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Intergenerational Earnings Mobility in Singapore and the United States

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Abstract

This study compared intergenerational earnings mobility in Singapore and the United States by replicating the limitations in the Singapore National Youth Survey on the U.S. Panel Study of Income Dynamics. The mean estimated earnings elasticities are almost identical: 0.26 in Singapore and 0.27 in the United States. Transformed to 0.45 and 0.47 respectively to reflect permanent status, mobility in the two countries is moderately low compared internationally. The finding of similar mobility is not surprising given that the economic realities, welfare systems, education regimes, and labor structures in the two countries are similar. Policy makers face the daunting challenge of overcoming immobility and inequality while maintaining global competitiveness.

Keywords: Intergenerational earnings mobility; Singapore; United States

JEL Classification: J62, C81

1. Introduction

Until recently, empirical studies on intergenerational earnings mobility are limited to advanced countries as data are not readily available in less advanced countries. Some recent contributions to the understanding of intergenerational earnings persistence in less advanced countries include Lillard and Kilburn (1995) on Malaysia; Hertz (2001) and Louw, Berg and Yu (2007) on South Africa; Dunn (2007) and Ferreira and Veloso (2006) on Brazil; Grawe (2001, 2004) on Ecuador, Nepal, Pakistan, and Peru; and Ng (2007) on Singapore. In addition, data from less advanced countries may be drawn from a one-time cross-sectional survey instead of a panel data, or the second generation may be biased to a younger age group. These limitations make a direct comparison with the intergenerational earnings elasticity of advanced countries with comprehensive panel data problematic. So that the intergenerational earnings elasticities obtained are more comparable, one may replicate the sample selections and the statistical methods in the studies of the less advanced countries on an advanced country with a richer data. In this paper, we will compare the intergenerational earnings mobility in Singapore and the United States by replicating the limitations in the Singapore National Youth Survey (NYS) on the U.S. Panel Study of Income Dynamics (PSID).

Ng (2007) used interval regressions on the NYS as dependent variables were given in earnings intervals. Instrumental variables were used to address problems of respondent errors and unobserved permanent earnings. Then, scales from Behrman and Taubman (1990), Eide and Showalter (1999) and Corak (2006) were used to translate elasticities from income to earnings, and from contemporaneous elasticities to elasticities reflecting older offspring and younger parents. With elasticities estimated from 0.23 to 0.28 before scaling, and from 0.58 to 1.20 after scaling, she concluded that intergenerational mobility was moderately low in Singapore.

Ng (2007) did not make direct comparisons with estimates from other countries but only made conclusions in terms of ranges, because transformations using scales rely on very restrictive assumptions such as similar age-earnings distributions and similar earnings-income associations. Nevertheless, comparisons across countries with very different elasticities can be made with confidence. For example, she suggested that Singapore is less mobile than Canada, the Scandinavian countries, and developing countries such as Nepal and Pakistan, but that Singapore has mobility similar to that of the United States.

This paper is a follow-up paper of Ng (2007) and attempts to compare Singapore, a small open economy with very rapid economic growth over the past four decades, and the United States, the leading advanced country in the world. Specifically, we will replicate as closely as possible the limitations in the Singapore data on the PSID, a U.S. data set which has been widely used in intergenerational mobility research. The findings in this analysis will serve to verify the validity of results found by empirical adjustments and transformations done in Ng (2007). The rest of the paper is as follows. Section 2 will review the empirical studies on intergenerational earnings mobility, with a focus on comparability issues. Section 3 discusses the data and the methodology on how we re-organize the U.S. data so that it has the structure as close as that of the Singapore data. Empirical results are given in section 4 and section 5 provides the concluding discussions on why the intergenerational earnings elasticities in Singapore and the U.S. are similar, and proposes future research.

2. Literature Survey

We use the following baseline empirical model to measure intergenerational earnings mobility:

$$y_i^{child} - \bar{y}^{child} = \beta(y_i^{parent} - \bar{y}^{parent}) + \varepsilon_i^{child}$$

$$=> \quad y_i^{child} = (\bar{y}^{child} - \beta\bar{y}^{parent}) + \beta y_i^{parent} + \varepsilon_i^{child} \qquad (1)$$

$$=> \quad y_i^{child} = \alpha + \beta y_i^{parent} + \varepsilon_i^{child}$$

where y_i is the logarithmic earnings of the individual i, $\bar{y}$ is the mean log of earnings of the individual's generation, β is the intergenerational earnings elasticity, or the intergenerational earnings correlation if the variances of log earnings in the two generations are similar. A low β indicates high mobility.

What β values have researchers found and what have they concluded about mobility in different countries? There is agreement that among developed countries, Scandinavian countries such as Denmark (β=0.07, Jäntti et al. 2006) and Sweden (β=0.28, Björklund and Jäntti 1997) have higher mobility while U.K. (β=0.58, Grawe 2004) and U.S. (β=0.47, Grawe 2004) have lower mobility. However, the worst mobility situations seem to be in less developed countries such as Brazil (β=0.69, Dunn 2007) and South Africa (β=0.61, Hertz 2001). There is a conjecture that mobility may be lower in developing countries, but results so far are inconclusive due to the lack of comparability in data.

What are these comparability issues? First, some studies – such as Dearden et al. (1997) on England, Björklund and Jäntti (1997) on Sweden, and Hertz (2001) on South Africa had only one year of earnings data. Estimates based on the observed one-year earnings are biased downward because a given year's earnings comprises both transitory as well as permanent components, but only permanent earnings should be used to correlate earnings between the generations.

Researchers have derived measures of permanent status in two ways, first by averaging earnings over several years (e.g. Solon, 1992; Mazumder, 2005), and second, by instrumenting for permanent earnings with measures of parents' status such as education and occupation (e.g. Altonji and Dunn, 1991; Dearden et al., 1997; Grawe, 2004; and Dunn, 2007). Both methods have helped to achieve better measures of permanent earnings and larger β estimates.

The second comparability issue is that data in different countries are available for different ages. There are two parts to the biases caused by measuring earnings at different life stages: the age of offspring and the age of parents. Working on U.S. data, Reville (1995) obtained $\beta = 0.25$ when sons were in their 20s, and $\beta = 0.5$ when sons were in their 30s. Studies in other countries which had younger samples - such as Lillard & Kilburn (1995) on Malaysia, and Corak & Heisz (1999) on Canada – also had lower estimates. What is the influence of parental age on the estimated β? In a review of several American studies, Corak (2006) summarized that "the average estimate is 0.154 when fathers are on average 50 years or older, 0.406 when they are between 45 and 49 years, and 0.433 when they are younger than 45 on average".

In studies with contemporaneous data from more mature parents and younger offspring, elasticity estimates will be doubly reduced. Indeed, studies which used contemporaneous data turned in low estimates. Couch and Dunn (1997) replicated Germany's contemporaneous sampling in the U.S., and obtained a β of 0.11 and 0.13 respectively. Their estimate for the U.S. is smaller than estimates found in other U.S. studies. Using a common cross-section data set for several countries in Europe, Comi (2003) found very small estimates for these countries. Ideally, then, earnings should be obtained when respondents are middle-aged, the life stage when earnings reflect their permanent status more closely.

A third limitation faced by some studies is that earnings are reported in ranked categories. Dearden et al. (1997) on U.K. dealt with this in two ways. One approach was the usual ordinary least squares (OLS) using midpoints of categories. The second approach, using Stewart's (1983) Grouped Dependent Variable (GDV) estimator, is available as a command known as "interval regression" in STATA.

Fourth, estimates of beta depend on whether data on father's earnings or family income are used. Corak (2004) suggests that as a measure of family resources, father's earnings under-represent parental or family income, implying that β values from father's earnings will be underestimated. Indeed, studies which compared effects of parental income and earnings found larger estimates from parental income: using contemporaneous U.S. data, Behrman and Taubman (1990) found $\beta = 0.13$ for earnings and $\beta = 0.27$ for income. Eide and Showalter (1999) used five years of father's earnings and family income, and found estimates of 0.34 and 0.45, respectively.

The above four issues of comparability are applicable for the Singapore NYS: observed data of only one year; young offspring; categorical earnings; and parental combined earnings. The next section will discuss in detail how we deal with these limitations in the Singapore data and replicate these restrictions on the U.S. data.

3. Data and Methodology

3.1 Survey data

The Singapore data source for this study is the National Youth Survey (NYS) conducted by the National Youth Council in 2002. This was a one time cross-sectional survey. The sample in this study included youth aged 23 to 29 who were working full-time. Cases where the reported occupation is "not classifiable" - the majority of whom are national servicemen - are also dropped. Although national service is considered full-time employment, its meager and standardized stipend does not reflect true earnings potential.

Those whose fathers were retired or unemployed, and those who refused to answer are also dropped. Retired fathers have substantially lower earnings levels than the overall sample, which may be because reported earnings are from lower post-retirement salaries or from the last jobs held many years ago and when the earnings profiles have tapered off. Besides dropped cases, parents' earnings is missing for 88 cases. This leaves a maximum sample size of 271 with valid values of both youth and parents' earnings.

To prepare the PSID, we first found respondents aged 23 to 29 in the 2003 survey (therefore 2002 data) from a variable which gives the year in which respondents were born. Matching them to their parents in the 2002 data is not possible because when children become adults, they are assigned different family identification numbers from their parents. To find parents, then, we trace the youth respondents to the years when they were 12 years old and identified their parents in those years. We had traced youths back to one year old as well as six years old, but sample sizes get smaller when traced longer back in time. Although results are slightly different, we feel that compared to one and six years of age, 12 years optimizes the social effects and minimizes the biological effects of parents' status.

Then we trace the heads of household back to 2002. Tracing back and forth in the above manner loses many cases because through the years, either a parent drops out or a youth does so. As a result, the sample size is limited. In the above manner, we replicate the contemporaneous earnings of youth and parents when youth are aged 23 to 29. To ensure that youth and the main parent are working full-time, we exclude youth and heads in the PSID who worked fewer than 35 hours per week. Coincidentally, the resulting sample size is also 271.

3.2 Earnings

While the PSID data is truly intergenerational in the sense that both offspring and parents report their own earnings, parental incomes are reported by the youth in the NYS[1]. The NYS queries youth about income with the questions "what is your monthly income from all sources?" and "what are your parent's combined monthly income from all sources?" Although the questions specify "from all sources", in a survey setting, we think that respondents are likely to under-report non-labor income. Therefore, the results are likely to be between elasticity measures from true earnings and true income.

With this in mind, we use labor income in the PSID, which includes wages and salaries, any separate reports of bonuses, overtime, tips, commissions, professional practice or trade, market gardening, additional job income, and miscellaneous labor income. This in essence is earnings, but an earnings measure that encompasses more than the basic wages and salary. This is felt to be closer to the income in the NYS. Parents' incomes are derived from the aggregate incomes of household heads and their wives whilst those of youths are either the heads' or the wives' (if the youth in consideration is the wife).

The NYS reports monthly incomes not in actual numeric values but in nine ranges: less than S$500; S$500-S$1,000; S$1,001-S$1,500; S$1,501-S$2,000; S$2,001-S$3,000; S$3,001-S$5,000; S$5,001-S$7,500; S$7,501-S$10,000; S$10,001 and above. To generate a comparable set of categories for the PSID earnings, we use the household income distribution in the 2000 U.S. Census as an external benchmark. We combine some of the 16 categories in the U.S. Census into 9 categories, by fitting the U.S. distribution to be as close to the Singapore distribution as possible. These result in the following categories, after division by 12 to convert from annual to monthly earnings: less than $833, $833-$1667, $1667-$2500, $2500-$3333, $3333-$6250,

[1] Please refer to Ng (2007) for details on data limitations from youth report of parental income.

$6250-$8333, $8333-$14017, $14017-$16667, more than $16667. As can be seen from charts 1a and b, the income distributions in the NYS and PSID are still quite different. Indeed, the Kolmogorov-Smirnov equality-of-distribution test rejects the null hypothesis that the distributions are similar. However, experimenting with different cut-offs still yields dissimilar distributions yet similar coefficient estimates.

Finally, because income is given in categories, we apply interval regression rather than the standard OLS.

(Chart 1a)

(Chart 1b)

3.3 Instrumental and Control Variables

With only one year of earnings, elasticity estimates are likely to be attenuated. Hence, we instrument for permanent earnings with education and occupation[2]. The NYS reports education in categories, some of which overlap in terms of the educational level. This is due to different tracks that students may pursue. The PSID, on the other hand, gives educational qualification in terms of years of education. Besides differences in how education is reported, the general educational levels in the two countries are also very different. While there were 19 fathers without any education in Singapore, there were none in the U.S. Forty-nine percent American parents had high school education and above, compared to only 20% Singaporean parents.

With the above differences, we conceptualize education as four categories which represent significant qualifications in each country. In Singapore, the four levels are primary (elementary school) and below; secondary (grade 10); post-secondary (grade 11 to technical diploma); and

[2] Please refer to Ng (2007) for details on the choice of instruments.

bachelor degree and above. In the U.S., the four levels are 11 years of education and below, 12 years, 13 – 15 years, and 16 or 17 years (bachelor degree and above). Charts 2a and b give the distributions of father's education in Singapore and US respectively.

(Chart 2a)

(Chart 2b)

For occupation, we assign prestige scores to the nine occupational classes reported in the NYS using the Singapore Occupational Prestige Score (SOPS) from Chiew et al. (1991). SOPS was developed by replicating the U.S.-based National Opinion Research Center (NORC) survey in Singapore, and includes local occupations such as buddhist monk, Chinese physician, and coffee shop proprietor. Because the NYS gives occupations in terms of classes but Chiew et al. (1991) assigns prestige scores for specific occupations, the Singapore Standard Occupational Classification 2005 is used to match the two data. The prestige scores of the occupational classes were computed as the mean prestige scores of occupations under that class, weighted by the number of individuals in each occupation in Chiew et al. (1991). Table A.1 in the Appendix shows the SOPS scale corresponding to the occupational group in the NYS.

Constructing the equivalent occupational prestige scale in the PSID was a process of manually matching PSID occupations by name to SSOC groups and assigning the corresponding SOPS. We could have applied U.S. based prestige scores, but this still requires manual matching across Censuses because prestige scores such as that by Nakao and Treas (1994) use occupations from older Censuses while the PSID occupations are coded according to the 2000 Census.

Out of 509 PSID occupations, we could not find a match for 12 occupations. Examples of these unmatched occupations include logisticians, meeting planners, and hunters and trappers. For such cases where there were no clear matches, we compared the earnings of that respondent to the mean earnings of the broad group in the US Census that corresponded to the SSOC group. Using these mean earnings and the definitions of the occupations, we discussed and assigned the prestige score that we felt was most appropriate. In this way, all the PSID occupations were classified into the SOPS scale. The occupation distribution of fathers in Singapore is shown in Chart 3a and that of heads of household in the U.S. is in Chart 3b.

(Chart 3a)

(Chart 3b)

Age and sex are dichotomous variables. The age dummy equals one if respondents are aged 23 to 25 while the sex dummy equals one if respondents are female. Table 1 gives the age and sex profiles in the two data sets. Compared to the national profile, females and those in the younger age group are over-represented in the NYS, due largely to the exclusion of males who are in National Service.

(Table 1)

3.4 Empirical Approach

We start with a single stage interval regression that takes log of youth's earnings on the mid-point of log of parent's earnings categories. We control for age and sex dummies. Then we apply IV estimation by two stage interval regression. The second stage uses predicted parent's earnings from a first stage interval regression of log of parent's earnings on education and occupation, and also youth's age and sex, the control variables in the first stage. After these, we conduct OLS regressions on continuous earnings as originally reported in the PSID.

4. Results

Table 2 presents the elasticity estimates for Singapore and U.S., with single-stage regression results on the left and instrumental variables results on the right. Taking results from single-stage regressions as the lower bound and interval regressions as the upper bound, the results are striking. The dispersion in Singapore is narrower but well within range of the elasticity estimates in the U.S. Taking means of the lower and upper bounds, we get almost identical mean elasticities: 0.26 in Singapore and 0.27 in the U.S.

(Table 2)

Corak (2006) suggests using Grawe (2004)'s 0.47 as the benchmark that represents the earnings elasticity in the U.S. for a 45 year old with average father's earnings from 5 to 15 years. Dividing Grawe's "true" estimate by the estimate we got for the U.S. gives 1.74, the scale factor that we multiply our Singapore estimate by to obtain an estimate that reflects elasticity of permanent status. The resulting estimate of 0.45 puts Singapore close to U.S. and U.K., and behind more mobile countries such as Sweden, Canada, and Denmark.

Ng (2007) had scaled Singapore's estimate differently and arrived at a larger estimate, one in the range of 0.58 to 1.20. Without the benefit of a replicated data, Ng (2007) had assumed that incomes rather than earnings were reported and had applied the scaling factor of a German data set that had similar age and earnings profile. The former would decrease while the latter would increase magnitudes of estimates. The latter effect is evidently greater, as the German scale of 4.3 inflated the upper bound of Singapore's estimate to above 1, which theoretically is not possible.

Hence, applying a scaling factor of one country for another is a crude but imprecise method. More generally, scaling is a poor substitute to replication studies. However, they provide much faster estimations than the laborious process of making two completely different data comparable. And scaling can still provide meaningful conclusions, especially in comparison with very dissimilar countries - Ng (2007) was able to establish that Singapore is less mobile than high mobility countries such as Canada and the Nordic countries. The present study with replication is able to conclude with greater precision that Singapore has similar mobility to the U.S.

We performed one more set of regressions. Since the PSID earnings variables are originally continuous, we used this opportunity to check the validity of interval regression by comparing its estimates to estimates from the usual OLS on continuous earnings. The OLS results are reported in the lower half of Table 2. They suggest that relative to OLS, interval regression underestimates elasticities by about 0.03. This bias is fairly large compared to the biases Stewart (1983) estimated in its simulation exercises to test the two-step estimator that has become the interval regression used in this analysis. In Stewart (1983), the largest biases of only -0.01 (base estimate=1) came from specifications where the distributions of the error term were non-normal. Sample size was 1000. Therefore, the bias in the present study could be due to non-normality and small sample size. Substantively, the small negative bias of interval regression implies that there is slightly greater intergenerational persistence in Singapore than given by interval regressions. The scaled estimate of 0.54 (0.31X1.74) is slightly larger than estimates in the U.S. and U.K.

5. Conclusion

Three conclusions can be derived from this replication study. The first two are in relation to methodology. First, replication studies, if practicable, should be pursued instead of scaling, which provides a quick but imprecise way to compare intergenerational persistence across countries. Second, interval regression correcting for grouped dependent variable yields results with slight downward biases.

The third conclusion is that the findings here corroborate with the conclusion in Ng (2007), that intergenerational mobility in Singapore is moderately low. While striking, finding close mobility estimates for Singapore and the U.S. is not surprising because the two countries have very similar economic and policy environments. In terms of the economy, we have similar structure and challenges. Both countries are globalized economies experiencing skill-biased development, resulting in the outsourcing of lower end production and the immigration of low skilled workers. These are challenges which depress the wages of the bottom earners, which in turn have ramifications on intergenerational mobility.

In terms of welfare policy, Singapore and the U.S. tend towards residual aid while the Scandinavian countries emphasize universal support. While the Scandinavian model typically gives generous unemployment insurance and even guarantee paid employment by the government, receiving aid in Singapore and the U.S. rely on stringent means-testing. Tax rates in the two countries are relatively low as there is less need to fund redistributive policies compared to the more universalistic welfare regimes. Our emphasis on individual hard work is also evident in our highly meritocratic education systems and the muted roles of labour unions relative to those in Europe. Privately funded schools are dominant in the U.S., whereas education in Singapore is increasingly liberalized.

Evidently, the welfare, education, and labor systems in Singapore and the U.S. promote competitiveness and are less burdensome on the government. However, they are also intrinsically regressive. Those who are able to help themselves and prove their worth can reap abundant rewards, but those who are unable to help themselves may be left further and further behind. The ill effects of globalization and regressive policy systems on income distribution have been well established by research such as Easterly (2004), Solimano (2001), Caminada and Goudswaard (2000) and Smeeding (2005). Fewer studies have addressed policy effects on intergenerational mobility. Theoretical models such as Solon (2004) and Ho (2008, forthcoming) suggest that inequality and immobility are endogeneously and jointly determined. While Solon (2004) shows that inequality and immobility tend to move together, Ho (2008, forthcoming) presents scenarios where the two may respond differently to different types of policy changes. Therefore, we cannot assume that policies which widen inequality will also worsen immobility. This makes the job of policy-makers even more challenging as they grapple with not only rising inequality but also limited mobility in the context of skill-biased globalization. In particular, policy makers in Singapore and the U.S. face the daunting task of enacting creative policies to support those at the bottom without eroding competitiveness and compromising on a lean government. There is much room for future research to help us better understand the interplay between inequality, immobility and policies.

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Appendix

Table A1

Occupational Classification and Prestige Scale in Singapore

SSOC	SOPS
Legislators, senior officials and managers	76
Professionals	66
Associate Professionals and technicians	53
Clerical workers	34
Service workers and shop/market sales workers	21
Agricultural and fishery workers	19
Production craftsmen and related workers	26
Plant and machine operators and assemblers	21
Cleaners, laborers and related workers	12

Notes: SSOC = Singapore Standard Occupation Classification, 2000.

SOPS = Singapore Occupational Prestige Score.

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Figures

Chart 1(a) Distribution of Youth and Parent's Labor Income from NYS (S$)

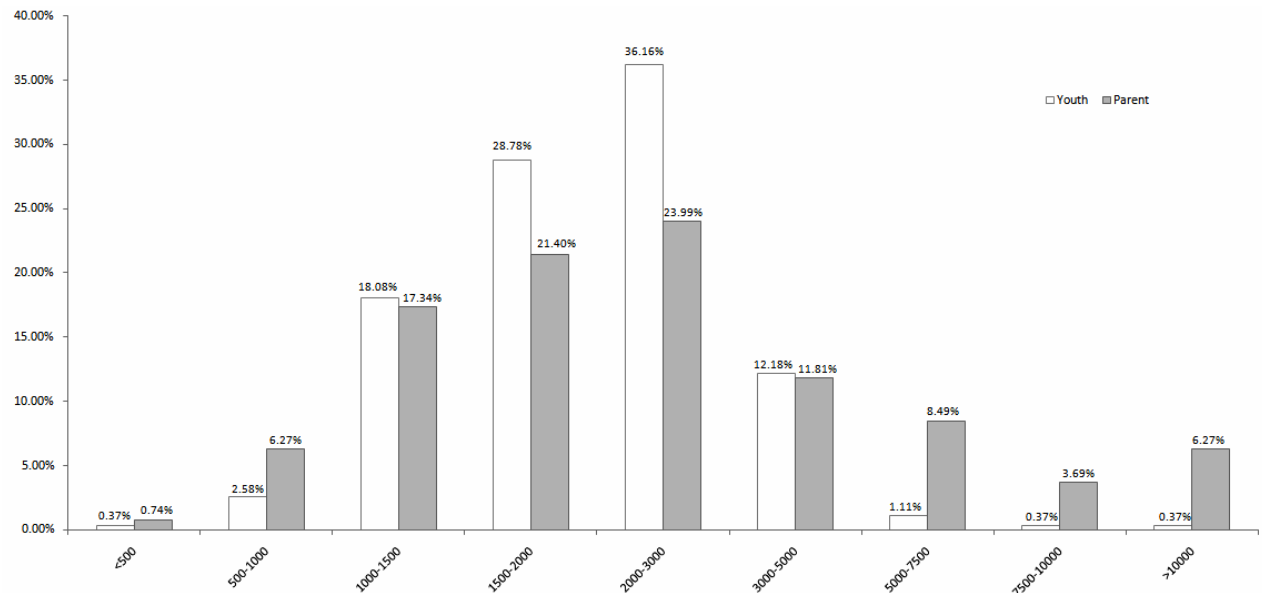


Chart 1(b) Distribution of Youth and Parents' Labor Income from PSID ($)

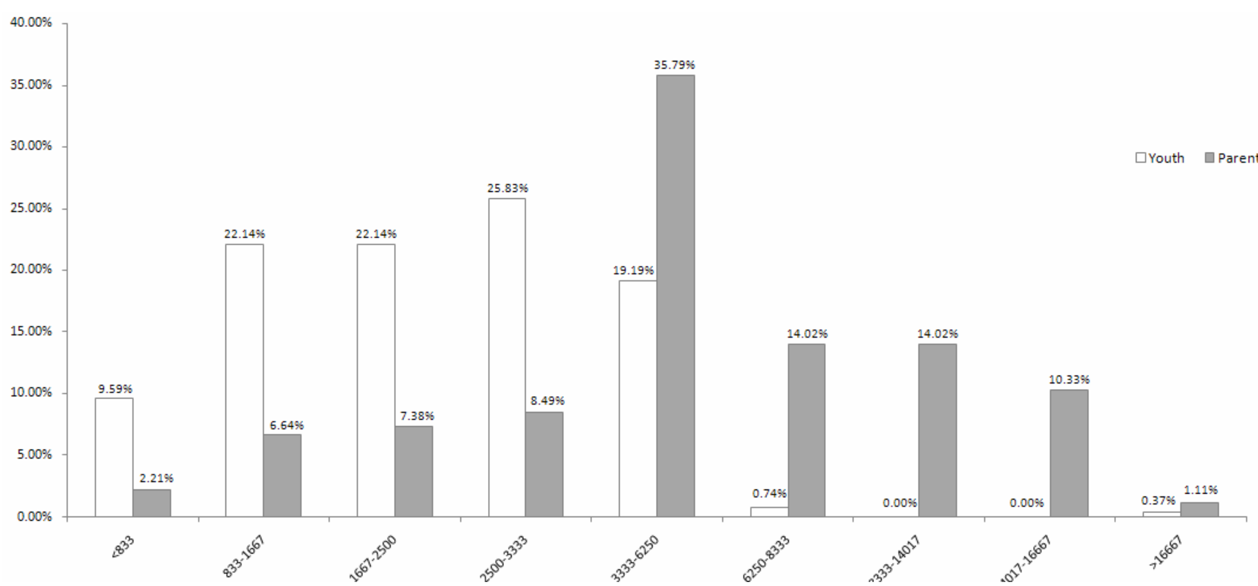


Chart 2(a) Distribution of Fathers' Education from NYS

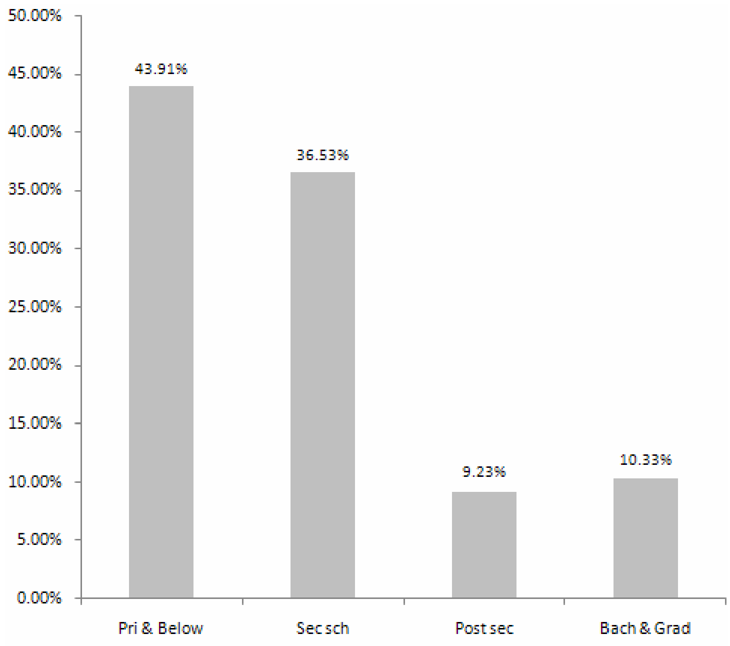


Chart 2(b) Distribution of Fathers' Education from PSID

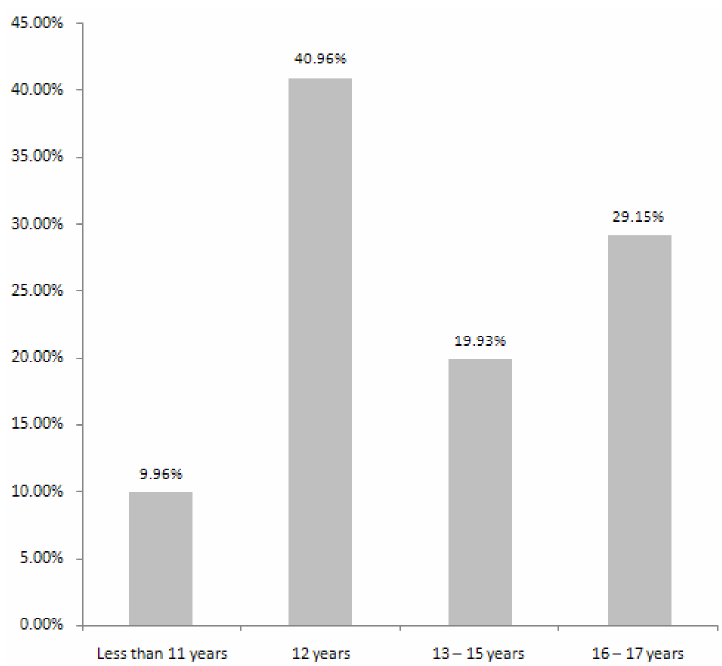


Chart 3(a) Distribution of Fathers' Occupation from NYS

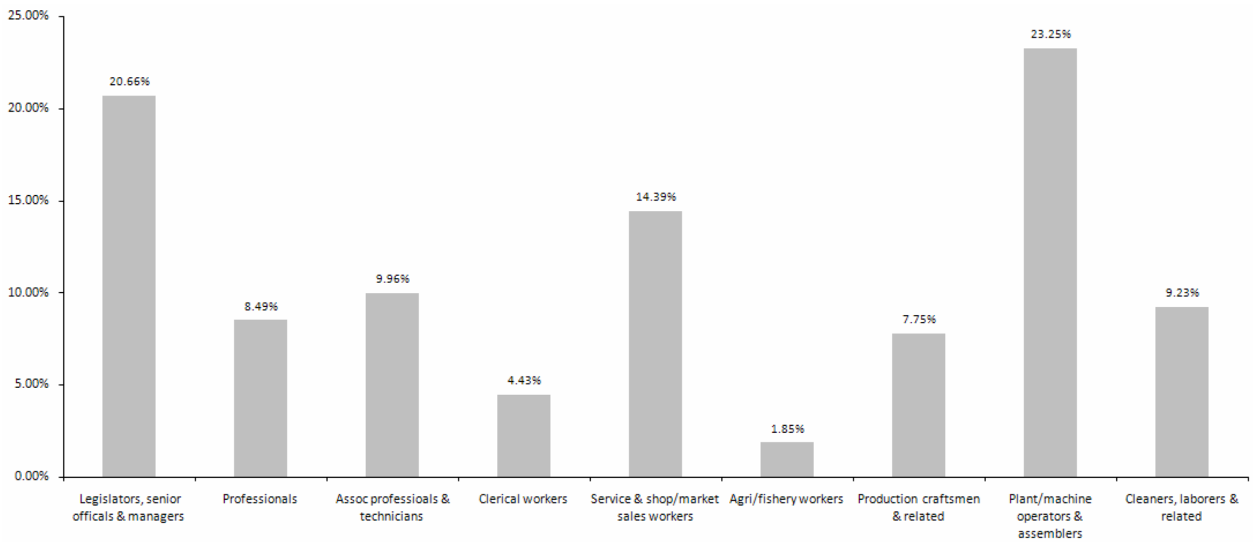
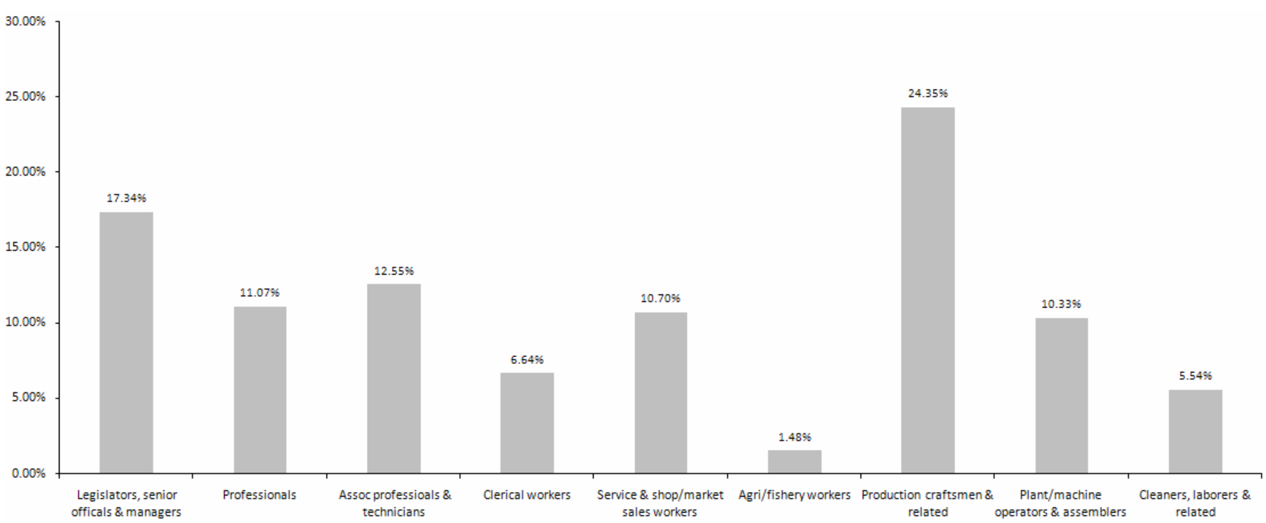


Chart 3(b) Distribution of Fathers' Occupation from PSID



Tables

Table 1

Age and Sex Profiles

Variable	Singapore		U.S.	
	N=271	%	N=271	%
Gender				
Male	113	41.7	129	47.6
Female	158	58.3	142	52.4
Age Group				
23~25	167	61.6	127	46.9
26~29	104	38.4	144	53.1

Table 2

Regression Estimates of Intergenerational Earnings Elasticity

Variable	Singapore		U.S.	
	Single Stage	IV^	Single Stage	IV^
			Interval Regression	
Earnings	0.23	0.28	0.19	0.37
	(.028) **	(.041) **	(0.048)**	(0.11)**
Youth's age	-0.17	-0.18	-0.28	-0.30
	(.046) **	(0.040) **	(0.071)**	(0.074)**
Female	-0.033	-0.040	-0.25	-0.23
	(.046)	(0.050)	(0.071)**	(0.067)**
Constant	5.91	5.60	6.33	4.78
	(0.22) **	(0.31) **	(0.41)**	(0.95)**
N	271	271	271	271
Log Likelihood	-378.30	-390.59	-434.28	-436.75
			OLS Regression	
Earnings			0.22	0.40
			(0.052)**	(0.13)**
Youth's age			-0.29	-0.31
			(0.077)**	(0.075)**
Female			-0.30	-0.27
			(0.077)**	(0.072)**
Constant			6.02	4.55
			(0.45)**	(1.08)**
N			271	271
R-squared			0.16	0.14

Notes: (Standard errors in parentheses). * significant at 5%; ** significant at 1%. ^ Standard errors estimated by bootstrap sampling.