and a random error component (u_{it}).

[1] Low overall attrition rates in the HILDA of approximately 8% in all 8 waves suggest that non-response in the three sub-samples should not bias the findings.
[2] We assume that the error term is independent of the explanatory variable. This assumption will be tested by a Hausman test.

The variance of the smoking outcome is then:

$$\sigma_{\varepsilon}^{M,C} = \sigma_{\alpha}^{M,C} + \sigma_{u}^{M,C} \qquad (3A,B)$$

$$\sigma_{\varepsilon}^{i} = \sigma_{\alpha}^{i} + \sigma_{u}^{i} \qquad (3C)$$

The first term in equation (3A,B), $\sigma_{\alpha}^{M,C}$ shows the variance in correlated individual effects for mothers and their children, the second term $\sigma_{u}^{M,C}$ shows the variance in the correlated random error component. In equation (3C) σ_{α}^{i} is the variance in the individual effects and σ_{u}^{i} is the variance in the random error. At this moment we only consider the permanent correlation from the individual effects. We will not utilise the variance in the random error component. (This may be used in later versions of the paper).

We use the variance in the individual effects to calculate the permanent correlation in smoking status resulting from the family:

$$\rho_1 = \frac{\sigma_{\alpha}^{M,C}}{\sigma_{\alpha}^{M,C} + \sigma_{\alpha}^{i}} \qquad (4)$$

This equation shows the correlation in smoking outcomes arising from the family.

The next stage is to add a vector of individual characteristics to the model, *X*:

$$Y_{it}^{M} = \pi + \beta^{M} X_{it}^{M} + \varepsilon_{it}^{M} \qquad (5A)$$

$$Y_{it}^{C} = \pi + \beta^{C} X_{it}^{C} + \varepsilon_{it}^{C} \qquad (5B)$$

$$Y_{it} = \pi + \beta X_{it} + \varepsilon_{it} \qquad (5C)$$

The variance from the correlated error term from estimating equation (5A) and (5B) simultaneously and the variance from the error term in equation (5C) is plugged into equation

(4) to calculate ρ_2. The magnitude of ρ_2 should be smaller than ρ_1 in equation (4) as more of the permanent correlation is explained in the model.

The final stage is to add variables related to risk and time preference to the model, *R*. The full model estimated is:

$$Y_{it}^{M} = \pi + \beta^{M} X_{it}^{M} + \xi^{M} R_{it}^{M} + \varepsilon_{it}^{M} \qquad (6A)$$

$$Y_{it}^{C} = \pi + \beta^{C} X_{it}^{C} + \xi^{C} R_{it}^{C} + \varepsilon_{it}^{C} \qquad (6B)$$

$$Y_{it} = \pi + \beta X_{it} + \xi R_{it} + \varepsilon_{it} \qquad (6C)$$

We then use the error term to find the correlated variance from estimating equations (6A) and (6B) simultaneously and the variance from the population univariate probit model (6C) to calculate, ρ_3. The magnitude on the correlation coefficient in ρ_3 is expected to be smaller than in ρ_2 as more of the model is explained by the inclusion of time and risk preferences.

The next step is to calculate the contribution of individual characteristics and risk and time preferences to the family component of the overall correlation in smoking. Following Mazumder (2008) the correlated variance, $\sigma_{\alpha}^{M,C}$ from equations (3A,B) is subtracted from the correlated variance $\sigma_{\alpha}^{M,C}$ from equations (5A,B) to determine the contribution of individual characteristics to the family component of the correlation in smoking. To determine the contribution of risk and time preferences, the correlated variance, $\sigma_{\alpha}^{M,C}$ from equations (6A,B) is subtracted from the correlated variance, $\sigma_{\alpha}^{M,C}$ in equation (5A,B). This provides an upper bound of the causal effect of individual characteristics and time and risk preferences as it includes all omitted factors that are also correlated with the individual effects.

If individual characteristics or risk and time preferences are not significantly correlated between mothers and their children then it is likely that the addition of these variables will not contribute to explaining the correlation in permanent smoking outcomes.

The analysis is separated by gender. It is likely that the intergenerational transmission of behaviours and characteristics will be gender dependent. For example, Van Gundy (2002) found a significant gender effect on the intergenerational transmission of alcohol consumption.

4. The Data

The Household Income and Labour Dynamics in Australia Survey (HILDA) began in 2001 as a national longitudinal survey with a focus on the family, employment and income. It was designed to be consistent with the British Household Panel Survey (BHPS) and the German Socio-Economic Panel (GSOEP). Survey methodology and the motivation behind the creation of the HILDA are described in greater detail in Watson and Wooden (2006). The first wave was conducted between August and December 2001, the sample consisted of 13,969 respondents; the sample is extended each year to include any new household members, account for household splits and the subsequent creation of new households. By wave 8 (2008), a total of 8,034 of the original respondents were re-interviewed and 6,451 households were successfully interviewed.

The analysis is restricted to families with young adults between the ages of 16-25 that are still living with their mother. The standard errors are clustered to control for families with multiple siblings in the 16-25 age range.

The dependent variable is a binary variable which equals one if the individual is observed to smoke and zero otherwise. The raw correlation in mother and son smoking is 0.179 (p=0.000) and the raw correlation in mother and daughter smoking is 0.220 (p=0.000). This suggests that mother's may have a greater influence on their daughter's smoking decision.

Time preferences

Two proxies are used for time preferences: planning horizon and savings plan. The question on planning horizon asks respondents which time period is most important to them in planning their saving and spending. Possible responses are: the next week; the next few months; the next year; the next 2 to 4 years; the next 5 to 10 years; and more than 10 years ahead. It is hypothesised that individuals with shorter planning horizons tend to have higher time preference rates than individuals with longer planning horizons. This was tested using data from the DNB household survey which elicited both planning horizon and implied time preference rates through a series of closed-ended choices. The correlation between planning horizon and time preference was highly significant (p-value of 0.0001). Samwick (1998) also explored the relationship between time preference rates, estimated using household wealth data and a lifecyle model of consumption, and planning horizon. Using data from the Survey of Consumer Finances the results showed that time preferences and planning horizon were correlated. The planning horizon variable is dichotomised where individuals with planning horizons longer than a year are identified as being future oriented and individuals with planning horizons of one year or less as being present oriented.

The question on savings plan asks respondent about their savings habits. Possible responses are: don't save: usually spend more than income; don't save: usually spend about as much as income; save whatever is left over at the end of the month — no regular plan; spend regular income, save other income; save regularly by putting money aside each month. It is hypothesised that individuals with higher time preference rates are more likely to save.

The raw correlation in mother and son planning horizon is 0.09 (p=0.000) and the raw correlation in mother and daughter planning horizon is 0.13 (p=0.000). The raw correlation in mother and son savings plan is 0.11 (p=0.000) and the raw correlation in mother and daughter savings plan is 0.15 (p=0.000).

Risk preferences

The Survey of Consumer Finances (SCF) risk-tolerance measure is used as a proxy for risk preferences. The question asks respondent which statement comes closest to describing the amounts of financial risk that they are willing to take with their spare cash (cash used for savings or investment). The statements are: I take substantial financial risks expecting to earn substantial returns; I take above average financial risks expecting to earn above average returns; I take average financial risks expecting to earn average returns; and I am not willing to take any financial risks. The first two categories can be interpreted as risk seeking, the third category as risk neutral and the final category as risk averse. If respondents do not have spare cash, they are asked to imagine that they do have spare cash. This measure is widely used. Grable and Lytton (2001) show in their review of the literature that this measure is stable over time and is correlated with investments in risky assets. Hanna and Lindamood (2004) showed that the risk tolerance measure if correlated with risk aversion measured using lotteries with different retirement income as outcomes. Lotteries are the most popular method of eliciting risk preferences within the field of economics.

The raw correlation in mother and son being classified as risk averse is 0.07 (p=0.001) and the raw correlation in mothers and daughters is 0.11 (p=0.000). The raw correlation in mothers and sons being classified as risk neutral is 0.12 (p=0.000) and for mothers and daughters the raw correlation is 0.12 (p=0.000). The raw correlation in mothers and sons being classified as risk-seeking is 0.06 (p=0.011) and for mothers and daughters the raw correlation is 0.05 (p=0.028).

The other explanatory variables included in the analysis are listed and described in Table 1.

The descriptive statistics for mothers and children are shown in Table 2. These are the means across the eight waves of the HILDA. Children are separated by gender. Approximately 22% of mothers are current smokers, 22% of sons are current smokers, and 17% of daughters are current smokers. These rates are consistent with data from the Australia Bureau statistics which found that 23% of Australians were smokers (National Health Survey 2004-2005). The mean age for mothers is 47 and the mean age for children is approximately 18. Most mothers are employed and are educated up to at least the degree level. For both boys and girls, most are likely still in education. The majority of mothers, sons, and daughters are risk averse and present oriented.

5. Results

There are two main aims in our estimation strategy. Firstly, we investigate the correlation in mother and child smoking. The next step is to determine the influence individual characteristics and risk and time preference to this correlation by estimating three model specifications. We start with a constant only model (Model A). Next we estimate an augmented model that includes individual characteristics (Model B). The final stage is to estimate our full model that adds time and risk preference to the equation with individual characteristics (Model C).

In each model specification (Model A, B, and C) we use the joint variance from the mother child equation and the variance from the general population to estimate the correlation arising from the family. These correlation coefficients are presented in Table 3. It is likely that as more explanatory variables are included in the model, the magnitude of the correlation coefficient will decline. Table 4 shows the contribution of individual characteristics to the family component used to calculate the overall correlation in smoking. The variance from the family component in Model (A) is subtracted from the variance of the family component in Model (B) to determine the contribution of individual characteristics. The contribution of risk and time preferences is calculated by subtracting the variance from the family component in Model (B) from the variance in the family component in Model (C). Finally, as robustness check on the coefficients included in Model (C) to explain correlated maternal and adolescent smoking outcomes we present the coefficient from the bivariate probit estimated using equations (6A) and (6B). The marginal effects are shown.

Firstly, looking at Table 3, Model (A), the correlation coefficient for sons is 0.248. The coefficient in Model (A) for daughters is slightly larger at 0.294. This suggests that there may be a stronger intergenerational transmission effect of mothers to daughters on behaviours related to smoking. Model (B) adds individual characteristics to the equation. The correlation coefficient for sons is now 0.228. From Table 4, we can see that individual effects contribute 13.5% to the correlation coefficient. For daughters, in Model (B), the correlation coefficient is 0.281. Moving to Table 4, individual characteristics contribute 9.27% to the correlation in smoking outcomes. Returning to Model (C) in Table 3 which adds risk and time preference to an equation with individual characteristics, the correlation coefficient for sons in 0.281. This is larger than the coefficient for Model (B) suggesting that time and risk preferences do not contribute to the family component of the overall correlation. The individual variance is smaller in Model (C) implying that time and risk factors contribute to explaining the likelihood of smoking. For daughters in Model (C) Table 3 the correlation coefficient is 0.232. In Table 4, we can see that risk and time preference contribute approximately 23% to the correlation in smoking outcomes. Gender effects suggest that daughters may be more likely to develop similar preferences to their mothers and this influences correlated smoking outcomes.

Finally, Table 5 shows the marginal effects from the bivariate probit model used to estimate the joint mother and child individual effect variance in Model (C). Potential endogeneity bias means that these coefficients have a qualitative interpretation only. Age has a positive and significant effect and education has a negative and significant effect on smoking for daughters, sons, and for mothers when estimated simultaneously with their sons but not in the equation estimated simultaneously with their daughters. Health has a negative effect on smoking for sons, mothers when estimated simultaneously with their daughters, and daughters. The time and risk preference variables are not significant for mothers in the equations estimated with their sons. This may influence the findings in Table 3 and 4, that risk preferences do not significantly contribute to the correlation in smoking for mothers and sons. A savings plan has a positive and significant on smoking whereas risk neutrality has a negative and significant effect on smoking. For mothers and daughters in the equation estimated simultaneously, risk neutrality has a negative and significant effect for mothers and risk aversion has a negative and significant effect on smoking for daughters. The findings from Table 5, suggests that overall the variables we included in the model explain some of the factors influencing smoking behaviour.

6. Discussion

The results show that time and risk preferences explained a significant part of the correlation between mother and daughters smoking outcomes. This did not hold for mother and sons. It has been argued that mothers are more likely to act as role models for their daughters and fathers for their sons and this may help explain the difference in results. It will therefore be interesting to extend the analysis to consider the role of risk and time preferences in the correlation between fathers and sons smoking outcomes. In addition we are planning to conduct several further analyses. Firstly, the range of health behaviours to be considered will be extended. Potential candidates include Body Mass Index (which is related to dietary and exercise behaviours) and use of preventative health care such as dental check-ups. Secondly, analyses will be repeated using the British Panel Household Survey data and possibly the German Socio-Economic Panel (GSOEP). This allows us to explore whether there are any cultural differences between Australia, the UK, and Germany. This comparison can be argued to be robust given that the HILDA survey was designed to be consistent with the BHPS and GSOEP. In terms of estimation we are planning to use ANOVA techniques to get more precise estimates of the variance structure and to estimate ‘between’ family effects.

Some limitations to this study can be identified. Firstly, proxies were used for risk and time preferences. It could be argued that the proxies reflect individuals’ financial situation rather than their risk and time preferences. Moreover, the questions used to measure risk tolerance and planning horizon are not incentive compatible. However, empirical evidence does suggest that these measures are correlated with more robust measures of risk and time preferences. Secondly, the question arises whether time and risk preferences for money are the most appropriate type of preferences when the interest is in health investments. However, whilst differences have been found between time preferences for health and money, they do tend to be highly correlated.

7. Conclusion

The aim of this paper was to examine the correlation in maternal and young adult BMI. We focus on investigating the contribution of individual characteristics and time and risk preferences to this correlation. To our knowledge this is the first study to examine this area.

Shared time invariant individual characteristics explain the majority of the smoking correlation between mothers and sons. For mothers and daughters risk and time preferences explain the majority of the correlation in smoking outcomes.

Future work will investigate the impact of fathers, and single family households on correlated smoking outcomes. A cross-country analysis will also be performed to determine if this country specific or Anglo-Saxon country outcome.

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Table 1: *Variable List and Description*

Variable Name	Description
Smokes	0=Not current smoker 1=Current smoker
Age	Age in year
Employed	0=Unemployed/Not in the Labour Force 1=Employed
Australian	0=Foreign Born 1=Born in Australia
Log hhincome	Log of household income measured as household financial gross income/number of individuals in household
Disadvantaged area	0=2nd-10th deciles of deprivation (less deprived) 1=Most deprived decile (1st)
Education	0=no educational qualifications (for all education categories)
Certificate 1-4	1=Certificate I-IV
Highschool	1=Grade 12 education
Diploma	1=Diploma/Advanced Diploma
Degree	1=First degree or higher
SF6D	Health state classification derived from the SF-36
Savings plan	0=Do not save spend more than income, do not save spend income, save extra income no saving plan, 1=Save extra income as saving plan, regular saver
Planning horizon	0=Next week, next few months, next year 1=2 or more years
Risk averse	0=Not risk averse 1=Risk averse
Risk neutral	0=Not risk neutral 1=Prefer average risks for average returns
Risk seeking	0=Not risk seeking 1=Prefer above average risk for above average return or prefer substantial risk for substantial returns

Table 2: *Descriptive Statistics*

	Mum	n	Sons	n	Daughters	n
Smokes	0.20	3002	0.22	2710	0.17	2482
Age	47.25 (6.22)	3575	18.95 (2.55)	3608	18.65 (2.42)	3126
Employed	0.96	2752	0.87	2647	0.91	2240
Australian	0.73	3575	0.92	3361	0.91	2946
Log hhincome	9.98 (0.63)	3556	10.00 (0.61)	3596	10.03 (0.61)	3109
Disadvantaged area	0.08	3575	0.07	3608	0.07	3126
Education						
Certificate 1-4	0.17	3575	0.09	3361	0.08	2946
Highschool	0.13	3575	0.34	3361	0.36	2946
Diploma	0.09	3575	0.02	3361	0.03	2946
Degree	0.23	3575	0.04	3361	0.05	2946
SF6D	0.75 (0.11)	3233	0.81 (0.10)	2917	0.78 (0.11)	2669
Savings plan	0.22	2407	0.33	2150	0.39	1929
Planning horizon	0.35	2410	0.22	2161	0.26	1931
Risk averse	0.40	2415	0.36	2163	0.43	1926
Risk neutral	0.31	2415	0.36	2163	0.31	1926
Risk seeking	0.05	2415	0.09	2163	0.05	1926

Notes: Except for age, log hhincome, and SF6D all variables shown are percentages. Standard errors are in parenthesis.

Table 3: *Variable List and Description*

	SONS						Daughters					
	Model A		Model B		Model C		Model A		Model B		Model C	
Individual	0.985	(0.000)	0.954	(0.001)	0.943	(0.002)	0.985	(0.000)	0.954	(0.001)	0.943	(0.002)
Family	0.325	(0.062)	0.281	(0.075)	0.310	(0.083)	0.410	(0.063)	0.372	(0.084)	0.286	(0.092)
Correlation	0.248		0.228		0.247		0.294		0.281		0.232	

Notes: Individual is the individual effects variance from the population sample. Family is the variance from the correlated individual effects variance from the simultaneously estimated mother and child equations. Correlation shows the correlation calculated from equation (4).

Table 4: *Contribution of Individual Characteristics and Risk and Time Preference to Smoking Correlation*

	Sons	Daughters
Individual Characteristics	13.54%	9.27%
Risk and Time Preferences	0.00%	23.12%

Notes: The contribution is calculated using the correlated variance from the 2^{nd} column in Table 3. This shows the contribution of individual characteristics and time and risk preferences to the family component of the correlation in smoking.

Table 5: *Variable List and Description*

Smokes	Mum		Sons		Mum		Daughter	
	dy/dx		dy/dx		dy/dx		dy/dx	
Age	**-0.01**	**(0.00)**	**0.03**	**(0.01)**	-0.01	(0.00)	**0.03**	**(0.01)**
Employed	-0.15	(0.10)	0.00	(0.04)	-0.13	(0.07)	-0.08	(0.04)
Australian	0.05	(0.05)	-0.07	(0.07)	-0.01	(0.04)	**0.15**	**(0.06)**
Log hhincome	0.03	(0.04)	0.04	(0.04)	0.02	(0.03)	0.05	(0.03)
Disadvantaged area	0.03	(0.07)	0.11	(0.07)	0.10	(0.06)	-0.01	(0.08)
Education								
Certificate 1-4	-0.05	(0.05)	0.05	(0.05)	0.03	(0.05)	0.04	(0.06)
Highschool	-0.06	(0.06)	-0.05	(0.04)	-0.03	(0.06)	-0.06	(0.04)
Diploma	**-0.15**	**(0.06)**	**-0.33**	**(0.13)**	-0.07	(0.06)	-0.12	(0.08)
Degree	**-0.14**	**(0.05)**	**-0.35**	**(0.10)**	-0.04	(0.05)	**-0.24**	**(0.09)**
SF6D	-0.16	(0.15)	**-0.71**	**(0.11)**	**-0.33**	**(0.14)**	**-0.34**	**(0.12)**
Savings plan	-0.07	(0.04)	**0.03**	**(0.04)**	-0.02	(0.04)	0.00	(0.06)
Savings horizon	-0.03	(0.04)	-0.07	(0.03)	-0.04	(0.03)	-0.06	(0.04)
Risk averse	-0.03	(0.04)	-0.05	(0.06)	-0.02	(0.04)	**-0.07**	**(0.04)**
Risk neutral	-0.06	(0.05)	**-0.06**	**(0.04)**	**-0.09**	**(0.04)**	-0.03	(0.03)
Risk seeking	-0.04	(0.07)	-0.10	(0.04)	-0.10	(0.07)	-0.04	(0.03)
n	963		963		910		910	

Notes: Bold indicates significance at the 5% level. Standard errors are in parenthesis. Marginal effects are shown. If a mum has a son and daughter then she will be present in both mum columns. The standard errors are clustered for families with multiple siblings.