

TEENAGE PARTICIPATION IN ECONOMIC ACTIVITIES: TRUE STATE DEPENDENCE OR HETEROGENEITY?

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ABSTRACT

In this study, a dynamic model and a twenty-one-year longitudinal data set are used to investigate whether a youth's past participation in normal economic activities (i.e. schooling or employment) raises his/her probability of being active in normal economic activities in the future. This increase in probability arises either because participation in normal economic activities modifies individual behavior (true state dependence) or because there exist unobserved components correlated over time (heterogeneity). Moreover, we analyze the relationship between the single-parent family structure and parental work patterns and children's later decisions to participate in normal economic activities. This study finds that being enrolled in school or participating in the labor market, as a form of human capital investment, raises a youth's probability of participating in normal economic activities in the near future even after accounting for unobserved heterogeneity. After controlling for state dependence, we find that poor economic circumstances and stress from family disruption lead to a negative association between a single-parent family structure and the children's later achievements. In contrast, employed parents, who may act as income contributors, job connectors, and role models, are positively associated with children's later achievements.

Keywords : Economic activities, True state dependence, Heterogeneity

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1. MOTIVATION

The labor force participation rates of youth between the ages of 16 and 19 not-enrolled in school in the U.S. have dropped over the last fifteen years, especially among males and minorities (see Table 1). Many empirical studies have investigated the causes of these drops. Conventional economic analysis has addressed factors from both the demand and supply sides of the labor market.¹ The demand-side evidence includes changes in relative and absolute real market wages (Gustman and Steinmeier 1981) and changes in the local unemployment rate (Gustman and Steinmeier 1981; Cain and Finnie 1990). The supply-side factors include changes in reservation wages (Holzer 1986; Welch 1990), changes in the general value of alternative uses of time outside the labor market (Freeman 1977), and the increasing attractiveness of non-market alternative income sources such as transfer income and illegal activities (Lerman 1986; Viscusi 1986). Huang (1993) also found that parents' living and working arrangements as the children grow up are associated with the process by which the market-valued characteristics and the reservation price of time are actually obtained and then associated with the children's later schooling and working behavior. However, both schooling and employment behavior during the teenage years might be state dependent. That is, a youth who has been active in the normal economic activities of either schooling or employment in one year is more likely to remain active in the next year. Conversely, an economically idle youth in the previous year is more likely to be idle in the following year. If dependence on past experiences is not properly accounted for, inferences concerning the impacts of childhood events on children's later school enrollment and employment behavior will be incorrect.

There are two diametrically opposing explanations for state dependence. One explanation is that preferences, prices, or constraints relevant to future choices are truly altered as a consequence of experiencing an event. This is a situation

¹ For an excellent survey, see Holzer (1990).

Heckman (1978, 1981) called “true state dependence”. Past experience has a genuine behavioral effect in the sense that a youth who has not experienced the event will behave differently in the future than an otherwise identical youth who has experienced the event. The second explanation is that youths may differ in terms of certain unmeasured variables that influence their probability of experiencing the event. If these variables are correlated over time and are not properly controlled, previous experience may appear to be a determinant of future experience because both experiences are connected to such a temporarily persistent unobservable. Heckman termed this case “spurious state dependence”, since previous experience is solely a proxy for a temporarily persistent unobservable that determines choices.

**Table 1 School Enrollment and Labor Force Participation Rates
of U.S. Youth Aged 16–19, 1972–1994**

Year	MALE		FEMALE		WHITE		BLACK	
	Fraction	LFPR	Fraction	LFPR	Fraction	LFPR	Fraction	LFPR
	Enrolled	Non- enrolled	Enrolled	Non- enrolled	enrolled	Non- enrolled	Enrolled	Non- enrolled
1972	0.718	87.2	0.652	62.1	NA	NA	NA	NA
1978	0.693	88.6	0.658	69.3	NA	NA	NA	NA
1986	0.610	78.0	0.597	66.7	0.599	74.7	0.609	60.7
1988	0.615	78.5	0.601	66.9	0.601	75.4	0.621	59.3
1990	0.625	77.0	0.615	64.9	0.614	73.8	0.630	57.7
1992	0.641	75.2	0.630	62.3	0.634	71.8	0.624	55.9
1994	0.658	74.8	0.655	63.5	0.653	72.6	0.662	54.8

Sources: Handbook of Labor Statistics and Employment and Earnings.

This study aims to investigate whether a youth’s past participation in normal economic activities (i.e. schooling or employment) raises his/her probability of being active in normal economic activities in the future. This increase in probability arises either because participation in normal economic activities modifies individual behavior (true state dependence) or because there exist unobserved components correlated over time (heterogeneity). Moreover, we analyze the association of

the single-parent family structure and parental work patterns with children's later decisions to participate in normal economic activities. Throughout this paper, we say a youth is defined as a normal-economic-activities participant if he/she is either enrolled in school or employed for more than zero hours at any time in the sample year.²

In this study, a dynamic model of youths' participation decisions with regard to normal economic activities between the ages of 17 and 20 is proposed, where the conditional probability of being active is a function of a teenager's childhood events and his/her past experiences. More specifically, we propose a random-effects probit model with a lagged dependent variable to distinguish true state dependence versus spurious state dependence (heterogeneity). This study shows that, after accounting for unobserved heterogeneity, being enrolled in school or participating in the labor market raises the probability that a youth will be active in the future. After controlling for state dependence, it is further shown that poor economic circumstances and stress from family disruption explain the negative association between a single-parent family structure and the children's later achievements. Lastly, it is found that employed parents, who may act as income contributors, job connectors, and role models, are associated with greater economic achievements on the part of their children.

In the next section, some of the economics and sociology literature regarding the effects of family background and family structure during childhood on later achievements is reviewed, and section III describes the data and the variables used for estimation. Section IV presents the dynamic model where true state dependence and spurious state dependence is distinguished. Sections V and VI provide the estimation results and conclusion, respectively.

2. DETERMINANTS OF CHILDREN'S LATER ACHIEVEMENTS

The past quarter of a century has seen a growing body of social science

² The definition of school non-enrollment and non-employment used in this paper is consistent with the one used in *Employment and Earning*, published by Bureau of the Census, U.S..

research on the processes that might determine the economic and social success of young adults. Economists have viewed the process of children's attainment as an integral part of family behavior. The family is viewed as a production unit that employs real inputs in order to generate utility for its members. Adults in the family (typically parents) make decisions regarding the generation of family economic resources (e.g., labor supply). They also determine the uses of these resources such as consumption, asset accumulation, and investment in children (Becker (1964, 1981), and Becker and Tomes (1986)). Parents care about the economic capabilities and success of their children, and can influence their human capital and future earnings by engaging in "expenditure on their skills, health, learning, motivation, 'credentials', and many other characteristics" (Becker and Tomes (1986), p. S5). These expenditures depend on parental preferences, parental time in fostering emotional and cognitive development, parental wealth (income and asset endowment), and fertility. The greater the expenditure on the children, the greater the children's later economic and social attainments will be.

The finding that children from single-parent families achieve lower economic and social success is supported by many studies. There are several hypotheses concerning these negative associations in the economics and sociology literature. (a) The "economic-deprivation hypothesis" states that a poor family's economic circumstances in single-parent families are associated with a smaller investment in their children and consequently results in children having lower attainments (Rainwater and Yancey (1967), McLanahan (1985)). (b) The "family-stress hypothesis" states that a marital disruption causes stress both for parents and their children that results in a lack of supervision on the part of the parents which in turn may result in children's behavior problems and lower attainments (Hetherington (1981), McLanahan (1985)). (c) The "no-effects hypothesis" states that the absence of one parent has no direct consequence on the attainments of the children. The lower attainments among children in single-parent families are due to race, lower parental education, or lower parental occupation.

The "working mother model" is also related to the human capital model. Mothers who work seem to have two offsetting effects. On the one hand, the

loss in parental time spent on children due to a mother's market work is viewed as a cause for developmental problems in children and a reduction in their later attainments. On the other hand, a working mother contributes income to the family and also provides "information or connections to the job market"; these resources may translate into increased attainments for the children. This hypothesis yields no unique prediction regarding the impact of the labor force behavior of mothers on their children's attainments.

Another perspective comes from the role model theory discussed by sociologists and developmental psychologists. This theory stresses the importance of the parents as role models (Hetherington (1981), Seltzer (1994)) to their children. Parents' working behavior, aspirations, and values (e.g., educational expectations) may affect directly the cognitive and social-psychological development of their children. Therefore, a parent with more education and a stronger incentive towards working serves as a role model to encourage similar behavior on the part of his or her children. Similarly, the absence of a parent decreases motivation for achievement and interferes with normal psychosexual development which may result in poorer academic performance. Parents who are dependent on welfare are viewed as a "bad model" which discourages independence and reduces their children's motivations for market success (Macauley (1977)).

To sum up, parents' living and working arrangements during their children's early years may be related to their children's later achievements for the following reasons: (1) family background, (2) family living arrangements and family stress, (3) parents' employment and (4) family economic circumstances.

3. THE DATA

In order to examine the impact of childhood events on a teenage child's economic idleness, we adopt a long panel data set from the 1992 tape of the PSID. The individuals selected from the 1992 tape are those who were 6 years old or younger in 1968, and who still responded to the survey sample in 1989 as young

adults aged 21 to 27.³ In total, there are 1519 individuals with 21 years of panel information in our data set.⁴ The children selected in each survey year were of different ages (e.g., ages 0–6 in 1968, and ages 24–30 in 1992). To make the childhood experiences comparable across the six different ages in each survey year, all information is transformed from a time-indexed format to an age-indexed format. For monetary data, all dollar values are expressed in 1980 constant prices.

3.1 Time Dependence

Table 2 presents longitudinal evidence from the PSID data sets on youths' normal productive activities (school enrollment and employment) between the ages of 17 and 20. Let $\{Y_{it}\}$ be a sequence of binary random variables. Define $Y_{it} = 1$ if youth i is either enrolled in school or employed more than zero hours at age t ; and state $Y_{it} = 0$ if youth i is not enrolled in school and not employed at age t , with $t = \text{age } 17\text{--age } 20$. Event (1,1,0,0), then, represents the youth being active at ages 17 and 18 and being idle at ages 19 and 20. Table 2 shows that 73.86 percent $((1114+8)/1519)$ of the youths (column 1 and column 5) from the PSID data were either participating in normal economic activities or not participating at all in them for the entire four years. For the other groups of youths (column 2–column 4), the majority stayed in the same state for at least two continuous years. To sum up, Table 2 reveals the fact that youths who have been active in normal economic activities in previous years are more likely to remain active in the subsequent years.

3.2 Childhood Events

Table 3 is a two-way tabulation showing longitudinal evidence of interaction

³ In 1968, there were 3,120 children aged 0–6 in the PSID. During the subsequent 21 years (1968–1989), 1426 children were lost from the sample for one reason or another.

⁴ Of the 1694 remaining observations, 120 had missing information for at least two continuous years, 18 had no information on education for the entire 21 years, and 37 had no information on either school enrollment or labor supply for ages 17–20. These observations were thus discarded. For those observations with one year of missing data (13 observations), the missing data were filled in as follows. If the individual's sibling was still living with the same family in the year with the missing data, then the observation's family information was filled in using the sibling's family information; otherwise, the missing data were filled in by averaging the data of the two nearby years. After these adjustments, 1519 observations with 21 years of completed information remained and were used in the analysis.

**Table 2 Longitudinal Evidence of Youths' Normal
Economic Activities during Ages 17–20**

$(Y_{i17}, Y_{i18},$ $Y_{i19}, Y_{i20})$	Youth with Four Years School Enrollment or Employment	Youth with Three Years School Enrollment or Employment	Youth with Two Years School Enrollment or Employment	Youth with One Years School Enrollment or Employment	Youth with Zero Years School Enrollment or Employment
(1,1,1,1)	1114				
(1,1,1,0)		181			
(1,1,0,1)		57			
(1,0,1,1)		23			
(0,1,1,1)		9			
(1,1,0,0)			55		
(1,0,1,0)			5		
(1,0,0,1)			18		
(0,1,1,0)			7		
(0,1,0,1)			5		
(0,0,1,1)			7		
(1,0,0,0)				18	
(0,1,0,0)				2	
(0,0,1,0)				4	
(0,0,0,1)				6	
(0,0,0,0)					8
Sample Size	1114	270	87	30	8
Percentage	73.33	17.77	5.73	1.97	0.53

- a. The numbers in the table are calculated from the 1992 tape of the University of Michigan's Panel Study of Income Dynamics.
- b. $Y_{it} = 1$ if the youth i is actively enrolled in school or employed at time t , and $Y_{it} = 0$ otherwise. Time t refers to age 17 to age 20.

between family structure and teenager behavior. In this table, the sample means are presented for five sub-samples of youth – youth with four, three, two, one and zero years of participation in normal economic activities (i.e. school enrollment or employment) during ages 17–20. The values of the likelihood ratio (LR) test statistics for the equality of sub-sample means are presented in Table 4. The positive values in Table 4 represent larger sub-sample means of the former group than of the latter group.

The *demographic variables* in Table 3 and Table 4 show that the group of youth with four years of school enrollment or employment has a significantly smaller percentage of nonwhites than the other groups. Economically active youths tend to have parents with a significantly greater number of years of schooling.

As for *childhood family structure variables*, youths who were either enrolled in school or were working between the ages of 17 and 20, on average, experienced significantly less incidents of parental separation and parental remarriage. They also lived shorter periods with one parent when they were young, compared to less economically active youths. In addition, youth who were economically more active between the ages of 17 and 20 were more likely to have grown up in families with parents who worked more, to have significantly fewer years of living in poverty, and to depend less on welfare.

Accordingly, teenage participation in economic activities appears state dependent and also associated with family background, family living arrangements and family stress, parents' employment and family economic circumstances as they grow up.

4. A DYNAMIC MODEL OF TEENAGE PARTICIPATION IN SCHOOL AND THE LABOR MARKET

Given Y_{it} as defined before, a youth's normal economic activities between the ages of 17 and 20 can be described by the joint probability $P(Y_{i1}, Y_{i2}, \dots, Y_{iT} | Y_{i0})$. The simplest way to specify this joint probability is to assume independence and specify $P(Y_{i1}, Y_{i2}, \dots, Y_{iT} | Y_{i0}) = \prod_{t=1}^T P(Y_{it})$, which implies $P(Y_{it} = 1 | Y_{i,t-1} = 1) =$

$P(Y_{it} = 1)$. The independence assumption implies that the status of participating in normal economic activity in the previous year offers no information concerning his/her status this year. Unfortunately, such an assumption would not be supported by our data. In Table 2, we find that youths who were active in the previous year tend to be active in the next year. Such a finding can be described as “state dependence”.

In this study, we propose a general model that can incorporate the ideas of both true state dependence and heterogeneity (spurious state dependence). It is assumed that there is an unobserved underlying continuous variable Y_{it}^* that determines the state of activity Y_{it} based on the rule:

$$Y_{it} = \begin{cases} 1 & \text{if } Y_{it}^* > 0 \\ 0 & \text{otherwise} \end{cases} \quad (1)$$

Given the observed explanatory variables X_{it} (i.e. family structure and childhood events), the activity state Y_{it} is generated by a first-order Markov process, namely,

$$Y_{it}^* = \beta_0 + \gamma Y_{it-1} + \beta_1 X_{it} + v_{it} \quad (2)$$

Here “true state dependence” means $\gamma \neq 0$, which implies that past experience has a genuine behavioral effect on current behavior. A youth who has experienced the event will behave differently in the future than an otherwise identical youth who has not experienced the event. The “heterogeneity” (spurious state dependence) means serial correlation of $\{v_{it}\}$, which implies that youths may differ in certain unmeasured variables that influence their probability of experiencing the event. Such “spurious state dependence” is formulated as a “component of variance” model $v_{it} = u_i + \varepsilon_{it}$. Therefore, the econometric model becomes:

$$\begin{aligned} Y_{it}^* &= \beta_0 + \gamma Y_{it-1} + \beta_1 X_{it} + u_i + \varepsilon_{it} \\ Y_{it} &= \begin{cases} 1 & \text{if } Y_{it}^* > 0 \\ 0 & \text{otherwise} \end{cases} \end{aligned} \quad (3)$$

where both u_i and ε_{it} are iid normally distributed with $N(0, \sigma_u^2)$ and $N(0, 1)$, respectively.⁵ Also, u_i and ε_{it} are assumed to be independent of each other, and the $\{\varepsilon_{it}\}$ are serially independent.

It is also assumed that the initial conditions or the relevant pre-sample history of the process are exogenous.⁶ Let Φ denote the cumulative distribution function of the standard normal distribution. The conditional probability of $Y_{it} = 1$ given Y_{it-1} , X , and u_i would then be:

$$P(Y_{it} = 1 | Y_{it-1}, X_{it}, u_i) = \Phi(\beta_0 + \gamma Y_{it-1} + \beta_1 X_{it} + u_i) \quad (4)$$

and the conditional probability of $Y_{it} = 0$ given $Y_{i,t-1}$, X_{it} , and u_i is

$$P(Y_{it} = 0 | Y_{it-1}, X_{it}, u_i) = \Phi(-\beta_0 - \gamma Y_{it-1} - \beta_1 X_{it} - u_i) \quad (5)$$

Therefore, the joint probability of $Y'_i = (Y_{i1}, Y_{i2}, \dots, Y_{iT})$, given X_{it} and u_i is⁷

$$\prod_{t=1}^T F(Y_{it} | Y_{it-1}, X_{it}, u_i) = \prod_{t=1}^T \Phi\{(\beta_0 + \gamma Y_{it-1} + \beta_1 X_{it} + u_i) \cdot (2Y_{it} - 1)\} \quad (6)$$

In order to estimate equation (6), we standardize the distribution of u_i and define $q_i = \frac{u_i}{\sigma_u}$. Since u_i is normally distributed, q_i follows a standard normal distribution. The likelihood function for the random-effect model under the assumption of the non-stochastic initial condition assumption is then:

$$L = \prod_{i=1}^N \int_{-\infty}^{\infty} \prod_{t=1}^T \Phi\{(\beta_0 + \gamma Y_{it-1} + \beta_1 X_{it} + \sigma_u q_i) \cdot (2Y_{it} - 1)\} d\Phi(q_i) \quad (7)$$

⁵ Since Y_{it} is a binary variable, the variance ε_{it} can be normalized to equal 1.

⁶ That the initial conditions are assumed to be exogenous is commonly used in the literature dealing with the dynamic model (Amemiya 1985, Heckman 1981). Since the joint probability of the dynamic process Y_{it} from period 1 to period T is $P(Y_{i1}, Y_{i2}, \dots, Y_{iT} | Y_{i0})$, the initial value Y_{i0} is given. In this study, The initial period of normal economic activities is age 16.

⁷ When $Y_{it} = 1$, equation (6) would become equation (4). Similarly, when $Y_{it} = 0$, equation (6) would become equation (5).

The consistent estimates of β_0 , γ , β_1 and σ_u^2 can be obtained by maximizing (7).

5. RESULTS

In addition to the main model (3), we also fit a few more specifications that are special cases of (3). Columns 1 and 2 in Table 5 present the ML coefficient estimates (t-ratios) for the true state-dependence models with heterogeneity (i.e. equation (7) in Section IV) and without heterogeneity ($v_{it} = \varepsilon_{it}$), respectively.⁸ Coefficient estimates (t-ratios) for static models with conventional components-of-variance formulation and without heterogeneity are shown in columns 3 and 4, respectively. By comparing the dynamic models with the static models where the first-order Markov formulation for true state dependence is not considered (i.e. $\gamma = 0$), the likelihood-ratio test statistics (twice the difference of the log-likelihood value shown in the last row of Table 5) indicate the acceptance of state dependence formulation. Previous participation in normal economic activities thus serves as an important determinant of current participation decisions.

Within the dynamic framework (models 1 and 2 of Table 5), the rejection of the null hypothesis $\rho = \frac{\sigma_u^2}{\sigma_u^2 + \sigma_\varepsilon^2} = 0$, which is shown in the last second row of Table 5, reveals that the unobserved individual heterogeneity also affect the participation of youth in normal economic activities.⁹ The time dependence among observed participation decisions arises from the fact that the actual experience of an event has modified individual behavior (true state dependence) and also from the unobserved heterogeneity. In other words, this study finds that enrollment in school or participation in the labor market, as a form of human capital investment, raises the probability that youths will be economically active in the next year. Certain

⁸ The likelihood function for the dynamic model without heterogeneity is as follows:

$$L = \prod_{i=1}^N \prod_{t=1}^T \Phi\{(\beta_0 + \gamma Y_{it-1} + \beta_1 X_{it}) \cdot (2Y_{it} - 1)\}$$

⁹ $\rho = \sigma_u^2 / (\sigma_u^2 + \sigma_\varepsilon^2)$, representing the percentage of unobserved variation due to unobserved individual heterogeneity. The estimate of ρ and the standard deviation of ρ can be obtained from ML estimation (Maddala 1983). The t statistics is used to test the null hypothesis that $\rho = 0$.

individual unobserved heterogeneity also influences their probability of experiencing the event. Accordingly, the assumption of state dependence with heterogeneity (column 1 of Table 5) is used as a maintained hypothesis in investigating the effects of childhood events. The result of the static model without heterogeneity (column 4 of Table 5), which is consistent with other previous studies, is used as the reference.

Column 1 of Table 5 shows that, after accounting for the state dependence, a nonwhite teen is still less likely to be economically active than a white teen. Also, a teen coming from a very religious family is more likely but insignificantly to be working or to be enrolled in school than other teens.

In relation to the impact from *family living arrangements and family stress*, the number of years that children live with a single parent during childhood is positively and significantly associated with normal economic activities between the ages of 17 and 20 in a traditional statistical model (column 4). However, this statistically significant association disappears in a dynamic model (column 1), which reveals the correlation between parents' living arrangements and unobserved individual and family heterogeneity. After controlling for state dependence, family stress from a parent's marital dissolution is still substantially and negatively associated with a youth's employment and school enrollment. Children who experience more incidents of parental remarriages are less likely to be working or to be enrolled in school between the ages of 17 and 20 than other children.

Poor *family economic circumstances* are negatively associated with a youth's employment or school enrollment behavior. A youth who spent a longer period in poverty during childhood is significantly more likely to be economically inactive. Receiving AFDC income during childhood has a negative but insignificant impact on a teenage child's economic activity. The parents' education has a significant and positive impact on their teenage child's economic activity in the conventional model (column 4). However, after accounting for state dependence, these significant associations disappear. The parents' education may serve as a proxy for state dependence in the conventional static model. If a father graduated from high school, the child is more likely to be enrolled in school or to be working between the ages of 17 and 20.

As for *parental employment variables*, a parent's employment is seen to be positively and significantly associated with his/her teenage child's participation in economic activities. Employed parents might serve as income contributors, job connectors and role models that positively affect their children's employment and school enrollment behavior. A higher county annual unemployment rate is found to significantly and adversely affect a youth's participation in normal economic activities, which is consistent with the findings of other studies (Gustman and Steinmeier 1981).

6. SUMMARY AND CONCLUSION

In this study, a dynamic model and a twenty-one-year longitudinal data set taken from the 1992 tape of PSID are used to investigate how current participation in normal economic activities (school enrollment or employment) affects economic activity in the future. Under the proper assumptions, the relationship between a single-parent family structure and parental work patterns and children's later decisions to participate in normal economic activities is examined. This study finds that being enrolled in school or participating in the labor market, as a form of human capital investment, raises the probability that a youth will participate in normal economic activities in the near future even after accounting for unobserved heterogeneity. The unobserved individual heterogeneity also affects participation behavior.

After controlling for state dependence, poor economic circumstances and stress from family disruption lead to a negative association between a single-parent family structure and the children's later achievements. Nonwhite teens are associated with higher probabilities of school non-enrollment and non-employment than other teens.

Better economic circumstances and the longer duration of parental work, which are associated with parental work efforts, are positively associated with teenagers' activities. Employed parents, who may act as income contributors, job connectors, and role models, are positively associated with children's later achievements.

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APPENDIX I: DESCRIPTION OF VARIABLES

Variable	Definition	Mean (Std. Dev.)
Female	Dummy; 1=female, 0= male	0.51(0.50)
Nonwhite	Dummy; 1=nonwhite, 0=white	0.46(0.50)
Catholic	Dummy; 1=catholic, 0=otherwise	0.20(0.40)
Protestant	Dummy; 1=protestant, 0=otherwise	0.70(0.46)
Father high school graduate	Dummy; 1=father completed high school, 0=otherwise	0.22(0.36)
Father some college	Dummy; 1=father has some college, 0=otherwise	0.86(0.23)
Father college graduate	Dummy; 1=father is college graduate, 0=otherwise	0.99(0.28)
Mother high school graduate	Dummy; 1=mother completed high school, 0=otherwise	0.29(0.40)
Mother some college	Dummy; 1=mother has some college, 0=otherwise	0.57(0.19)
Mother college graduate	Dummy; 1=mother is college graduate, 0=otherwise	0.44(0.19)
Number of siblings	Average number of siblings from age 6 to age 15	3.49(1.53)
Number of years living in poverty	Number of years family income below poverty line from age 6 to age 15	1.07(2.05)
Number of parental separations	Number of incidents that parents separated from age 6 to age 15	0.29(0.52)
Number of parental remarriages	Number of incidents that parents remarried from age 6 to age 15	0.27(0.52)
Number of location moves	Number of family moves from age 6 to age 15	1.64(0.18)
Number of years when mother worked	Number of years when mother worked from age 6 to age 15	5.74(0.68)
Number of years in a single-parent family	Number of years living with one parent from age 6 to age 15	2.66(3.80)
Annual unemployment hours of heads	Average of the household head's total	0.72(1.28)
Annual county unemployment rate	Average county unemployment rate from age 17 to age 20	0.67(0.04)

青少年經濟活動：True State Dependence 或 Heterogeneity

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摘 要

本文內容主要探討下列兩個主題：(1) 一青少年過去曾經參與正常經濟活動（就學或就業）是否會提升他（或她）本期是否參與正常經濟活動的機率？假若是，那此正向關係主要來自於“true state dependence”（亦即過去是否參與正常經濟活動會修正個人行為而使本期亦會參與）或“Heterogeneity”（亦即一些不可觀察的個人因素隨時間不變存在於各期中而使各期行為有相關）(2) 當我們控制了 state dependence 的因素之後，成長期的家庭事件是否仍會影響青少年期的就學或就業行為？為探討此二主題，本文採用美國 PSID 21 年的長期追蹤調查資料以及動態估計模型，結果發現青少年的正常經濟活動前後期會有高度相關，而此相關來自於 true state dependence 以及 Heterogeneity，而控制了這些因素後，成長期的家庭經濟因素及家庭結構變遷仍然顯著地影響青少年期的正常經濟活動。

關鍵詞：經濟活動、True state dependence、Heterogeneity

Table 3 The Subsample Means

	Youths with Four Years Schooling or Employment	Youths with Three Years Schooling or Employment	Youths with Two Years Schooling or Employment	Youths with One Year Schooling or Employment	Youths with Zero Years Schooling or Employment
<u>Demographic Variables:</u>					
Percentage of nonwhite	0.15	0.22	0.44	0.21	0.54
Father's Education	11.00	10.43	7.27	7.70	6.12
Mother's Education	10.07	9.49	7.72	7.47	6.17
<u>Living Arrangements and Family Stress:</u>					
Number of years living in a single-parent family, ages 6-15	0.40	0.86	1.41	1.59	2.10
Number of parental separations, ages 6-15	0.22	0.29	0.36	0.48	0.46
Number of parental remarriages, ages 6-15	0.23	0.29	0.32	0.70	0.49
Number of siblings, ages 6-15	1.45	1.78	2.31	2.62	2.51
<u>Employment Status:</u>					
Mother worked, ages 6-15: number of years	5.84	5.53	5.36	4.54	4.35
Average annual working hours	728	695	672	538	448
Father worked, ages 6-15: number of years	8.37	7.94	6.65	7.18	6.66
Average annual working hours	2,061	1,978	1,557	1,467	1,532
Annual unemployment hours of head, ages 6-15	52	55	110	138	161
<u>Family Economic Status:</u>					
Number of years living in poverty, ages 6-15	0.40	0.86	1.40	1.59	2.10
Number of years receiving AFDC, ages 6-15	0.48	1.01	1.75	2.22	1.55
Sample Size	1,114	270	97	30	8

Note: All the means were calculated by using 1989 weights. Sources: University of Michigan's Panel Study of Income Dynamics (PSID).

Table 4 The LR Test of the Equality of Subsample Means

	Youths with Four Years vs. Three & Two Years Schooling or Employment	Youths with Four Years vs. One & Zero Years Schooling or Employment	Youths with Three & Two Years vs. One & Zero Years Schooling or Employment
<u>Demographic Variables:</u>			
Nonwhite	-5.32***	-1.83*	0.18
Father's education	4.90***	4.77***	2.67***
Mother's education	4.93***	4.94***	2.98***
<u>Living Arrangements and Family Stress:</u>			
Number of years living in a single-parent family, ages 6-15	-3.61***	-2.96***	-1.34
Number of parental separations, ages 6-15	-2.82***	-3.20***	-1.81*
Number of parental remarriages, ages 6-15	-2.26**	-5.45***	-4.09***
Number of siblings, ages 6-15	-3.39***	-2.47***	-0.99
<u>Employment and Unemployment Status:</u>			
Mother worked, ages 6-15: number of years	1.68*	2.30**	1.72*
Average annual working hours	0.96	1.79*	1.50
Father worked, ages 6-15: number of years	3.87***	2.52***	0.89
Average annual working hours	3.60***	4.20***	2.65***
Ann. Unemployment hrs. of head, ages 6-15	-2.32**	-4.70***	-3.14***
<u>Family Economic Circumstances:</u>			
Number of years living in poverty, ages 6-15	-6.74***	-6.09***	-2.00***
Number of years receiving AFDC, ages 6-15	-6.72***	-6.56***	-2.25***

Note: *Significant at the 10% level, two-tailed test. **Significant at the 5% level, ***Significant at the 1% level, two-tailed test.

**Table 5 Maximum Likelihood Estimates (t-ratios) of Various Models for Youths' Participation Decisions
in Normal Economic Activities during Ages 17–20**

Variable	State Dependence With Heterogeneity	State Dependence Without Heterogeneity	No State Dependence With Heterogeneity	No State Dependence Without Heterogeneity
Constant	0.76*** (3.23)	0.49*** (2.85)	1.41*** (5.80)	1.17*** (7.24)
Youth's participation in normal economic activities in last year	0.61*** (5.79)	0.78*** (12.50)		
<u>Gender, Ethnic Group, and Religion</u>				
Female	−0.59 (−1.01)	−0.58 (−1.23)	−0.85 (−1.22)	−0.98** (−2.10)
Nonwhite	−0.15** (−1.97)	−0.13** (−2.07)	−0.19** (−2.09)	−0.15*** (−2.46)
Catholic	0.12 (1.13)	0.22** (2.16)	0.26* (1.79)	0.22** (2.28)
Protestant	0.13 (1.25)	0.13 (1.49)	0.14 (1.17)	0.13 (1.63)
<u>Family Living Arrangements and Family Stress</u>				
Number of years living in a single-parent family, ages 6–15	0.24 (1.44)	0.22 (1.53)	0.28 (1.42)	0.22* (1.65)
Number of location moves ages 6–15	−0.27 (−1.62)	0.23* (1.68)	−0.36* (−1.86)	−0.32*** (−2.35)
Number of parental separations, ages 6–15	0.13* (1.73)	0.12** (2.00)	0.15* (1.66)	0.13** (2.16)
Number of parental remarriages, ages 6–15	−0.18*** (−2.63)	−0.16*** (−2.92)	−0.22*** (−2.77)	−0.20*** (−3.57)

Table 5 Maximum Likelihood Estimates (t-ratios) of Various Models for Youths' Participation Decisions in Normal Economic Activities during Ages 17–20 (continued)

Variable	State Dependence With Heterogeneity	State Dependence Without Heterogeneity	No State Dependence With Heterogeneity	No State Dependence Without Heterogeneity
<u>Family Economic Circumstances</u>				
Number of years living in poverty, ages 6–15	–0.39*** (–2.59)	–0.32*** (–2.64)	–0.49*** (–2.80)	–0.38*** (–3.18)
Number of years receiving AFDC, ages 6–15	–0.10 (–0.70)	–0.91 (–0.78)	–0.11 (–0.60)	–0.70 (–0.61)
<u>Family Background</u>				
Father high school graduate	0.24*** (2.47)	0.21*** (2.53)	0.30*** (2.67)	0.26*** (3.17)
Father some college education	0.27 (1.59)	0.24* (1.72)	0.35* (1.76)	0.32*** (2.35)
Father college graduate	0.24 (1.59)	0.22* (1.68)	0.29* (1.65)	0.27** (2.14)
Mother high school graduate	0.11 (1.08)	0.96 (1.18)	0.12 (1.06)	0.10 (1.30)
Mother some college education	–0.28 (–1.50)	–0.25 (–1.59)	–0.32 (–1.46)	–0.25* (–1.66)
Mother college graduate	0.14 (0.59)	0.122 (0.63)	0.18 (0.66)	0.17 (0.89)
Living without father	–0.16 (–0.01)	–0.91 (–0.08)	0.64 (0.04)	–0.60 (–0.05)
Living without mother	–0.83*** (–2.37)	–0.74*** (–2.33)	–0.98*** (–2.43)	–0.83*** (–2.69)

**Table 5 Maximum Likelihood Estimates (t-ratios) of Various Models for Youths' Participation Decisions
in Normal Economic Activities during Ages 17–20 (continued)**

Variable	State Dependence With Heterogeneity	State Dependence Without Heterogeneity	No State Dependence With Heterogeneity	No State Dependence Without Heterogeneity
Sibling	−0.20 (−1.01)	−0.17 (−1.02)	−0.32 (−1.34)	−0.31* (−1.91)
<u>Parents' Employment and Unemployment</u>				
Mother's annual working hours, ages 6–15	0.30*** (3.28)	0.26*** (3.63)	0.36*** (3.35)	0.30*** (4.25)
Father's annual working hours, head, ages 6–15	0.99 (1.62)	0.89* (1.84)	0.11 (1.48)	0.79* (1.67)
<u>Local Unemployment</u>				
Annual county unemployment rate, ages 17–20	−1.88*** (−2.47)	−1.92*** (−2.97)	−1.45* (−1.74)	−1.22** (−1.91)
$\rho = \frac{\sigma_u^2}{\sigma_u^2 + \sigma_\varepsilon^2}$	0.18** (2.01)		0.33*** (6.05)	
Log-Likelihood	−1,725	−1,734	−1,751	−1,809

Note: *significant at the 10% level, two-tailed test; ** significant at the 5% level, two-tailed test; *** significant at the 1% level, two-tailed test.