中央研究院經濟所學術研討論文

IEAS Working Paper

Parenting Practices and Children's Education Outcome

Kamhon Kan and Wei-Der Tsai

IEAS Working Paper No. 03-A005

November, 2003

Institute of Economics
Academia Sinica
Taipei 115, TAIWAN
http://www.sinica.edu.tw/econ/

中央研究院　經濟研究所

INSTITUTE OF ECONOMICS, ACADEMIA SINICA

TAIWAN

Parenting Practices and Children's Education Outcomes*

Kamhon Kan[a] Wei-Der Tsai[b]

Abstract

This paper analyzes the effects of parenting practices on children's education. Our empirical analyses are based on household data from Taiwan. More specifically, we investigate the influence of parents' child-rearing practices (i.e., encouragement and punishment) on their children's education attainments and aspirations. We also explore the association between parents' socioeconomic background and their child-rearing practices. The empirical results help explain the relationship between family background and education attainments.

Keywords: Education Outcomes, Parenting Practices, Family Background

JEL classification: I20, J13, C35

*We thank Professor F.M. Huang and two anonymous referees for constructive comments, which have led to substantial improvements in the paper. Financial support provided by Taiwan's National Science Council through grant NSC92-2415-H-001-037 and by Academia Sinica through grant IEAS-03-09 is gratefully acknowledged. Corresponding author: Kamhon Kan.

[a]Institute of Economics, Academia Sinica, Nankang, Taipei, Taiwan 11529; Tel: 886-2-27822791 (x505); Fax: 886-2-7853946; E-mail: kk@sinica.edu.tw.

[b]Graduate Institute of Industrial Economics, National Central University, Chungli, Taiwan 320; Tel: 886-3-4227151 (x6473); Fax:886-3-4273800; E-mail: twd@cc.ncu.edu.tw.

Parenting Practices and Children's Education Outcomes*§

Kamhon Kan
Institute of Economics
Academia Sinica
and
Department of Public Finance
National Cheng Chi University

Wei-Der Tsai
Graduation Institute of
Industrial Economics
National Central University

Abstract

This paper analyzes the effects of parenting practices on children's education. Our empirical analyses are based on household data from Taiwan. More specifically, we investigate the influence of parents' child-rearing practices (i.e., encouragement and punishment) on their children's education attainments and aspirations. We also explore the association between parents' socioeconomic background and their child-rearing practices. The empirical results help explain the relationship between family background and education attainments.

JEL Classification: I20, J13, C35
Keywords: Education Outcomes, Parenting Practices, Family Background

*We thank Professor F.M. Huang and two anonymous referees for constructive comments, which have led to substantial improvements in the paper. Financial support provided by Taiwan's National Science Council through grant NSC92-2415-H-001-037 and by Academia Sinica through grant IEAS-03-09 is gratefully acknowledged.

Corresponding Addresses:
Kan: Institute of Economics, Academia Sinica, Nankang, Taipei, Taiwan 11529; Tel: 886-2-27822791 (x505); Fax: 886-2-7853946; E-mail: kk@sinica.edu.tw.
Tsai: Graduate Institute of Industrial Economics, National Central University, Chungli, Taiwan 320; Tel: 886-3-4227151 (x6473); Fax:886-3-4273800; E-mail: twd@cc.ncu.edu.tw.
§Corresponding author: Kamhon Kan.

1 Introduction

This paper pertains to the determinants of a youth's education outcomes (as proxied by education expectations and aspirations). The determinants of a youth's outcomes have been widely studied, with the literature containing contributions from economists and other social scientists, e.g., sociologists and psychologists. See Haveman and Wolfe (1995) for a review. A major finding is that parents' socioeconomic status and behavior have significant bearings on their children's education outcomes. See, for example, Sewell and Shah (1968), Teachman (1987), Kodde and Ritzen (1988), Kane (1994), Astone and McLanahan (1991), Seltzer (1994), Blau (1999), O'Brien and Jones (1999), and Weinberg (2001). However, the channels that relate parents' characteristics to children's education outcomes are still not very clear. The connection is seldom elaborated on, with only a few exceptions, e.g., Becker (1964, 1981), Becker and Tome (1979), Leibowitz (1974), Astone and McLanahan (1991), and Weinberg (2001).

In the economic models of Becker (1964, 1981) and Becker and Tome (1979) it is postulated that the connection between parents' characteristics (especially income and education) and their children's education arises from the parents' genetic endowment and their human capital investment. Leibowitz (1974) conjectures that the influence of parents' education on children's education outcomes could be through heredity or through the effect of parents' education/income on the quality and quantity of home investment in their children's human capital (e.g., time input and education resources). His conjecture is supported by his empirical results.

The more recent study by Astone and McLanahan (1991) empirically shows that children living with single parents or step-parents during adolescence receive less encouragement and less help with school work than those who live with both parents. They also obtain evidence that parental involvement has a positive impact on children's school achievement. The focus of Weinberg (2001) is on the connection between family income and children's outcomes. His

hypothesis is that the positive connection between the former and the latter is through the limited use of pecuniary incentives by low income parents. He demonstrates this connection by a behavioral model, and his empirical results confirm this hypothesis.

The current study's focus is the connection between parents' socioeconomic characteristics (especially education) on children's education outcomes. We use children's education aspirations and expectaions as a measure of their education outcomes. Similar to Leibowitz (1974) and Astone and McLanahan (1991), our purpose is to investigate the channels through which parents' socioeconomic characteristics affect children's education outcomes. This paper explores the hypothesis that parents of different socioeconomic status (especially pertaining to parents' education level) use different parenting practices. It is through differences in parenting style that parental characteristics, at least partially, influence the children's education outcomes.

In the social science literature, there is sufficient evidence showing that parenting styles are correlated with children's school performance. For example, Dornbusch, *et al* (1987) find that inconsistent and mixed parenting styles are associated with lower grades for adolescents. Steinberg, *et al* (1988) obtain evidence that authoritative parenting facilitates school success. The empirical results of Steinberg, *et al* (1992) show that authoritative parenting and parents' involvement in schooling are positively correlated with adolescent school achievement, while parental encouragement to succeed is negatively correlated with adolescent school achievement.

Our analysis departs from previous studies by focusing on two instruments of parenting, namely positive and negative reinforcements, whose effects on adolescents' education outcomes are rarely investigated. We also examine the association between parents' socioeconomic status, especially income and education, and their use of these parenting methods. By doing so, we attempt to illustrate the connection between family background and children's education outcomes, with parenting methods as a mediating factor.

We use adolescents' education expectations (i.e., the level of education that they expect

to attain conditional on all circumstantial factors) and education aspirations (i.e., the level of education that they desire to attain ignoring circumstantial constraints) as the measures of education outcomes. The reason why we use a child's education expectation and aspiration rather than his/her actual education outcomes (e.g., high school completion, college attendence, test scores, grades, etc.) is that we do not have this information. Most of the adolescents in our sample are still in school.

Since the expected/aspired education level rather than the expected/aspired number of years of education is a meaningful measurement unit, we econometrically model the expected and aspired education levels as ordinal discrete variables via ordered probit models. In the literature on the determinants of education outcomes the ordinary linear regression model is often used to model education outcomes. The drawback of the ordinary linear regression model is that the ordinal nature of education levels is ignored.

A special feature of the current study is the use of econometric techniques which take account of the possibility that parenting practices are endogenous. The endogeneity of parenting practices occurs when there are common unobservable factors which affect both the education outcomes of adolescents and the choice of parenting practices. For example, an adolescent's unobservable ability[1] may affect both his/her education outcomes and the way his/her parents interact with him/her. See, for example, Maccoby and Martin (1983). However, in the education outcomes literature in explaining adolescents' education outcomes, the endogeneity of parenting practices is seldom accounted for.

To allow for the endogeneity of parenting practices, we adopt a generalized method of moments approach. By exploiting the ordered probit model's orthogonality conditions, our GMM procedure follows that of Avery, Hansen, and Hotz (1983) and Poirier and Ruud (1988). We also follow the guidelines of Wooldridge (1996), who expounds upon the instrumental variable approach to a general class of non-linear models.

Based on household data from Taiwan, our results show that parenting practices are

[1]This is unobservable to the econometrician, but observable to the adolescent and parents.

important determinants of adolescents' education outcomes. Moreover, parents' education and health status are important determinants of the education outcomes of adolescents, both numerically and statistically. This confirms our conjecture that parenting practices are an important channel through which family background affects an adolescent's education outcomes.

The remaining part of the paper is as follows. Section 2 describes the data. Section 3 presents the econometric method. Section 4 discusses the empirical results. Section 5 contains a conclusion of the current study.

2 Data

In this study we use survey data from the Panel Study of Family Dynamics (PSFD). The aim of the PSFD is to understand the structure and evolution of the Chinese family in Taiwan, as well as the mode of interaction of its members. The questionnaire of the PSFD is designed in such a way that the special features of the Chinese family in Taiwan are underscored.

The PSFD comprises multi-year panel surveys starting from 1999. The survey adopts a three-stage random sampling procedure. In the first stage, a number of geographical areas (cities or towns, which are the equivalence of "standard metropolitan statistical areas" in the U.S.) is randomly selected. The probability for a geographical area to be selected is proportional to its population size. In the second stage, smaller administrative districts (communities, called "li" in Taiwan, and villages) are randomly drawn from the selected geographical areas. Again, the probability for a district to be selected is proportional to its population size. In the third stage, individuals are randomly drawn from the selected administrative districts. Given Taiwan's population size of twenty-three million, our sample of around 3,000 is fairly representative. The representativeness of the PSFD sample is comparable to that of the University of Michigan's Panel Study of Income Dynamics (PSID). For the year 2001, there are 7,406 families in the PSID sample, which is considered to be

representative of the U.S. population of 284.8 million.

In February 1999, a nationally representative, random sample of 1000 individuals aged 36–45 was drawn and interviewed. The survey of these respondents is called *RI1999*. It is expected that all subsequent surveys will be carried out in February. In the second wave, conducted in 2000, in addition to interviewing the *RI1999* individuals, i.e., the *RII2000* survey, we drew and interviewed a new random sample of individuals aged 47–66. This survey of the new sample is code named *RI2000*. This new sample is also nationally representative. We call members in these surveys the "core respondents." These individuals will be interviewed every year. For *RII2000*, with an attrition rate of less than 20%, 802 of the RI1999 respondents were successfully interviewed. With a targeted number of respondents of 2000, the RI2000 survey successfully interviewed 1960 individuals.

From the year 2000 interviews, we collected contact information on the children of the *RII2000* and *RI2000* respondents. This enables us to trace and interview the children of these respondents. We decided to trace children aged 16–23, because these are the years when they undergo important transitions and make decisions which have major impacts on their later life. These "children" were interviewed in August 2000. We call members in this sample the "child respondents" and the 2000 survey *CI2000*. We have collected the contact information of 1685 children of the core respondents, but only 1271 of them were successfully interviewed. The second interviews of the child respondents were carried out in February 2002, to be synchronized with the surveys of the core respondents.

The current study is based on the second wave of the PSFD, consisting of data from the *RII2000*, *RI2000*, and *CI2000* surveys. This is the largest cross-section of data available from the PSFD. After deleting missing values, we end up with 840 pairs of parents and childs.

In this study we are mainly interested in the relationship between a child's education outcomes and his/her parents' use of positive and negative reinforcement parenting practices. We use a variable, namely $ENCOURAGE$, indicating the extent to which a parent praises or gives awards to his/her children for good behavior as a proxy for positive reinforcement

practices; and a variable, namely $PUNISH$, indicating the extent to which a parent punish (e.g., scolding, corporal punishment, or negative pecuniary incentives) his/her children when they make mistakes as a proxy for negative reinforcement practices.

It is noted that a respondent of the *RII2000* and *RI2000* surveys, i.e., a core respondent, may be the father or the mother of a child respondent. Information on $ENCOURAGE$ and $PUNISH$ are collected from the core respondents only so that we do not have such information on their spouses. In other words, for a child respondent, information on his/her parents' parenting practices may be obtained from his/her father or mother. To allow the effects of a father's $ENCOURAGE$ and $PUNISH$ to be different from those of a mother, instead of using $ENCOURAGE$ and $PUNISH$ directly in the regressions, we use $ENCOURAGE_H$ and $PUNISH_H$, and $ENCOURAGE_W$ and $PUNISH_W$, which are created by $ENCOURAGE$ and $PUNISH$ interacting, respectively, with SEX (a variable indicating whether the respondent is a father or a mother):[2]

$$\begin{aligned} ENCOURAGE_H &= ENCOURAGE \times SEX, \\ PUNISH_H &= PUNISH \times SEX, \\ ENCOURAGE_W &= ENCOURAGE \times (1 - SEX), \\ PUNISH_W &= PUNISH \times (1 - SEX). \end{aligned}$$

We use a child's expected education attainment ($EXPECTATION$) and his/her aspired attainment ($ASPIRATION$) as proxies for his/her education attainments. This is because we do not have information on their actual education attainments. Some of the child respondents have not completed schooling yet. Admittedly, these two variables are not perfect substitutes for actual education attainments, but we believe that they bear a close and positive relation with the actual education attainments. To some extent, a child's education expectation and aspiration can predict his/her education attainments. While one's expected education attainment is his/her prediction of his/her own education attainment, education aspiration indicates one's ambition, which should bear some positive correlation with the actual outcome.

[2]When the respondent is a father $SEX = 1$, otherwise $SEX = 0$.

Our variables of interest (i.e., *ENCOURAGE* and *PUNISH*) are attitudinal variables. With the use of attitudinal variables, interpersonal comparison may be problematic. The problem arises from the fact that each individual's benchmarks are different. For example, an individual's definition of "close to actual experience" (i.e., *ENCOURAGE*=3) may be different from another individual's. However, by using a 5-point scale and labeling the two end points as "not close at all" and "extremely close," respectively, we try to set a benchmark for the respondents. This may alleviate the problem.

The variables used in our empirical analyses are listed and defined in Table 1. The descriptive statistics of the sample are displayed in Table 2. The frequency distributions of parenting practices are displayed in Table 3, while those of the child respondent's education expectation and aspiration are in Table 4. The exact wording of the question soliciting pertinent information from the respondents is also reported under Tables 3–4.

Table 3 reports the frequency distribution of the two parenting practices: $ENCOURAGE$ and $PUNISH$. Most respondents stated that they use $ENCOURAGE$ and $PUNISH$. For example, 47.37% and 41.65% of male respondents, respectively, and 59.06% and 47.15% of female respondents, respectively, indicated that the use of $ENCOURAGE$ and $PUNISH$ is extremely close to their actual experience; whereas, only 3.43% and 4.35% of male respondents, respectively, and 2.23% and 2.23% of female respondents, respectively, stated that it is not at all close to their experience. The frequency distributions of Table 4 show that most adolescents (66.91%) expect that they will at least obtain a college education. However, more of them (79.76%) want to have a college education or above. This shows that to a certain extent adolescents do realize what constraints they face.

3 Econometric Method

In the empirical analysis we first estimate the effect of parenting practices on an adolescent's education expectation and aspiration. We then examine the determinants of these practices

by estimating a model of each practice with the adolescent and his/her parents' characteristics as explanatory variables. Since education expectation and aspiration and parenting practices are ordinal variables, we model them using ordered probit models. However, since it is likely that parenting practices as a regressor in the education expectation and aspiration models are endogenous, we use a generalized method of moments approach for estimation. The endogeneity of parenting practices may arise when parents' adoption of parenting practices is determined partly by children's abilities, which are unobservable to the investigator. An adolescent's unobservable abilities, of course, have an effect on his/her education outcomes. In this case, we must find instruments which are correlated with the parents' choice of parenting practices, but uncorrelated with an adolescent's unobservable abilities.

The estimation of our ordered probit model is via the generalized method of moments (GMM). Our GMM procedure follows that of Avery, Hansen, and Hotz (1983) and Poirier and Ruud (1988), who exploit the panel probit model's orthogonality conditions for estimation. By exploiting the orthogonality conditions, such that the numerical evaluation of high-dimensional integrals is avoided, computation costs are greatly reduced. While Avery, Hansen, and Hotz (1983) and Poirier and Ruud (1988) apply the GMM approach to the multiperiod or dependent probit models, we adapt it to the estimation of an ordered probit model with endogenous variables. In addition, Wooldridge (1996) provides useful a guideline on the instrumental variable estimation of a general class of non-linear models.

We adopt the GMM approach for estimation mainly because we have several potential endogenous variables. If we use the likelihood-based approach, we have to model the variable of interest (i.e., $EXPECTATION$ or $PUNISH$ in our study) and all the endogenous variables simultaneously. By doing so we will be dealing with a high-dimensional, non-linear system of equations, which is liable to numerical problems (e.g., non-convergence, local maximum, etc.). In contrast, the GMM procedure does not require the modeling of endogenous variables. Moreover, under the likelihood-based framework, a misspecification (e.g., functional form, distributional assumption, etc.) of any auxiliary models (i.e., models pertaining

to the endogenous variables) will lead to inconsistency in the parameters of interest. As for the GMM procedure, consistency in the parameters of interest only requires the correction specification of the model of interest and the validity of the orthogonality conditions.

In the following, a concise presentation is given to expound upon the general structure of the ordered probit model. Our general method of moments approach is given further below. Let V_i denote an ordinal variable (e.g., an adolescent i's education expectation and aspirations, or parenting practices) so that

$$V_i = j \quad \text{if option} \quad j \quad \text{is chosen;} \quad j = 1, \cdots, L+1. \tag{1}$$

To further express the specification, we introduce the latent variable Y_i^* so that

$$Y_i^* = \beta X_i + \epsilon_i,$$

$$V_i = \begin{cases} j & \text{if} \quad \sum_{k=1}^{k=j-1} \alpha_k \leq Y_i^* < \sum_{k=1}^{k=j} \alpha_k, \\ 0 & \text{if} \quad Y_i^* < \alpha_1, \end{cases}$$

where α_j and β are parameters to be estimated, and X_i is a vector of independent variables. For identification, we assume $\alpha_0 = -\infty$, $\alpha_1 = 0$, and $\alpha_{L+1} = \infty$. The probability for V_i to take the value j is

$$\begin{aligned} \text{Prob}(V_i = j) &= \text{Prob}\left(\sum_{k=1}^{k=j-1} \alpha_k < \beta X_i \leq \sum_{k=1}^{k=j} \alpha_k \right) \\ &= \Phi\left(\sum_{k=1}^{k=j} \alpha_k - \beta X_i \right) - \Phi\left(\sum_{k=1}^{k=j-1} \alpha_k - \beta X_i \right), \end{aligned}$$

where $\Phi(\cdot)$ is the standard normal cumulative distribution function.

We employ this simple structure for modeling parenting practices (i.e., $ENCOURAGE$ and $PUNISH$) and estimate the parameters by the method of maximum likelihood.[3] However, for education expectation and aspiration, we estimate them by GMM (see Avery, Hansen, and Hotz, 1983, Poirier and Ruud, 1988, and Wooldridge, 1996). This method is explained below.

[3]The estimation is by means of the statistical package STATA.

We introduce a variable y_{ji}, which is an indicator variable taking the value 1 if $V_i \leq j$, i.e.,

$$y_{ji} = \begin{cases} 1, & \text{if } V_i \leq j \text{ or } \sum_{k=1}^{k=j} \alpha_k - \beta X_i < \epsilon_i \\ 0, & \text{otherwise.} \end{cases} \tag{2}$$

The error term ϵ_i is unobserved, but we can derive its conditional expectation. That is,

$$u_{ij} = \mathrm{E}(\epsilon_i | \beta, X, y_{ji}) \tag{3}$$

$$= \left[y_{ji} - \Phi\left(\sum_{k=1}^{k=j} \alpha_k - \beta X_i \right) \right] \frac{\phi\left(\sum_{k=1}^{k=j} \alpha_j - \beta X_i \right)}{\Phi\left(\alpha_j - \beta X_i \right) \left[1 - \Phi\left(\sum_{k=1}^{k=j} \alpha_j - \beta X_i \right) \right]}. \tag{4}$$

See Poirier and Ruud (1988).

We take account of the possibility of endogeneity by employing a $(P \times 1)$ vector of instruments z_i for identification. Our identification condition is[4]

$$\mathrm{E}(z_i' u_{ji}) = 0. \tag{5}$$

With $j = 1, \ldots, L+1$ options for the dependent variable, we have $L \times P$ moment conditions. For compactness of notation, we define

$$\mathrm{E}(Z_i' U_i) = 0,$$

where $U_i \equiv \{u_{1i}, u_{2i}, \cdots, u_{Li}\}$ and $Z_i \equiv z_i \otimes I_L$, such that Z_i is an $L \times (L \times P)$ matrix.

Assuming i.i.d. across i, we can define the variance covariance matrix of u_i as

$$\mathrm{var}(U_i) = \Omega_i, \tag{6}$$

where the $\{r, s\}$ element of Ω_i equals

$$\Omega_{i,rs} = \begin{cases} \dfrac{\phi_r \phi_s}{\Phi_s (1 - \Phi_r)} & \text{if } r \leq s, \\ \dfrac{\phi_r \phi_s}{\Phi_r (1 - \Phi_s)} & \text{if } r \geq s, \end{cases} \tag{7}$$

[4]It is noted that the moment condition (5) is analogous to the first-order condition of the log likelihood function

$$\mathcal{L} = \sum_i (1 - y_{ji}) \log \left[1 - \Phi\left(\sum_{k=1}^{k=j} \alpha_k - \beta X_i \right) \right] + y_{ji} \log \Phi\left(\sum_{k=1}^{k=j} \alpha_i - \beta X_i \right).$$

.

where $\phi_r \equiv \phi\left(\sum_{k=1}^{k=r}\alpha_k - \beta' X_i\right)$ and $\Phi_r \equiv \Phi\left(\sum_{k=1}^{k=r}\alpha_k - \beta' X_i\right)$. See page 167 of McCullagh and Nelder (1989).

The estimation of the parameters is conducted by finding the solution to

$$Q(\beta, \alpha_1, \cdots, \alpha_L) = \min_{\beta,\alpha_1,\cdots,\alpha_L} \left(\frac{1}{N}\sum_{i=1}^{N} Z_i' U_i\right)' \left(\frac{1}{N}\sum_{i=1}^{N} Z_i' \Omega Z_i\right)^{-1} \left(\frac{1}{N}\sum_{i=1}^{N} Z_i' U_i\right). \quad (8)$$

The coefficient estimates are obtained by means of the optimization algorithm of Broyden, Fletcher, Goldfarb, and Shanno (BFGS), which is used to minimize the criterion function in (8).[5] The asymptotic variance of the above estimator is given by

$$\text{var}(\beta, \alpha_1, \cdots, \alpha_L) = \left(R' C^{-1} R\right)^{-1}, \quad (9)$$

where $R \equiv E(Z_i' \nabla_i)$, ∇_i is the Jacobian of U_i, and $C \equiv E(Z_i \Omega_i Z_i)$.

The validity of the instruments is tested by Hansen's (1982) J-test, which has test statistics as follows.

$$J_N = NQ(\beta, \alpha_1, \cdots, \alpha_L), \quad J_N \sim \chi^2_{M-R}. \quad (10)$$

Here $Q(\beta, \alpha_1, \cdots, \alpha_L)$ is as defined in (8) and under the null hypothesis the moment conditions are satisfied, and J_N is chi-squared distributed with the degrees of freedom $(M - R)$ equal to the number of moment conditions $M = P \times L$ minus the number of parameters R.

In the estimation of the models for *EXPECTATION* and *PUNISH*, we use the following variables as explanatory variables: $ENCOURAGE_H$, $ENCOURAGE_W$, $PUNISH_H$, $PUNISH_W$ (i.e., parents' parenting practices), $EDUYR_H$ (i.e., number of years of education of the father), $EDUYR_W$ (i.e., number of years of education of the mother), AGE_H (i.e., age of the father), AGE_W (i.e., age of the mother), $WPAY$ (i.e., total monthly income of the family), $NCHILD$ (i.e., number of children in the family), SEX_C (i.e., gender of the child), AGE_C (i.e., age of the child), and $HEALTH_C$ (i.e., health of the child).

[5]The BFGS algorithm is a quasi-Newton method, which requires information on the first derivative only. The BFGS algorithm obtains the Hessian, which requires information on the second derivative in the Newton algorithm, by approximation. The advantages of using a quasi-Newton algorithm, as compared with the Newton algorithm, is that (i) it is more stable than the Newton algorithm, and (ii) it is less time consuming than the Newton algorithm.

Allowing $ENCOURAGE_H$, $ENCOURAGE_W$, $PUNISH_H$, and $PUNISH_W$ to be endogenous, the instruments that we use for identification in the education outcomes models are $HEALTH_H$ (i.e., health status of the father), $HEALTH_W$ (i.e., health status of the mother), $HOUR_H$ (i.e., number of work hours of the father), $HOUR_W$ (i.e., number of work hours of the mother), $NSIB_H$, and $NSIB_W$ (i.e., number of siblings of the father and the mother, respectively).[6] It is expected that all these variables are uncorrelated with the unobservable determinants of education outcomes, but correlated with $ENCOURAGE$ and $PUNISH$.[7]

4 Results Discussion

Determinants of Education Outcomes

The estimation results are discussed in this section. We first proceed with the results pertaining to education outcomes as displayed in Table 5 and will examine the validity of the instruments. The test statistics of the J-test for both models are very low, and with the p-values being very close to 1, we can conclude that the instruments are valid.

It is noted that the surveys solicit information on parenting practices from a core respondent, who might be a father or a mother of a child respondent. Since the effects of parenting practices of the father and the mother could be different, we thus interact $ENCOURAGE$ and $PUNISH$ with dummy variables (namely, SEX and $(1-SEX)$) indicating whether the respondent is the father or the mother. By using the interaction terms pertaining to the father, namely $ENCOURAGE_H$ and $PUNISH_H$, and the mother, namely $ENCOURAGE_W$ and $PUNISH_W$, as explanatory variables, we allow the effects of the father and mother's parenting practices on a child's education outcomes to be different.

[6]The variables $NSIB_H$ and $NSIB_W$ are obtained by interacting $NSIB$, i.e., a respondent's number of siblings, with SEX, i.e., whether the respondent is the father or mother in the family.

[7]It is noted that instruments are used to ensure that the orthogonality conditions hold. An instrument will not have a coefficient since they do not enter the education outcome equations as a regressor. To achieve identification, the number of instruments has to be more than the number of explanatory variables. The difference in the two numbers should be equal to (i.e., just identification) or larger than (i.e., over-identification) the number of endogenous variables.

The results in Table 5 show that both $ENCOURAGE_H$ and $ENCOURAGE_W$ have a positive effect on both education expectation and aspiration. The effect of parenting through encouragement or award by the father or the mother on education outcomes is positive. This result is somewhat different from the results obtained by Steinberg, *et al.* (1992), who find that the effect of parental school encouragement has a mildly negative effect on adolescents' school performance.[8] To gauge and compare the magnitude of the impact by the father and the mother, we look at the marginal effects of $ENCOURAGE$ on the probabilities of each category of education outcomes as reported in Tables 6–7. The marginal effects of $ENCOURAGE_W$ are sizable relative to those of other explanatory variables.[9] In addition, the marginal effects of the mother's positive reinforcement parenting ($ENCOURAGE_H$) are larger on both education expectation and apsiration than those of the father's. The results reflect the fact that mothers play a more important role than fathers in shaping the education outcomes of children. This is in accordance with the general observation that mothers take on more parenting responsibility.

Both across mothers and fathers, and between education expectation and aspiration, the effects of $PUNISH$ are more diverse. With respect to $EXPECTATION$, the effect of $PUNISH_H$ is positive while $PUNISH_W$ is negative. However, the effects of both $PUNISH_H$ and $PUNISH_W$ are statistically insignificant and their marginal effects are not large compared with those of other variables. These results point out that the use of pun-

[8]It is noted that their measurement of parenting practice is restricted to being pertinent to school encouragement and their measurement of education outcome is school performance. The courterparts in the current study are encouragement/award for good behavior, education expectation, and aspiration. Thus, the results may not be directly comparable. Steinberg et al. (1992) restrict their attention to parental involvement in their children's schooling. By contrast, from looking at parents' use of encouragement and punishment in general, we focus on a broader aspect of parental behavior. The advantage of the Steinberg et al. (1992) measurement is that evidence on the effects of a very specific parental behavior is obtained, whereas, we are able to examine the effects of a broader aspect of parental behavior.

[9]It is noted that a given explanatory variable's marginal effects across all the categories of the dependent variable sum to zero. The interpretation of an explanatory variable's marginal effects is illustrated by taking the results of $ENCOURAGE_W$ as an example in the following. The marginal effects of $ENCOURAGE_W$ are negative for $EXPECTATION = 3$ and $EXPECTATION = 4$, and they turn positive for $EXPECTATION = 5$, $EXPECTATION = 6$ and $EXPECTATION = 7$. This indicates that a higher level of $ENCOURAGE_H$ is associated with a higher probability for a child to expect to complete at least a college eduaction and the probability for him/her to complete junior college or below.

ishment either by the father or by the mother does not result in any beneficiary effects on the education outcomes of a child.

As for education aspiration variable $ASPIRATION$, with the coefficient of $PUNISH_H$ being statistically insignificant, the effect of $PUNISH_H$ is negligible, while that of $PUNISH_W$ is negative and statistically significant. This suggests that parenting with negative reinforcement has a harmful effect on adolescents' education outcomes.

Based on the results pertaining to $ENCOURAGE$ and $PUNISH$, another finding is that the effect of a mother's involvement in parenting has a much large effect than a father's on a child's education outcomes. We can see this by comparing the marginal effects of $ENCOURAGE_H$ and $ENCOURAGE_W$, and those between $PUNISH_H$ and $PUNISH_W$. The marginal effects of $ENCOURAGE_W$ is much larger than $ENCOURAGE_H$, while the marginal effects of $PUNISH_W$ and $PUNISH_H$ are comparable for $EXPECTATION$. As for $ASPIRATION$, both $ENCOURAGE_W$ and $PUNISH_W$, respectively, have a much larger marginal effect than those of $ENCOURAGE_H$ and $PUNISH_H$.

To summarize up, we find that parenting by positive reinforcement generates positive effects on children's education outcomes, while parenting by negative reinforcement is harmful to children's education outcomes.

Now we turn to the results pertaining to other explanatory variables. The other findings are not surprising as they are mostly in accordance with previous findings. A child's father's and mother's education (denoted $EDUYR_H$ and $EDUYR_W$, respectively) has positive effects on his/her education expectation and aspiration.[10,11] Parents' ages do not have a statistically significant impact on their children's education expectation and aspiration. Family income (denoted $WPAY$) has a positive effect on both education expectation and aspiration of a child. This is consistent with the finding in the literature that family income has a positive effect on children's education outcomes (see, e.g., Weinberg, 2001). The num-

[10]The effect of a mother's years of education is statistically insignificant though.

[11]It is interesting to see that according to the reported marginal effects (see Tables 6–7), a parent's education is a very important determinant of his/her children's education expectation and aspiration.

ber of children in the family ($NCHILD$) has a negative (but statistically insignificant) effect on a child's education expectation and a statistically significant, positive effect on his/her education aspiration. The positive effect of $NCHILD$ on $ASPIRATION$ may come from the existence of competition among siblings. That is, a child may aspire to outperform his/her siblings by attaining a higher level of education.

As shown by the coefficient estimates of AGE_C, an older adolescent would expect to attain a higher level of education, while this child will in fact aspire to achieve a lower level of education. This may be due to the fact that as an adolescent grows older, he/she may realize that attaining a higher level of education is not as difficult as he/she previously thought. However, he/she may not want as much education as he/she previously wished (that is, when he/she was younger). Male adolescents (i.e., $SEX_C = 1$) in general expect and aspire to achieve a lower level of education.[12] As indicated by the negative coefficient of $HEALTH_C$, a child with poorer health (i.e., a higher $HEALTH_C$) will expect to attain a lower level of education. This reflect a child's recognition of the physical constraint imposed by his/her health condition. However, a child health condition does not affect his/her education aspiration.

Determinants of Parenting Practices

We now turn to the ordered probit results pertaining to the determinants of *ENCOURAGE* and *PUNISH*, as presented in Table 8. Since a father and a mother may play different roles in parenting such that their parenting style may be associated with their socioeconomic characteristics in different ways, we perform estimations for the male and female respondents (i.e., fathers and mothers) separately. The estimation results are displayed in Table 8, and the explanatory variables' marginal effects on the probabilities for $ENCOURAGE$ and $PUNISH$ to take on different values are reported in Tables 9–12.

According to Table 8, a male respondent's education (i.e., $EDUYR_H$) has a statistically

[12]This finding is consistent with those obtained in developed countries. For example, the empirical results of Kaestner (1997), Aaronson (1998), Dearden, Ferri, and Meghir (2002), and Pollak and Ginther (2003) indicate that ceteris paribus females have more favorable education outcomes.

insignificant effect on his use of $ENCOURAGE$, and it has a statistically significant, negative effect on his use of $PUNISH$. The marginal effects of $EDUYR_H$ on a father's use of $PUNISH$ are not large relative to those of other variables though. Nevertheless, it has a statistically significant and positive effect on a mother's use of both $ENCOURAGE$ and $PUNISH$. In addition, the marginal effects of $EDUYR_H$ on a mother's use of ENCOURAGE and $PUNISH$ are quite sizable relative to those of other explanatory variables.

A mother's education (denoted $EDUYR_W$) has a negative effect on her use of $PUNISH$, whereas it does not have any statistically significant effect on her use of $ENCOURAGE$. In addition, her education has a positive effect on the father's use of $ENCOURAGE$, and its marginal effects are not small compared with those of other variables. Since $ENCOURAGE$ and $PUNISH$ have important bearings on the education outcomes of adolescents, the aforementioned results suggest another channel through which education status is transmitted intergenerationally.

A male individual's age (i.e., AGE_H) has a statistically significant, negative impact on his use of $PUNISH$, while having no effect on his use of $ENCOURAGE$. By contrast, a male individual's age has a positive impact on his spouse's use of $ENCOURAGE$, but statisitically insignificant effect on his spouse's use of $PUNISH$. On the other hand, a female individual's age (i.e., AGE_W) has a positive effect on her use of $PUNISH$ and a negative effect on the father's use of $PUNISH$, while having no statistically significant effect on her own use and the father's use of $ENCOURAGE$. In other words, an older father is conducive to his children's expection/aspiration to attain a higher education level through his and his spouse's parenting style; whereas a mother's age has mixed indirect effects on her children's education outcomes. Nevertheless, from Tables 9–12 we see that the marginal effects of AGE_H and AGE_W are not large.

According to the coefficient estimates of $HEALTH_H$, in a family with a healthier father (i.e., with a lower value of $HEALTH_H$) the mother tends to use $ENCOURAGE$, while the father's own use of $ENCOURAGE$ and $PUNISH$ and the mother's use of $PUNISH$

are not affected by $HEALTH_H$. Moreover, a healthier mother (i.e., with a lower value for $HEALTH_W$) tends to use *ENCOURAGE*, while her use of $PUNISH$ and the father's use of *ENCOURAGE* and $PUNISH$ are not affected by $HEALTH_W$. This portraits an indirect, positive role played by a parent's healthiness in his/her children's educational attainment. Gauged by the size of their marginal effects, $HEALTH_H$ and $HEALTH_W$ are important determinants of parents' parenting style.

We now turn to the results pertaining to hours of labor supply, i.e., $HOUR_H$ and $HOUR_W$. A father's work hours do not have any statistically significant impact on his own use of $ENCOURAGE$ or $PUNISH$. However, as he works more number of hours, the extent to which his wife uses both $ENCOURAGE$ and $PUNISH$ will increase. These results seem to be produced by the fact that a busy husband will shift his parenting responsibility to his wife. By contrast, while a mother's work hours do not have any effect on the father's parenting style, they have a negative effect on her own use of $ENCOURAGE$ and no effect on her own use of $PUNISH$. From the results pertaining to labor supply hours, we see that having a busy father is associated with mixed indirect effects on children's education expectation/aspiration, while having a busy mother will produce harmful effects on their education expectation/aspiration. However, the small marginal effects suggest that $HOUR_H$ and $HOUR_W$ play only a minor role in determining parenting style.

Total family income (i.e., $WPAY$) has a positive effect on a father's use of *ENCOURAGE* and no effect on his use of $PUNISH$. Nevertheless, total family income has a negative impact on a mother's use of *ENCOURAGE*. The marginal effects of $WPAY$ are quite small relative to other variables.

The number of children in the family (i.e., $NCHILD$), the number of siblings that an individual has (i.e., $NSIB$), and the characteristics of a child (i.e., SEX_C, AGE_C, and $HEALTH_C$) do not have any statistically significant effect on either $ENCOURAGE$ or $PUNISH$ for both male and female individuals.

5 Conclusion

The current paper investigates the determinants of education outcomes and parenting practices. Our objective is to find a channel through which family background (especially the parents' socioeconomic background) affects the education outcomes of an adolescent. We conjecture that the style of parenting is one of the channels connecting family background and adolescents' education outcomes. The current study focuses on two practices: (1) positive reinforcements, e.g., verbal encouragement and awards, and (2) negative reinforcements, e.g., scolding, corporal punishment, or negative pecuniary incentives.

We verify our conjecture by empirically estimating a model of children's education expectations and another model for education aspiration with parenting practices as explanatory variables. We guard against the possibility of parenting practices' endogeneity by adopting a generalized method of moments approach for estimations. In addition, we also estimate models of parenting practices using a family's background as explanatory variables. The empirical work is based on data from Taiwan's *Panel Study of Family Dynamics*.

The results herein show that parenting practices are influential determinants of adolescents' education outcomes. Moreover, parents' education and health status are important determinants of the education outcomes of adolescents, both numerically and statistically. This is consistent with our conjecture that parenting practices are significant channel through which family background affects an adolescent's education outcomes.

References

[1] Aaronson, D. (1998), "Using Sibling Data to Estimate the Impact of Neighborhoods on Children's Educational Outcomes," *Journal of Human Resources*, 33, 915-46

[2] Astone, N.M. & McLanahan, S.S. (1991), "Family Structure, Parental Practices and High School Completion," *American Sociological Review*, 56, 309–320.

[3] Avery, R.B, Hansen,L.P. & Hotz, V.J. (1983) "Multiperiod Probit Models and Orthogonality Condition Estimation," *International Economic Review*, 24(1), 21–35.

[4] Becker, G.S. (1964), *Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education,* New York: Columbia University Press, for the National Bureau of Economic Research.

[5] Becker, G.S. (1981), *A Treatise on the Family,* Cambridge, MA: Harvard University Press.

[6] Becker, G.S. & Tome, N. (1979), "An Equilibrium Theory of the Distribution of Income and Intergenerational Mobility," *Journal of Political Economy,* 87(6), 1153–1189.

[7] Blau, D.M (1999), "The Effect of Income on Child Development," *Review of Economics and Statistics*, 81(2), 261–276.

[8] Dearden, L., Ferri, J. & Meghir, C. (2002), "The Effect of School Quality on Educational Attainment and Wages," *Review of Ecobnomics and Statistics*, 84, 1–20.

[9] Dornbusch, S.M., Ritter, P.L., Leiderman, P.J., Roberts, D.F. & Fraleigh, M.J. (1987), "The Relation of Parenting Style to Adolescent School Performance," *Child Development*, 58, 1244–1257.

[10] Haveman, R. & Wolfe, B. (1995), "The Determinants of Children's Attainments: A Review of Methods and Findings," *Journal of Economics Literature,* 33, 1829–1878.

[11] Kaestner, R. (1997) "Brothers Really Better? Sibling Sex Composition and Educational Achievement Revisited," *Journal of Human Resources,* 32, 250–284.

[12] Kane, T.J. (1994), "College Entry by Blacks Since 1970: The Role of College Costs, Family Background, and the Return to Education," *Journal of Political Economy,* 102(5), 878–911.

[13] Kodde, D.A. & Ritzen, J.M.M. (1988), "Direct and Indirect Effects of Parental Education Level on the Demand for Higher Education," *Journal of Human Resources* 23(3), 356–371.

[14] Leibowitz, A. (1974) "Home Investment in Children," *Journal of Political Economy,* 82(2,II), S111-S131.

[15] Lepper, M.R., & Greene, D. (1978), *The Hidden Costs of Reward: New Perspective on the Psychology of Motivation,* Hillsdale, NJ: Erlbaum.

[16] Lepper, M.R., Greene, D., & Nisbett, R.E. (1973), "Undermining Children's Intrinsic Interest with Extrinsic Rewards: A Test of the 'Over Justification' Hypothesis," Journal of Personality and Social Psychology, 28(1), 129–137.

[17] Lueptow, L.B. (1975), "Parental Status and Influence and the Achievement Orientations of High School Seniors," *Sociology of Education,* 48, 91-110.

[18] Maccoby, E.E. & Martin, J.M. (1983), "Socialization in the Context of the Family: Parent-Child Interation," *Handbook of Child Psychology: Socialization, Personality, and Social Development,* by E.M. Hetherington (ed.), New York: Wiley.

[19] McCullagh, P. & Nelder, J.A. (1989), *Generalized Linear Models,* 2nd Ed., London: Chapman & Hall.

[20] O'Brien, M. & Jones, D. (1999), "Children, Parental Employment and Educational Attainment: An English Case Study" *Cambridge Journal of Economics,* 23(5), 599–621.

[21] Pollak R. A. & Ginther, D.K. (2003), "Does Family Structure Affect Children's Education Outcomes?" National Bureau of Economic Research Working Paper 9628.

[22] Poirier, D.J. & Ruud, P.A. (1988), "Probit with Dependent Observations," *Review of Economic Studies,* 55, 4, 593–614.

[23] Seltzer, J.A. (1994), "Consequences of Marital Dissolution for Children," *Annual Review of Sociology,* 20, 235–266.

[24] Sewell, W.H., & Shah, V.P., (1968), "Parents' Education and Children's Educational Aspirations and Achievements," *American Sociological Review*, 33(2), 191–209.

[25] Steinberg, L., Brown, B.B., Cazmarek, N., Cider, M., & Lazarro, C. (1988), *Noninstructional Influences on High School Student Achievement*, University of Wisconsin, Madison: National Center for Effective Secondary Schools.

[26] Steinberg, L., Lamborn, S.D., Dornbusch, S.M., & Darling, N. (1992), "Impact of parenting practices on adolescent achievement: Authoritative parenting, school involvement, and encouragement to succeed," *Child Development*, 63(5), 1266–1281.

[27] Teachman, J.D. (1987) "Family Background, Education Resources and Educational Attainment," *American Sociological Review*, 52, 548–557.

[28] Weinberg, B.A. (2001), "An Incentive Model of the Effect of Parental Income on Children," *Journal of Political Economy,* 109(2), 266–280.

[29] Wooldridge, J.M. (1996), "Estimating Systems of Equations with Different Instruments for Different Equations," *Journal of Econometrics,* 74, 387–405.

Table 1: Variable Definition

Variable	Definition
$EXPECTATION$	Child's education expectation. Ranges 1–7; $EXPECTATION = 1$ if expects to complete junior high school, $EXPECTATION = 7$ if expects to complete a Ph.D. degree. See Table 4 for details.
$ASPIRATION$	Child's education aspiration. Ranges 1–7; $ASPIRATION = 1$ if aspires to complete junior high school, $ASPIRATION = 7$ if aspires to complete a Ph.D. degree. See Table 4 for details.
$ENCOURAGE$	Parent's use of positive reinforcements. Ranges 1–5. See Table 3 for details.
$PUNISH$	Parent's use of negative reinforcements. Ranges 1–5. See Table 3 for details.
$ENCOURAGE_H$	$ENCOURAGE_H = ENCOURAGE \times SEX$.
$PUNISH_H$	$PUNISH_H = PUNISH \times SEX$.
$ENCOURAGE_W$	$ENCOURAGE_H = ENCOURAGE \times (1 - SEX)$.
$PUNISH_W$	$PUNISH_H = PUNISH \times (1 - SEX)$.
$EDUYR_H$	Husband's (i.e., father's) number of years of education.
$EDUYR_W$	Wife's (i.e., mother's) number of years of education.
AGE_H	Husband's (i.e., father's) age.
AGE_W	Wife's (i.e., mother's) age.
$HEALTH_H$	Husband's (i.e., father's) health status. Ranges 1–5; very good: 1; very poor: 5.
$HEALTH_W$	Wife's (i.e., mother's) health status. Ranges 1–5; very good: 1; very poor: 5.
$HOUR_H$	Husband's (father's) work hours per week.
$HOUR_W$	Wife's (mother's) work hours per week.
$WPAY$	Total monthly family income. In thousands of New Taiwan Dollar. As of September 6, 2003, the New Taiwan dollars to U.S. dollar exchange rate is 34.1.
$NSIB$	Respondent's number of siblings.
SEX	Gender of the respondent.
$NCHILD$	Number of children in the family.
AGE_C	Child's age.
SEX_C	Child's gender. Male: 1 ; Female: 0.
$HEALTH_C$	Child's health status. Ranges 1–5; very good: 1; very poor: 5.

Table 2: Sample Statistics

Variable	Full Sample	Respondents are Husbands*	Respondents are Wives**
$ENCOURAGE$	4.2857	4.1808	4.3995
	(0.96)	(1.01)	(0.89)
$PUNISH$	4.0429	3.9817	4.1092
	(1.09)	(1.13)	(1.04)
$EDUYR_H$	10.4214	10.3776	10.4690
	(3.73)	(3.43)	(4.03)
$EDUYR_W$	9.3905	9.2197	9.5757
	(3.52)	(3.39)	(3.65)
AGE_H	48.4060	47.3684	49.5310
	(4.81)	(3.88)	(5.43)
AGE_W	44.8917	44.1442	45.7022
	(3.60)	(3.48)	(3.55)
$HEALTH_H$	2.1071	2.0938	2.1216
	(0.87)	(0.82)	(0.93)
$HEALTH_W$	2.1440	2.0892	2.2035
	(0.85)	(0.85)	(0.83)
$HOUR_H$	48.1738	52.5675	43.4094
	(61.57)	(82.14)	(23.47)
$HOUR_W$	34.2191	27.5675	41.4318
	(71.24)	(25.53)	(98.92)
$WPAY$	71.7220	69.3032	74.3449
	(86.17)	(88.82)	(83.23)
$NCHILD$	2.9643	3.0160	2.9082
	(0.92)	(0.90)	(0.94)
$NSIB$	4.7036	4.7254	4.6799
	(1.83)	(1.91)	(1.74)
AGE_C	19.2321	19.0435	19.4367
	(1.93)	(1.91)	(1.92)
SEX_C	0.5023	0.5172	0.4864
	(0.50)	(0.50)	(0.50)
$HEALTH_C$	2.0440	2.0389	2.0496
	(0.85)	(0.87)	(0.83)
Observation	840	437	403

Note: *Female respondents.
**Male respondents.

Table 3: Frequency Distribution— $ENCOURAGE$, $PUNISH$

	Husband Subsample				Wife Subsample			
	$ENCOURAGE$		$PUNISH$		$ENCOURAGE$		$PUNISH$	
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
1	15	3.43	19	4.35	9	2.23	9	2.23
2	16	3.66	36	8.24	8	1.99	24	5.96
3	51	11.67	61	13.96	34	8.44	71	17.62
4	148	33.87	139	31.81	114	28.29	109	27.05
5	207	47.37	182	41.65	238	59.06	190	47.15

- Wording of the questionnaire:
  On a scale of 1–5, how close are the following statements to your actual experience; "1" stands for "not close at all" and "5" stands for "extremely close":
  (ENCOURAGE) I praise, encourage, or give rewards to my children for good behavior.
  (PUNISH) I punish or scold my children when they make mistakes.
- In the estimation of the ordered probit models for $ENCOURAGE$ and $PUNISH$, we group categories 1–3 together, because of the low frequency of categories 1 and 2.

Table 4: Frequency Distribution—$EXPECTATION$, $ASPIRATION$

	$EXPECTATION$		$ASPIRIATION$	
	Frequency	Percent	Frequency	Percent
Junior High School	1	0.12	2	0.24
Senior Vocational High School	5	0.60	4	0.48
Senior High School	64	7.62	45	5.36
Junior College	208	24.76	119	14.17
College	341	40.60	258	30.71
Master's Degree	176	20.95	201	23.93
Ph.D.	45	5.36	211	25.12

- Wording of the questionnaire:
  $EXPECTATION$: *Taking into account all factors, what level of education do you expect you will achieve?*
  $ASPIRIATION$: *Ignoring all constraints, what level of education do you aspire to achieve?*
- In the estimation of the models for $EXPECTATION$ and $ASPIRATION$, we group the categories "Junior High School," "Senior Vocational High School", and "Senior High School" together, because of the low frequency of the three categories.

Table 5: GMM Estimation Results—Education Outcomes.

Variable	$EXPECTATION$	$ASPIRATION$
Constant	-2.6364**	-0.8950**
	(-245.92)†	(-79.92)
$ENCOURAGE_H$	0.0714**	0.0592*
	(2.20)	(1.74)
$ENCOURAGE_W$	0.1237**	0.1412**
	(3.82)	(4.14)
$PUNISH_H$	0.0173	0.0034
	(0.55)	(0.10)
$PUNISH_W$	-0.0164	-0.0818**
	(-0.54)	(-2.54)
$EDUYR_H$	0.8904**	0.6660**
	(75.60)	(53.86)
$EDUYR_W$	0.0233	0.0128
	(0.22)	(0.11)
AGE_H	0.0561	-0.0460
	(1.08)	(-0.84)
AGE_W	0.0483	0.0531
	(0.10)	(0.11)
$WPAY$	0.0820**	0.0453**
	(6.93)	(3.65)
$NCHILD$	-0.0050	0.0680**
	(-0.15)	(1.97)
SEX_C	-0.1369**	-0.0583**
	(-18.53)	(-7.51)
AGE_C	0.1587**	-0.4873**
	(7.67)	(-22.53)
$HEALTH_C$	-0.0592**	0.0210
	(-2.52)	(0.85)
α_2	1.0226**	0.7194**
	(101.5)	(57.42)
α_3	1.1864**	0.9011**
	(156.3)	(61.88)
α_4	1.0272**	0.7255**
	(320.0)	(57.81)
J-Test Statistic	0.1148	0.1436
	(0.990)	(0.9861)

Note: †Asymtotic t-statistics in parentheses.
**Statistically significant at the 5% level.
*Statistically significant at the 10% level.
$ENCOURAGE_H = ENCOURAGE \times SEX$
$ENCOURAGE_W = ENCOURAGE \times (1 - SEX)$
$PUNISH_H = PUNISH \times SEX$
$PUNISH_W = PUNISH \times (1 - SEX)$

Table 6: Marginal Effects on $EXPECTATION$.

Variable	$EXPECTATION = 3$	$EXPECTATION = 4$	$EXPECTATION = 5$	$EXPECTATION = 6$	$EXPECTATION = 7$
$ENCOURAGE_H$	-0.0091	-0.0162	0.0029	0.0159	0.0065
$ENCOURAGE_W$	-0.0157	-0.0280	0.0050	0.0276	0.0112
$PUNISH_H$	-0.0022	-0.0039	0.0007	0.0039	0.0016
$PUNISH_W$	0.0021	0.0037	-0.0007	-0.0037	-0.0015
$EDUYR_H$	-0.1131	-0.2017	0.0357	0.1984	0.0807
$EDUYR_W$	-0.0030	-0.0053	0.0009	0.0052	0.0021
AGE_H	-0.0071	-0.0127	0.0023	0.0125	0.0051
AGE_W	-0.0061	-0.0109	0.0019	0.0108	0.0044
$WPAY$	-0.0104	-0.0186	0.0033	0.0183	0.0074
$NCHILD$	0.0006	0.0011	-0.0002	-0.0011	-0.0005
SEX_C	0.0174	0.0310	-0.0055	-0.0305	-0.0124
AGE_C	-0.0202	-0.0360	0.0064	0.0354	0.0144
$HEALTH_C$	0.0075	0.0134	-0.0024	-0.0132	-0.0054

Note:
The marginal effect of variable z_i on category j is calculated as

$$\mu_z^j = \frac{\partial \left[\Phi(\alpha_j - \beta\bar{X}) - \Phi(\alpha_{j-1} - \beta\bar{X})\right]}{\partial \bar{z}},$$

where $\bar{X}$ stands for the mean of the vector of regressors and $\bar{z}$ is the mean of z_i. That is, the marginal probabilities are evaluated at the mean of the regressors. If z_i is binary, then the marginal effect equals

$$\mu_z^j = [\Phi(\alpha_j - \beta\bar{X}) - \Phi(\alpha_{j-1} - \beta\bar{X})]\Big|_{\bar{z}=1} - [\Phi(\alpha_j - \beta\bar{X}) - \Phi(\alpha_{j-1} - \beta\bar{X})]\Big|_{\bar{z}=0}.$$

Table 7: Marginal Effects on $ASPIRATION$.

Variable	$ASPIRATION = 3$	$ASPIRATION = 4$	$ASPIRATION = 5$	$ASPIRATION = 6$	$ASPIRATION = 7$
$ENCOURAGE_H$	-0.0065	-0.0095	-0.0076	0.0058	0.0179
$ENCOURAGE_W$	-0.0157	-0.0226	-0.0180	0.0137	0.0426
$PUNISH_H$	-0.0004	-0.0005	-0.0004	0.0003	0.0010
$PUNISH_W$	0.0091	0.0131	0.0104	-0.0079	-0.0247
$EDUYR_H$	-0.0741	-0.1065	-0.0851	0.0647	0.2009
$EDUYR_W$	-0.0014	-0.0020	-0.0016	0.0012	0.0039
AGE_H	0.0051	0.0074	0.0058	-0.0045	-0.0139
AGE_H	-0.0059	-0.0085	-0.0068	0.0051	0.0160
$WPAY$	-0.0050	-0.0072	-0.0058	0.0044	0.0136
$NCHILD$	-0.0076	-0.0109	-0.0087	0.0066	0.0205
SEX_C	0.0065	0.0093	0.0074	-0.0057	-0.0176
AGE_C	0.0542	0.0779	0.0622	-0.0474	-0.1470
$HEALTH_C$	-0.0023	-0.0034	-0.0026	0.0020	0.0063

Note: See Table 6.

Table 8: Ordered Probit Results for $ENCOURAGE$ and $PUNISH$.

	Father Subsample		Mother Subsample	
	$ENCOURAGE$	$PUNISH$	$ENCOURAGE$	$PUNISH$
Constant	-2.3423**	-2.0415**	-1.5431	-4.257**
	(-2.58)	(-2.33)	(-1.46)	(-4.37)
$EDUYR_H$	-0.0281	-0.0359*	0.0895**	0.0574**
	(-1.30)	(-1.67)	(4.01)	(2.78)
$EDUYR_W$	0.0506**	-0.0068	0.0062	-0.0514**
	(2.19)	(-0.30)	(0.25)	(-2.21)
AGE_H	-0.0054	-0.0521**	0.0276*	-0.0099
	(-0.26)	(-2.55)	(1.76)	(-0.73)
AGE_W	-0.0186	0.0456**	-0.0121	-0.0603**
	(-0.80)	(2.00)	(-0.51)	(-2.70)
$HEALTH_H$	-0.0195	0.0939	-0.1935**	0.0567
	(-0.27)	(1.30)	(-2.73)	(0.87)
$HEALTH_W$	0.0658	0.0351	-0.2019**	-0.0720
	(0.93)	(0.51)	(-2.47)	(-0.97)
$HOUR_H$	0.0009	0.0009	0.0065**	-0.0056**
	(1.27)	(1.30)	(2.23)	(-2.09)
$HOUR_W$	-0.0018	0.0003	-0.0013**	-0.0007
	(-0.85)	(0.18)	(-2.28)	(-1.36)
$WPAY$	0.0010*	-0.0003	-0.0020**	0.0000
	(1.78)	(-0.55)	(-2.82)	(0.03)
$NCHILD$	-0.0307	-0.0223	-0.0066	0.0710
	(-0.43)	(-0.32)	(-0.09)	(0.99)
$NSIB$	-0.0021	0.0073	0.0580	0.0129
	(-0.07)	(0.25)	(1.52)	(0.36)
SEX_C	-0.0380	-0.0005	-0.1014	-0.0928
	(-0.34)	(-0.01)	(-0.81)	(-0.80)
AGE_C	0.0082	-0.0200	-0.0336	0.0260
	(0.27)	(-0.67)	(-0.95)	(0.80)
$HEALTH_C$	0.0062	0.0606	-0.012	0.0164
	(0.10)	(0.96)	(-0.17)	(0.23)
α_2	-1.7357*	-1.5024*	-0.8462	-3.475**
	(-1.91)	(-1.72)	(-0.80)	(-3.58)
α_3	-0.7393	-0.6372	0.2313	-2.686**
	(-0.82)	(-0.73)	(0.22)	(-2.78)
Log likelihood	-490.91	-540.45	-362.75	-467.43
χ^2_{17}	31.18	24.59	88.86	47.63
	[0.0190]	[0.1043]	[0.0000]	[0.0001]
Observation	437	437	403	403

Note: †Asymtotic t-statistics in parentheses.
**Statistically significant at the 5% level.
*Statistically significant at the 10% level.

Table 9: Marginal Effects on the Father Subsample's $ENCOURAGE$.

Variable	$ENCOURAGE$=2	$ENCOURAGE$=3	$ENCOURAGE$=4	$ENCOURAGE$=5
$EDUYR_H$	0.0034	0.0038	0.0038	-0.0111
$EDUYR_W$	-0.0062	-0.0069	-0.0070	0.0201
AGE_H	0.0006	0.0007	0.0007	-0.0021
AGE_W	0.0022	0.0025	0.0025	-0.0074
$HEALTH_H$	0.0024	0.0026	0.0027	-0.0078
$HEALTH_W$	-0.0081	-0.0089	-0.0091	0.0262
$HOUR_H$	-0.0001	-0.0001	-0.0001	0.0003
$HOUR_W$	0.0002	0.0002	0.0002	-0.0007
$WPAY$	-0.0001	-0.0001	-0.0001	0.0004
$NCHILD$	0.0037	0.0042	0.0042	-0.0122
$NSIB$	0.0002	0.0002	0.0003	-0.0008
SEX_C	0.0046	0.0051	0.0052	-0.0151
AGE_C	-0.0010	-0.0011	-0.0011	0.0032
$HEALTH_C$	-0.0007	-0.0008	-0.0008	0.0024

Note: See Table 6.

Table 10: Marginal Effects on the Father Subsample's $PUNISH$.

Variable	$ENCOURAGE$=2	$ENCOURAGE$=3	$ENCOURAGE$=4	$ENCOURAGE$=5
$EDUYR_H$	0.0070	0.0045	0.0023	-0.0139
$EDUYR_W$	0.0013	0.0008	0.0004	-0.0026
AGE_H	0.0102	0.0065	0.0034	-0.0203
AGE_W	-0.0090	-0.0057	-0.0030	0.0177
$HEALTH_H$	-0.0185	-0.0118	-0.0062	0.0366
$HEALTH_W$	-0.0069	-0.0044	-0.0023	0.0136
$HOUR_H$	-0.0001	-0.0001	-0.0001	0.0003
$HOUR_W$	-0.0001	-0.0001	-0.0000	0.0002
$WPAY$	0.0001	0.00004	0.00002	-0.0001
$NCHILD$	0.0044	0.0028	0.0014	-0.0087
$NSIB$	-0.0014	-0.0009	-0.0004	0.0028
SEX_C	0.0001	0.0001	0.00003	-0.0002
AGE_C	0.0039	0.0025	0.0013	-0.0078
$HEALTH_C$	-0.0119	-0.0076	-0.0040	0.0236

Note: See Table 6.

Table 11: Marginal Effects on the Mother Subsample's $ENCOURAGE$.

Variable	$ENCOURAGE$=2	$ENCOURAGE$=3	$ENCOURAGE$=4	$ENCOURAGE$=5
$EDUYR_H$	-0.0045	-0.0103	-0.0197	0.0346
$EDUYR_W$	-0.0003	-0.0007	-0.0013	0.0024
AGE_H	-0.0014	-0.0031	-0.0061	0.0106
AGE_W	0.0006	0.0014	0.0026	-0.0047
$HEALTH_H$	0.0098	0.0223	0.0427	-0.0749
$HEALTH_W$	0.0102	0.0233	0.0446	-0.0781
$HOUR_H$	-0.0003	-0.0007	-0.0014	0.0025
$HOUR_W$	0.0001	0.0001	0.0002	-0.0005
$WPAY$	0.0001	0.0002	0.0004	-0.0007
$NCHILD$	0.0003	0.0007	0.0014	-0.0025
$NSIB$	-0.0029	-0.0066	-0.0128	0.0224
SEX_C	0.0051	0.0117	0.0223	-0.0392
AGE_C	0.0017	0.0038	0.0074	-0.0130
$HEALTH_C$	0.0006	0.0014	0.0027	-0.0048

Note: See Table 6.

Table 12: Marginal Effects on the Mother Subsample's $PUNISH$.

Variable	$ENCOURAGE$=2	$ENCOURAGE$=3	$ENCOURAGE$=4	$ENCOURAGE$=5
$EDUYR_H$	-0.0074	-0.0102	-0.0051	0.0228
$EDUYR_W$	0.0066	0.0091	0.0045	-0.0204
AGE_H	0.0012	0.0017	0.0008	-0.0039
AGE_W	0.0078	0.0107	0.0053	-0.0239
$HEALTH_H$	-0.0073	-0.0101	-0.0050	0.0225
$HEALTH_W$	0.0093	0.0128	0.0064	-0.0286
$HOUR_H$	0.0007	0.0010	0.0005	-0.0022
$HOUR_W$	0.0001	0.0001	0.0001	-0.0002
$WPAY$	-2.35e-6	-3.22e-6	-1.60e-6	7.17e-6
$NCHILD$	-0.0092	-0.0126	-0.0063	0.0282
$NSIB$	-0.0016	-0.0023	-0.0011	0.0051
SEX_C	0.0121	0.0165	0.0082	-0.0369
AGE_C	-0.0033	-0.0046	-0.0023	0.0103
$HEALTH_C$	-0.0021	-0.0029	-0.0014	0.0065

Note: See Table 6.

Number	Author(s)	Title	Date
03-A001	Chung-Ming Kuan Wei-Ming Lee	A New Test of the martingale Difference Hypothesis	11/03
03-A002	Chung-Ming Kuan, Yu-Lieh Huang Ruey S. Tsay	A Component-Driven Model for Regime Switching and Its Empirical	11/03
03-A003	Yi-Ting Chen Chung-Ming Kuan	A Generalized Jarque-Bera Test of Concitiional Normality	11/03
03-A004	Kamhon Kan, Sunny Kai-Sun Kwong Charles Ka-Yui Leung	The Dynamics and Volatility of commercial and Residential Property Prices : Theory and Evidence	11/03
03-A005	Kamhon Kan Wei-Der Tsai	Parenting Practices and Children's Education Outcome	11/03