Catalogue no. 11F0019MIE — No. 261
ISSN: 1205-9153
ISBN: 0-662-40833-0

Research Paper

Analytical Studies Branch Research Paper Series

All in the Family: A Simultaneous Model of Parenting Style and Child Conduct

by Peter Burton, Shelley Phipps and Lori Curtis

Family and Labour Studies Division
24th floor, R.H. Coats Building, Ottawa, K1A 0T6

Telephone: 1 800 263-1136

Statistics Canada Statistique Canada

Canada

All in the Family: A Simultaneous Model of Parenting Style and Child Conduct

by

Peter Burton
Shelley Phipps
and
Lori Curtis

11F0019MIE No. 261
ISSN: 1205-9153
ISBN: 0-662-40833-0

Family and Labour Studies Division
Statistics Canada

How to obtain more information:
National inquiries line: 1 800 263-1136
E-Mail inquiries: infostats@statcan.ca

The paper is available on Internet: (www.statcan.ca)

August 2005

We would like to thank Lynn Lethbridge for superb research assistance and Miles Corak, Director of Family and Labour Studies at Statistics Canada for access to the data. Burton and Phipps gratefully acknowledge the financial support of the Social Sciences and Humanities Research Council of Canada; Curtis acknowledges the financial support of the Dalhousie Faculty of Medicine.

Published by authority of the Minister responsible for Statistics Canada

Note of appreciation:

Canada owes the success of its statistical system to a long-standing partnership between Statistics Canada, the citizens of Canada, its businesses, governments and other institutions. Accurate and timely statistical information could not be produced without their continued cooperation and goodwill.

Table of Contents

Abstract

The upbringing of children is modeled as a modified principal agent problem in which children attempt to maximize their own well-being when faced with a parenting strategy chosen by the parent, to maximize parent's perception of family well-being. Thus, children as well as parents are players, but children have higher discount rates than parents. The simultaneity of parenting and child behaviour is confirmed using the 1994 Canadian National Longitudinal Survey of Children.

Keywords: Children, parenting, within-family

JEL Classifications: J13

1 Introduction

> Parenting is probably the most important public health issue facing our society. It is the single largest variable implicated in childhood illnesses and accidents; teenage pregnancy and substance misuse; truancy, school disruption, and underachievement; child abuse; unemployability; juvenile crime; and mental illness. These are serious in themselves but are even more important as precursors of problems in adulthood and the next generation (Hoghughi, 1998).

A significant body of empirical literature, largely outside economics, suggests that parenting style is a key determinant of both child health and academic achievement (e.g., Feinstein and Symons, 1999; Lamborn, et al., 1991; McLeod and Shanahan, 1993; Steinberg, et al., 1992). Much of this evidence is from the United States or United Kingdom. However, recent Canadian research using the National Longitudinal Survey of Children and Youth (NLSCY) also emphasizes the importance of parenting style as a determinant of children's health (e.g., Chao and Willms, 1998; Ross et al., 1998).

As indicated by the quotation at the beginning of the paper, the direction of causality in this literature is generally taken to be from the parent to the child (i.e., good parenting leads to good outcomes for children), with the policy implication that we may be able to improve educational and health outcomes for children by improving parenting practices. This paper takes a somewhat different approach. While, we do not dispute the idea that better parenting skills would be beneficial for children, we do argue that treating 'parenting style' as an exogenous variable in models of children's attainment oversimplifies a complicated reality. Although children presumably respond to their parents' behaviour, it is also true that parents respond to their children's behaviour. That is, more praise may encourage a child to do well, but it is also true that parents may praise more when their children are doing well; censure more severely when the child is misbehaving.

Although occasional reference is made in the parenting literature to the possibility of endogeneity of parenting style to child behaviour (see, for example, Lamborn et al., 1991, p. 1062), we are aware of none which make this their theoretical focus and only two which make any effort to deal with the issue empirically (see Feinstein and Symons, 1999; and Hou, 2000).

1.1 Economic models of 'parenting'

Economists have paid less attention than scholars in other disciplines to 'parenting behaviour'. While there is a significant amount of literature attempting to explain children's attainments (see Haveman and Wolfe, 1995 for an excellent survey), the focus of this research could be described as being on 'production inputs' rather than upon an 'interactive production process'.

Economics as a discipline is dominated by models in which individual agents make utility-maximizing choices. Hence, it is not surprising that the most influential model of the determinants of child attainment is one which focuses upon how parental choices affect outcomes for children (see Becker and Tomes, 1986). Very simply, it is assumed that parents

allocate resources between personal consumption today and investment in the future of their children in order to maximize parents' utility today. Utility maximization occurs subject to the constraint of available income, and the relative prices of consumer goods versus investment in children. Children's attainments will depend upon how much parents choose to invest in them, where 'investing' means making expenditures on their skills, health, learning, motivation, 'credentials', and many other 'characteristics' (Becker and Tomes, 1986, p. S5). The child himself/herself is not a participant in this process, nor is the process by which this happens really outlined.

Leibowitz (1974) adds the idea that investments in children will depend upon the amount and the quality of time parents spend with their children, upon material investments, where quality of time is assumed to increase with parental education. The focus upon both the quantity and the quality of time provides a richer description of the process of child-rearing, but the child is again essentially just a 'lump of raw material' acted upon by the parent.

In the first stage of our paper, we develop a model in which child well-being is the outcome of a simple game in which *both* parent and child are players. In this way, we aim to get inside the 'black box' of parent/child interactions within the family and study the process by which time and money are combined to result in particular outcomes for children. Haveman and Wolfe (1995) also argue that children's attainments will depend upon choices made by children themselves, though they do not develop this idea theoretically. In the game used here, an important point is that the child players are not just 'small adults' (see Phipps, 1999 for a discussion of some of the key ways, in the context of microeconomic theory, in which children differ from adults). For our purposes, the key difference between the adult and child players is that it is assumed that children have much higher discount rates than adults.

Children are assumed to maximize individual utility which depends upon their own behaviour as well as responses from the parent (e.g., praise versus punishment, or 'parenting' behaviours). Parents are assumed to maximize the parent's idea of 'family welfare' which depends upon adult as well as child utility.

We acknowledge the on-going nature of parent/child interactions. However, a recent literature on the development of 'reputation' suggests that, under certain conditions, the dynamic game might be approximated by a static problem of mechanism design. For instance, we argue that parents can develop reputations about how they will respond to particular child behaviours (e.g., they may be perceived as 'strict' or 'soft'). Fudenberg and Levine (1989, 1992) find that a relatively 'patient' player (i.e., in this case the parent) can convince single period opponents (i.e., children with very high discount rates) who are aware of past actions that the parent is committed to a strategy of response in each period (i.e., to picking a parenting strategy that would make 'family welfare' as high as possible, given the child's response). Schmidt (1993) finds the same result for a 'patient' player facing less patient long-run opponents as long as there are conflicting interests (i.e., there must be some reason for the less patient player to experiment). Celentani et al. (1996) and Evans and Thomas (1997) extend this to allow for imperfect observability as a reason that a less patient opponent would try off-equilibrium actions and generalize the required conditions.

Thus, if children have higher discount rates than parents, theory suggests that parents should be able to do at least as well as they could by being actually committed to adhere to a strategy. Any improvement on this outcome (e.g., from not remaining consistent with the chosen parenting

style) is only possible if the child cannot distinguish the parent's actual behaviour from the perceived strategy and therefore continues to play taking the parenting strategy as given. While acknowledging that the parent may be able to engage in some behaviour that is inconsistent with the chosen parenting strategy (e.g., not censuring an occurence of bad behaviour), we assume that the child is perceptive enough about any changes in the 'rules' that such inconsistent behaviour is very limited. As a result, this paper models the parent/child interactions as a simple problem of static mechanism design.

The next section of this paper contains a simple model of parent/child interactions in which both the parent and the child are players and where the child is assumed to differ from the adult by having a higher discount rate. As a result, both the child's observed behaviour and parent's observed behaviour depend upon the influences on and characteristics of both parent and child. Section 3 is an empirical exploration of the parent/child interaction using microdata from the Statistics Canada National Longitudinal Survey of Children and Youth. By explicitly addressing the simultaneous nature of parent/child interactions, we add to the empirical literature in this area which generally treats parental behaviour as exogenous to child actions. Section 4 addresses the conclusions.

2 The model

The model presented in this paper amounts to a simple mechanism design decision by the parent[1] who is assumed to have incomplete information about the child's mood, which may vary from day to day or even moment to moment (e.g., as a result of lack of sleep, problems at school, "too much sugar", etc.). Thus, the parent's strategy space is not defined in terms of a single action but in terms of a set of responses to all possible actions of the child. This may be summarized as a 'parenting strategy'. In its simplest form, this might consist of the choice of an expected level of good behaviour, above which the child is praised, and below which the child is censured. In addition, the parent must choose how the level of praise (or censure) responds to the level of behaviour (e.g., how quickly does censure escalate in response to increasing bad behaviour on the part of the child). Since the child has a relatively high discount rate, he is assumed not to care about the implications of his actions on his future utility. A high discount rate also implies that he can be assumed to take the parent's choice of strategy as given and to act accordingly (given his personality and the stresses he faces). Thus, different children or the same child under different conditions (e.g., not enough sleep) may behave differently though faced with the same parenting strategy.

In particular, assume that the child's current well-being[2], $U_0^C(p, e(a \mid x) \mid x)$, depends upon the amount of praise, *p*, he receives and the effort, *e*, he must exert to maintain a level, *a*, of good

1. For ease of exposition, we will refer to the 'parent' as 'she' and the child as 'he'. In fact, in the empirical section of the paper, almost all parents are mothers.

2. The use of 'effort' in the child's utility function is done to avoid the interpretation that the child dislikes 'good' behaviour. Instead, a child may 'find it hard to be good'.

behaviour.[3] Of course, the relationship between behaviour level and effort depends upon the 'personality" of the child, *x*, which is in turn a product of the child's genetic, physiological, and environmental influences (e.g., age, gender, stress at school/day care). However, the parent's choice of parenting strategy, *Z*, has established a relationship between behaviour and the level of praise, $p = f(a \mid Z)$.

Thus, the child attempts to solve $\max_a U_0{}^C(p, e(a \mid x) \mid x)$ subject to $p = f(a \mid Z)$.

The first order condition,

$$\frac{\partial U_0{}^C}{\partial p}\frac{\partial f}{\partial a} + \frac{\partial U_0{}^C}{\partial e}\frac{\partial e}{\partial a} = 0,$$

reveals that the child would balance the marginal (dis)utility of behaving 'better', $\partial U_0{}^C / \partial a \equiv (\partial U_0{}^C / \partial e)(\partial e / \partial a)$, with the marginal utility of praise, $\partial U_0{}^C / \partial p$, multiplied by response of praise to more good behaviour, $\partial f / \partial a$.

The outcome in terms of both child's behaviour/misbehaviour and the level of praise/punishment will depend upon both the parenting strategy and the child's type, $a^*(Z, x)$ and $p^*(Z, x)$. This means that we may observe different combinations of behaviour/mis-behaviour and praise/censure when different children or even the same child in different moods interact with any particular parenting strategy. For instance, Figure 1 indicates the outcomes for a child who is short on sleep and therefore less willing/able to make the effort to 'behave well/control himself.' (This could equally well be interpreted as indifference curves for different children -- e.g., one who is naturally more 'boisterous' than another.)

The parent, in turn, attempts to maximize a family welfare function[4] depending upon her own current well-being, U^P, the child's future well-being[5], $U_1{}^C$ and the child's current utility, $U_0{}^C$,

$$W(U^P, U_1{}^C, U_0{}^C).$$

---

3. It is assumed that the child's utility is increasing in praise, $\partial U_0{}^C / \partial p > 0$, and decreasing in effort, $\partial U_0{}^C / \partial e < 0$, as well as being quasiconcave in these variables. In addition, effort is assumed to be increasing, $\partial e / \partial a > 0$, and convex in the level of good behaviour, $\partial^2 e / \partial a^2 \geq 0$. Finally, it is assumed that the parent chooses a parenting style so that the level of praise is increasing and concave in the level of good behaviour, $\partial f / \partial a > 0$, $\partial^2 f / \partial a^2 \leq 0$.

4. Note that this could include the possibility of a paternalistic social welfare function, $W(U^P, U_1{}^C, U_0{}^C, a)$.

5. More precisely, the parent's measure of family welfare should depend upon her *perception* of the child's utility, $\hat{U}_0{}^C$, $\hat{U}_1{}^C$.

The parent's well-being depends upon the child's behaviour/mis-behaviour and the level of praise (or censure) provided, given the parent's type, y, $U^P(a^*, p^* \mid y)$. In addition, the child's current and future well-being may depend upon his current behaviour and the praise received, $U_0{}^C(a^*, p^* \mid x)$, $U_1{}^C(a^*, p^* \mid x)$. Of course, the 'types' of both parent and child may depend upon the stresses in their lives as well as their innate characteristics. For instance, Figure 2 indicates the outcome of parenting style that may develop in a parent who is experiencing marital stress.

In this case, lower amounts of praise are provided at every level of good behaviour and the parent provides less additional praise in response to a given improvement in behaviour (i.e., both the intercept and slope of the parenting strategy are changed). In addition, note that stresses on the parent indirectly cause the child's well-being to be reduced (he/she is on a lower indifference curve).

Thus, the welfare function can be written in terms of the child's behaviour and the level of praise, and the types of both parent and child. However, the realized levels of activity and praise were chosen by the child from the menu of combinations made available by the parenting strategy (i.e., $a^*(Z, x)$ and $p^*(Z, x)$. As a result, the parent can be thought of as choosing dimensions of a parenting strategy, z_i (e.g., behaviour threshold for praise, degree of response to better behaviour), in an attempt to solve $\max W(a^*(Z, x), p^*(Z, x) \mid y, x)$.

The first order conditions

$$\frac{\partial W}{\partial a}\frac{\partial a^*}{\partial z_i} + \frac{\partial W}{\partial p}\frac{\partial p^*}{\partial z_i} = 0 \;\forall i$$

balance the effects of changing some component of the parenting strategy on better behaviour and the effects on praise. The optimal parenting strategy for any particular parent will depend upon the types of both the child, *x*, and the parent, *y*; $Z^*(x, y)$. As a result it should be possible to determine how the level of praise is related to the behaviour of the child and the characteristics of both child and parent, *p=f(a,x,y)*. In addition, the child's first order conditions should allow behaviour to be related to the amount of praise as well as the characteristics of parent and child, a(p,x,y).

2.1 An example

A child attempts to maximize utility,

$$U^C(a, p) = \alpha \ln(p) - \beta \ln(a),$$

subject to the parenting strategy, $p = -\bar{c} + sa$, where *a* is a measure of 'good behaviour' and *p* is positive reinforcement or praise ($p<1$ is discipline or censure). Note that the child is assumed to find it difficult (i.e., it reduces utility) to achieve a level of good behaviour greater than $a=1$.

The first order conditions imply that

$$a = \frac{\beta}{\alpha s}\, p.$$

Substituting into the parenting strategy yields the equilibrium levels of child behaviour and praise depending upon the type of the child (as given by α and β) and the choice of parenting strategy parameters (i.e., $\bar{c}, s$),

$$a^* = \frac{\beta \bar{c}}{(\beta - \alpha)s}$$

$$P^* = \frac{\alpha \bar{c}}{(\beta - \alpha)}.$$

The parent(s) decide upon a parenting strategy by choosing the maximum amount of censure, $\bar{c}$, and the marginal praise in response to more of the 'good' activity, *s*, (i.e., the intercept and slope)[6] so as to maximize $W(\bar{c}, s, \alpha, \beta) = U^P + \theta U^C$ where $U^P = \gamma a - \delta(p - \pi)$ (i.e., some effort is required to praise beyond a certain level, π). Here the child's future utility is subsumed within the parent utility function, U^P.

The first order conditions yield

$$\bar{c}^* = \frac{\theta(\beta - \alpha)}{\delta}$$

$$s^* = \frac{\gamma}{\delta}.$$

These result in reduced form expressions for behaviour and praise that depend upon the preferences of both the parent and child and the parent's concern for the child's immediate well-being,

$$a^{**} = \frac{\theta\beta}{\gamma}$$

and

$$p^{**} = \frac{\alpha\theta}{\delta}.$$

To derive simultaneous equations, normalize the child's preferences so that $\beta - \alpha = 1$, let the child's type affect the value of alpha, $\alpha(x)$, and let the parent's type affect the relative weight given to the child's current wishes versus and the parent's current (or the child's future) well-

6. Note that this is equivalent to choosing an activity threshold for praise versus censure, $\bar{c} / s$, and the marginal praise in response to more good activity, *s*.

being, $\theta(y)$. As a result, the child's choice of behaviour level will be written as a function of his 'type' (including external influences on the child) and the amount of praise,

$$a^* = \frac{(1+\alpha(x))\delta}{\alpha(x)\gamma}\, p,$$

while the amount of praise depends upon the parent's 'type' (including external influences on the parent) and the level of good behaviour,

$$p^* = \frac{-\theta(y)}{\delta} + \frac{\gamma}{\delta} a.$$

The possibility that parent/child interactions are best estimated with such a system of equations is investigated in the following section.

3 Empirical support

3.1 The data

The data employed for our empirical investigation of parent/child interactions are drawn from Cycle One of the National Longitudinal Survey of Children and Youth (NLSCY) which is a representative national sample of Canadian children aged 0 to 11 years in 1994.[7] Children included in the data set come from a subset of households that had recently participated in the Labour Force Survey. Thus, children living in the northern territories, on Indian Reserves or in institutions are not included in the sample. The information about the child used in this paper is provided by the 'person most knowledgable about the child' (pmk)—the mother in 90.3 percent of cases in our sample. Information was collected during face-to-face interviews, usually lasting about 2 hours for 1 child and more if multiple children from the same family were included in the sample.

To motivate the main part of our empirical analysis, we first present some evidence about *differences* in reported parenting behaviours for a subset of children from two-parent families, who have *siblings* who are also included in the data set, and where both children are aged 4 to 11 years (3,565 observations). Thus, the same parent, generally a mother, answered the questions about *both* children. We are curious to know whether the mother says she parents the same way for both children or whether she reports cross-child differences. The NLSCY reports 4 different parenting scores: 1) a positive interactions score; 2) a hostile/ineffective score; 3) a consistency score; 4) and a punitive aversive score. (Details of the content of these scores are provided in Appendix 1.) In Table 1, we indicate the percentage of children for whom the parent reports exactly the same score. This ranges from 14.1 percent for 'hostile-ineffective' parenting (a 25 point scale) to 29.4 percent with identical scores for 'punitive-aversive' parenting (a 16 point scale). The correlation between sibling parenting scores ranges from 0.552 for 'hostile-

7. Although 1996 and 1998 data are now available, not all variables required for this analysis are contained in the later survey years. This paper uses the master files for 1994.

ineffective parenting' to 0.676 for 'punitive-aversive' parenting. This evidence, while very informal, suggests that observed parenting behaviours are not identical for all children in a family. This is consistent with our hypothesis that the parenting behaviours and child outcome pairs we observe depend upon *both* the parent and the child—that parenting is at least partially a response to the behaviour of the child.

The main part of our empirical analysis focuses upon children aged 6 to 11 years, regardless of whether or not the child has a sibling in the sample (i.e., we now drop the sibling pair analysis). We prefer to focus on children in this age range for two reasons: 1) although anyone who has dealt with a two-year old knows that he can have a 'mind of his own', the sort of decision-making outlined above seems more appropriate as a description of older children; 2) we do not have children older than 11 available in the first wave of the NLSCY data which we use here (and some of the variables which we employ are not available in subsequent waves of the NLSCY which would have older children). We have excluded children who do not live in two-parent families since it seems likely that parenting of any individual will be affected by his or her marital status. These exclusions, as well as exclusion of observations with non-response to any question used in our analysis leaves us with a final estimating sample of 8,481 children aged 6-11. Basic means/frequencies are reported in Table 2.

3.2 Empirical specification

The main message of the theoretical framework outlined above is that any observed combination of parent/child behaviour will be the result of an *interactive* process. That is, causality is not uni-directional from 'parenting' to child behaviour but 'parenting' can also be a *response* to child behaviour. Thus, an appropriate empirical strategy involves estimation of a simultaneous system of parent/child behavioural equations.

Although, as noted above, the NLSCY contains information about a variety of parenting behaviours, for illustration of this point, we have decided to study what is labelled as the 'punitive/aversive' parenting index. The four questions included in the 'punitive/aversive' index of parenting style are: 1) "When your child breaks the rules or does things that he/she is not supposed to, how often do you calmly discuss the problem?" 2) "When your child breaks the rules or does things that he/she is not supposed to, how often do you raise your voice, scold or yell at him/her?" 3) "When your child breaks the rules or does things that he/she is not supposed to, how often do you use physical punishment?" 4) "When your child breaks the rules or does things that he/she is not supposed to, how often do you describe alternative ways of behaving that are acceptable?" Possible answers to each of the parenting questions were: always = 1; often = 2; sometimes = 3; rarely = 4; never = 5. Values were reversed for the last two questions before summing to generate a score which ranges in reported value from 4 to 19. The mean punitive/aversive score for pmk's in our sample was 8.80 (see Table 2).

We chose the 'punitive/aversive' parenting index because it seemed closest to the theoretical model outlined above. For example, parents who report that they yell more often might be viewed as having more 'steeply-sloped' parenting strategies. A problem with several of the other measures was that they contain many questions about parenting with important duration components (e.g., how many times during the day you laugh with your child depends upon how much time you spend with your child—see Appendix 1). To capture the idea of parenting

strategy, we believed it to be more important to focus upon percentages of time spent. A final comment to make about our choice of parenting index is that the punitive/aversive parenting index exhibits the highest correspondence across siblings of any of the measures available in the NLSCY (see Table 1). Thus, if anything, we might expect to find *less* endogeneity for this than for other measures of parenting (i.e., if anything, our choice should lead to a bias *against* finding that parenting behaviour is endogenous to child conduct).

Our measure of child behaviour is an index of 'conduct disorder/physical aggression.' Pmk's were asked 'How often would you say that your child:' 1) gets into many fights; 2) when another child accidentally hurts him/her (such as bumping into him/ her) assumes the child meant to do it, then reacts with anger and fighting; 3) physically attacks people; 4) threatens people; 5) is cruel, bullies or is mean to others; 6) kicks, bites, hits other children. Possible answers to each question were: 'never or not true' = 0; 'sometimes or somewhat true' = 1; 'often or very true' = 2. Values were summed to obtain a total score which could thus range in value from 0 to 12. The mean for our sample was 1.21 (see Table 2).

While child conduct may not seem as 'typically economic' an outcome as, say, over-all health, we wanted to choose an outcome which would have some scope for being the result of the children's own choices as well as being an important predictor of the child's eventual attainment. Pragmatically, the choice of conduct disorders facilitates the econometrics since this outcome is measured on a scale from 4 to 14 rather than on a scale from 1 to 5 (as was the case for success at school, which would otherwise have been an ideal candidate for analysis).

The first step in our empirical analysis was to estimate simple ordinary least squares regressions for both parenting behaviour and child conduct. Explanatory variables included in both models are: 1) a dummy variable equal to one if the family is low income, defined as having family income less than 50 percent of median equivalent income for the country, using an OECD equivalence scale—17.6 percent of children—see Table 2); 2) number of children in the household (mean = 2.5); 3) age of the child (mean = 8.5 years); 4) a dummy=1 if the child if female (48.4 percent); 5) a dummy=1 if the pmk has less than high-school education (15.5 percent); 6) a dummy if the pmk is more than 35 years of age (66.7 percent); 7) a dummy=1 if the pmk is an 'at home' mother (28.9 percent); 8) number of weekly hours *not* spent in paid employment by the pmk (mean = 88.8 hours). Past work with the NLSCY (see, for example, Dooley et al., 1998; Curtis and Phipps, 2000; Curtis et al., forthcoming) suggests that these are a reasonable basic set of controls for both equations.

Additionally, in the child conduct equation, we include a dummy=1 if the child has changed child care (presumably 'after-school' care since all children in our sample are school-aged) in the last year because the caregiver or program was no longer available (1.7 percent). We take this to be an exogenous event likely to affect the child's behaviour but unlikely to affect parenting. Finally, we include a dummy=1 if the pmk indicates that the child has no close friends (1.8 percent). Again, this may well influence how much the child 'acts out' but is unlikely to influence parenting style.

In the parenting equation, in addition to the basic controls noted above, we include, first, a dummy variable indicating that the pmk is attending school as opposed to working in the paid labour market (we have already controlled in both equations for pmk being 'out of home'). In our sample, 8.6 percent of children have pmk's who are attending school. Controlling for family

income, from the child's perspective, it should not matter if the pmk is at the office[8] or in the classroom. However, this may well influence parenting style since different pressures/expectations would be in place (and/or this could be an indicator of parental motivation).

Finally, we include a variable indicating the proportion of people aged 15+ in the neighbourhood who have less than a high-school education (mean is 34.5 percent). If low levels of parental education are associated with 'poorer' parenting behaviour, then it is possible that reference group norms could negatively affect parenting style, but it is not obvious how this would directly affect the child's conduct.

3.3 Empirical results[9]

Basic OLS regressions, without the potentially endogenous variables, are reported in column 1 of Tables 3 and 4, for child conduct and parenting style, respectively. Note the improvement in each equation when we add 'parenting' to the child conduct equation and 'child conduct' as a predictor of parenting style. The adjusted R-squared for the child conduct model increases from 0.036 to 0.095; the adjusted R-squared in the parenting equation increases from 0.013 to 0.071. Our index of 'punitive/aversive' parenting has a strongly statistically significant association with child conduct (p-value less than 0.0001). A 1 point increase in the parenting index is associated with an increase in the child conduct score of 0.203, or 10 times the standard deviation for the child conduct score reported in Table 2. Similarly, child conduct is a strongly significant predictor of parenting scores (p-value less than 0.0001). A 1 point increase in the child conduct index is associated with an increase in punitive/aversive parenting of 0.291 points, again 10 times the standard deviation for parenting scores reported in Table 2.

3.3.1 Specification tests

Of course, the key point of our analysis is that it is inappropriate to estimate child conduct as an OLS model in which parenting style is taken to be an exogenous explanatory variable (or to estimate parenting style as an OLS model in which child conduct is an exogenous variable). Thus, the next step of our empirical work is to estimate both equations via two-stage least squares. To do this, we require 'good instruments.' A good instrument must be correlated with the potentially endogenous variable (e.g., parenting style in the child conduct equation), but not correlated with the error term (e.g., in the child conduct equation). As argued above, our candidate instruments for child conduct are 'daycare changed because the program or care-giver disappeared' and 'child has no friends.' For parenting style, our candidate instruments are 'pmk is attending school' and 'proportion in neighbourhood with less than high-school education.'

Table 5 reports some summary statistics from reduced form estimation of both child conduct and parenting style on: 1) all common exogenous variables; 2) all common exogenous variables +

8. The 1994 master files of the NLSCY provide some summary information about the neighbourhood in which the family resides.

9. As noted earlier, some respondents to the NLSCY are siblings and hence not independent observations. We have also estimated all models reported here selecting only one sibling from each family. Substantive results are unaffected.

candidate instruments for that variable; 3) just candidate instruments. Consider first the candidate instruments for child conduct. Adding the 'daycare change' and 'no friends' dummies provides little improvement in fit for the reduced form child conduct model (adjusted R-squared increases from 0.031 to 0.036), but an F-test of the joint hypothesis that the coefficients on both instruments = 0 is clearly rejected (F-value = 25.78; p-value = 0.0001). This is the key requirement for identification.

The candidate instruments for the parenting equation are 'parent is in school' and 'proportion in neighbourhood with less than high-school.' The adjusted R-squared in the reduced form estimate increases from 0.008 to 0.013 when the instruments are added; the F-statistic for the joint test that the 2 instruments jointly add nothing to the equation is 23.26 so that the hypothesis must be rejected (p-value less than 0.0001).

Table 6 reports results of tests of over-identifying restrictions. For both child conduct and parenting style, the predicted error from the structural model estimated by two-stage least squares was regressed on all exogenous variables in the system. Under the null hypothesis that all instruments are uncorrelated with the error in the structural model, the R-squared obtained from the above auxiliary regression multiplied by the number of observations is approximately distributed as chi-squared with degrees of freedom equal to the number of instruments less the number of endogenous variables (i.e., degrees of freedom equal 1 for both equations). Since the reported R-squared in both auxiliary regressions are so close to zero, we are unable to reject the null hypothesis of no correlation between the error and the instruments, even though we have a very large sample size (8,481 observations).

Thus, we conclude that our instruments are 'good' insofar as they *are* correlated with the potentially endogenous explanatory variable and they *are not* correlated with the error in the structural model.

Finally, we need to test for exogeneity, given the instruments we have chosen. We use a version of the Hausman test[10], which involves obtaining reduced form estimates for our two potentially endogenous variables (i.e., we regress, for example, child conduct on all basic exogenous variables + 'daycare changed' and 'no friends'). We then add the predicted value of the potentially endogenous variable (i.e., child conduct as predicted from the reduced form estimate) to the structural model for the other variable. The test for exogeneity is then a simple test of the hypothesis that the estimated coefficient on the predicted value of the potentially endogenous variable = 0. As indicated in Table 7, we must reject the hypothesis of exogeneity for both models.

This conclusion is central to our argument. Parenting behaviour is *not* exogenous to child behaviour (and child behaviour is not exogenous to parenting behaviour).

10. See, for example, Pindyck and Rubinfeld, 1998.

3.3.2 Final results

The second and third columns of Tables 3 and 4 present structural estimates obtained using two-stage least squares (i.e., using the instruments discussed above, but paying no attention to possible correlation across the errors in the two equations) and using three-stage least squares (acknowledging cross-equation correlations in the errors). There is little difference between the two-stage and three-stage least squares estimates.

However, there are some very important differences in the results obtained when we appropriately acknowledge endogeneity of parenting behaviour to child behaviour (and vice versa) compared to the result we obtain using simple OLS techniques. Consider, first, the child conduct equation. In terms of basic control variables, we find relatively few important qualitative differences. 'Acting out' increases if the family is low income, increases if there are more siblings, is less likely for girls than boys, is less likely if the pmk is over 35 years of age, is more likely if the child has changed child care arrangements because the caregiver or program is no longer available, and is more likely if the child is reported to have no close friends[11].

The estimated size of the association between parenting behaviour and child conduct is, however, much larger in the two- and three-stage least squares models (over double) than in the OLS model. For example, a 1 point increase in the punitive/aversive parenting index increases the child conduct score by 0.202 in the OLS model; a 1 point increase in punitive/aversive parenting increases the child conduct score by 0.541 points in the more appropriately estimated two- and three-stage least squares models. Level of significance is very high in all models (p less than 0.0001).

In the OLS estimate of punitive/aversive parenting, more children in the family and more people in the neighbourhood with less than high school are both associated with 'worse' parenting behaviour (i.e., a higher punitive/aversive score)[12]. Parenting behaviour is 'better' (i.e., the punitive/aversive score is lower) when the child is older, if the child is female, or if the pmk is currently attending school (as opposed to working for pay)[13]. In the two- and three-stage estimates, however, almost none of these associations remain statistically significant (only drinking being a source of tension and pmk attending school remain statistically significant). The estimated size of the association increases about 3 times (e.g., from 0.291 in the OLS estimates to 0.719 in the three-stage least squares estimates).

The message we take from these results is that children's behaviour is affected by a variety of socioeconomic factors (e.g., family size, age and gender of child, mother's age), but these

11. In general, family low income status has negative associations with child outcomes (see Curtis and Phipps, 2000). However, in other work (see Curtis, Dooley and Phipps, 1999) we found that child conduct is less influenced by low income than most other child outcomes studied.

12. Note that this assumes it is always better to calmly discuss things than it is to yell, for example, though it is possible to imagine scenarios in which it might be better for a parent to 'let off steam' and then drop the subject than to continue protracted 'rational discussion'.

13. On-going research suggests that while the fundamental parenting strategy adopted by a parent is not affected by income level, *consistency* of parenting behaviour to any particular strategy is affected by economic stress.

socioeconomic factors appear to affect parenting behaviour more indirectly insofar as they lead the child to change behaviour and hence the parent to respond.

4 Conclusions

This paper is an attempt to move beyond the 'black box' models linking family behaviour and children's attainments currently dominant in the economics literature by modeling 'parenting strategies.' In the first major section of the paper, we present a simple model of parent/child interactions in which *both* the parent and the child are players. A key assumed difference between parent and child is that the child has a much higher discount rate.

A major point to take from the theoretical model presented is that parenting behaviour should not be regarded as an exogenous determinant of child behaviour, as has been common in much empirical research on the link between parenting behaviour and child outcomes. Rather, child outcomes and parenting behaviour should be modeled as simultaneously determined. That is, for example, the parent will praise more if the child behaves well; more praise may encourage the child to behave well.

The second major section of the paper involves an empirical exploration of the idea that parent and child behaviour are simultaneously determined using the 1994 Statistics Canada National Longitudinal Survey of Children and Youth. We find clear evidence of simultaneity. Thus, care must be taken in formulating policy. 'Bad parenting' should not be interpreted as 'causing' poor child outcomes in a simple unidirectional sense. While parenting classes would presumably be beneficial for both parent and child, they are unlikely to be a panacea. Our results suggest that underlying socioeconomic factors, as well as parenting style, are very important determinants of child behaviour; observed parenting behaviour is influenced by stresses in the parent's life, but is also a response to child behaviour.

Figure 1. Child 's possible response to stress

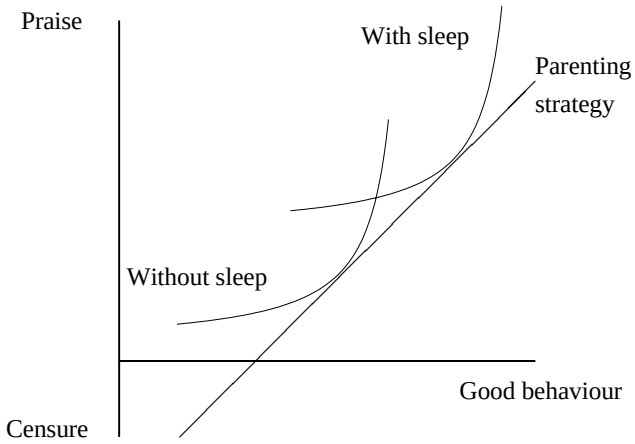

Figure 2. Parent's possible response to stress

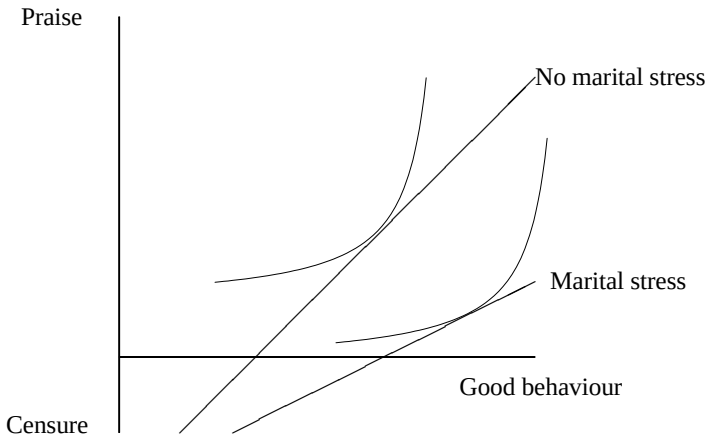

Table 1

Within family parenting patterns

- only children with siblings aged 4-11; PMK is biological parent of both children

	% of children whose sibling has the same parenting score	% of children whose sibling is within one point of parenting score	Correlation between parenting score for child and parenting score for sibling	Mean score for the PMK (selected child)	Minimum, maximum values for index (possible)
Positive interactions	18.7%	50.9%	0.637	12.48	0.20
Hostile/ Ineffective score	14.1%	43.0%	0.552	9.05	0.25
Consistency score	19.1%	51.4%	0.672	14.90	0.20
Punitive / Aversive score	29.4%	68.8%	0.676	8.91	4.19

Table 2
Variable means
Children aged 6-11

	Mean	Standard error
Punitive/(Aversive) parental score	8.80	0.022
Conduct disorder - Physical aggression score	1.21	0.019
Dummy=1 if low income[1]	17.6%	0.41%
Number of kids in the household	2.51	0.011
Age of the child	8.52	0.018
Dummy=1 if child is female	48.4%	0.54%
Dummy=1 if PMK has less than high school education	15.5%	0.39%
Dummy=1 if PMK >= 35 years of age	66.7%	0.51%
Dummy=1 if PMK currently is not working or attending school	28.9%	0.49%
Number of available parental hours - PMK	88.85	0.196
Dummy=1 if changed child care because caregiver/program no longer available	1.7%	0.14%
Dummy=1 if PMK indicates child has no close friends	1.8%	0.14%
Percentage of the population in the neighbourhood who have less than a high school education	34.5%	0.15%
Dummy=l if PMK is attending school	8.6%	0.30%

[1] A household is low income if total household equivalent income before tax falls below one half the median equivalent income for the entire count where the equivalence scale used is that recommended by the OECD.

Table 3
Conduct disorder - Physical aggression score
Children aged 6-11

	Ordinary least squares-no parenting	Ordinary least squares-full specification	Two-stage least squares	Three-stage least squares
Intercept	1.638*	-0.208	-3.287*	-3.287*
	(0.145)	(0.162)	(1.168)	(1.168)
Dummy=1 if low-income[1]	0.119**	0.114**	0.107***	0.107***
	(0.053)	(0.052)	(0.056)	(0.056)
Number of kids in the household	0.107*	0.088*	0.055**	0.055**
	(0.019)	(0.019)	(0.024)	(0.024)
Age of the child	-0.034*	-0.027**	-0.015	-0.015
	(0.011)	(0.011)	(0.012)	(0.012)
Dummy=1 if child is female	-0.494*	-0.443*	-0.358*	-0.358*
	(0.037)	(0.036)	(0.050)	(0.050)
Dummy=1 if PMK has less than	0.147*	0.133*	0.109***	0.109***
high school education	(0.053)	(0.051)	(0.056)	(0.056)
Dummy=1 if PMK >= 35 years of	0.169*	-0.144*	-0.101**	-0.101**
age	(0.040)	(0.039)	(0.045)	(0.045)
Dummy=1 if PMK currently is not	0.001	0.006	0.014	0.014
working or attending school	(0.050)	(0.049)	(0.053)	(0.053)
Number of available parental hours -	-0.001	-0.001	-0.00099	-0.00099
PMK	(0.001)	(0.001)	(0.0013)	(0.0013)
Dummy=1 if changed child care	0.651*	0.559*	0.405**	0.403*
because caregiver/program no	(0.143)	(0.139)	(0.161)	(0.129)
longer available				
Dummy=1 if PMK indicates child	0.760*	0.650*	0.467*	0.469*
has no close friends	(0.138)	(0.134)	(0.161)	(0.140)
Punitive/(Aversive) parental score	--	0.203*	0.541*	0.541*
		(0.009)	(0.127)	(0.127)
Adjusted R-squared	0.036	0.095	0.035	-
F value	33.08	80.48	28.84	

[1] A household is low income if total household equivalent income before tax falls below one half the median equivalent income for the entire country where the equivalence scale used is that recommended by the OECD.

* statistically significant with 99% confidence

** statistically significant with 95% confidence

*** statistically significant with 90% confidence

Table 4
Punitive/Aversive parental score
Children aged 6-11

	Ordinary least squares-no child conduct	Ordinary least squares-full specification	Two-stage least squares	Three-stage least squares
Intercept	8.794*	8.341*	7.677*	7.700*
	(0.184)	(0.180)	(0.327)	(0.325)
Dummy=1 if low income[1]	-0.026	-0.055	-0.097	-0.092
	(0.064)	(0.063)	(0.069)	(0.068)
Number of kids in the household	0.099	0.068*	0.022	0.022
	(0.023)	(0.022)	(0.030)	(0.030)
Age of the child	-0.039*	-0.028**	-0.011	-0.011
	(0.013)	(0.013)	(0.015)	(0.015)
Dummy=1 if child is female	-0.259*	-0.114*	0.099	0.099
	(0.044)	(0.043)	(0.096)	(0.096)
Dummy=1 if PMK has less than	0.013	-0.023	-0.075	-0.071
high school education	(0.064)	(0.062)	(0.069)	(0.069)
Dummy=1 if PMK >= 35 years of	-0.081***	-0.038	0.026	0.022
age	(0.049)	(0.048)	(0.057)	(0.057)
Dummy=1 if PMK currently is not	-0.114***	-0.098	-0.074	-0.080
Working or attending school	(0.062)	(0.060)	(0.065)	(0.065)
Number of available parental hours	0.0006	0.0008	0.001	0.001
- PMK	(0.002)	(0.0015)	(0.002)	(0.002)
Percentage of neighbourhood	0.845*	0.737*	0.579*	0.502*
Population with less than a high	(0.175)	(0.170)	(0.191)	(0.159)
school education				
Dummy=1 if PMK is attending	-0.398*	-0.326*	-0.220**	-0.255*
school	(0.081)	(0.079)	(0.093)	(0.080)
Conduct disorder -	--	0.291 *	0.719*	0.719*
Physical aggression score		(0.013)	(0.172)	(0.171)
Adjusted R-squared	0.013	0.071	0.014	-
F value	11.87	60.00	11.71	

[1] A household is low income if total household equivalent income before tax falls below one half the median equivalent income for the entire country where the equivalence scale used is that recommended by the OECD.

* statistically significant with 99% confidence
** statistically significant with 95% confidence
*** statistically significant with 90% confidence

Table 5
Strength of instruments

Child conduct			
	OLS reduced form on basic controls	OLS reduced form on basic controls and instruments[1]	OLS just instruments
R-squared	0.032	0.038	0.006
Adjusted R-squared	0.031	0.036	0.006
F-value (all R=0)	34.70	33.08	26.23
F-value (R;~ = 0)	N/A	25.78	N/A
Punitive aversive parenting score			
	OLS reduced form on basic controls	OLS reduced form on basic controls and instruments[2]	OLS just instruments
R-squared	0.008	0.014	0.006
Adjusted R-squared	0.008	0.013	0.006
F-value (all R=0)	8.98	11.87	24.94
F-value (0, = 0)	N/A	23.26	N/A

[1]I Vs = child care change because of care giver/program gone; child has no friends
[2]IVs=PMK attends school; drinking causes tension in the family

Table 6
Tests of over-identifying restrictions

	R^2	$n*R^2$
Child conduct	0.0001	0.8481
Punitive parenting	0.00000007	0.0006

Table 7
Hausman tests for exogeneity

	T-value for H_0: $R^2 = 0$	p- value
Predicted punitive parenting in child conduct equation	2.89	0.0038
Predicted child conduct equation in parenting equation	2.68	0.0074

References

Becker, Gary S. 1991. *A Treatise on the Family*. Cambridge: Harvard University Press.

Becker, Gary S. and Nigel Tomes. 1986. "Human Capital and the Rise and Fall of Families." *Journal of Labor Economics*. 4:3, S1-S39.

Celentani, Marco, Drew Fudenberg, David Levine and Wolfgang Pesendorfer. 1996. "Maintaining a Reputation Against a Long-lived Opponent." *Econometrica*. 64, 3: 691–704.

Chao, Ruth K. and J. Douglas Willms. 1998. "Do Parenting Practices Make a Difference?" Paper presented at "Investing in Children: A National Research Conference." Ottawa. October 1998.

Curtis, Lori, Martin Dooley, Ellen Lipman and David Feeny (forthcoming). "The Role of Permanent Income and Family Structure in the Determination of Child Health in the Ontario Child Health Study." *Health Economics.*

Curtis, Lori, Martin Dooley and Shelley Phipps. 1999. "Child Well-Being and Neighbourhood Quality: Evidence from the National Longitudinal Survey of Children and Youth." Xerox.

Curtis, Lori, Martin Dooley and Shelley Phipps. 2000. "Does Mother or Father Know Best? An Assessment of Parent/Child Agreement in the NLSCY. Xerox.

Curtis, Lori and Shelley Phipps. 2000. "Economic Resources and Children's Health and Success at School: An analysis with the NLSCY." Applied Research Branch. Strategic Policy, Human Resources Development Canada. Working Paper W-01-1-4E. September.

Dooley, Martin D., Lori Curtis, Ellen L. Lipman and David H. Feeny. 1998. "Child Psychiatric Disorders, Poor School Performance and Social Problems: The Roles of Family Structure and Low Income in Cycle One of the National Longitudinal Survey of Children and Youth." Chapter 7 in Miles Corak (ed.) *Labour markets, Social Institutions and the Future of Canada's Children*. Catalogue No. 89-553-XIB. Ottawa: Statistics Canada.

Evans, Robert and Jonathan Thomas. 1997. "Reputation and Experimentation in Repeated Games with Long-run Players."*Econometrica.* 65, 5: 1153–1173.

Feinstein, Leon and James Symons. 1999. "Attainment in Secondary School." *Oxford Economic Papers*. 51: 300–321.

Fudenberg, Drew and David Levine. 1989. "Reputation and Equilibrium Selection in Games with a Patient Player." *Econometrica.* 57: 759–778.

Fudenberg, Drew and David Levine. 1992. "Maintaining a Reputation When Strategies Are Imperfectly Observed." *Review of Economic Studies.* 59: 561–579.

Haveman, Robert and Barbara Wolfe. 1995. "The Determinants of Children's Attainments: A Review of Methods and Findings." *Journal of Economic Literature.* 33 (December): 1829–1878.

Hoghughi, M. 1998. "The Importance of Parenting in Child Health." *British Medical Journal*. 316: 1545–1550.

Hou, Feng. 2000. "It Takes Two to Interact: Parenting and Child Behaviours." Health Statistics Division. Ottawa: Statistics Canada. Xerox.

Lamborn, Susie D., Nina S. Mounts, Laurence Steinberg and Sanford M. Dornbusch. 1991. "Patterns of Competence and Adjustment Among Adolescents from Authoritative, Authoritarian, Indulgent, and Neglectful Families." *Child Development*. 62: 1049–1065.

Leibowitz, Arleen. 1974. "Home Investments in Children." *Journal of Political Economy*. Part II, March-April, 82, 2: S111–S131.

McLeod, Jane D. and Michael J. Shanahan. 1993. "Poverty, Parenting, and Children's Mental Health." *American Sociological Review.* 58: 351–366.

Phipps, Shelley. 1999. "Economics and the Well-being of Canadian Children." The Innis Lecture. *The Canadian Journal of Economic*. 32, 5: 1135–1163.

Pindyck, Robert S. and Daniel Rubinfeld. 1998. *Econometric Models and Economic Forecasts*. 4th Edition. Boston: McGraw-Hill.

Ross, David, Paul Roberts and Katherine Scott. 1998. "How Do Lone-parent Children Differ from All Children?" Strategic Policy. Applied Research Branch. Human Resources Development Canada. Ottawa. Working Paper W-98–7Es.

Schmidt, Klaus. 1993. "Reputation and Equilibrium Characterization in Repeated Games with Conflicting Interests." *Econometrica.* 61, 2: 325–351.

Steinberg, Laurence, Susie D. Lamborn, Sanford M. Dornbusch, and Nancy Darling. 1992. "Impact of Parenting Practices on Adolescent Achievement: Authoritative parenting, School Involvement, and Encouragement to Succeed." *Child Development*. 63: 1266–1281.