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Intergenerational earnings mobility in Taiwan

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Abstract

This study aims to estimate the extent of intergenerational mobility of earnings in Taiwan. The intergenerational elasticity of a child's earnings with respect to its parent's earnings is estimated by using household micro-data from the Panel Study of Family Dynamics (PSFD) in Taiwan. We apply an estimation method using the predicted earnings of parents. The estimation result suggests that the elasticity for sons is 0.25–0.3 and that for daughters is roughly 0.4. The estimate looks intermediate or moderately low from an international perspective, suggesting that Taiwan is a moderately mobile society.

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1. Introduction

Economic inequality is a widely studied issue in economics. It is often addressed as some unequal economic outcome, such as income. Another important economic issue from the perspective of unequal access to human capital formation is inequality of economic *opportunity*, such as education and health (e.g., Asian Development Bank 2012).

Studies on the latter issue include empirical estimation of the extent of intergenerational mobility of income by focusing on the relation between the income of parents and their children. These studies provide an important insight into the intergenerational transmission of income inequality, suggesting the existence of unequal economic opportunity for children in relation to the financial condition of their parents. Transmission channels might be sought for investment in human capital such as education and health as well as genetic inheritance and other home background (Björklund and Jäntti 2009).

The purpose of this study is to estimate the extent of intergenerational mobility of earnings (labor income) in Taiwan. Taiwan is one of the Four Asian Tigers that achieved rapid economic growth in the last half century; the others are Singapore, Hong Kong, and South Korea. These East Asian countries have been recognized as relatively equal societies. Taiwan's GINI coefficient was officially reported as 0.302 in 2009.[1] However, a recent trend suggests increasing inequality in East Asian societies (Asian Development Bank 2012), with Taiwan being no exception, showing increasing inequality since the 1980s (Welle-Strand et al. 2011). With slower economic growth after achieving economic advancement, the allocation of economic outcomes begins to gain attention in these societies.

The extent of intergenerational mobility of income is estimated by the elasticity of a child's income with respect to its parent's income. The seminal studies of Solon (1992) and Zimmerman (1992) consider the measurement error problem and estimate the elasticity as to the order of 0.4 for the father–son relation in the United States. This finding indicates that a son whose father earns twice as much as another father is expected to earn 40% to 50% more than the child of the other father.

International studies have investigated the income mobility of various countries. These studies suggest that intergenerational elasticity varies across countries, although reviews by Solon (2002) and Blanden (2013) suggest that estimates might be influenced by data sources and estimation methods. The elasticity is estimated to be relatively low (0.3 or less) in some societies such as the Scandinavian countries (Björklund and Jäntti 1997; Bratberg et al. 2005; Bratsberg et al. 2007), Canada (Corak and Heisz 1999), and Australia (Leigh 2007). Meanwhile, the

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1 Per capita disposable income inequality indices, the Directorate-General of Budget, Accounting and Statistics, Government of the Republic of China (http://win.dgbas.gov.tw/fies/a11.asp?year=99, Table 5, last accessed on May 29, 2014).

estimation is moderately high (the orders of 0.4 and 0.5) for the United States, Britain (Dearden et al. 1997), and Italy (Mocetti 2007; Piraino 2007). With regard to Latin America, the estimation is as high as 0.6 for Brazil (Dunn 2007) and 0.7 for Chile (Nunez and Miranda 2010).

Recent studies also report the elasticity for East Asia. Ng (2007) and Ng et al. (2009) conclude that the degree of the intergenerational mobility of earnings for Singapore is similar to that for the United States. The elasticity estimation for Japan and South Korea is roughly 0.3–0.4 (Ueda 2009, 2013; Lefranc et al. 2013), which is intermediate or moderately low. Gong et al. (2012) estimate an elasticity of 0.63 for the father–son pairs and even higher elasticity for the father–daughter pairs in urban China.

This study contributes to the intergenerational mobility issue in East Asia by investigating the case of Taiwan. We adopt a method based on the prediction of parent's earnings as initially proposed by Björklund and Jäntti (1997). The estimation result suggests that the elasticity is 0.25–0.3 for sons and roughly 0.4 for daughters, with the average age of children at the point of observation almost 40. The estimate seems to be intermediate or moderately low from an international perspective. The extent of mobility looks comparable to that of Japan and South Korea as well as some Western societies.

The remainder of this paper is structured as follows. Section 2 explains the empirical framework used to estimate intergenerational elasticity based on relevant literature. Section 3 describes the data used in our analysis. Section 4 presents the estimation result. Section 5 presents the concluding remarks.

2. Estimation framework

We follow the empirical framework widely used in the relevant literature. Let y_{0i} denote the lifetime economic status of the parent and y_{1i} that of the child in family i. Suppose that the relation between y_{0i} and y_{1i} is linear as follows:

$$y_{1i} = a_0 + \rho \cdot y_{0i} + \varepsilon_i \tag{1}$$

where a_0 is a constant, ρ a coefficient, and ε_i the error term. When economic status is measured by the logarithm of income, the coefficient ρ is interpreted as the elasticity of the child's income with respect to its parent's income.

A major limitation to estimate equation (1) is that lifetime incomes are seldom obtained from household surveys. Instead, short-time economic status (e.g., annual income) is usually observable as a proxy for lifetime income. Solon (1992) proposes the approach that handles the measurement error problem arising from the short-time parent's income as well as adjusting the age effect at the point of observation, when short-time incomes are observed for both the generations in longitudinal surveys.

Another fairly common limitation is that the parent's income cannot be observed from a one-time or longitudinal survey with a relatively short history. Hence, Björklund and Jäntti (1997) propose a two-sample two-stage approach without the parent's actual income provided the parent's characteristics can be observed. At the first stage of the two-stage approach, the income equation is estimated with the parent's characteristics such as education and social status. Then, the parent's income is predicted from the estimated income equation by applying the parent's observed characteristics. At the second stage, the elasticity is estimated by using the parent's predicted income. This approach requires neither the parent's actual income nor correction of the measurement error.

Now, assume that the logarithm of the child's annual income y_{1it} at time t for family i is expressed as

$$y_{1it} = y_{1i} + a_1 A_{1it} + a_2 A_{1it}^{\ 2} + u_{1it} \tag{2}$$

where A_{1it} denotes the age of child i at time t, a_1 and a_2 are coefficients, and u_{1it} denotes other temporal factors. By substituting equation (2) into equation (1), we obtain

$$y_{1it} = a_0 + \rho \cdot y_{0i} + a_1 A_{1it} + a_2 A_{1it}^{\ 2} + \{\varepsilon_i + u_{1it}\}. \tag{3}$$

Assuming that y_{0i} is explained as a vector of parent's characteristics denoted by q_{0i}, equation (3) can be estimated by substituting y_{0i} with the parent's predicted income $\hat{y}_{0i} = y(q_{0i})$.

3. Data

3.1 Data source and samples

The data for this study are obtained from the Panel Study of Family Dynamics (PSFD), an annual survey conducted by Academia Sinica, the Government of the Republic of China (Taiwan), from 1999. The PSFD is a longitudinal household survey of income activities in which men and women respondents are randomly selected from all over the Taiwan area and interviewed face-to-face. The survey consists of several different cohorts starting from different years. The initial cohort for the 1999 round includes 999 respondents born in 1953–1964. The 2000 round adds 1959 respondents born in 1933–1953, and the 2003 round adds 1152 respondents born in 1964–1976. Further, the respondents' children aged over 16 are interviewed for the 2000 round as a children sample and 298 children aged over 25 are added to the adult sample for the 2004 round and after.

The questionnaire includes the age, education, and earnings of the respondents and other family members. Regarding a child's earnings, we use the respondent's pre-tax annual labor income consisting of the total of monthly labor income and annual bonus in the previous year by converting it into real terms based on the Consumer Price Index. The parent's information surveyed includes the education and occupation of the respondent at age 16. We focus on the father to represent the parent.[2]

Previous studies suggest that the estimates of elasticity are influenced by the age of respondents. If the child is in an early stage in its career, such as in its early twenties, the estimate of elasticity tends to be much smaller than that in later stages. Thus, leading studies focus on the child in their thirties (as reviewed by Solon, 2002). The recommended age is the thirties to mid-40s (Haider and Solon 2006) or around 40 (Grawe 2006).

We obtain the micro-data for this study from the 2005–2009 rounds of PSFD in order to obtain the maximum number of respondents aged 30–60 as of 2006. We also consider the earnings especially of daughters and sons because lifetime economic status is affected by spouse's earnings in Taiwan where marriages are a common practice.[3] In this study, we examine three samples: sons with their own earnings, married sons with the couples' total earnings, and married daughters with the couples' total earnings.

Table I reports the sample size and characteristics for the years 2004–2008. The sample size differs across years because only observations with positive earnings are selected. The samples include at the minimum 438 sons, 230 married sons, and 170 married daughters every year. The average age of children in 2004 is around 40 for sons and 38 for married daughters. Because of data availability, the daughter's age ranges from 30 to 53 in 2006.

Table II reports the intergenerational transition of educational levels for the father–son pairs. With regard to fathers, nearly two out of three have only primary school education or even less. With regard to sons, 57% are senior high school graduates and 24% have tertiary education. The table clearly indicates a positive intergenerational correlation in education, although sons have a much higher educational level than their parents. With regard to schooling years, the correlation coefficient is 0.46.

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[2] We focus on the father because of the difficulty of predicting the mother's earnings from government statistics in the 1980s, as described later, and to maintain the sample size. We also try to find pairs of parent and child reporting actual earnings from PSFD, but the number of observation is too small for our analysis.

[3] Regarding marriages, the never-married rates are as low as 5.8% (5.6%) for men (women) aged 50–54 in Taiwan in 2005 (Ministry of Interior, the Government of the Republic of China).

Table I: Sample characteristics

		Sons		Married sons		Married daughters	
2004	Father's years of schooling	7.03	(4.11)	6.95	(3.89)	6.82	(3.69)
	Offspring's years of schooling	12.76	(2.83)	12.98	(2.90)	11.95	(2.75)
	Offspring's age	39.04	(6.55)	40.22	(5.90)	37.73	(5.13)
	Number of observations	479		238		227	
2005	Father's years of schooling	7.18	(4.10)	7.03	(3.76)	6.68	(3.68)
	Offspring's years of schooling	13.02	(2.85)	13.15	(2.93)	11.77	(2.89)
	Offspring's age	40.34	(6.47)	41.09	(5.77)	38.76	(5.11)
	Number of observations	512		234		209	
2006	Father's years of schooling	7.19	(4.13)	6.69	(3.86)	6.43	(3.83)
	Offspring's years of schooling	12.91	(2.92)	13.04	(2.87)	11.88	(2.84)
	Offspring's age	41.28	(6.62)	41.63	(5.58)	39.64	(5.25)
	Number of observations	488		236		201	
2007	Father's years of schooling	7.16	(4.09)	6.79	(3.84)	6.22	(3.78)
	Offspring's years of schooling	12.94	(2.92)	12.99	(2.86)	11.96	(2.60)
	Offspring's age	42.18	6.41	42.98	(5.83)	40.21	(4.88)
	Number of observations	446		266		184	
2008	Father's years of schooling	7.19	(4.07)	6.81	(3.82)	6.28	(3.62)
	Offspring's years of schooling	12.94	(2.95)	13.04	(2.98)	12.03	(2.66)
	Offspring's age	43.11	(6.53)	43.92	(5.63)	41.53	(5.18)
	Number of observations	438		230		170	

Note: Standard deviations are in parentheses.

Table II: Intergenerational transition of education for son–father pairs

Father \ Son		Primary school and below	Junior high school	Senior high school	Junior college and university	Graduate school	Total
Below primary school	(14.3%)	8.6%	45.7%	40.0%	4.3%	1.4%	100%
Primary school	(50.4%)	2.4%	16.7%	64.2%	12.2%	4.5%	100%
Junior high school	(12.5%)	1.6%	8.2%	68.9%	19.7%	1.6%	100%
Senior high school	(17.4%)	0.0%	2.4%	49.4%	40.0%	8.2%	100%
Tertiary education	(5.3%)	0.0%	0.0%	30.8%	38.5%	30.8%	100%
Total		2.7%	16.4%	57.0%	18.2%	5.7%	100%

Note: The sample includes 488 son-father pairs.

3.2 Prediction of parent's earnings

For predicting a parent's earnings, we need to estimate the earnings equation by using data when parents in the labor market are in their thirties or forties. However, because of data limitation, we consider two alternative approaches for predicting the parent's earnings. In the first approach, Case (A), we apply the parent's earnings predicted by using the aggregated data from the Report on the Survey of Family Income and Expenditure in Taiwan Area (RSFI) 1983, a national household income survey.[4] Here, we use the average earnings based on 10-year age groups, 6 educational levels, and 13 occupations.[5] An advantage of Case (A) is that we can predict the parent's earnings by using the data when they are in their working ages; for example, a respondent aged 40 in 2006 was 17 in 1983 when their fathers were likely to be in their early forties. A disadvantage of this data source is that the averaged earnings are not classified by gender even when the majority of workers are likely to be men.

In the second approach, Case (B), we predict the parent's earnings by using micro-data taken from the 1998 PSFD, that is, the earliest round. The parent's earnings are predicted from the following earnings equation:

$$y_j = \beta_0 + \beta_1 A_j + \beta_2 A_j^{\ 2} + \delta \cdot q_j + u_j \qquad (4)$$

where y_j denotes log earnings; A_j denotes age; β_0, β_1, and β_2 are coefficients; q_j denotes a set of education and occupation; δ is a vector of coefficients; and u_j is the error term for individual *j*. The parent's income is predicted as $\hat{y}_{0i} = \hat{\delta} \cdot q_{0i}$ from the estimated coefficients of $\hat{\delta}$. In this case, the parent's characteristics include 7 educational levels and 12 occupations.[6]

An advantage of this approach is that we estimate the parent's earnings based on gender, education, and occupation using the same classification as parent's information. A disadvantage of this approach is that the effects of education and occupation in 1998 might be somewhat different from those when the parents are in their working ages in the labor market.

4. Estimation result

4.1 Elasticity for sons and daughters

Table III reports the estimates of elasticity. Standard errors are adjusted according to Murphy and Topel (1985) because prediction is applied as an independent variable in Case (B).[7] The elasticity range is 0.21–0.30 in Case (A) and 0.18–0.28 in Case (B) for the father–son relation with the son's own earnings. With regard to married sons with couple's earnings, the elasticity range is 0.18–0.38 in Case (A) and 0.19–0.36 in Case (B). For married daughters with couple's

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4 The year 1983 is considered as having the earliest available statistics.

5 Regarding age, we apply a middle value for each age group. The education levels are primary school and below, middle school, high school and senior vocational school, junior college, university and college, and graduate school. The occupations are professional and technical; administrative, executive and managerial; clerical; sales; services; farming and hunting; forestry; fishery; crafts and production processes; transport equipment operators; labor; military servicemen; and teachers.

6 The category of primary school and below is divided into primary school and below primary. The occupational characteristics include 12 occupations (excluding fishery).

7 R^2 of the earnings equation is 0.322.

earnings, the elasticity range is 0.35–0.52 in Case (A) and 0.29–0.47 in Case (B). The estimates for Cases (A) and (B) appear similar, although it is slightly higher in Case (A) than Case (B). With regard to sons, the elasticity looks slightly higher for married sons.

We also examine a pooled sample of five years 2004–2008 to reduce the variation of estimates.[8] The result suggests an elasticity of 0.25–0.30 for sons and roughly 0.4 for daughters. From an international perspective, this elasticity appears intermediate or moderately low, especially for the father–son relation. Among the East Asian countries, the mobility in Taiwan looks to be comparable to that in Japan and South Korea. The result of higher elasticity for daughters than for sons is similar to that in South Korea and China as well as Britain, but opposite to that in other countries such as the United States (Chadwick and Solon 2002).

Table III: Estimation result of elasticity

Sample/ child's earnings	Year	(A) Using RSFI 1983 Estimate		(B) Using PSFD 1998 Estimate		Sample size
Sons/ son's earnings	2004	0.249	(0.061)	0.260	(0.061)	479
	2005	0.299	(0.053)	0.279	(0.055)	512
	2006	0.260	(0.061)	0.254	(0.059)	488
	2007	0.213	(0.066)	0.179	(0.062)	446
	2008	0.304	(0.059)	0.265	(0.060)	438
	2004-2008	0.268	(0.027)	0.252	(0.027)	2363
Sons/ couple's earnings	2004	0.181	(0.081)	0.188	(0.077)	238
	2005	0.346	(0.072)	0.295	(0.074)	234
	2006	0.308	(0.075)	0.263	(0.076)	236
	2007	0.321	(0.076)	0.256	(0.073)	266
	2008	0.375	(0.095)	0.359	(0.086)	230
	2004-2008	0.300	(0.036)	0.265	(0.034)	1204
Daughters/ couple's earnings	2004	0.411	(0.104)	0.358	(0.106)	227
	2005	0.462	(0.088)	0.439	(0.087)	209
	2006	0.401	(0.089)	0.317	(0.091)	201
	2007	0.348	(0.084)	0.285	(0.083)	184
	2008	0.518	(0.097)	0.466	(0.096)	170
	2004-2008	0.427	(0.042)	0.373	(0.042)	991

Notes: Standard errors are in parentheses. R^2 ranges from 0.023 to 0.169.

4.2 Elasticity by age group

Table IV reports the estimation results based on age group in Case (B) for the pooled sample for

[8] By averaging the son's earnings, we can reduce the measurement error of the dependent variable. However, the sample size becomes too small for estimation when averaging the earnings of multiple years.

2004–2008. The estimates for the subsamples of married children in their fifties are not reported because of the small sample size. In case of sons, the elasticity is estimated as small as 0.13 for those in their thirties but exceeding 0.3 for those in their forties and fifties. The estimates are 0.23 for married sons in their thirties and 0.34 for those in their forties; they are slightly higher than those for sons with own earnings.

In case of daughters, the elasticity is estimated as 0.51 for those in their thirties, which is fairly higher than the elasticity of 0.30 for those in their forties. The result for daughters is different from that of sons and also previous literature in which the elasticity moves upward with increasing age at the point of observation. With regard to sample characteristics, the log of a couple's total earnings is higher for both minimum and maximum for those in their forties than thirties, but slightly lower for the average with larger variation. Also, the averaged individual earnings are slightly lower for daughters in their forties than thirties, and vice versa for spouses. This suggests that the wife's contribution to a couple's income might be smaller, and thus the relation with the parent's status is also smaller for those in their forties than thirties. We need to note that for both sons and daughters, differences in age group might be explained by both the cohort effect (that is, generational effect depending on born years) and age effect.

Table IV: Estimates of elasticity by age group

Sample/ child's earnings	Year	Age	Estimate		Sample size
Sons/ son's earnings	2004-2008	30-39	0.131	(0.033)	1017
		40-49	0.303	(0.039)	1013
		50-59	0.360	(0.090)	304
Sons/ couple's earnings	2004-2008	30-39	0.231	(0.061)	432
		40-49	0.337	(0.044)	623
Daughters/ couple's earnings	2004-2008	30-39	0.507	(0.071)	484
		40-49	0.301	(0.055)	460

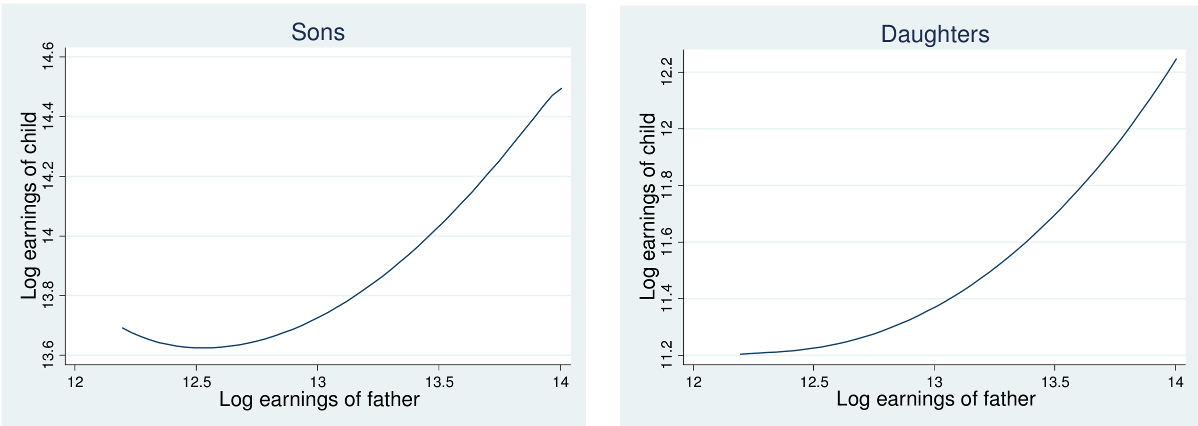
Notes: We apply the prediction using the PSFD of 1998. Standard errors are in parentheses.

4.3 Nonlinear relation

The relevant literature for other countries has investigated whether the intergenerational income relation in equation (1) is linear or nonlinear. Studies that show relatively low elasticity sometimes find lower elasticity for low-income parents than for other parents (Bratsberg et al. 2007; Bratberg et al. 2005 for Scandinavian countries; Corak and Heisz 1999 for Canada). These studies interpret that children from low-income families might be supported in their societies to overcome their unfavorable economic situation. Thus, other children from middle or high income families are likely to face higher elasticity than linear estimation suggests.

Figure 1 illustrates a nonlinear nonparametric fit in case of married sons and daughters when applying age-adjusted couple's earnings in Case (B). The slope indicates the elasticity for children conditioned on parent's earnings. For both sons and daughters, the nonlinear fit looks almost flat for low-income fathers.[9] The result is similar to studies that show comparatively low elasticity, in which case the low elasticity of low-income families contribute to reducing overall elasticity.

Figure 1: Nonparametric fit



Note: We use the predicted log earnings for the father in the X-axis, and the log of couple's earnings after adjustment by age for married sons and daughters.

5. Concluding remarks

This study has measured the intergenerational earnings mobility in case of Taiwan by using the predicted earnings of parents. The estimation results suggest an elasticity of 0.25–0.3 for sons and roughly 0.4 for daughters. Taiwan seems to be a moderately mobile society in terms of earnings. A nonlinear analysis suggests that the elasticity is lower for those from low-income families than middle and high-income families. One possible reason for this is that a society successfully supports low-income families and thus lowers overall elasticity.

We need to note that intergenerational mobility might change over time even within the same society. After achieving rapid economic growth, an increasing number of the young in Taiwan have sought tertiary education in the last decade. As a result of reforms of the national educational system in the 2000s, nearly three out of four students advanced to tertiary education in 2011, whereas only one out of four students did so in 2000. Meanwhile, the government spends less than 4% of GDP on education in Taiwan, while the private sector financed 5.5% or

[9] The result appears pretty similar when using the earnings of sons only.

even more almost every year between 2000 and 2009.[10] Rapid advancement in education and the heavy financing of education by the private sector could possibly affect future intergenerational transmission in Taiwan.

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