Parental Schooling, Gender and the Accumulation of Specific Human Capital: Longitudinal Evidence from Thailand

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March 2004

Abstract:

This paper examines parental schooling effects on wages and tenure among production workers in manufacturing industries in Thailand, with unique microdata available from recent longitudinal employee surveys. The aim of this paper is to disentangle the intergenerational correlations of schooling and earnings, often observed but underling factors not carefully identified in the literature. We found that mother's schooling raises both child schooling and, more importantly, tenure of workers. With longituginal data available from two points in time, the latter finding is robust to censoring problems in the observed tenure distribution. Since a longer tenure means more accumulation of firm-specific human capital and production experience capital, investment in female education has intergenerational spillovers not only to schooling investments but to the accumulation of specific human capital in manufacturing industries.

1 Introduction

It has become increasingly recognized that human capital accumulation is crucial to productivity growth in developing countries (e.g., Lucas, 1988). In most of the studies that identify sources of productivity change, the accumulation of human capital is approximated by educational attainment, i.e. years of schooling and primary and/or secondary school enrollment, although the investment in child schooling is just one form of human capital investments (Becker, 1962). For instance, experience and investments in on-the-job training that are directly associated with production activities should also be considered to constitute the stock of human capital. In the previous literature, however, the role of the production-specific human capital has not been identified as a source of productivity change though some theoretical studies focus on the active role (e.g. Lucas, 1993). On the other hand, microeconomic-empirical studies of wage determination (e.g. Mincer, 1958; Topel, 1991) show that the accumulation of human-capital specific to production also contributes to productivity gain, if the technology and organization are efficient, This line of micro empirical findings, therefore, imply that not only educational attainment, but the accumulation of production-specific human capital contributes to productivity change.

In manufacturing industries, workers upgrade their technical skills through their own learning-by-doing and on-the-job and off-the-job training investments. In contrast to educational investments, however, these factors are hard to quantify; it is difficult to incorporate them explicitly in econometric analysis. To bypass this measurement issue, researchers often use tenure – the length of period in a particular workplace – as a proxy for the accumulation of work-specific human capital.

We consider that experience accumulation, e.g., that measured by tenure, is particularly important to production workers in manufacturing industries. The principal reason is that production technology is highly specific to specifications of products and is frequently upgraded over time. For this reason, the learning process of those skills is hard to standardize and summarize in a written format, in contrast to general knowledge acquired through education. So in many cases technical skills can only be acquired on production lines. Experience accumulation in production is, therefore, crucial to productivity gain in manufacturing industries. Jovanovic and Nyarko (1995) show learning-by-doing effects in a variety of production activities.

In this paper, we disentangle the determination of wage, tenure and schooling choice, focusing on family background factors, with a recent employee survey from Thailand. In a variety of empirical studies, family backgrounds such as parents' schooling affect the formation of child human capital (e.g., Wolfe and Behrman, 1989). Educational attainment of children is enhanced by parental schooling in both developed and developing countries (e.g. Kremer, 1993; Foster, 1995; many others). The abundant evidence in this line demonstrates the existence of externalities from parents' to the next generations.

A question arises in this line. Do those family backgrounds influence not only the accumulation

of general human capital such as the above, but also affect that of human capital specific to production technologies? Although it is often found that earnings are statistically correlated with parental schooling and other background variables in reduced-form wage equations (e.g. Lam and Schoeni, 1992; Strauss and Thomas, 1995 for survey), these correlations can be easily inferred in the situations where background factors, such as ability, affects schooling investment and returns to schooling or effective accumulation of specific human capital, i.e., a longer tenure, or all these interactively. Since parental schooling is an input to the production of child endowment through family education, this question can also be addressed in the context of child endowment formation. In this paper, more specifically, we address a question of how parental schooling facilitates the accumulation of general and specific human capital, through endowment formation, and of which channel is more significant. To answer these questions, we use detailed information collected in our recent employee survey in selected Thai manufacturing industries.

This paper also sheds lights on a new perspective of gender issues. In recent studies of intrahousehold desicion makings, household members, e.g., husband and wife, areknown to play different roles in intrahousehold resource allocation such as consumption distribution and child education (e.g. Browning and Chiappori, 1998; Foster, 1995). In our context, we distinguish mother and father in terms of their schooling effects on tenure and schooling of their children. In the literature, it is confirmed in many developing countries that mother's schooling influences schooling choice of children more strongly than father's schooling. Our finding on the schooling choice also supports this empirical proposition. Furthermore interestingly, it is also found that mother's schooling affects the tenure of production workers, but father's schooling does not. Mother's human capital may have externalities to the accumulation of both general and specific human capital in the next generation.

This finding offers some policy implications. For example, government subsidies targeting to women's education, which is called for in many developing economies with a variety of theoretical justification, could have intergenerational externalities to productivity gain through the ex post improvement in production-related skills in manufacturing industries, not only to an increase in schooling investments in children. These externalities can be large in the situations where employment opportunities are limited to women. If so, women's time spent on family education would be longer than men's. For example, if returns to schooling are low for women, schooling investments to women would enhance the improvement in intrahousehold resource allocation since the returns are relatively higher than that outside. In some recent findings (Pitt, et. al., 1998, 2001, for Bangladesh), credit programs selectively targeting to women, that raise women's bargaining power and endowment inside households, are more effective in improving intrahousehold resource allocation than those given to men. Evidently, Bangladesh is in the situation where female employment opportunities are quite limited. [1]

The organization of paper is as follows. Sections 2 and 3 describe our model and empirical framework respectively. A key identification condition for parents' schooling effect in wage equations is based on asymmetric information between employers and employees (see also Farber and Gibbons, 1996). Since employers do not know ex ante most of family background variables

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[1] For the role of female education, see also Behrman, et. al. (1998).

including mother's and father's schooling, these variables could influence wages ex post only through unobservable workers' endowment if family backgrounds are correlated with the endowment. Our working hypothesis is that, due to selection mechanism, larger endowment raises tenure and experience in production.

Section 4 describes our data from employee surveys in Thailand. In summer 2001, the data were collected from four industries located near Bangkok: hard-disk drives, PC/IC, auto parts and food processing industries. The sample consists of 1867 employees from 20 firms. Nearly 78.5 percent of our sample workers are taken from production lines, and the rest from engineers, technicians, managers, and others. Following same workers in late 2003, we collect additional information on turnover behavior from 17 firms. Mering the two surveys, we obtain a londitudinal sample of employees which enable identification of tenure determination - the focus of this pepr.

Our empirical findings are summarized in Section 5. First, it is found that parents' schooling influences child schooling, consistently with the literature. Secondly, it is found that mother's schooling raises tenure and therefore enhances the accumulation of specific human capital. Concluding remarks are made in the final section.

2 Model

2.1 Wage and Tenure

In this section, we model how endowment affects earnings, tenure and schooling investments. The endowment contains various sorts of background factors that employers and labor markets cannot observe, including parents' schooling and occupations, individual traits, abilities, and preference. We assume that marginal product of labor is determined by general and firm-specific human capital, and other observable characteristics, $p(s, h_t, x_t)$ where s is schooling (general human capital), h_t is firm-specific human capital, often measured by tenure, and x_t is a vector of other characteristics. We also assume that unobservable endowment μ_j is additively separable to $p(s, h_t, x)$. Log of wage is determined as the expected value of the sum of these two components:

$$\ln w_{jt} = E[p(s_j, h_{jt}, x_{jt}) + \mu_j \mid \Omega_t] \qquad (1)$$

where Ω_t is employer's information set at time t. Assume that $p(s_j, h_{jt}, x_{jt})$ is observable. Therefore, $(p(.), s, h, x) \in \Omega_t$ for all t, but $\mu_j \notin \Omega_0$. The function p has standard features, i.e. $p_s > 0$, and $p_h > 0$. Wage is paied according to employer's expectations on worker's productivity, which consists of the observable component $p(s_j, h_{jt}, x_{jt})$ and unobserved endowment μ_j. If the subjective expectations on μ_j is changing over time, wage also moves accordingly.

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Endowment μ_j is unobservable to employers. We assume that employers learn about the endowment over time, with information contained in signals from workers in production lines. Employers collect signals for each individual worker, $y_{jt} = \mu_j + \kappa_{jt}$ where κ_{jt} is an i.i.d. mean-zero noise normally distributed with a finite variance σ_κ^2. From signals and the initial prior, employers sequentially estimate μ_j and update their perception over time. That is, $\hat{\mu}_{jt} = E[\mu_j \mid y_{j1}, y_{j2}, ..., y_{jt}, \mu_{j0}]$ where μ_{j0} is the initial prior. For newly recruited employees who enter the plant at the same time, assume that the initial prior is identical. However, since signals are assumed to be idiosyncratic, uncorrelated across workers, the variance of $\hat{\mu}_{jt}$ increases over time. With normality assumption on prior, it is possible to explicitly specify the updating of the conditional expectations of worker's endowment.

$$E\left[\mu_j|\Omega_t\right] = \mu_{j|t-1} + \frac{\sigma_{\mu_j|t-1}^2}{\sigma_{\mu_j|t-1}^2 + \sigma_\kappa^2}\left(y_{jt-1} - \mu_{j|t-1}\right)$$

where $\mu_{j|t-1}$ is the prior mean at $t-1$, and $\sigma_{\mu|t-1}^2$ is the prior variance at $t-1$. In this formulation, the learning speed - the adjustment of prior mean - is faster at earlier stages.[2]

The above construct has two main implications on dynamics of wage and tenure. First, the correlation between wage and endowment increases as workers stay longer in the firm. From this result, we reach an implication that any proxies for worker's endowment become more strongly correlated with wage as workers stay longer in the firm. For example, if mother's education determines the endowment, the effect of mother's education on wage increases as tenure gets longer.

On the other hand, the effect of endowment on wage is small in a situation where noise variance is large. For example, if production is risky and supervisors' monitoring is unreliable, the positive correlation of endowment and wage will be small.[3] If less uneducated workers have a larger noise variance, the effect of endowment on wage growth will be small in this case.

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[2]More specifically, it is written as

$$
\begin{aligned}
E\left[\mu_j|\Omega_t\right] &= \frac{\sigma_{\mu|t-1}^2}{\sigma_{\mu|t-1}^2 + \sigma_\kappa^2}y_{jt-1} + \left(1 - \frac{\sigma_{\mu|t-1}^2}{\sigma_{\mu|t-1}^2 + \sigma_\kappa^2}\right)\mu_{j|t-1} \\
&= \omega_{t-1}y_{jt-1} + (1-\omega_{t-1})\mu_{j|t-1} \\
&= \omega_{t-1}y_{jt-1} + (1-\omega_{t-1})\left[\omega_{t-2}y_{jt-2} + (1-\omega_{t-2})\mu_{j|t-2}\right] \\
&= ... \\
&= \sum_{k=1}^{t-1}\omega_{t-k}\prod_{q=1}^{k-1}(1-\omega_{t-q})y_{jt-k} \\
&= \sum_{k=1}^{t-1}\omega_{t-k}\prod_{q=1}^{k-1}(1-\omega_{t-q})\left[\mu_j + \kappa_{jt-k}\right]
\end{aligned}
$$

[3]In the sample industries that we study in the empirical analysis below, firms are producing hard disks, electronic appliances, automobile parts, and processing food. In contrast to agricultural production, production risk and monitoring problems are of less importance.

Second, if larger endowment implies a greater probability of staying in the firm, tenure is positively correlated with endowment. Though we do not model this process, employer may select workers who are sufficiently productive or well matched with the firm, or less productive workers may voluntarily move to other firms (Jovanovic, 1979).

If firm-specific human capital accumulates as workers work in a firm longer, larger endowment implies more accumulation of firm-specific human capital.

However, if the experience of higher productivity growth reveals greater capability (endowment) and this information and human capital (skills) are transferable to other firms, those workers are likely to get better offers and therefore are more likely to leave the current firm. This mechanism may shorten the length of tenure in the current firm. Hence, the above conjecture depends on the transferability of information and human capital across different firms. The concept of firm-specific human capital means that the transferability of skills is limited (Becker, 1962).

Next we discuss the determination of endowment from intrahousehold resource allocation.

2.2   Endowment and the Distribution of Parental Schooling

On the determination of μ, we can simply rely on the conventional framework of intrahousehold time allocation in home production. Assume that the endowment is determined by parental time input to family education. The efficiency of time spent on child education in family is augmented by parents' human capital, measured here by education. Assume that child endowment is determined as

$$\mu(t^m e(s^m), t^f e(s^f), \xi; x)$$

where t^k ($k = f$: father, m: mother) is time spent on child education at home, e measures the efficiency of home production which increases in parents' schooling s^k, and x is child's characteristics such as gender. Let ξ denote a shock to the endowment. We assume that μ monotonically increases in both parents time inputs.

Suppose that the household maximizes the weighted sum of husband's and wife's utilities subject to a budget constraint, deciding i) their time allocation between market and home, and ii) level of child schooling. Assume also that wages are increasing in schooling, and that child endowment is increasing in parents' schooling and their time inputs at home.

$$\max_{s^c, t^m, t^f} \sum_{k=m,f} \theta^k u^k(c^k, w^c(s^c, \mu))$$

s.t.

$$c^m + c^f + s^c p_s \leq w^m(s^m)(1 - t^m) + w^f(s^f)(1 - t^f)$$

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where c^k is consumption of k, s^l is schooling for l ($l = m, f, c$), t^k is time spent on family education, p_s is the unit price of schooling investment, and w^l is wage for l ($l = m, f, c$). The first order conditions are

$$
\begin{aligned}
\theta u'(w^c)\partial w^c/\partial s^c - \lambda p_s &= 0 \\
\theta u'(c) &= \lambda \\
\lambda w(s^m) &= \theta u'(w^c)[\partial w^c/\partial \mu]\mu_1 e(s^m) \\
\lambda w(s^f) &= \theta u'(w^c)[\partial w^c/\partial \mu]\mu_2 e(s^f)
\end{aligned}
$$

where $\theta u'(c) = \frac{1}{2}\sum_{k=m,f}\theta^k\left[\partial u^k/\partial c^k\right]$ and $\theta u'(w^c) = \sum_{k=m,f}\theta^k\left[\partial u^k/\partial w^c\right]$. From the above conditions,

$$
\frac{w(s^m)}{w(s^f)} = \frac{\mu_1 e_m(s^m)}{\mu_2 e_f(s^f)}
$$

In the case that $w'(s^m) << w'(s^f)$, and $e'_m(s) = e'_f(s)$ and $\mu_1 = \mu_2$, an increase in s^m raises mother's time spent on family education. Wage structure affects time allocation of family education.

If parents' wages are increasing and concave in their schooling, it is easy to show that t^m/t^f decreases in s^m/s^f. However, the sensitivity of time allocation to schooling distribution depends on market returns to schooling and family education efficiency. Suppose that market returns to female education are low. Then, mothers tend to spend more time on family education (child care) and therefore the intrahousehold schooling effects on child endowment will be larger for mothers. In this case, $\partial\mu/\partial s^m > \partial\mu/\partial s^f$ given the optimal time allocation. Based on the above framework, we specify our empirical strategy to identify the effects of parents' schooling on wages, tenure and child schooling.

3   Empirical Framework: Specification and Identification

To identify endowment effects on wages, tenure and schooling, we take two approaches: i) wage equations and ii) tenure equations. In wage equations, we test whether or not well-endowed

workers experience a larger wage growth. In tenure equation, we also test a hypothesis that greater endowment implies a longer tenure.

3.1 Wage Equations

We linearize productivity function $p(s_j, h_{jt}, x_{jt})$ and then obtain a linearized wage equation of (1):

$$\ln w_{jt} = \alpha + \beta_1 s_j + \beta_2 h_{jt}(\tau_{jt}) + x_{jt}\beta_3 + \phi_1 \mu_j + \omega_j + \varepsilon_{jt} \tag{2}$$

where ϕ measures the marginal effect of individual endowment on log wage and $\phi \geq 0$. In Section 2, it is implied that the effect of endowment on wage depends on tenure τ_{jt} and potentially on individual characteristics x_j. In (2), schooling and tenure are endogenous in the sense that they could be correlated with unobserved endowment. The accumulation of specific human capital is an increasing function of tenure τ_{jt}. For simplicity, we assume that $h'_{jt}(\tau_{jt}) \geq 0$ and $h''_{jt}(\tau_{jt}) \leq 0$.

We suppose that endowment has two components: those which can and cannot be attributable to parents' education.

$$\mu_j = \mu(s_j^m, s_j^f) \tag{3}$$

where s_j^m and s_j^f denote mother's and father's schooling respectively. We allow for flexible functional forms of endowment equation (3).

Inserting (3) into (2) and using $h_{jt}(\tau_{jt}) = \tau_{jt}$,

$$\ln w_{jt} = \alpha + \beta_1 s_j + \beta_2 \tau_{jt} + x_{jt}\beta_3 + \phi_1 \mu(s_j^m, s_j^f) + \omega_j + \varepsilon_{jt} \tag{4}$$

To estimate Eq.(4), we use instruments to control endogenous variations in schooling and tenure. These instruments are family background variables such as the number of siblings, birth order, parents' schooling, birth province indicators and other exogenous variables that are also in (4). We also include company and position fixed effects.

3.2   Tenure and Schooling Equations

In this section, we discuss the estimaton of tenure equations. For this purpose, it is important to understand the nature of our sampling. First, since we collect information on tenure at a give moment of time in 2001, tenure computable from the 2001 survey is incomplete. In 2001, we have asked the time when workers entered the current firms. Thus, potential (complete) tenure can be longer than the observed incomplete tenure.

Second, in 2003, we collected information from the same set of individuals on whether they had left companies. By construct, therefore, we are able to identify complete tenure for those who had left companies before the 2003 survey. For the rest of sample workers, the observed tenure is still incomplete. Hence, it is possible by merging the two surveys to construct a longitudinal data set and to have two components of likelihood on complete and incomplete tenure. This structure of observations is so called a right censored problem in which for those who still work in the sample compenies, tenure observed are right censored in the sense that potential tenure is longer than observed tenure. For those who had left the companies, there is no censored problem. It is possible to construct the likelihood function which consists of two parts: censored and non-censored observations with a hypothetical probability distribution of complete tenure.[4],[5]

Specific human capital (experience) is approximated by a linearized tenure function,

$$
\begin{aligned}
\tau_j^* &= \alpha_\tau + \gamma_1 s_j + x_j \gamma_2 + \phi_2 \mu_j + v_{jt} \\
\tau_j^* &= \tau_{jt} \quad \text{if left before December 2003} \\
\tau_j^* &> \tau_{jt} \quad \text{if work in December 2003} \qquad (5)
\end{aligned}
$$

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[4] This structure essentially converges to the problem of censored Tobit.

[5] If all observations are censored, the structure is so called stock sampling (Lancaster, 1990, pp.185-190). In this case, in contrast to flow sampling in which individuals are traced over a period of time, such data have no observations of complete tenure. Rather than starting from probabilistic assumptions, we build a likelihood function based on the numbers and proportions of entering and surviving workers (e.g., Lancaster, 1990, pp.185-1990; Nickell, 1979). Let $n(t^0; x)$ denote the number of newly recruited workers of characteristics x at time t^0. Survey was conducted at t. Hence, $\tau = t - t^0$ measures observed tenure (incomplete) if starting at time t^0. It is called the backward recurrence time or elapsed duration. In this stock sampling, all the observations are censored. The probability that workers entering the firm at t^0 are working at survey time t is $1 - F(t - t^0; x)$ where $F(.)$ is the c.d.f. of complete tenure. The number of workers who entered the firm at $t - \tau_t$ and stayed until t is $n(t - \tau_t; x) [1 - F(\tau_t; x)]$.

The density of the elapsed tenure, $\tau_t = t - t^0$, at date t is the ratio of the stock entering at date $t^0 = t - \tau_t$ and remaining in the firm to the total number of workers, $g(\tau_t; x) = \frac{n(t - \tau_t; x)[1 - F(\tau_t; x)]}{\int_{-\infty}^{t} n(q; x)[1 - F(t - q; x)] dq}$ where time starts at $-\infty$. With stationarity, we assume that i) the proportion of workers entering of characteristics x is constant at any time, i.e., $n(q; x) = c(x) N(q)$ and that ii) the number of entrants is constant over time, i.e., $N(q) = N$. Under this condition, the expression converges to $[1 - F(\tau_t; x)] / \int 1 - F(u; x) du$. In finite sample, however, this population result does not necessarily hold.

The empirical counterpart is approximated as $g(\tau_t; x) = \frac{N(t - \tau_t)[1 - F(\tau_t; x)]}{\sum_{q=-\infty}^{t} N(q)[1 - F(t - q; x)]}$. Log likelihood function of observations $j = 1, 2, .., N$ is therefore, $\sum_{j=1}^{N} \ln \frac{N(t - \tau_{jt})[1 - F(\tau_{jt}; x)]}{\sum_{q=-\infty}^{t} N(q)[1 - F(t - q; x)]}$. The survival function is defined as, using hazard function $\theta(\tau; x)$, $1 - F(\tau; x) = \exp \left\{ - \int_0^\tau \theta(q; x) dq \right\}$. For example, in log logistic hazard and survival function, $\theta(\tau; x) = \frac{k(x; \beta) \alpha \tau^{1-\alpha}}{1 + f(x; \beta) \tau^\alpha}$, $1 - F(\tau; x) = \frac{1}{1 + k(x; \beta) \tau^\alpha}$, and $k(x; \beta) = \exp(x' \beta)$ where x is a vector of variables.

With the probability that workers entering the firm at t^0 are working at survey time t is $1 - F(\tau_{jt}; x_j)$ where $\tau_{jt} = t_j - t_j^0$ and $F(.)$ is the c.d.f. of complete tenure, the log likelihood is

$$\sum_j (1 - d_j(t)) \ln [1 - F(\tau_{jt}; x_j)] + d_j(t) \ln f(\tau_{jt}; x_j)$$

where $d_j(t)$ takes the value of one if j has left the company before t and zero otherwise.

We also incorporate the endogeneity of schooling years in Eq.(5). Following Brundel and Smith (1986) and Rivers and Vuong (1988), we assume normality in the complete tenure distribution and error terms in schooling equations as below.

$$
\begin{aligned}
s_j &= \alpha_s + \delta z_j + \phi_3 \mu_j + \epsilon_j \\
&= \alpha_s + \delta z_j + \phi_3 \mu(s_j^m, s_j^f) + \epsilon_j
\end{aligned}
$$

where z_j contains the number of siblings, birth order, and birth province indicators in addition to parental schoolings. These are instruments for years of schooling in the tenure equation as well as the wage equation. Hence, with predicted values of s_j and residuals $\hat{\epsilon}_j$, we estimate

$$\tau_j^* = \alpha_\tau + \gamma_1 \hat{s}_j + x_j \gamma_2 + \phi_2 \mu_j + \lambda \hat{\epsilon}_j + v_{jt} \qquad (5)'$$

where $\lambda \hat{\epsilon}_j$ works as a correction term for adjusting the effect of endogenous schooling and λ is used as the exogeneity test. Identical conditions for complete and incomplete tenure observations apply in (5)'.

Summing up, parents' schooling effects on log wage are

$$\frac{\partial E_t \ln w_{jt}}{\partial s_j^k} = [\phi_1 + \beta_1 \phi_3 + \beta_2(\phi_2 + \gamma_1 \phi_3)] \frac{\partial E_t \mu_j}{\partial \mu_j} \frac{\partial \mu_j}{\partial s_j^k}$$

where $\partial E_t \mu_j / \partial \mu_j > 0$ if employers are Bayesian, and if so, it is increasing in t. $\beta_1 \phi_3$ is the returns to endowment through schooling returns, and $\beta_2(\phi_2 + \gamma_1 \phi_3)$ is the returns to endowment through the tenure augmentation effect. We do no know whether γ_1 is positive or not; it depends

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on demands for general and specific human capital in the plant. Moreover, once we control schooling and tenure augmenting effects of endowment, it is not clear that ϕ_1 is still estimated to be positive.

4   Data

The data we use is from our employee surveys targeted on selected manufacuturing industries in Thailand, fielded by the Sectoral Economics Section of Thailand Development Research Institute (TDRI) in August through October 2001 and a follow-up survey conducted in 2003. The main purpose of the 2001 survey is to assess productivity gain that is attributed to various training investments conducted on the job, off the job, in formal education and training centers, and at related/parent companies, in manufacturing industries. For this purpose, we collected information on wages, training, education, technical changes, job experience and various family backgrounds both from individual employees and employers. The choice of industries in this survey is quite selective: Hard Disk Drive, PC/IC, Auto Parts, and Food Processing manufactures, all located in suburb of Metropolitan Bangkok. The total of 20 firms was fielded, and the sample size is 1867. In this survey, we collected information on wages as of January 1998, 1999, 2000 and as of the previous month of survey week in 2001, and training incidences and training amounts within each of the past three years.

In November to December 2003, we have also conducted a follow-up survey to track sample workers in 17 firms. One important purpose of the 2003 survey is to know whether or not sample workers in the 2001 survey continued to work during the period of 2001 to 2003. If sample workers had left companies, we collected information on date of turnover. Therefore, it enables identifying completed tenure for those who had left before December 2003.

The good feature of the 2001 survey data is that various information on family backgrounds is also collected from employees. Employee or establishment surveys usually do not collect information on individual backgrounds, while household surveys do not collect information on work tenure. Moreover, it is important that most of family and individual background variables collected in our survey are unobservable to employers, therefore the investigation of correlations between these factors and wages and tenure would reveal the effect of some unobservable components on wage and tenure determination. In particular, since parents' schooling is included in the set of background variables, we can identify how parents' schooling influences employment condition such as wages and tenure. Family background variables such as the number of siblings, birth order and birth province indicators also enable us to estimate schooling choice equation, which provides instruments for schooling variable both in wage and tenure equations. Table 1 shows descriptive statistics of some key variables, and Figure 1 depicts the distributions of complete tenure and all tenure observations.

Table1   :   descriptive statistics

Figures 1   :   tenure distributions

There are some issues requiring some considerations. In 2001, our sample consists of employees who are currently working in the firms. In other words, those who have been working, not moved out, are interviewed in the 2001 survey. In this structure, it is essentially impossible to correct selectivity bias arising from endogenous turnover decisions. That is, $P[\mu_j > \theta \mid x_{jt}, s_j, \Omega_{jt}]$ depends on t. In one way to see how severely this problem affects our estimates, we need to estimate wage equations from different years and compare the estimates. However, a fraction of sample employees have started work during the period of 1998 to 2001. Thus, another selectivity problem arises from endogenous entry time, which makes this approach invalid. On the other hand, if the cross-section sample of the 2001 survey year could well represent true variations of wages and tenures in each firm, it could mitigate the problem at least in wage equations.

As discussed in the previous section, the 2003 survey's information on turnover behavior solves the selectivity problem in tenure equations. There are two subsamples of workers - those who had left companies and those who continue working at the time of the 2003 survey. Right censored sample (i.e., those who keep working) has a different distribution of μ_j than the uncensored sample (i.e., those who had left). The effect of this censoring problem is well handled with combining the two likelihoods from both samples.

5 Empirical Results

In this section, we summarize estimation results on tenure and schooling equations. The results from schooling equations provide instrumental variables for estimating tenure equations. As discussed in Section 3, we incorporate censoring problems in the estimation of tenure equation in that completed tenure and incomplete tenure are distinguished.

Table 2: schooling and tenure

Columns 1 and 2 in table 2 show the determinants of years of schooling. Family background and birth province indicators are used to identify the effects of family and environmental factors determined prior to the entry to school. The number of siblings captures household resource

constraint, and birth order, gender as well as the eldest indicator reflect parents' preference and differences in returns to schooling between the sexes and siblings. Importantly, parents' schooling is included and of our interest.

In column 1, both mother's and father's schooling increase years of schooling for children. Interestingly, mother's effect is larger than father's, which suggests that mother's schooling is a more important factor in family education that forms child's endowment. As expected, a larger number of siblings significantly decreases schooling investments. Higher birth order increases years of schooling. Boys receive more education than girls.

Column 2 includes nonlinear terms of parents' schooling and interactions with male indicator. Mother's schooling remains significant. On father's schooling, though the linear term is insignificant, the square term has a significantly positive effect on years of schooling. This implies that at higher levels of father's education, children receive positive benefits from father's schooling. In contrast, at any levels, mother's education has a constantly robust effect on child's education. Second, interaction terms of parents' schooling with male indicator show both negative effects, which implies that the marginal effects of parents' education are significantly lower for boys than girls. Third, the effects of siblings factors remain the same.

This result is consistent with the literature. Sibling size has a significantly negative effect on schooling investments, due to household resource constraint (e.g. Becker and Lewis, 1976; Rosenzweig and Wolpin, 1980). An increase in birth order raises schooling investments, and boys are more favored than girls in investments in their schooling. If birth order is high (i.e., born later), burden to inherit parents' jobs (e.g., farmer) is less so that they can receive more education as well as freedom to seek chances in urban areas. In the above results, birth province fixed effects are also included so that unobserved environmental factors specific to origin regions do not spuriously generate the above findings. Another interesting finding is that while the mother's schooling effect is found to be linear, father's schooling has a significant nonlinear effect on child schooling. An increase in father's schooling accelerates child schooling. However, for a reasonable range of years of schooling, the marginal effect of father's schooling is much smaller than that of mother's.

The results on tenure equations are shown in columns 3 to 6. Columns 3 and 4 do not control the endogeneity of years of schooling. In columns 5 and 6, instruments are taken from the specification of schooling equations in column 2 and we follow Blundell and Smith (1986) method under joint normality on error terms. Both instrumented and non-instrumented results provide some common findings. First, mother's schooling has a significant positive effect on tenure (though it is marginal in columns 3 and 5). This is in sharp contrast to insignificance of father's schooling. Second, however, mother's and father's schooling are substitutable in the sense that the higher father's schooling is, the lower the marginal effect of mother's schooling is. Third, in columns 4 and 6, interactions of parents' schooling with male indicator are included. Interestingly, the mother's schooling effect is significantly weaker for boys than girls. This gender difference is not found for father's schooling. This finding may reflect some socio-cultural factors specific to the Thai. However, mother's role seems more effective for girls than boys in this empirical setting.

The positive effect of mother's schooling on tenure brings about a possibility that those who

entered firms early (thus, with a longer observed tenure) come from families of educated parents. However, if educational attainment tends to improve over time in Thailand, recent relatively young entrants (i.e. of shorter tenure) are likely to be born with more educated parents. This prediction does not hold if firms changed recruitment policies so that they intend to hire more workers of less educated parents recently. However, since in our interviews with human resource managers they reported that they had not asked specific questions on parents schooling, we conjecture that it is unlikely.

Own schooling has a significant negative effect. This is because the more they receive education, the elder they complete education thus the later they enter labor force. Therefore, more education tends to shorten tenure on average. Second, in columns 5 and 6, residuals from the first stage estimation of schooling years are significant. This result rejects exogeneity of schooling years in the tenure equations.

Table 3: returns to schooling and tenure

We estimate log wage equations with and without instruments, summarized in Table 3 Instruments for years of schooling and tenure are taken from column 2 in Table 2 and the same as those instruments used in tenure equations. First, returns to schooling are significant and positive. With instrumentation, the returns are higher than those without, which suggests negative bias. This is contrary to usually assumed screening hypothesis that higher earnings endowment is positively correlated with years of schooling.

Second, more interestingly, though tenure has significant positive returns in specifications without instruments, the return disappears with instruments in columns 2 and 4. This results imply that, controlling parents' schooling, seemingly positive returns to tenure might generate from positive correlations between earnings endowment and tenure. This is rather consistent with our main hypothesis that through employer's learning and selection process in firms, highly endowed workers (possibly with higher mother's education) are likely to work longer in firms, thus leading to a longer observed tenure on average.

Lastly, we categorize positions such that all positions in production including operators, foremen, line leaders, and supervisors are as a group, technicians and engineers are as a group, and administration and plant heads are another group. The benchmark case is that of production. In this way, we may redefine returns to tenure so that promotions highly correlated with accumulation of specific skills play a central role in the determination of returns to tenure, rather than defining them within a narrowly defined position as used in columns 1 to 4. Columns 5 and 6 show the corresponding results. Returns to tenure are significantly positive in this specification both with and without instrumenting schooling and tenure. Hence, it is likely that the major source of tenure returns is associated with promotions within production lines; from operators to foremen and line leaders, for example.

6   Conclusion

This paper provides evidence for positive intergenerational spillovers from parents to children through endowment formation regarding wage, tenure and schooling determination for children, using our recent longitudinal employee surveys in selected manufacturing industries in Thailand. To identify family background and endowment effects on wage and tenure, we use a reasonable assumption on information structure within firms: at the initial stage, employers do not know schooling levels of employees' parents. Therefore, if parents' schooling increases wage and tenure of children at later stages, this effect reflects firms' learning of initially unobserved workers' productivity which is positively correlated with parents' schooling.

In our empirical analysis that correct for the endogeneity of both schooling and tenure, we obtained a couple of interesting findings. First, mother plays a larger role in determining child education than father does, as often confirmed in the literature. Second, mother's schooling has a significant positive effect on tenure, and there is no significant effect of father's schooling. Third, the mother's schooling effect on tenure depends on gender. The mother's schooling effect on tenure is larger for girls.

One standard interpretation of the gender gap in tenure effects of parental schooling comes from differences in wage structure revealed in labor markets for men and women. Particularly, in the situation that returns to schooling in labor markets are much higher for men than women, the optimal intrahousehold allocation of time between family education (including child care) and outside work provides a prediction consistent with our finding. Even if schooling increases for women, their time spent on working outside does not increase but time spent on family education likely increases if they have comparative advantage in household production. In fact, schooling returns to female education are significantly lower than those for men in our sample, although this finding on schooling return gaps pertains to the current generation, not their parents' generation. To analyze the relationship between the functioning of labor markets and differentiated parents' schooling effects is an interesting topic, but it is beyond the scope of this paper. If our conjecture is correct, the functioning of labor markets has dynamic implications on intergenerational human capital accumulation and income movements in developing countries.

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Table 1 Summary Statistics

variable	# obs	mean	std. dev.	min	max
age	1867	28.57204	6.110674	15	63
male	1867	0.4124264	0.492403	0	1
log base wage 2001	1862	9.242588	0.5447973	7.313221	11.51293
log base wage 2000	1649	9.250197	0.5487842	6.476973	11.35041
log base wage 1999	1533	9.207571	0.5352189	6.802395	11.29911
log base wage 1998	1424	9.154834	0.5352395	6.802395	11.24783
start time	1867	2538.803	4.406407	2512	2544.833
tenure 2001	1867	5.946842	4.406346	0	32.75
tenure 2003	1498	7.611318	4.675736	0.3334147	35
years of schooling	1867	11.71505	3.100186	0	18
no edu	1867	0.0026781	0.0516948	0	1
elementary	1867	0.1130155	0.3166966	0	1
lower secondary	1867	0.1981789	0.3987345	0	1
upper secondary	1867	0.2463846	0.4310206	0	1
lower vocational	1867	0.1023032	0.3031278	0	1
upper vocational	1867	0.1687199	0.3746046	0	1
univ social sciences	1867	0.0460632	0.2096782	0	1
univ science	1867	0.0551687	0.2283705	0	1
univ engineering	1867	0.0637386	0.2443522	0	1
post graduate	1867	0.0037493	0.0611333	0	1
mother yrsch	1807	5.986718	2.618581	0	16
father yrsch	1764	6.790249	2.962461	0	19
eldest	1867	0.304767	0.460432	0	1
youngest	1859	0.2415277	0.4281246	0	1
number of siblings	1867	3.758972	2.572167	1	13
birth order	1867	2.919657	2.035846	1	13
production	1867	0.7852169	0.4107818	0	1
technician/engineers	1867	0.1456883	0.3528879	0	1
head/managers	1867	0.0690948	0.2536832	0	1

Base wages for 1998, 1999 and 2000 are as of January, and that for 2001 is as of the previous month of survey. Starting time is in Thai Calendar (= Western calendar year +543), and one month is counted as 1/12 year. Production dummy take the value of one if workers are operators, leaders, foremen, supervisors or the assistants.

Dependent:	years of schooling		tenure 2003		tenure 2003	
			No Instruments	Instruments	No Instruments	Instruments
Mother's schooling	0.1779	0.2223	0.1960	0.2570	0.2917	0.3852
	(6.71)	(3.48)	(1.22)	(1.58)	(1.71)	(2.21)
Squared mother's schooling		-0.0014				
		(0.32)				
Father's schooling	0.1502	0.0420	0.0809	0.1304	0.0231	0.0987
	(6.66)	(0.59)	(0.64)	(1.01)	(0.16)	(0.66)
Squared father's schooling		0.0090				
		(2.15)				
Mother's * father's schooling		0.0027	-0.0339	-0.0326	-0.0299	-0.0271
		(0.46)	(2.30)	(2.22)	(2.00)	(1.82)
Male*mother's schooling		-0.1053			-0.2791	-0.3362
		(2.02)			(1.59)	(1.91)
Male*father's schooling		-0.1206			0.0881	0.0481
		(2.71)			(0.56)	(0.31)
Number of siblings	-0.2811	-0.2787				
	(4.47)	(4.44)				
Eldest	-0.1809	-0.2152				
	(0.94)	(1.13)				
Birth order	0.2626	0.2512				
	(3.79)	(3.63)				
Male	1.8396	3.3008	-1.0176	-0.3445	0.0748	1.5472
	(13.91)	(9.36)	(1.80)	(0.52)	(0.06)	(1.11)
Age			1.2473	1.2262	1.2395	1.2126
			(6.19)	(6.10)	(6.14)	(6.02)
Age squared			-0.0127	-0.0124	-0.0125	-0.0122
			(4.01)	(3.96)	(3.94)	(3.87)
Yrs schooling			-0.3240	-0.6762	-0.3367	-0.7749
			(3.42)	(3.26)	(3.54)	(3.61)
Residuals (yrs schooling)				0.3988		0.4894
				(2.85)		(2.94)
Birth province fixed effects	yes	yes				
Position and company fixed effects			yes	yes	yes	yes
Number of observations	1749	1749	1403	1403	1403	1403
R squared	0.3553	0.3649	0.1541	0.1550	0.1548	0.1561

Number is parentheses are absolute t values. In tenure equations with instruments, predicted years of schooling is used from the first stage regression (column 2). The numbers of observations right censored and uncensored are 987 and 416 respectively.

Table 3 Wage

Dependent: log monthly wage in 2001

	No instruments	Instruments	No Instruments	Instruments	No Instruments	Instruments
Years of schooling	0.0422	0.0592	0.0406	0.0510	0.0573	0.1418
	(8.31)	(3.26)	(8.64)	(3.02)	(10.81)	(9.92)
Tenure 2001 (years)	0.0169	0.0025	0.0165	0.0028	0.0213	0.0350
	(3.51)	(0.20)	(3.40)	(0.22)	(3.89)	(4.12)
Age	0.0502	0.0588	0.0511	0.0591	0.0654	0.0311
	(5.92)	(5.32)	(5.10)	(5.55)	(7.52)	(1.79)
Age squared	-0.0005	-0.0006	-0.0005	-0.0006	-0.0007	-0.0002
	(3.41)	(2.66)	(3.01)	(2.94)	(4.95)	(0.68)
Male	0.1398	0.1169	0.1499	0.1252	0.1829	0.0905
	(3.72)	(2.73)	(3.93)	(2.87)	(5.02)	(2.26)
Mother's schooling			0.0057	0.0038	0.0073	-0.0036
			(1.32)	(0.99)	(1.79)	(0.94)
Father's schooling			0.0029	0.0010	0.0051	-0.0040
			(0.94)	(0.37)	(1.62)	(1.34)
Position 2	0.1733	0.1913	0.1720	0.1938		
	(4.96)	(4.54)	(4.80)	(4.60)		
Position 3	0.3413	0.3163	0.3421	0.3328		
	(7.56)	(6.31)	(7.95)	(6.93)		
Position 4	0.5734	0.5350	0.5654	0.5540		
	(6.49)	(7.33)	(6.60)	(7.26)		
Position 5	0.1743	0.1439	0.1708	0.1544		
	(4.11)	(3.42)	(3.88)	(3.78)		
Position 6	0.5860	0.5250	0.5858	0.5444		
	(10.66)	(7.33)	(10.48)	(8.83)		
Position 7	0.9886	0.9087	0.9644	0.9385		
	(11.46)	(8.14)	(11.28)	(8.20)		
Technicians and engineers					0.1953	0.0808
					(4.70)	(1.94)
Head and managers					0.4737	0.2694
					(7.45)	(4.13)
Company fixed effects	yes	yes	yes	yes	yes	yes
Number of observations	1862	1745	1745	1745	1745	1745
R squared	0.7155	0.7032	0.7168	0.7082	0.6708	0.5544

Numbers in parentheses are absolute t values. Instruments are taken from column 2 in Table 2.
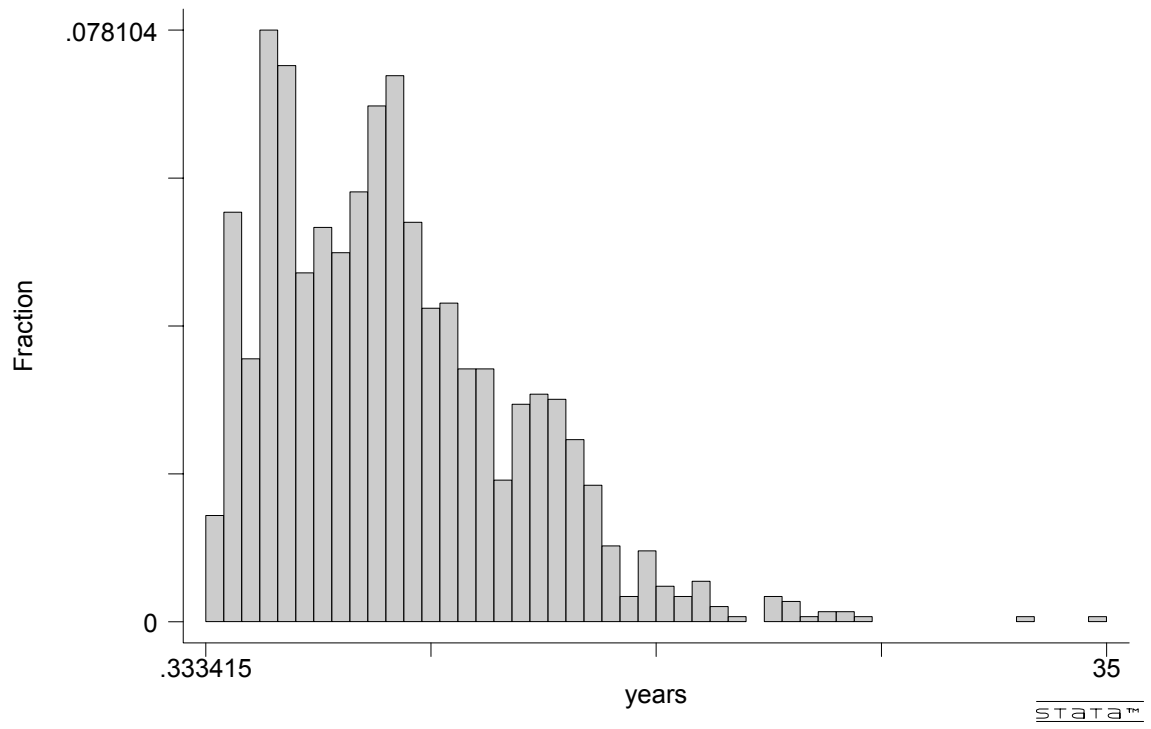
Figure 1a Tenure: both right censored and complete

Figure 1b Tenure: complete