Family in the Making of Educational Inequality:

A Comparative Analysis of Taiwan and the U.S.*

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1. Introduction

Educational inequality is a central area of sociological interest in its own right and for its causal role in the process of stratification. In the longstanding literature on educational stratification, family and school are two of the most studied social institutions. However, only family is an exogenous and the most consistent social predictor of micro (i.e., interpersonal) educational inequality over time and across societies. Family background effects are central to the highly influential Coleman EEO Report (Coleman et al. 1966) on educational inequality and the equally seminal Blau and Duncan (1967) study of American stratification. By now, social scientists have taken for granted that family plays a significant role in the genesis of educational inequality. Not surprisingly, family background variables are the most common controls in micro statistical models of virtually any kinds of educational outcomes, even as stratification research in general has gone well beyond a focus on the effects of family background. What remains open is the question of how and the extent to which the effects may vary across institutional, cultural, and historical contexts.

In this paper, we revisit the classical concern with the role of the family in the making of educational inequality. The reconsideration is motivated by two related reasons: (1) theoretical muddle is one of the most pressing theoretical problems to date (to unravel confounding theories, especially those that are plausible yet divergent in their social implications), resolving the theoretical problem will need sharp findings; (2) cross-national comparative analysis offers promising opportunities for doing so -- contrasting societies that are significantly different on institutional and cultural contexts would potentially generate sharp new empirical findings.

Our objectives are twofold. The first objective is to introduce a new opportunity of comparative analysis: educational inequality of adolescents in Taiwan (a major overseas Chinese society in East Asian) and the U.S. (a benchmark case of the West). Although a single study cannot be expected to resolve the current theoretical muddle, our second objective is to let the results demonstrate that the comparative opportunity indeed can yield sharp new findings. The findings are informative of the role of family income versus parental education, and the family versus the school in the creation and persistence of cognitive inequality among adolescents.

The rest of the paper is as follows. Section 2 describes the theoretical and empirical observations that motivate this study. Section 3 first introduces the data -- the new Taiwan Education Panel Survey (TEPS) and the familiar National Education Longitudinal Study (NELS) of the U.S. These panel data provide the new opportunity for cross-national comparative analysis of the East and the West. It then discusses the analytic strategy that centers on the estimation of family background effects on cognitive achievement across three time points from K7/K8 to K12 in Taiwan and the U.S. Section 4 presents the findings. Section 5 concludes the study.

2. Background

The literature on family and educational inequality has witnessed a rich array of theories and perspectives from sociology and economics. Most theories offer plausible interpretations of, e.g., family income and parental education effects. Sociological theories are concerned with structural and cultural mediating mechanisms of family effects. Some focus on social capital (Coleman 1988; Morgan and Sorensen 1999) and cultural capital (Bourdieu and Passeron 1977; Farkas 1996). Others focus on the causal significance of identity, with varying emphasis on the role of single versus dual parents

(McLanahan and Sandefur 1994; Seltzer 1994), peers and neighbors (Whyte 1943; Willis 1977; Wilson 1987).

By contrast, most economic theories concentrate on formalizing the ways in which home investments in a child involve tradeoffs between the capability of a child and family consumption or between the capabilities of different children (Liebowitz 1974; Becker and Tomes 1986). Other economic theories are devoted to specifying the fundamental structure of a family utility function, whether a common utility function can be assumed for each family (as if the family is run by a dictator) or each family member has his/her individual utility function and all members negotiate/bargain before settling on home investment decisions (McElroy 1990).

The proliferation of a diversity of theories is both good news and bad news. The good news is that researchers have no shortage of guiding perspectives and interpretive tools. The bad news is that family background effects have a large number of confounding interpretations. No theory to date is devoted to specifying how and the extent to which family effects -- both its magnitudes and mediating mechanisms -- vary across contexts. The theoretical problem is aggravated by the problem of incomparability stemming from ill-coordinated studies of family background effects.

For reasons of convenience, a good number of well-cited empirical studies have utilized large-scale cross-sectional surveys of adults to examine the role of the family in the process educational stratification (e.g., Blau and Duncan 1967; Hauser and Featherman 1977; Featherman and Hauser 1978; Shavit and Blossfeld 1993; Rijken 1999). But it is also well known that this research design has fundamental limitations. Cross-sectional adult surveys cannot, e.g., tell us anything about family effects during the formative period of cognitive inequality at school. Empirical researchers recognize the critical usefulness of having longitudinal surveys that follow students through their schooling careers – the earlier the start of observation, the longer the follow-up, and the more comprehensive the survey the better.

Since Coleman's path-breaking multi-cohort survey of American students at different grade levels in 1965, the U.S. Government has launched three generations of panel surveys for multiple cohorts of high school students who are approximately 10 years apart. The three generations of panel surveys (NLS-72,, HSB, and NELS) have proven to be an extremely fertile resource for studying the generating mechanisms of educational inequality. While there are panel surveys of college students as well, the most important strategic resource for studying the making of educational inequality is the Early

Childhood Longitudinal Study (ECLS) that extends the window of observation back to the formative period of kindergarten. Nonetheless, the bulk of what we know from the mainstream literature is based on the cross-sectional adult surveys and high school panel surveys in the United States.

The United States is by far the most intensively studied case of educational inequality. Because of the unmatched size of the American research community and the richness of data resources, the existing theories and findings on the role of the family are largely based on the American case. To date, only a handful of European societies (the U.K. and, to some extent, such as Sweden and the Netherlands) have somewhat comparable student panel surveys for studying the role of the family in educational inequality. We are not aware of any European panel survey of students that is consciously designed to facilitate comparison with the American case. Strict comparisons and generalizations are therefore difficult.

Even if European student surveys allow comparisons with American studies, we remain ignorant about the rest of the world. In particular, high school students from East Asian societies have some of the highest average scores on international math and science tests conducted around the world

(e.g., TIMSS and TIMSSR). They come from Chinese societies (Taiwan, Hong Kong, and Singapore) and so-called Confucius societies (Japan and South Korea). Whether in terms of achievement outcome or social context (institutional, cultural, and historical), these societies are as different from the U.S. as one can imagine. As such they offer some of the ideal testing cases for standard theories developed for American and European societies.

As we will demonstrate in the rest of the paper, comparative analysis with East Asian societies using panel surveys of students is now a reality. Such comparative analysis does generate sharp new findings and enhance the prospect for productive theory building and theory testing – which we believe is one of the highest ideals for comparative research. As a starting point of this comparative research program, we will address three empirical questions in this paper. (1) How does socioeconomic background, measured in terms of family income and parental education, matter for the cognitive achievement of students? How does financial constraint compare to parental education? (2) How do the socioeconomic background effects vary across grades? (3) How different are the qualitative and quantitative effects of family background in Taiwan and the U.S.?

3. Data and Method

Data

These questions would be simply cheap talk if there is no comprehensive survey data with large and representative samples of students. Fortunately, for the first time in a major Chinese society such a survey is publicly available – the Taiwan Education Panel Survey (TEPS). TEPS provides the ideal basis for studying the family effect question, with obvious potential for a wide range of other research problems. As the multi-phased public release of the survey has begun only recently and all documentations and internal labeling of data files are in Chinese. Detailed description of TEPS is available online at http://www.teps.sinica.edu.tw as well as in the user guide available from the Center for Survey Research, Academia Sinica.

The Taiwanese data were drawn from two cohorts of students for whom TEPS has collected detailed questionnaire and cognitive test data in the 7th grade (K7, the junior cohort in the fall of 2001), 11th grade (K11, the senior cohort in the fall of 2001), and 12th grade (K12, senior in winter 2003). Currently only the senior cohort has two waves of data, and 2nd wave data are still being audited for public release. The K12 results of TEPS should therefore be regarded as preliminary. As soon as the data for K9 (junior in fall 2003) are

ready for analysis, the K9 results would also be incorporated as a supplement to the K7 results and will be compared with the K8 results in the U.S.

The American data were drawn from the CD-ROM release of the 1988 (base year) through 1994 (third follow-up) surveys of the National Education Longitudinal Study (U.S. Department of Education 1996). The release provides four waves of longitudinal data from the eighth grader cohort of 1988. For our purposes, only three waves of data (K8 in 1988, K10 in 1990, and K12 in 1992) are used for comparison with Taiwanese students. Descriptive statistics are presented in table 1.

INSERT TABLE 1 ABOUT HERE.

For both TEPS and NELS, item response theory has been applied to generate psychometrically sound estimates of cognitive ability based on a battery of aptitude test items including math and reading, among other subject domains (Yang, Tam, and Huang 2004). This is the primary source of our dependent variable. We call it the IRT score henceforth. But IRT score is an abstract unobservable construct with an arbitrary metric.

The independent variables are simple. They consist of just two family background measures: total family income (monthly for TEPS and annual for NELS) and parental education (highest level attained by either parent). By

design both variables are categorically defined. The income variable is based on incomparable categories but the variable is coded into the same number of ordinal categories for TEPS and NELS. The education variable is much more comparable, except for the junior college degree which is always vocational in Taiwan but not necessarily so in the U.S. Still, the typical years of schooling corresponding to this degree are twelve for both societies.

Figure 1 shows the marginal distributions of the income and education variables for the K7/K8 samples in Taiwan and the U.S. By and large, the distributions of American parents are quite symmetric whereas those of Taiwanese parents are positively skewed. As it turned out, the distributional differences between the two societies are inconsequential because they could not have produced the central comparative finding of this paper -- the remarkable similarities between the results of the two societies.

INSERT FIGURE 1 ABOUT HERE.

Analytic Plan

Metric Comparability. It is important to point out that the IRT score is almost universal metric of cognitive inequality in the sociology and economics literature. But the scale and location of the IRT metric is arbitrary for any

sample. For comparing family effects across grades and between societies, we must impose some basis of reference. Hence we standardize the IRT metric at zero mean and one standard deviation for each grade within a society.

However, the (standardized) IRT score is not the only metric of cognitive inequality we use. In fact, we have estimated all models in pair – each model is defined for two dependent variable metrics: the IRT score and the competitive status index (CSI). Originally proposed by Tam (2003), CSI is a simple monotonic function of positional status in a hierarchy of competitive achievement. In this paper, the hierarchy of achievement is just the distribution of IRT scores. High IRT score means higher achievement and so higher CSI.

Unlike the IRT score that is an arbitrary metric, the metric size of CSI has concrete and absolute social meaning – the CSI for a position X in a hierarchy of positions (A, B, … X, …) measures the average number of competitors a position holder has to beat in order to reach the position X or above. The same interpretation holds for any competitive pool, irrespective of its size, timing, or social context, rendering the metric intrinsically suitable for comparative analysis across groups, time periods, and societies. Although we always estimate and present results from the models with IRT score and log CSI as

dependent variables, our substantive interest is in the family effects on competitive status achievement behind the IRT scores.

Formally, CSI resembles an odds transformation of a cumulative probability. When given the logarithmic transformation, the dependent variable becomes a logit metric of positional status in a hierarchy of cognitive ability. A nice bonus of this transformation is that an effect estimate from a regression of the logit metric can be easily translated into a percentage effect on CSI. This property holds for both continuous and categorical independent variables.

Family Effects. Our first analytic objective is to specifically contrast the family income and parental education mechanisms by which family background becomes causally relevant and significant in the stratification process. For this purpose, we adopt categorical coding to minimize the potential complication of nonlinear effects for comparing between the two dimensions. For the ease of interpretation, we also present effect estimates relative to the lowest category of income or education. However, we have also tested for the statistical significance of contrasts between the effects of adjacent categories of income or education.

Most important, throughout the analysis we have consciously chosen to examine very simple models that amount to basically estimating the total effects (direct and indirect) of family income and parental education. Of the two, parental education is necessarily the exogenous variable and family income the endogenous. Jointly analyzing the two is essential to eliminating the potentially spurious effect of family income due to parental education.

Although comparative analysis of mediating mechanisms of family effects will be the focus of our future research, it is actually a source of analytic strength for us to avoid introducing mediating mechanisms at this stage. The reader will know exactly what the parameter estimates mean and, as it turned out, the central findings are all the more striking and telling given this analytic simplicity. A similar strategy is also central to the oft-cited study of Neal and Johnson's (1996). Departing from the prior literature that relies on a multitude of statistical control variables, they focus on unusually simple models and this focus has led to the discovery of remarkably sharp new evidence for the role of premarket cognitive ability in accounting for the racial wage gap in the U.S.

4. Findings

As this is the first time that a large representative sample of students is available for assessing the role of the family in the making of cognitive inequality in Taiwan, we will start with the results for the Taiwanese case before turning to a comparative analysis with the American case.

INSERT TABLE 2 AND FIGURE 2 ABOUT HERE.

Two Dimensions of Family Effects

To address the first empirical question of this study, we start with the junior high cohort in the 7th grade. Table 2 presents the first and most basic numerical results and figure 2 summarizes the gross and net effects of family income and parental education. Socioeconomic background, even if measured with a simple indicator of family income or parental education, is a sharp predictor of cognitive achievement – higher income or better educated parents are predictive of cognitive success. Taken individually, the gross effects of family income and parental education are very similar qualitatively and quantitatively, and hard to tell which is which *a priori*. However, most interesting is the finding that about two-third of the income effects on cognitive status are spurious of parental education effects. Jointly considered,

the effects of parental education are almost four times those of family income – a result highly consistent with the discovery of Cameron and Heckman (1998, 2001) with very different data and analytic strategies for the U.S. context. (By contrast, when the IRT score is the measure of cognitive inequality, about half of the income effects are spurious of parental education effects whereas only a fraction of the parental education effects are mediated by family income. For a graphic comparison, see figures A1 and A2 in the Appendix.)

The finding stands in stark contrast to the public presumption that family income is the most crucial aspect of family inequality that diminishes equal educational opportunity in Taiwan. If socioeconomic background signifies resource inequality, then the effects of financial resource inequality are just about one-fourth those of parental human capital resource inequality.

This finding is a good reminder of the danger of casual empiricism. Although we are not yet in position to specify the mediating mechanisms of parental education, it is informative to know the fact that much of the gross financial resources effects are spurious of parental education.

In a nutshell, money is limited in what it can buy for cognitive success in Taiwan so long as economic subsistence is not a problem. Children of the very

poor are at risk, but children of very wealthy families can do no better than children of upper working class or lower middle class.

Family Inequality across Grades

The second empirical question of this study is about changes over time: how the family effects may vary across grades. To address this question, we need analysis of data from different grades. Tables A1 and A2 in the appendix present numerical results for K11 and K12, parallel to those of table 2 for K7. Figure 3 summarizes the key parameter estimates for all three grades. The central finding is that the family income effects are strikingly persistent through high school (from K7 to K12). The persistence of parental education effects is mainly in qualitative terms and between the top and bottom families, much less so in quantitative terms and for middle-range families (parents with junior college or university degrees).

INSERT FIGURE 3 ABOUT HERE.

Also worth emphasizing is the substantial and statistically significant decline in the parental education effects from K7 to K11 and from K11 to K12. The cumulative declines from K7 to K12 are large for parents with junior college degrees or university degrees, but more modest for parents with

graduate degrees. In contrast, the effects of family income inequality rise from K7 to K11, though pulling back from K11 to K12.

Judging from the decline of parental education effects, it is tempting to infer that high schools in Taiwan have successfully diminished the consequences of parental education inequality. This is a hypothesis worth careful investigation. Nonetheless, it must be cautioned that the senior cohort has undergone substantial selection from K7 to K12 through the public examination system. Truncated regression models would predict that family inequality effects in general diminish across grades because of the much higher attribution rates for the lowest performing students. As a result, bias-adjusted estimates of parental education effects across grades would likely reveal a substantially less decline than they appear in figure 3.

INSERT TABLE 3 ABOUT HERE.

Cross-national Comparisons

All previous results are focused on the Taiwan case. A parallel set of results are available for the American case. Tables 3, A3, and A4 are exactly parallel to tables 2, A1, and A2, respectively. Figure 4 is parallel to figure 3, showing the family income and parental education effects across grades. To

facilitate comparison, it is useful to zoom in on K7/K8 results. Figure 5 juxtaposes the results for TEPS (K7) and NELS (K8). The similarities are striking and so is the third central finding of this study.

INSERT FIGURES 4, 5 ABOUT HERE.

Despite the wildly different institutional and cultural contexts, family effects on cognitive inequality in the two societies are surprisingly similar. Qualitatively, parental education plays a much stronger role than family income in both societies. Quantitatively, the net family income effects are absolutely similar except for the two top income categories, whereas the parental education effects are also similar except for junior college graduates.

It is hard to have predicted *ex ante* the similarities between the results for the two wildly different societies. We are not aware of any sociological or economic theory of family effects of educational inequality that would have made the prediction. As such, the finding is a sharp new piece of evidence that all major theories of family effects have to reconcile with.

5. Conclusion

This paper has taken advantage of the newly available TEPS to launch a comparative analysis of family effects on cognitive inequality in two radically

different institutional and cultural environments. With student data from multiple grades and cognitive tests, this comparative analysis can do much that conventional cross-sectional adult surveys cannot. If the results from the two societies are wildly different, educational institutions and culture may matter much in shaping family-based inequality. The results will not be very informative. However, if the results are highly congruent, the comparative results would offer a powerful challenge to theories that emphasize historically and culturally specific institutional or policy contexts.

Surprisingly, we find striking similarities between the Taiwanese and American results. In both societies, parental education is much more consequential than family income in determining the cognitive success of children. The family inequality effects for K7 Taiwanese students and K8 American students are remarkably close in both qualitative and quantitative terms.

Two cross-national differences stand out. Apparently there is a decline of parental education effects across grades in Taiwan but not in the U.S. The top income families do not enjoy an advantage of middle class families in Taiwan but they do in the U.S. Our hunch is that this latter difference is likely due to the strength of the elite private schooling system in the U.S. that money can

buy. By contrast, all the top schools in Taiwan are public schools. Entry to top schools is based on merit rather than family background.

Nevertheless, the similarities are much more striking than the differences. It is a puzzle that begets serious investigation.

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APPENDIX

INSERT TABLES A1-A4 HERE.

INSERT FIGURES A1 AND A2 HERE.

Table 1: Weighted Means of Variables[1]

			TEPS			NELS		
Variables			K7	K11	K12	K8	K10	K12
IRT score[2]			0.055	-0.226	-0.209	-0.036	0.035	0.018
			(0.986)	(1.014)	(0.997)	(0.973)	(0.963)	(0.951)
Log CSI			0.095	-0.378	-0.347	-0.060	0.0556	0.026
			(1.672)	(1.676)	(1.656)	(1.631)	(1.610)	(1.591)
Family Income[3]								
	TEPS	NELS						
[1]	<20k	<10k	0.105	0.093	0.093	0.123	0.105	0.103
[2]	20-50k	10-20k	0.419	0.419	0.418	0.167	0.147	0.146
[3]	50-100k	20-35k	0.343	0.347	0.347	0.288	0.293	0.291
[4]	100-150k	35-50k	0.078	0.077	0.077	0.205	0.212	0.217
[5]	150-200k	50-75k	0.023	0.021	0.021	0.142	0.162	0.161
[6]	>=200k	>=75k	0.017	0.014	0.014	0.075	0.081	0.082
Parental Education								
Less than High School			0.275	0.308	0.308	0.101	0.082	0.084
High School			0.435	0.403	0.403	0.205	0.204	0.203
Junior College			0.163	0.154	0.154	0.430	0.425	0.413
University			0.086	0.086	0.086	0.142	0.152	0.157
Graduate			0.028	0.022	0.022	0.122	0.136	0.142
N			12503	11455	11441	21930	14801	12321

Note: (1) All statistics are weighted by weights for each wave. (2) IRT are scores of student test results based on Item Response Theory, standardized to have unweighted means of zero and variance of one for each wave, weighted standard deviations are in parentheses. (3) Dummy variables for family income and parental education levels. Monthly income in ten thousand NTD for TEPS while annual income in USD for NELS.

Table 2: K7 in TEPS Cross-sectional (N=12503)

	(1) IRT score	(2) Log CSI	(3) IRT score	(4) Log CSI	(5) IRT score	(6) Log CSI
Monthly Family Income						
<10k	---	---			---	---
20-50k	0.312	1.628			0.211	1.378
	(0.050)**	(0.136)**			(0.048)**	(0.113)**
50-100k	0.648	2.902			0.378	1.845
	(0.055)**	(0.269)**			(0.055)**	(0.171)**
100-150k	0.966	5.050			0.491	2.252
	(0.064)**	(0.536)**			(0.066)**	(0.245)**
150-200k	0.934	4.799			0.454	2.125
	(0.091)**	(0.729)**			(0.087)**	(0.310)**
>=200k	0.954	5.030			0.478	2.238
	(0.117)**	(0.999)**			(0.112)**	(0.434)**
Parental Education						
Less than High School			---	---	---	---
High School			0.364	1.803	0.288	1.589
			(0.033)**	(0.097)**	(0.032)**	(0.080)**
Junior College			0.822	3.976	0.683	3.149
			(0.043)**	(0.285)**	(0.039)**	(0.200)**
University			1.041	5.831	0.860	4.291
			(0.046)**	(0.449)**	(0.049)**	(0.345)**
Graduate			1.217	8.062	0.987	5.430
			(0.057)**	(0.870)**	(0.063)**	(0.648)**
R-squared	0.08	0.08	0.13	0.13	0.15	0.15

Note: 1. Coefficients of logC are all exponential form.

2. Constant terms are suppressed all from the tables.

Table 3: K8 in NELS (N=21930)

	(1) IRT score	(2) Log CSI	(3) IRT score	(4) Log CSI	(5) IRT score	(6) Log CSI
Annual Family Income						
<10k	---	---			---	---
10-20k	0.302	1.641			0.233	1.462
	(0.027)**	(0.077)**			(0.025)**	(0.064)**
20-35k	0.617	2.756			0.448	2.083
	(0.025)**	(0.119)**			(0.024)**	(0.089)**
35-50k	0.839	3.966			0.561	2.510
	(0.027)**	(0.185)**			(0.027)**	(0.118)**
50-75k	1.015	5.240			0.597	2.640
	(0.030)**	(0.270)**			(0.030)**	(0.137)**
>=75k	1.306	8.489			0.717	3.239
	(0.038)**	(0.542)**			(0.038)**	(0.207)**
Parental Education						
Less than High School			---	---	---	---
High School			0.401	1.963	0.259	1.555
			(0.026)**	(0.090)**	(0.025)**	(0.070)**
Junior College			0.617	2.783	0.415	1.998
			(0.025)**	(0.121)**	(0.024)**	(0.087)**
University			1.110	6.210	0.787	3.664
			(0.029)**	(0.313)**	(0.031)**	(0.195)**
Graduate			1.451	10.809	1.071	5.813
			(0.030)**	(0.561)**	(0.032)**	(0.314)**
R-squared	0.14	0.13	0.17	0.16	0.21	0.20

Table A1: K11 in TEPS (N=11455)

	(1) IRT score	(2) Log CSI	(3) IRT score	(4) Log CSI	(5) IRT score	(6) Log CSI
Monthly Family Income						
<10k	---	---			---	---
20-50k	0.268	1.493			0.198	1.326
	(0.071)**	(0.170)**			(0.071)**	(0.150)*
50-100k	0.619	2.675			0.425	1.928
	(0.107)**	(0.450)**			(0.096)**	(0.292)**
100-150k	0.957	4.792			0.596	2.594
	(0.130)**	(0.997)**			(0.106)**	(0.434)**
150-200k	1.014	5.393			0.627	2.781
	(0.162)**	(1.370)**			(0.151)**	(0.649)**
>=200k	0.933	4.777			0.579	2.611
	(0.145)**	(1.196)**			(0.116)**	(0.514)**
Parental Education						
Less than High School			---	---	---	---
High School			0.282	1.595	0.200	1.400
			(0.045)**	(0.120)**	(0.043)**	(0.100)**
Junior College			0.582	2.636	0.424	2.044
			(0.083)**	(0.352)**	(0.060)**	(0.204)**
University			0.939	4.806	0.713	3.321
			(0.104)**	(0.846)**	(0.076)**	(0.441)**
Graduate			1.246	8.645	0.945	5.253
			(0.124)**	(1.833)**	(0.093)**	(0.858)**
R-squared	0.08	0.09	0.10	0.12	0.12	0.08

Table A2: K12 in TEPS (N=11441)

	(1) IRT score	(2) Log CSI	(3) IRT score	(4) Log CSI	(5) IRT score	(6) Log CSI
Monthly Family Income						
<10k	---	---			---	---
20-50k	0.241	1.501			0.177	1.348
	(0.060)**	(0.146)**			(0.060)**	(0.132)**
50-100k	0.545	2.484			0.375	1.872
	(0.090)**	(0.366)**			(0.082)**	(0.254)**
100-150k	0.831	3.961			0.517	2.351
	(0.110)**	(0.716)**			(0.093)**	(0.361)**
150-200k	0.923	4.685			0.583	2.659
	(0.123)**	(0.933)**			(0.107)**	(0.464)**
>=200k	0.779	3.715			0.463	2.193
	(0.137)**	(0.819)**			(0.117)**	(0.411)**
Parental Education						
Less than High School			---	---	---	---
High School			0.273	1.586	0.201	1.407
			(0.043)**	(0.109)**	(0.044)**	(0.101)**
Junior College			0.494	2.251	0.355	1.788
			(0.071)**	(0.258)**	(0.056)**	(0.164)**
University			0.813	3.845	0.617	2.778
			(0.098)**	(0.625)**	(0.077)**	(0.358)**
Graduate			1.136	6.771	0.874	4.386
			(0.116)**	(1.320)**	(0.097)**	(0.724)**
R-squared	0.06	0.06	0.07	0.07	0.09	0.09

Table A3: K10 in NELS (N=14801)

	(1) IRT score	(2) Log CSI	(3) IRT score	(4) Log CSI	(5) IRT score	(6) Log CSI
Annual Family Income						
<10k	---	---			---	---
10-20k	0.363	1.786			0.315	1.655
	(0.038)**	(0.112)**			(0.038)**	(0.103)**
20-35k	0.601	2.580			0.459	2.055
	(0.037)**	(0.160)**			(0.039)**	(0.132)**
35-50k	0.833	3.805			0.584	2.547
	(0.038)**	(0.239)**			(0.041)**	(0.169)**
50-75k	0.961	4.603			0.584	2.497
	(0.045)**	(0.360)**			(0.048)**	(0.203)**
>=75k	1.351	9.092			0.811	3.770
	(0.052)**	(0.915)**			(0.055)**	(0.379)**
Parental Education						
Less than High School			---	---	---	---
High School			0.323	1.667	0.175	1.555
			(0.036)**	(0.100)**	(0.036)**	(0.070)**
Junior College			0.576	2.476	0.381	1.998
			(0.033)**	(0.135)**	(0.033)**	(0.087)**
University			1.056	5.443	0.746	3.664
			(0.038)**	(0.338)**	(0.041)**	(0.195)**
Graduate			1.330	8.629	0.956	5.813
			(0.051)**	(0.809)**	(0.052)**	(0.314)**
R-squared	0.13	0.12	0.16	0.15	0.19	0.18

Table A4: K12 in NELS (N=12321)

	(1) IRT score	(2) Log CSI	(3) IRT score	(4) Log CSI	(5) IRT score	(6) Log CSI
Annual Family Income						
<10k	---	---			---	---
10-20k	0.306	1.625			0.250	1.485
	(0.038)**	(0.102)**			(0.038)**	(0.092)**
20-35k	0.577	2.523			0.417	1.952
	(0.035)**	(0.147)**			(0.037)**	(0.116)**
35-50k	0.784	3.618			0.510	2.318
	(0.038)**	(0.225)**			(0.039)**	(0.145)**
50-75k	0.913	4.348			0.485	2.158
	(0.050)**	(0.368)**			(0.049)**	(0.178)**
>=75k	1.293	8.396			0.718	3.261
	(0.052)**	(0.739)**			(0.055)**	(0.299)**
Parental Education						
Less than High School			---	---	---	---
High School			0.321	1.668	0.191	1.350
			(0.036)**	(0.100)**	(0.036)**	(0.083)**
Junior College			0.581	2.528	0.401	1.885
			(0.033)**	(0.140)**	(0.034)**	(0.106)**
University			1.052	5.484	0.778	3.508
			(0.039)**	(0.356)**	(0.041)**	(0.244)**
Graduate			1.336	8.954	1.010	5.250
			(0.052)**	(0.806)**	(0.053)**	(0.479)**
R-squared	0.12	0.12	0.17	0.16	0.19	0.19

Figure 1A. Marginal distribution of family income

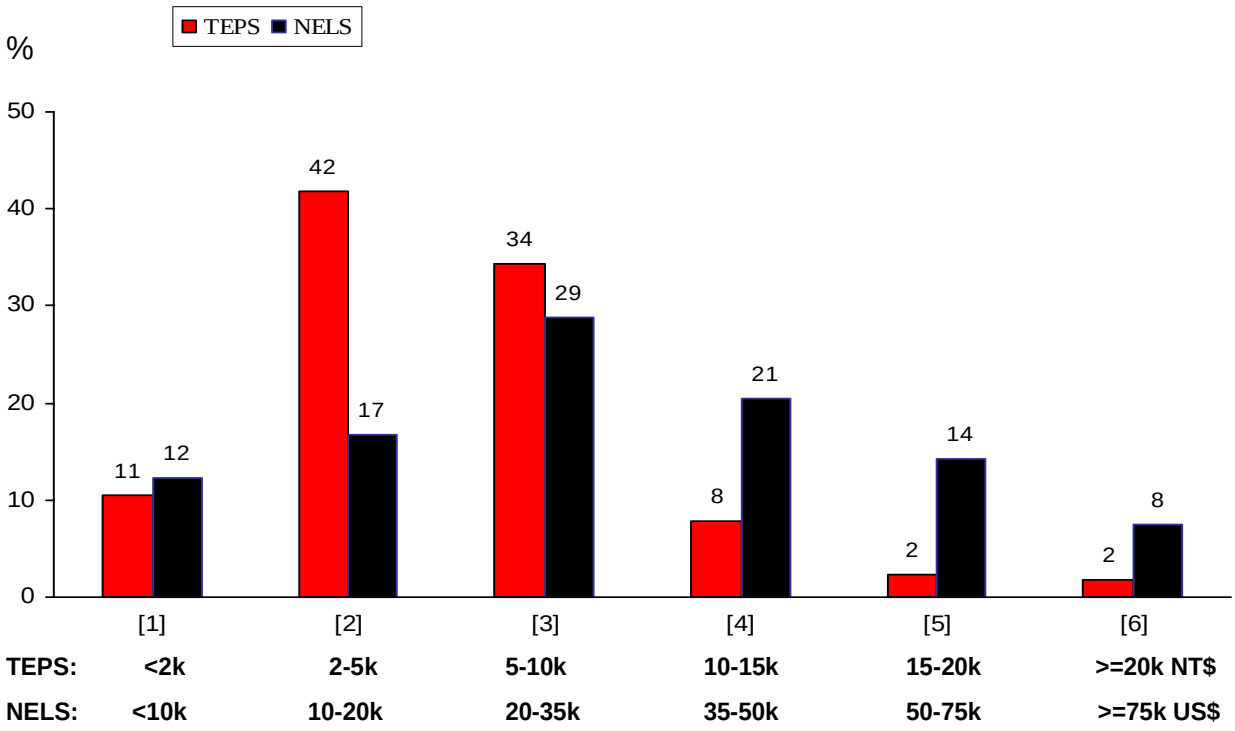

Figure 1B. Marginal distribution of parental education

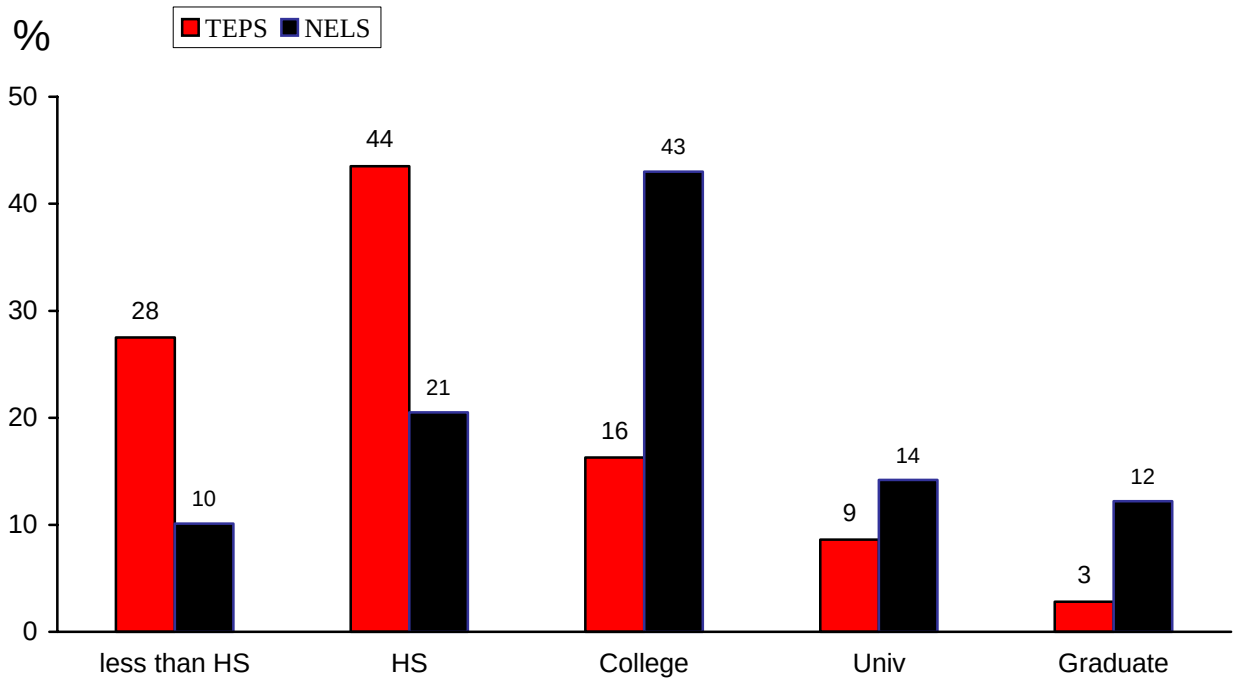

Figure 2. Family Income, Parental Education & Cognitive Achievement: K7
(TEPS 2001, N=12503) % effect on CSI

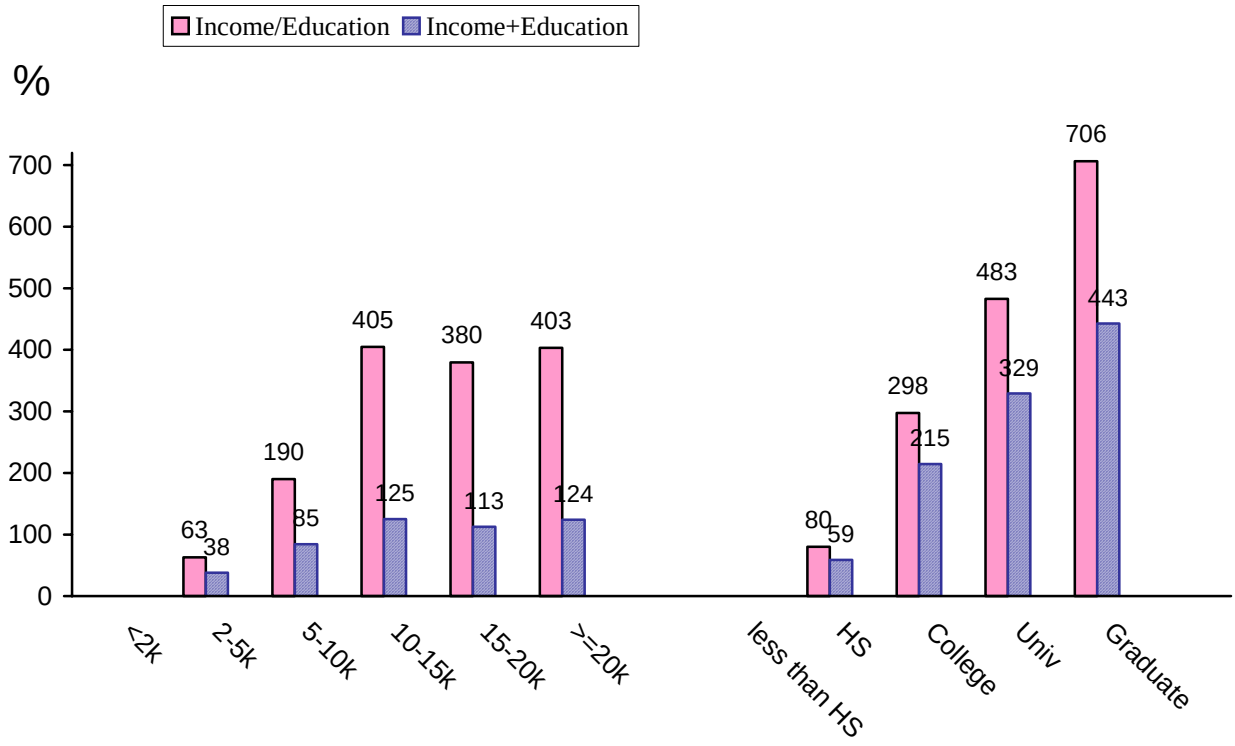

Figure 3A. Net Family Income Effect:
K7, K11,& K12
(TEPS 2001 & 2002) % effect on CSI

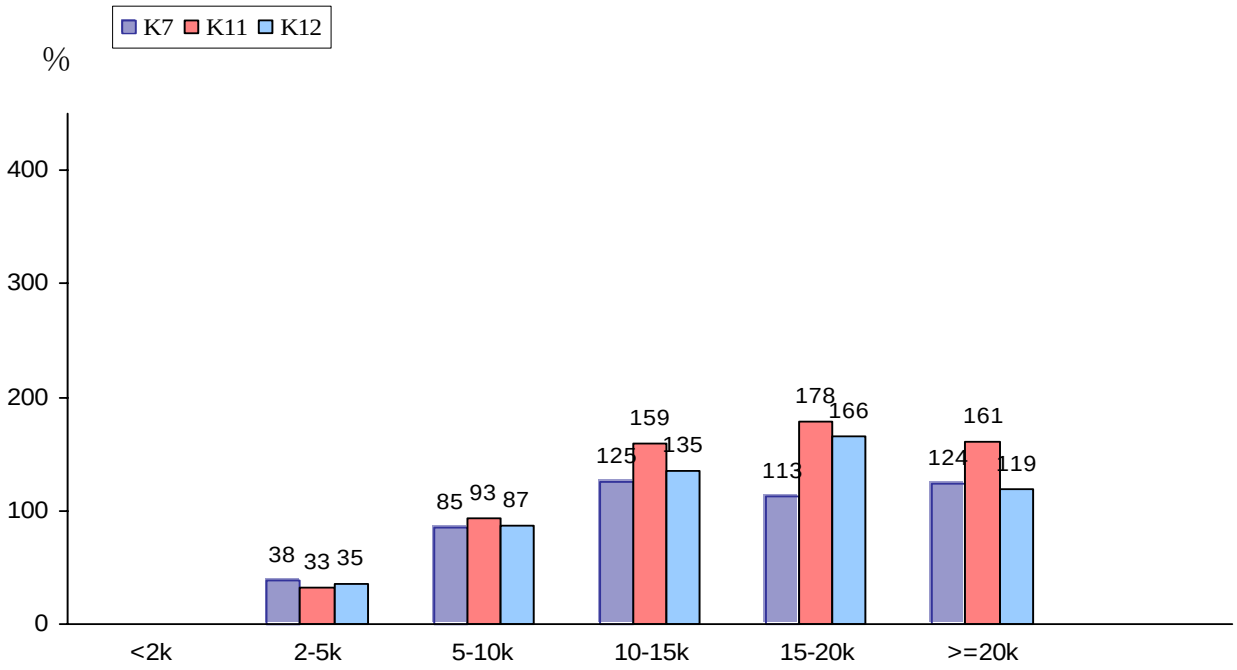

Figure 3B. Net Parental Education Effect:
K7, K11,& K12
(TEPS 2001 & 2002) % effect on CSI

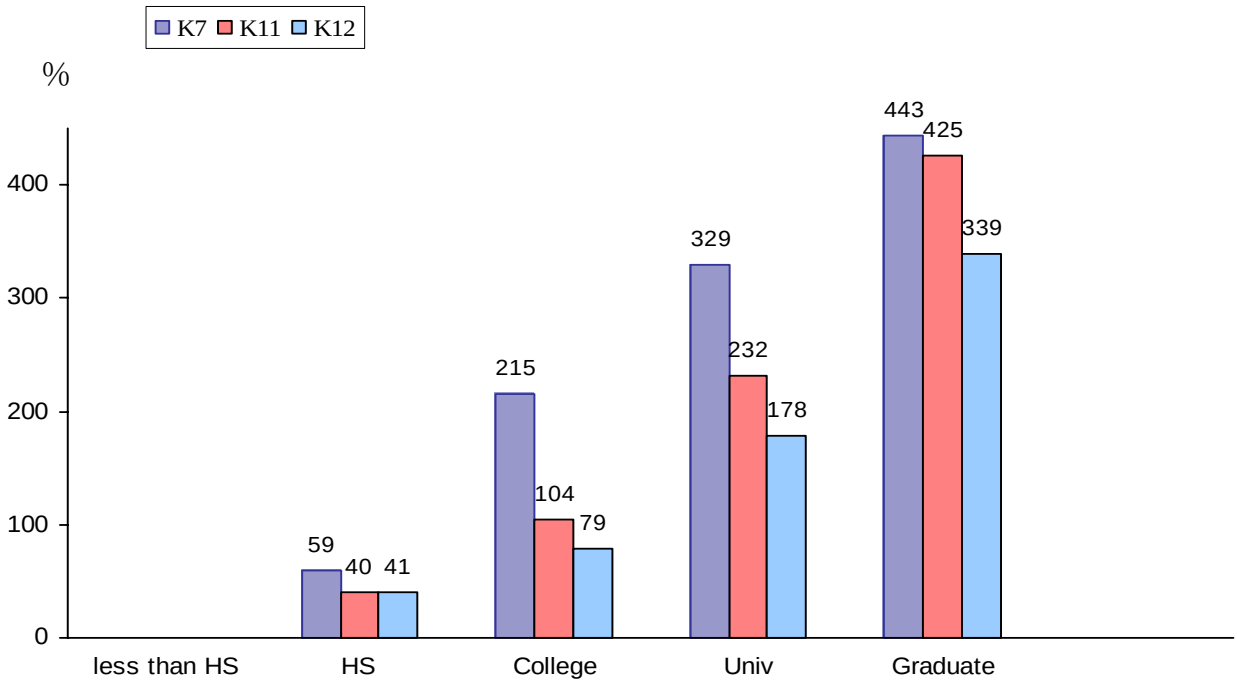

Figure 4A. Net Family Income Effect:
K8, K10 & K12
(NELS 1988, 1990 & 1992) % effect on CSI

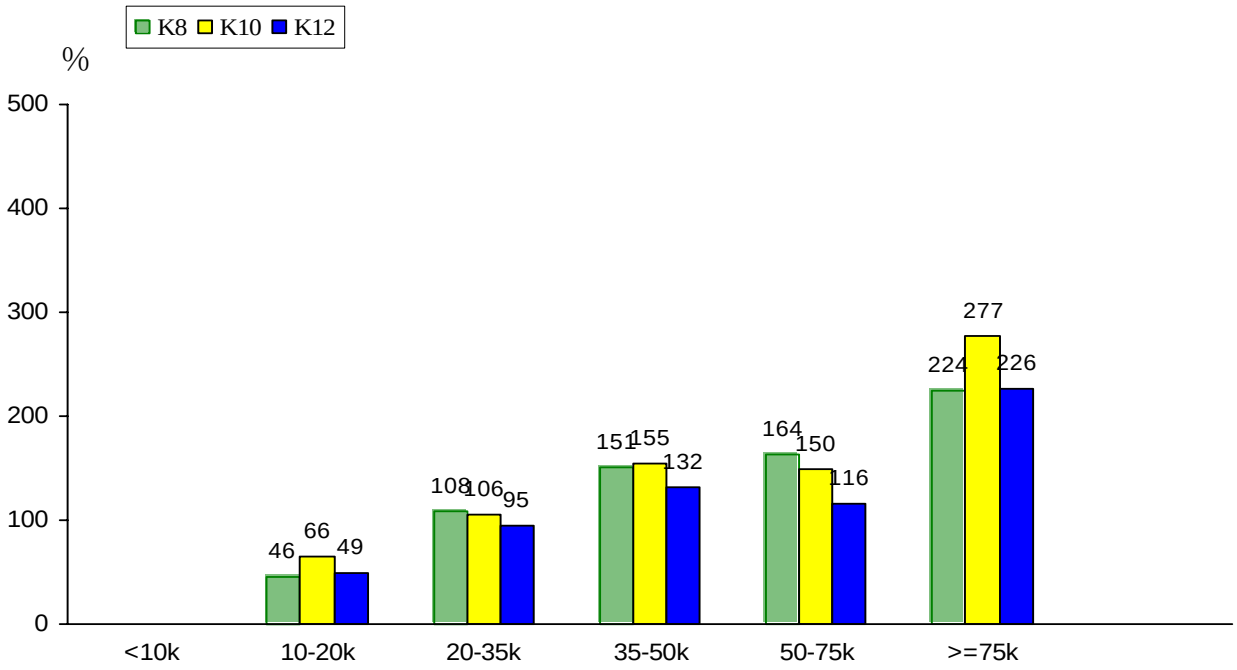

Figure 4B. Net Parental Education Effect:
K8, K10 & K12
(NELS 1988, 1990 & 1992) % effect on CSI

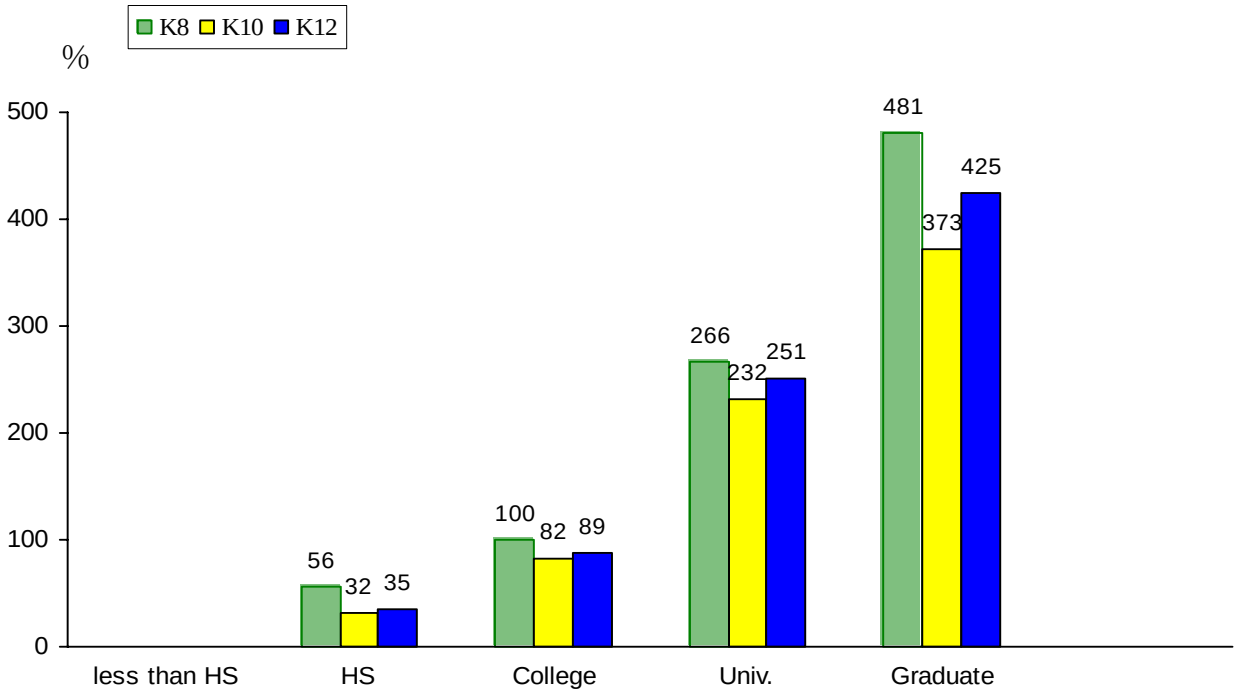

Figure 5. Net Family Income & Net Parental Education Effects: % effect on CSI

K7(TEPS 2001) vs K8(NELS 1988)

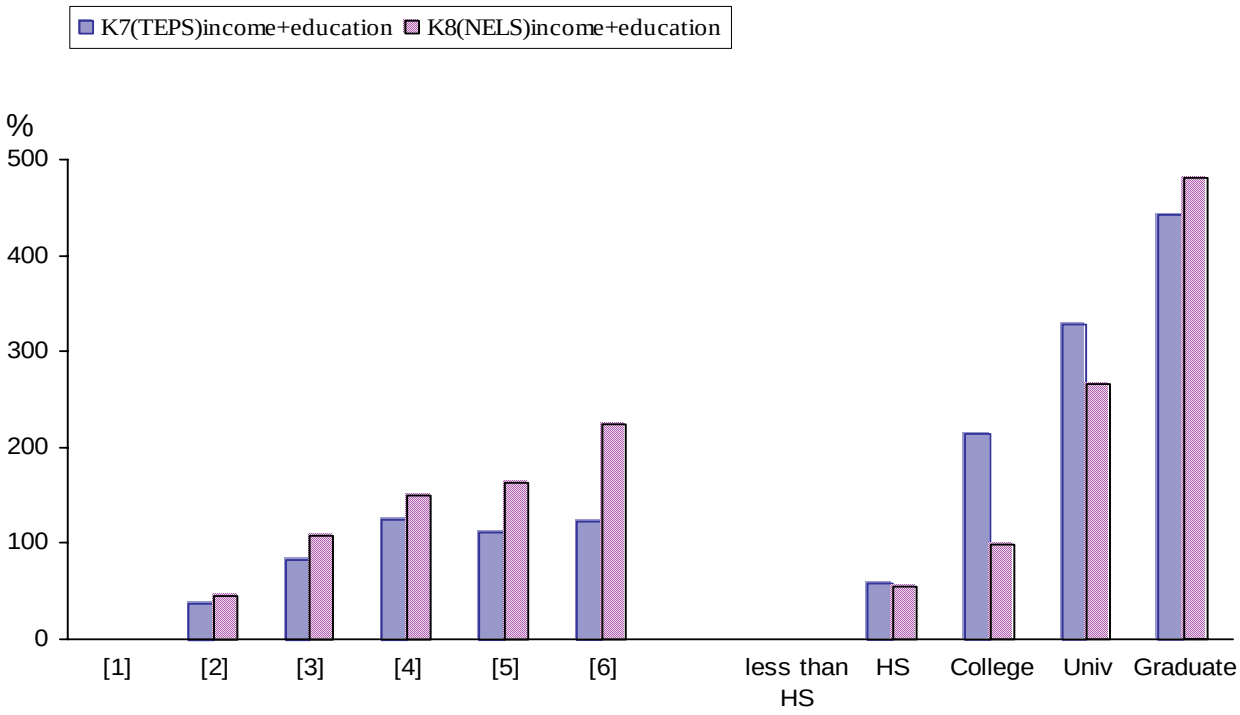

Figure A1. Family Income: K7

(TEPS 2001, N=12503) % effect on CSI

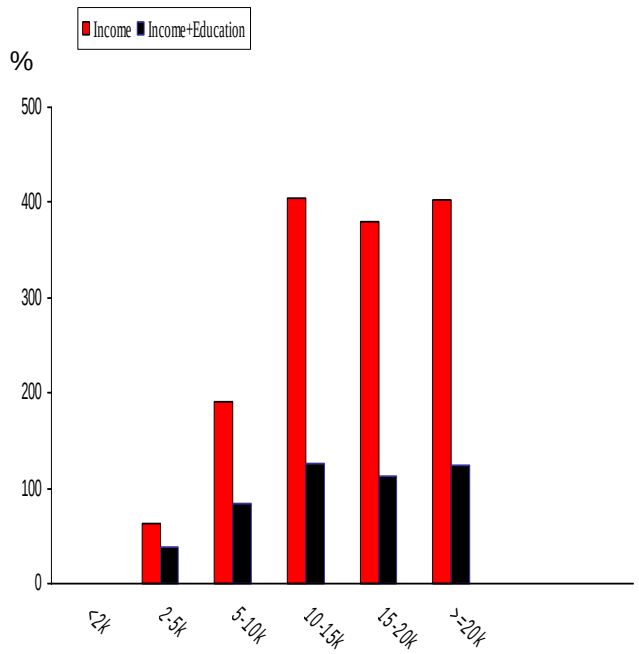

Figure A1. Family Income: K7

(TEPS 2001, N=12503) IRT score

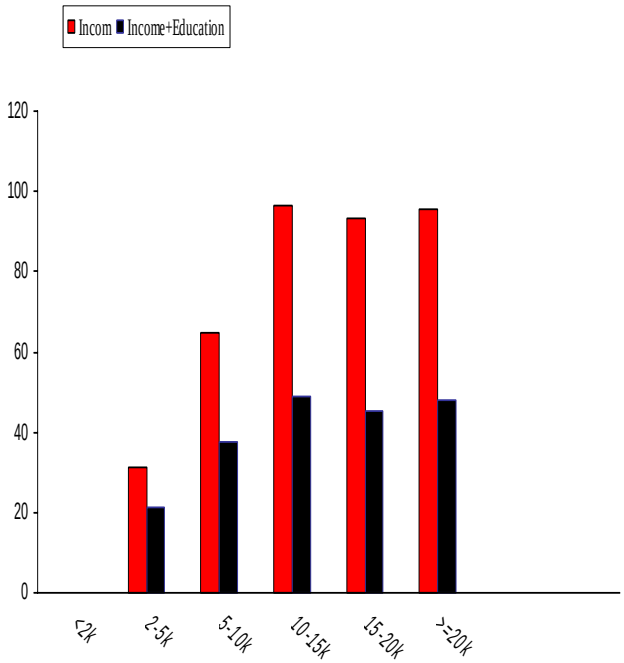

Figure A2. Parental Education : K7

(TEPS 2001, N=12503) % effect on CSI

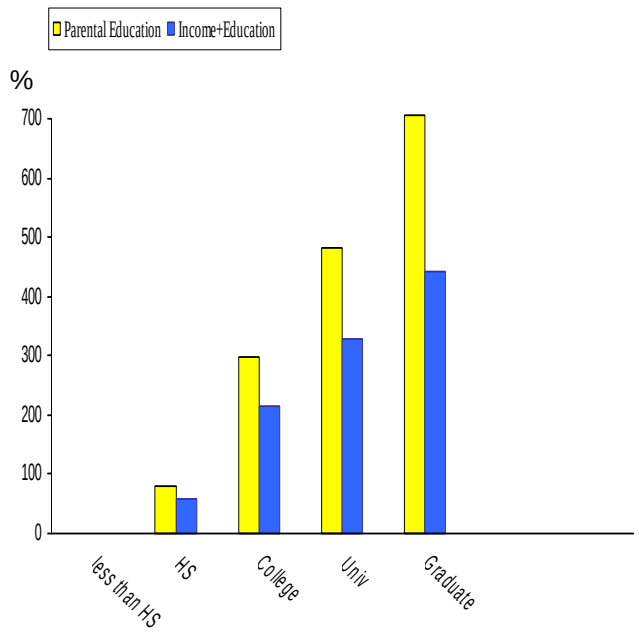

Figure A2. Parental Education:K7

(TEPS 2001, N=12503) IRT score