Returns to Education in Taiwan:

A Cross-Sectional and Cohort Analysis

Jessica L. Baraka
Research Program in Development Studies
Princeton University

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ABSTRACT

The last two decades have seen a rapid increase in the average educational attainment of the population of Taiwan. This paper examines the effects of that educational expansion on Taiwan's wage structure. I examine not only changes in the cross-sectional return to education, but the experiences of synthetic birth cohorts. I find that in younger cohorts, those with university degrees have seen a decline in their earnings premium. I then look to see whether this decline can be explained by the increase in supply of better-educated workers, rather than by a combination of supply and demand factors. I conclude that under certain reasonable assumptions, changes in the earnings structure in Taiwan may be attributed to changes in the relative size of education-level groups.

PART I: INTRODUCTION

Taiwan, Republic of China, has seen explosive growth in the educational attainments of its people since World War II. Prior to the 1950's, education was the exception, not the norm, for Taiwanese children, and education beyond primary level was virtually unknown. Today, nearly all Taiwanese children complete the mandatory nine years of schooling, and 90% of these continue to some form of high school (Taiwan Government Information Office 1997). From 1979 to 1995, the percentage of the population who were high school or middle school graduates increased substantially. The percentage of the population who attended at least junior college doubled from 10% to 20%. Concurrently, the proportion of persons with only a primary level education or less dropped sharply (see Figures 1 and 2, and Tables 1 and 2).

This increase in the overall stock of education in Taiwan reflects an even more rapid increase in enrollments. Over the past several years, enrollment in post-secondary education in Taiwan has increased especially quickly. Starting in 1987, total enrollment in baccalaureate and graduate programs increased steadily from around 210 thousand, to over 380 thousand in 1996. This represented an increase from around 15% of the 18-21-year-old population enrolled in post-secondary education in 1987, to over 26% in 1995 (Ministry of Education 1996). In comparison, the percentage of the U.S. population aged 25-29 who have completed at least four years of college was around 15% in 1966, but did not reach 26% for another 29 years (U.S. Bureau of the Census 1988). While the statistics are not directly comparable, they indicate that the increase in educational attainments in Taiwan was quite rapid, in comparison to the U.S. Any increase of this magnitude in the educational attainment of the work force is likely to have measurable effects on the labor market.

The goal of this paper is to examine the return to education in Taiwan, and attempt to determine the effects on this return of the influx of university-educated workers. Because of the size of this influx, one hypothesis is that the premium accruing to a university education should fall during the time period in question, due to the rapid increase in supply (assuming stable, or less-rapidly-increasing demand – see Part II for details). An alternative hypothesis, put forward by Becker et. al., is that the return to education should rise as the stock of education rises, because the education-producing sectors (i.e., schools) are relatively intensive users of educated labor (Becker, Murphy et al. 1993).[1] To examine this question, I will look not only at the cross-sectional return to education over time, but also at the experiences of "synthetic cohorts."

Taiwan has collected cross-sectional labor force survey data annually since 1979. The existence of so many years of cross-sectional data (see Part III for data description) provides the opportunity to examine synthetic cohorts over time. In addition to the cross-sectional and synthetic cohort analyses, I create and analyze different measures of the relative supply of educated workers and their relative earnings. I use these measures to test for the existence and magnitude of shifts in the demand for educated labor in Taiwan (Freeman 1986; Katz and Murphy 1992; Johnson 1997). Almost no work of a similar nature has been done in Taiwan, and

[1] Becker et. al.'s claim is that returns to education should rise *over some range* of stocks of education. After some point, returns to education will begin to decrease. Where this point of decrease may be is left unclear.

none has combined all of these methodologies into a comprehensive view of the wage-education pattern in that country (Gindling, Goldfarb et al. 1995).

There is a large literature in the United States on the effects of cohort size on earnings (Welch 1979; Berger 1985; Freeman 1986; Murphy, Plant et al. 1988; Murphy and Welch 1989). Much of the literature on cohort size in the U.S. has focused on the effect of the large baby-boom cohort on their own and other cohorts' earnings, both as they entered the labor market, and over time. In his influential 1979 paper, Finis Welch concluded that the entry of the post-World-War II baby boomers into the labor market had depressed the entry-level wages of this large cohort, but the effects were most noticeable in the early phases of the career, and wore off over time (Welch 1979). Mark Berger challenged this view in 1985, arguing that the large baby boom cohort was experiencing depressed earnings throughout its career, and that the "wearing off" that Welch had found, was an artifact of his structural model (Berger 1985). However, the apparent fact that the small "baby bust" cohort experienced depressed relative wages casts doubt on the idea that wages must be inversely related to cohort size.[2] In this paper I draw from the U.S. literature on cohort size to assess the effects *not* of a large birth cohort entering the labor force in Taiwan, but of a large "birth/education" cohort entering the market. The question of the effect of cohort size on earnings will have to be addressed empirically in Taiwan.

[2] Of course, there may be other powerful forces at work, such as international trade fluctuations, changes in minimum wage laws, et cetera.

In this paper, I find little evidence of wage compression (or expansion) between more- and less-well-educated workers in the cross-section over time. However, the conclusions I draw change when I look at the experiences of synthetic cohorts. I find that in younger cohorts, where the relative supply of well-educated persons has increased, the return to education has declined steadily since the mid-1980's. My supply and demand analysis suggests that the cross-sectional result may be attributable to supply shifts. Under plausible assumptions about the elasticity of substitution between well-educated and less-educated labor, the shift outward in the relative supply of well-educated persons in later years explains the observed drop in their earnings premium, compared to well-educated persons in earlier years.

In Part II, I describe the theoretical framework for this paper. In Part III, I discuss the data that I will use for this analysis. Part IV begins the analysis of the cross-sectional return to education in Taiwan. Part V extends this analysis to synthetic cohorts. In part VI, I look at changes in relative supply and relative earnings for various age-education cohorts, and discuss what the elasticity of substitution between different types of labor has to say about the relative roles of supply and demand in determining market wages in Taiwan. Part VII provides a summary and conclusions.

PART II: THEORETICAL FRAMEWORK

The standard Mincerian Returns to Education equation has been discussed extensively in the literature (Mincer 1974; Card 1995). One thing the standard Mincer model ignores is the aggregate effects of individuals' schooling choices. An individual's wage (or earnings) may be dependent not only on the individual's own schooling level, but also on the average level of education in society. Put another way, the market wage for a given education level may well be affected by the (relative) number of people who hold that education level. Any one person may not have the power to affect market wages, but large changes in the stock of education in the economy will affect the wage structure.

In this paper I make use of a simple supply and demand framework. I make the assumption that the size of a birth cohort is exogenous. While this may be questionable over the long-run, in the short-run, the size of the cohort becoming working-age is clearly pre-determined. In addition, for much of the paper, I make the assumption that the number of persons receiving a university education is also exogenous. If this is true, and relative demand is fixed, than an increase in the relative supply of university-educated labor should decrease that group's relative wage. A finding that relative wages were not changing in the face of relative supply changes would imply concomitant demand shifts.

The assumption that the number of university graduates in a given year is exogenous deserves further discussion. If the return to a university education is high, then rational decision-makers in a free market for education should choose to pursue higher education until the university premium is bid down to a level which makes the marginal student indifferent toward pursuing advanced schooling. However, Taiwan's government over the past several decades has purposely restricted enrollment in university programs. Beginning in the 1960's, Taiwan has published multi-year Manpower Development Plans (MDP's) which include specific targets for university enrollment. For instance, the fourth MDP, published in 1972, limited the growth in university enrollment to a maximum of 5%, while the fifth MDP, in 1977, reduced that number to 3%. Unlike many such plans, the MDP's were implemented with a great deal of success, and the growth in enrollment at the university level dropped from around 9% during the 1970-71 school year, to only 3% by 1975-76 (Woo 1991). Fiscal reforms in 1987 led to a shift in this policy (Huang 1997). As Figure 1 shows, university enrollment growth began a noticeable increase in that year. Concurrently, the size of the 18-year-old population in Taiwan actually declined. Hence, a much higher proportion of persons attended college in birth cohorts that reached age 18 after 1987.

Even in these years, however, evidence from the number of disappointed applicants for university slots indicates that the supply of university places, rather than demand considerations, limited the number of university degrees received. To obtain a university education in Taiwan, students must pass the Joint University Entrance Examination (JUEE). This national examination is offered once every year, and tests students in a variety of subjects. Of the over 100,000 students taking the exam each year, only about half pass (Epstein and Kuo 1991). The large and increasing number of students sitting the entrance examination shows that both the decrease in enrollment growth during the 1970's and the subsequent slow increase in enrollment growth after 1987 reflect a supply constraint on the number of university slots. There are very real barriers to entry for students who wish to pursue tertiary education in Taiwan. We can view students in Taiwan as queuing for strictly limited university slots, and the government choosing, years in advance, how many slots to provide.

Returning to the structure of the problem, suppose that we have an aggregate production function with J different types of labor inputs. Our associated factor demands are:

(1) $$L_t = D(W_t, Z_t)$$

where L_t is a Jx1 vector of labor inputs in year t, W_t is the associated Jx1 vector of market prices, and Z_t is a vector of demand shift variables, reflecting such things as product demand and technology effects. Rewriting the above equation in differential form, we get:

(2) $$dL_t = D_w dW_t + D_z dZ_t$$

If we assume that the aggregate production function is concave, then D_w is negative semi-definite, and we have:

$$dW_t'(dL_t - D_z dZ_t) = dW_t' D_w dW_t \leq 0,$$

(3) *or*, assuming stable demand,

$$(dW_t)'(dL_t) \leq 0.$$

This inequality gives us our desired result. In the absence of demand shifts, changes in factor supply and changes in wages must negatively covary. This simple framework, which is essentially the same as that in Katz and Murphy (1992), allows us to test the (somewhat extreme) hypothesis that it is solely changes in supply factors, here the number of persons obtaining a university degree, which drive changes in the wage structure.

In this framework, the extent to which relative supplies of workers affect their relative earnings depends on the substitutability of different types of labor (these cross-price elasticities are embedded in the D matrix, above). We define two types of labor, types 0 and 1, which may be thought of as middle school and university labor, and call the elasticity of substitution between these two types of labor σ. Then we have:

(4)
$$s_t = \frac{d\ln\left(L_{1t} / L_{0t} \right)}{d\ln\left(w_{1t} / w_{0t} \right)}$$

where L_{it} represents the size of education group i at time t, and w_{it} represents the wage or earnings of group i at time t. Assuming that σ is constant over time, and substituting the change between times t and t-1 for the differential, we get:

(5)
$$\ln\left(\frac{w_{1t}}{w_{0t}}\right) - \ln\left(\frac{w_{1t-1}}{w_{0t-1}}\right) = \frac{1}{s}\left(\ln\frac{L_{1t}}{L_{0t}} - \ln\frac{L_{1t-1}}{L_{0t-1}}\right)$$

Note that this is essentially the last inequality from (3) above, rewritten to include the factor of 1/σ. If we know the value of σ, we can use the above equation to estimate the size of the expected change in wages given the observed changes in the size of the educated versus non-educated labor pool. A comparison of the expected and actual changes will give an indication of how much of the observed change in the earnings structure can be attributed to changes in the educational stocks of the population.

How do we interpret deviations from the expected wage change? By assuming that the economy is always on the demand curve for labor, we can interpret these deviations as demand shifts that favor one type of labor over another. However, it is important to note that the "causal" interpretation of changes in the relative supply of different groups of labor rests heavily on the assumption that education-cohort size is exogenous. To the extent that this is not true, these results must be viewed with caution. A more thorough treatment of this topic would include a model of the education market, where students vie for limited positions in higher education.

PART III: DATA AND DEFINITION OF VARIABLES

The primary source of data for this paper is the 1979-1995 annual Taiwan Manpower Utilization Surveys (TMUS). The TMUS is a household survey covering the non-institutionalized population of Taiwan. It includes approximately 17 thousand households and 55 thousand individuals each year.[3] The households were sampled following a two-stage randomization procedure. First approximately 400 townships were selected from the over 7000 townships in Taiwan. Then households were randomly selected within these townships. The analyses in this paper account for this clustering effect in calculating standard errors.

In these data, education is measured as a series of levels, from no education through university level. For some parts of the analysis, I convert these education levels to a quasi-linear years-of-education variable (see Appendix B for the mapping scheme). Only in years 1988 and later is graduate school indicated separately from undergraduate, and only in 1995 are Ph.D.'s indicated separately.[4] The income variable is average monthly earnings in the primary job in New Taiwan Dollars. I use this variable (or its natural log) as my earnings measure. To adjust for topcoding in this earnings variable (which affects approximately 0.04% of the sample), I assume that earnings are log-normally distributed, then replace the topcoded values with the estimated mean of the censored part of the distribution,

[3] The (unweighted) number of households ranges from 14,117 in 1979 to 19,736 in 1995. The (unweighted) number of individuals ranges from in 49,683 1979 to 61,091 in 1995.

estimated separately in each year. This adjustment does not make a noticeable difference to the analysis.

For the purposes of this analysis, I use two main subsamples of the data. In order to estimate the size of the working-age population, and relative sizes of education groups, I create a "Count" sample, which includes everyone in the data ages 20-64. Another sample, which I will refer to as my "Active" sample, includes only those persons ages 25-54 who listed their major activity of the past week as either working, or not working due to vacation or temporary illness. I limit the age-range for this sample in order to avoid retirement and end-of-schooling issues. Further, the Active sample includes only *employees*, that is, it excludes self-employed workers, employers, and "free" family labor. It further excludes those persons who report that they worked fewer than 40 hours the previous week because of housework or homework. The purpose of these exclusions is to create a sample of persons with a strong attachment to the labor force.

For measurements that involve cohorts, I break my data into 5-year birth cohorts, starting with those born in 1920-24 and ending with those born in 1965-69.

In addition to the TMUS data, I used GDP and CPI data from DataStream International, and the 1996 Statistical Yearbook for the Republic of China, as well

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[4] Data on the number of graduate degrees granted by year indicate that this number is very small in relation to the number of Bachelor's Degrees awarded. Hence, the measurement error induced by

as supplementary enrollment data from Taiwan's Ministry of Education (DataStream International; Taiwan Government Information Office 1997). All earning figures are adjusted to reflect real 1991 Taiwan Dollars.[5]

PART IV: WHAT IS THE RETURN TO EDUCATION IN TAIWAN?

Economists have been estimating cross-sectional returns-to-education equations for decades. The simplest such models posit that education affects log earnings linearly through years of schooling. In order to make use of the information on schooling levels provided in the data, I expand this simple model to allow for different effects by education level. In other words, in each year for which I have data, I estimate the equation:

$$(6) \qquad \ln y_{it} = a_t + \sum_j b_{jt} E_{ijt} + \sum_k g_{kt} X_{ikt} + e_{it}, \quad t = 1979,...,1995$$

where y_{it} represents earnings of individual i in year t, the E_{jt} represent a series of eight education-level dummy variables (assumed to be fixed in time once a person leaves school for the labor force), and the X_{it} are a series of (possibly time-varying) individual-level covariates. The excluded education category for these regressions is middle school, and covariates include dummy variables for female and for married; a married and female interaction term; and linear terms for age and age squared. I model the error term in each year as being composed of a cluster-specific term (see data description above), and an individual, spherical error term. I

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grouping graduate and undergraduate degrees together is likely to be small.

[5] The Taiwanese currency is the New Taiwan Dollar (NT$). As of November 1997, there were approximately 32 NT$ per US$.

estimate these equations for my Active sample using ordinary least squares. Figure 3 plots the coefficients on the education-level indicator variables from these regressions (the complete regression results are in Appendix A: Table 1).

The figure shows that the return to various levels of education has not changed very much over the 17-year period of the sample; the most pronounced trend in these coefficients is the lack of a trend. For levels of education below middle school, F-tests fail to reject the hypothesis that the educational coefficients are the same for all seventeen years of data.[6] Returns to the highest levels of education (university and junior college) show a slight increase during the late eighties, but end the period much where they began.[7]

What do these findings tell us about Becker et al's assumption? Their claim is that the return to education is increasing in stocks of education, over some "range" of educational stocks in the population. To see if the Becker hypothesis is even relevant, we need to know whether the educational stocks in Taiwan in the period in question fall into a reasonable "range." As shown in the first two tables of this paper, stocks of education have increased significantly over the seventeen-year period in question. At the start of the period, most of the Taiwanese population had only primary schooling or less. By the end of the period, most of the population

[6] P-values for the F-tests of the hypothesis that the coefficients are equal in all years are: for no schooling, $p>.05$; for self-taught, $p>.16$; and for primary schooling, $p>.49$.
[7] We cannot reject the hypothesis, for example, that the return to university education was the same in 1995 as it was in 1982 ($p>.20$).

had completed high school or more. Because of the magnitude of the shift, we expect that Taiwan falls into the relevant range for the Becker hypothesis at some point during the period in question. If returns to education increase in stocks of education over some range, we should see this reflected in these data, even if Taiwan is now outside of that range. However, the measured return to education appears quite stable in Taiwan over this time period. These findings cast doubt on Becker's hypothesis.

Splitting apart the sample by sex, we see a slightly different pattern. Figures 3a and 3b show the coefficients on education-level indicator variables from regressions run separately for females and males, respectively (see Appendix A: Tables 2 and 3 for complete regression results). Comparing the results for the two sexes, we see that the range in returns to different education levels is wider for females. Women in Taiwan are rewarded less well for schooling at low levels of education and better at high levels of education than are men. In addition, while the stability in the measured return to education for women mirrors the stability in the overall return (compare Figures 3 and 3a), the pattern for men shows a decline in the return to higher education for later years (Figure 3b). Comparing only the endpoints of the sample period, men with university degrees see a decline in their earnings premium from 36% to 29% above middle school graduates.[8]

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[8] In estimating this equation by ordinary least squares, I have focused on the mean of the earnings distribution, and may be ignoring important effects in other parts of the distribution. To examine whether other parts of the distribution are experiencing different trends, I estimate my return to

PART V: RETURN TO EDUCATION BY COHORT

Is the cross-sectional return hiding something? The above regressions show very little change over time in the return to education, even though we know that stocks of education have been changing rapidly. However, the above work implicitly assumes that the return to education is the same across cohorts. If workers of different ages are not perfect substitutes for each other, a large group of well-educated workers in one cohort may depress the wages of the better-educated members of their own cohort, but leave the wages of other cohorts unaffected. In fact, it is this very type of effect that the baby boom literature in the U.S. examines. If we want to say something about the actual lifetime experiences of different cohorts (of different sizes and different average educational attainments), we need to measure the return to education separately for these cohorts.

The existence of so many years of (consistently collected) survey data allows me to examine life experiences by creating synthetic cohorts. To this end, I identify each person in each year of the data as a member of a 5-year birth cohort, and estimate annual returns-to-education for these cohorts. To abstract from certain selection

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education equation using quantile regressions for each of the nine deciles. I estimate the equations both separately by sex, and jointly. The estimates follow similar trends over time, though the return to years of schooling for those in the top decile declines somewhat more than for those in the bottom decile. However, quantile regression estimates are quite similar to the OLS estimates, and do not provide much evidence that OLS is missing important trends in different parts of the earnings distribution.

issues, I estimate returns in any given year only for those cohorts where all ages of the cohort are present in the data. That is, my oldest cohort is the birth cohort of 1925-29. I calculate returns to education including this cohort only in the year 1979, when all of its members are within the age limits (25-54 years) set in my Active sample.

I estimate the following equation separately for each synthetic birth cohort in my data:

$$(7) \qquad \ln y_{ibt} = a_b + \sum_j b_{bj} E_{ij} + \sum_k g_{bk} X_{ibkt} + e_{ibt}, \quad \text{b} = 1,\ldots,\text{B}$$

where y_{ibt} is the usual real monthly earnings of person i in birth cohort b, and other covariates include age, age-squared, and indicator variables for married, female, and the interaction between the two. While these equations do not include a time trend, they do include an age term, which will capture the effects of time passing. Note that each regression includes observations which represent persons belonging to the same birth cohort, but which come from different calendar years of the TMUS survey. Figure 4 plots the coefficients on the education-level indicator variables in these regressions (see Appendix C for full regression results). In the figure, each line represents the return to a specific education level, with middle school being the omitted level.

Figure 4 seems to tell a different story from the cross-sectional analysis. For education levels above middle school, we see a decline in the estimated return to education, starting with the birth cohort of the early 1940's, and continuing with younger cohorts. Table 7 shows p-values from F-tests for pairwise equality of the coefficients on university education across cohorts. We see a clear pattern rejecting the hypothesis of pairwise equality. Similar results hold for tests on the pairwise equality of the coefficients on junior college and on academic and vocational high school. Younger cohorts are receiving a significantly lower premium for these higher education levels than are their counterparts from earlier birth years. These are the very cohorts for whom we have seen the large increases in average educational attainments (see again Table 2). Hence, the answer to the question posed at the beginning of the section appears to be "yes." The cross-sectional returns are hiding what appears to be an important variation across cohorts. Younger cohorts are gaining additional years of education much more rapidly than the overall "stock" of education in the Taiwanese economy is increasing, and in these younger cohorts we see a large decline in the return to higher education.

Breaking apart our cohorts by sex, we can re-estimate the above equation, omitting the variables for female and the married/female interaction. When we do so, we find a pattern similar to the one above: that of declining returns for younger cohorts. This result holds true for both men and women. See Figure 4b to compare the coefficient on the university-level education dummy for males and females.

How do we reconcile the apparent inconsistencies between the cross-sectional and synthetic cohort results? Ideally, we would estimate an equation for each birth cohort, which includes education levels, age, the year of observation, and other covariates. However, the fact that year, age, and birth cohort are collinear prevents this most general formulation. To address this question I estimate a less restricted[9] version of the previous equation. I start by stacking all of my data for different cohorts and years. I then create interaction terms between birth cohorts and education levels, and estimate the following equation:

$$\begin{aligned} \ln y_{it} &= a + \sum_t b_t YEAR_t + \sum_j g_j Cohort_j \\ &+ \sum_k q_k E_{ik} + \sum_k \sum_j (Cohort_{ij})(E_{ik}) + \sum_l l_l X_{itl} \end{aligned} \tag{8}$$

The coefficients on the interaction terms between birth cohort and university-level education are listed in Table 3. Clearly, the effects of obtaining a university education decline dramatically for younger cohorts, as found above. The main effects for education levels, however, remain in line with what was found in the earlier cross-sectional regressions. University education is associated with an approximately 38% increase in earnings compared to middle school.

All of the above estimates of the return to education in Taiwan rely on the standard parametric framework of Ordinary Least Squares regression. As such, they are subject to all the usual criticisms, most notably specification error. Perhaps what appears to be a cohort-related decline in the return to education is actually a spurious effect arising from a true interaction between age and education level, which the framework provided above was too rigid to show. To address this issue, I make use of the available range of age and birth cohorts to create the estimates in Table 4. Each entry in this table is the difference in the natural logarithm of real earnings for university versus middle school graduates in the appropriate age group and birth cohort. Reading down a column of this table shows the effect on this premium of being born in a younger cohort, holding age group constant. In each of the age categories under examination, we find an almost monotonic decline in the university premium when moving from older cohorts (those born in earlier years) to younger cohorts (those born in later years). This result, then, appears to be a solid one, and not merely an artifact of functional form.

These synthetic cohort results cast further doubt on Becker's hypothesis that the return to education should rise as the stock of education rises. Given that the average educational attainment of the different birth cohorts in these data has changed far more quickly than have the cross-sectional education stocks, the individuals in the data, when looked at as members of cohorts, come from an even wider range of experiences in terms of the education environment in which they work. In other words, we have people in these data who were well-educated when

[9] Actually, they are not directly comparable in terms of restrictions. The new equation allows for interaction terms between education and cohort, but requires the effects of other covariates (e.g., sex

almost no-one else was, and people who were well-educated when higher education was quite common. Somewhere within this continuum, we should see the appropriate range for Becker's hypothesis to hold, if that hypothesis is indeed valid. However, the cohort returns very clearly show a pattern of declining returns to education as the stock of education increases.

The extent to which large increases in the supply of university graduates affects their wages will in part be due to the substitutability of labor of different education levels. If less-educated workers can be easily substituted for university graduates (and vice-versa), we would not expect an influx of university graduates like that in Taiwan to make large changes in their relative earnings (wages). However, if less-educated workers cannot be freely substituted for university graduates, we would expect to see large earnings (wage) effects of an influx of one type of worker.

The framework described in Part II, in which the substitutability of different types of labor is assumed to be constant over time, can provide insight into how much changes in cohort size (where cohort is defined by birth year and education level) can be expected to affect relative earnings for different types of labor.

PART VI: SUPPLY AND EARNINGS

As with the price of any commodity, the price of educated labor will depend upon both supply and demand. Given the changing educational composition of the

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and marital status) to be the same for different birth cohorts.

workforce in Taiwan, it is interesting to examine whether supply shifts are driving earnings patterns. If we make the assumption that the economy is always operating on the (possibly shifting) demand curve for labor, we can use our data on the size of the educated labor force over time, along with knowledge of the substitutability of different types of labor, to estimate expected earnings changes over time. A comparison with actual earnings changes will allow us to determine whether the price of educated labor has been impacted by demand shifts over time, or whether changes in supply are the major factor affecting prices.

For the purposes of this paper, it is more useful to look at the relative supply of degree holders (relative to the supply of non-degree holders), rather than their absolute numbers. This is because we are not concerned with overall growth in the population and the economy; rather, we are concerned with changes that affect the premium received by university graduates *relative* to other types of labor. I create relative supply variables using my Count sample, which includes all those of working age, regardless of their actual employment status. I divide the data into cells defined by age, sex, and education in each year, then aggregate these cells into larger groups based on a fixed-weight scheme, where the fixed weights are the average relative earnings of each cell over the entire sample period (see below for calculation of relative earnings). If we assume that wages indicate marginal productivity, the average relative wage will give us the average productivity, or average efficiency of labor in each cell. Aggregation using these weights is natural if we think in terms of efficiency units (Katz and Murphy 1992).

Relative Supply

A quick glance at the number of people in Taiwan with university degrees in any given year shows that the number of such degree holders has increased dramatically over the past couple of decades (see Table 2). Looking at the cross-section for all 17 years of TMUS data, we see that the percentage of the non-institutionalized population holding at least a bachelor's degree increased from 6.1% to 9.2% over the 1979-95 period, a 51% increase. More impressively, the percentage of persons with junior college diplomas has increased from 4.9% to 10.9%, and the percentage of persons with terminal vocational high school degrees has gone from 9.2% to 20.9% over the same period. The differences across older versus younger cohorts are more dramatic. For the cohort born in 1925-29, only 6.8% had attended junior college or university, whereas over 18% of recent cohorts have received tertiary education (and over a quarter of current young people are enrolled in college or university).

In Table 5, I use the scheme described above to calculate relative supplies of labor. Panel A of the table gives the percentage change in the relative supply of labor by various categories, where percentage change is measured as 100 times the difference in the natural logarithms. As we saw with the raw percentages, the relative supply of less-educated persons is shrinking, while better educated people are becoming more numerous. This table also gives some insight into the timing of relative labor supply changes. In the earlier part of the 1979-95 period, we see large shifts out of the no school and self-taught categories, and into the vocational high school category. In the later part of the period, the movement into middle school and high school slows, while increasingly greater numbers of students pursue tertiary education.

Relative Earnings

Following the methodology of Katz and Murphy, I calculate a relative earnings measure, where the earnings of each age-sex-education group are weighted by their average share of total employment over the 17 years for which I have data (Katz and Murphy 1992). This measure tells us whether the earnings of group i are higher or lower than the average for all education groups in the given year. It captures the real earnings of a given education group at a given time, relative to total weighted earnings for all education groups at that time, where the weights are a measure of the average productivity of that education group. In symbols,

$$relwage_i = \frac{r_{it}}{\sum_i a_i r_{it}} \quad (9)$$

where r_{it} is the real earnings of group i in year t, and α_i is the average share of total employment of group i over the 17 years. This weighting abstracts from changes in real wages that are due to the changing demographic composition of the work force, and focuses on earnings for a fixed demographic composition, namely the average employment distribution over the period. Panel B of Table 5 gives the percentage changes in relative monthly earnings by education categories. Over the 1979-95 period, real earnings for the entire sample grew by 78%, with somewhat higher growth in the latter half of the period.

Relying on the framework described in Part II, I use this time pattern of relative supplies and relative earnings, along with an estimate of the elasticity of substitution, σ, between different types of labor, to determine whether observed changes in relative supplies can account for the observed pattern of earnings changes. I am unaware of any estimates of σ for Taiwan, so for my estimate I turn to the U.S. literature.

Labor economists in the U.S. have a long history of estimating elasticities of substitution between different types of labor. Freeman (1986) gives a summary of results from previous studies in the U.S.; the value of the elasticity of substitution between highly educated and less educated workers in these studies ranges from 0.4 to 1000, with most estimates in the low single digits (Freeman 1986). More recently, Katz & Murphy (1992) arrived at a point estimate of 1.4, but indicate that there remains substantial uncertainty.

Using this estimate of 1.4 as a starting point, I estimate the changes in relative earnings that would be due to the observed changes in relative supply, if the demand for educated labor remained constant over the time period in question. This information is organized in Table 6, where the changes are calculated by breaking the 17-year period into two or four sub-periods.

Table 6 is based on equation 5 (repeated from earlier in the text):

$$(5) \qquad \ln\left(\frac{w_{1t}}{w_{0t}}\right) - \ln\left(\frac{w_{1t-1}}{w_{0t-1}}\right) = \frac{1}{s}\left(\ln\frac{L_{1t}}{L_{0t}} - \ln\frac{L_{1t-1}}{L_{0t-1}}\right)$$

where w_{it} is interpreted here as the relative earnings of education group i (university or middle school) in year t. The first column of Table 6 shows the actual difference in the natural logarithms of the ratios of (relative) earnings for university and middle school graduates. In other words, the first column shows the left-hand side of equation (5). Similarly, the second column shows the difference in the natural logarithms of the ratios of the relative supplies of university and middle school graduates in the (potential) workforce (the right-hand side of the equation, without the multiplier). Each of the remaining columns shows the expected value of the change in the natural log of the ratios of earnings (that is, the expected value of the number in column 1), given the observed value in column 2, and the value of sigma at the head of the column.

When dividing the total time into two sub-periods (top two lines), we see that none of the assumed values of σ gives a very good prediction of the actual value of the change in the log earnings ratio. When we divide the sample into four time periods, however, we see that a value of σ around 2.5 gives fairly good agreement between predicted and actual values, except for the period from 1987-91. Given this good agreement, we might conclude that the relative demand for university- versus middle school-educated labor has been fairly stable over the past couple of decades, and that the elasticity of substitution between these two types of labor is around 2.5, a number that seems quite plausible. If this is the case, we can conclude that the decline in the return to education for younger cohorts may be largely due to the fact that so many of them are well educated. We would still need to turn to a demand shift explanation, however, to explain the observed changes in relative earnings for the 1987-91 period.

PART VII: CONCLUSION

The focus of this paper has been on the return to education in Taiwan, and how that return has changed over time. The average level of education in the population in Taiwan has risen dramatically over the past couple of decades. Concurrently, enrollments in tertiary education have increased across birth cohorts, with younger cohorts entering university at much higher rates than older cohorts. This has taken place despite government policies that restrict the supply of university slots. However, even with these rapid changes in the education structure of the labor force, cross-sectional returns to education have been remarkably stable over the time period measured in these data. Such stable returns deserve some explanation.

One possibility is that the cross-sectional return to education may not be the relevant parameter to examine to determine the impact of the larger “age-education” cohorts on the labor market. When I looked at the return to education by cohort, I found that younger cohorts do indeed appear to be experiencing a reduction in the return they receive to higher education. This result implies not only that workers of different *educational* backgrounds are imperfect substitutes, but also that different-*aged* workers at the same education level are not easily substitutable. Another explanation is that the elasticity of substitution between different types of labor has allowed shifts in relative supply to leave relative earnings unaffected. As we have seen above, it would require an elasticity of substitution of around 2.5 to give this result. Since this number is certainly plausible, I conclude that relative demand for different types of labor may well have been stable over the period in question. However, this estimate depends heavily on how we divide the sample into time periods, so should not be taken as strong evidence that earnings are being driven by changes on the supply side of the labor market. Also, this result explains the stable cross-sectional return, but not the lower return for younger cohorts.

This paper has also commented upon a hypothesis by Becker, Murphy, and Tamura, which maintains that positive spillovers, and the relative education-intensity of the education sector, should cause the return to education to increase with a rising stock of education over some range. While these data are not ideal to examine the hypothesis, they do provide a look at the labor market return to education in a country in which different cohorts have quite different average education levels. Because Becker et. al. do not specify the range or the education levels to which they refer, I cannot claim to refute their hypothesis using these data. However, the data certainly cast doubt upon the applicability of that hypothesis.

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Table 1
Enrollment Rates (%) in Taiwan by Year and Level of Education

	Primary School 6-11 yrs		**Junior High School** 12-14 yrs		**Senior High School** 15-17 yrs		**College and above** 18-21 yrs	
	Male	Female	Male	Female	Male	Female	Male	Female
1981	99.76	99.76	85.26	83.52	52.03	53.17	12.15	10.75
1982	99.79	99.78	84.76	84.03	56.67	56.60	12.33	11.25
1983	99.81	99.80	86.97	85.98	57.15	58.12	12.84	11.93
1984	99.81	99.83	88.66	87.76	60.07	61.22	12.78	12.34
1985	99.84	99.86	87.18	86.86	61.80	62.86	14.24	13.49
1986	99.86	99.87	89.18	89.06	64.49	68.52	14.47	14.00
1987	99.88	99.90	89.27	88.76	66.05	70.94	14.90	14.74
1988	99.89	99.91	88.00	87.86	67.02	74.00	15.86	16.04
1989	99.89	99.91	89.32	90.35	67.38	74.38	16.67	17.72
1990	99.89	99.89	90.05	90.59	69.36	76.85	18.33	20.44
1991	9.89	99.91	91.49	91.30	69.34	76.71	20.22	21.78
1992	99.83	99.75	90.23	91.17	72.31	78.84	23.04	23.92
1993	99.87	99.92	91.25	92.02	74.15	80.59	24.99	26.26
1994	99.93	99.94	92.02	93.28	74.89	82.47	24.99	27.60
1995	99.90	99.30	93.83	94.47	75.84	82.65	25.88	29.78

Source: Education Statistics of the Republic of China

Table 2
Percentage of Potential Labor Force in Various Categories
Count Sample

			Education Level							
	Male	**Female**	**No School**	**Self-Taught**	**Primary**	**Middle**	**Acad HS**	**Voc HS**	**Jr College**	**Univ+**
1979	53.3%	46.7%	13.9%	3.5%	44.2%	11.7%	6.4%	9.2%	4.9%	6.1%
1980	53.3%	46.7%	12.4%	3.5%	43.3%	12.4%	6.7%	10.0%	5.4%	6.3%
1981	53.1%	46.9%	12.0%	3.2%	42.8%	13.2%	6.6%	10.5%	5.3%	6.3%
1982	52.8%	47.2%	11.5%	2.9%	41.9%	13.8%	6.9%	11.3%	5.7%	6.0%
1983	52.6%	47.4%	11.4%	2.6%	39.6%	14.5%	6.8%	12.9%	6.0%	6.2%
1984	52.4%	47.6%	10.2%	2.6%	38.5%	15.4%	6.9%	13.7%	6.4%	6.3%
1985	52.6%	47.4%	9.7%	2.9%	38.8%	15.8%	6.6%	13.9%	6.5%	5.8%
1986	52.2%	47.8%	9.5%	2.9%	36.9%	16.7%	6.6%	14.3%	6.8%	6.4%
1987	52.2%	47.8%	8.3%	2.4%	35.4%	16.8%	6.9%	15.5%	7.7%	7.0%
1988	52.0%	48.0%	7.1%	2.1%	34.4%	17.0%	7.5%	16.7%	8.0%	7.2%
1989	51.9%	48.1%	6.7%	2.1%	33.2%	17.3%	7.5%	17.6%	8.1%	7.5%
1990	51.6%	48.4%	6.3%	1.8%	32.3%	18.0%	7.9%	17.7%	8.4%	7.6%
1991	51.5%	48.5%	5.6%	1.7%	32.0%	18.5%	8.2%	17.9%	8.7%	7.4%
1992	51.3%	48.7%	5.0%	1.6%	30.4%	18.6%	8.3%	18.9%	9.5%	7.8%
1993	51.2%	48.8%	4.7%	1.4%	29.0%	18.8%	8.0%	20.0%	9.8%	8.4%
1994	51.1%	48.9%	4.6%	1.3%	27.8%	19.3%	8.2%	20.1%	10.2%	8.5%
1995	51.0%	49.0%	4.5%	1.1%	26.2%	19.1%	8.1%	20.9%	10.9%	9.2%
Mean	**52.1%**	**47.9%**	**8.4%**	**2.3%**	**35.7%**	**16.3%**	**7.3%**	**15.4%**	**7.6%**	**7.1%**

Continued Next Page

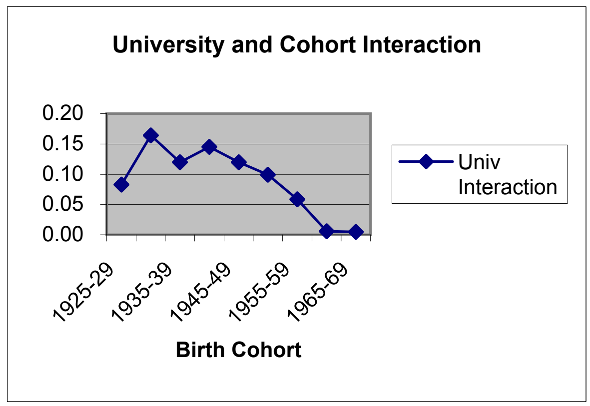
Table 2 (continued)
Percentage of Potential Labor Force in Various Categories
Count Sample

	Age Category							
	20-24	**25-29**	**30-34**	**35-39**	**40-44**	**45-49**	**50-54**	**55-59**
1979	21.2%	17.5%	11.0%	10.8%	9.8%	9.7%	8.5%	6.6%
1980	21.0%	17.9%	11.3%	10.8%	9.7%	9.2%	8.5%	6.6%
1981	20.7%	18.3%	11.5%	11.0%	9.4%	9.0%	8.7%	6.8%
1982	20.3%	18.7%	13.3%	9.3%	9.4%	8.7%	8.6%	6.8%
1983	20.3%	18.2%	14.4%	9.2%	9.4%	8.4%	8.1%	6.9%
1984	19.8%	18.2%	15.1%	9.1%	9.3%	8.2%	8.0%	7.1%
1985	19.4%	18.1%	15.4%	9.9%	8.6%	8.5%	7.7%	7.0%
1986	19.0%	17.5%	15.9%	10.4%	8.7%	8.2%	7.4%	7.3%
1987	18.5%	17.9%	15.9%	11.3%	8.1%	8.2%	7.4%	7.1%
1988	18.2%	17.3%	15.8%	12.6%	8.1%	8.1%	7.2%	7.0%
1989	17.5%	17.4%	15.6%	13.5%	8.0%	8.2%	7.1%	6.9%
1990	16.6%	17.3%	15.9%	13.8%	8.5%	8.0%	7.1%	6.8%
1991	16.3%	17.0%	15.8%	14.1%	9.2%	7.8%	7.1%	6.6%
1992	15.6%	16.5%	15.9%	14.4%	10.3%	7.4%	7.2%	6.5%
1993	15.5%	16.0%	15.7%	14.6%	11.2%	7.4%	7.3%	6.1%
1994	14.9%	15.7%	16.0%	14.4%	12.2%	7.3%	7.2%	6.2%
1995	14.9%	15.1%	15.8%	14.9%	12.3%	7.8%	7.0%	6.3%
Mean	**18.2%**	**17.3%**	**14.7%**	**12.0%**	**9.5%**	**8.2%**	**7.7%**	**6.8%**

Table 3
Coefficients on Interaction Terms Between University-Level Education and Given Birth Cohort

Dependent Variable: ln(average real monthly earnings).
(robust standard errors in parentheses)

Yr of Birth	Coefficient
1925-29	0.083
	(0.046)
1930-34	0.164
	(0.042)
1935-39	0.120
	(0.040)
1940-44	0.145
	(0.039)
1945-49	0.120
	(0.039)
1950-54	0.099
	(0.039)
1955-59	0.058
	(0.039)
1960-64	0.006
	(0.039)
1965-69	0.005
	(0.058)



Sample Size = 226,341
R-squared = .559

Covariates are indicators for female, married, and single years dummies.

Table 4
University Vs. Middle-School Wage Premium
(Difference in the Natural Log of Earnings for Each Group)

	Age Category					
Yr of Birth	25-29	30-34	35-39	40-44	45-49	50-54
1930-34						0.538
1935-39					0.671	0.677
1940-44				0.526	0.631	0.632
1945-49			0.544	0.532	0.623	0.458
1950-54		0.456	0.537	0.497	0.452	
1955-59	0.341	0.439	0.496	0.499		
1960-64	0.360	0.385	0.457			
1965-69	0.264	0.223				

Table 5

Panel A
% Change in Relative Supplies

	None	Self-Taught	Primary	Middle-Schl	acad. HS	voc. HS	Jr Coll	Univ+	Male	Female
1979-95	-135%	-177%	-57%	78%	45%	102%	85%	48%	-2%	4%
1979-83	-22%	-40%	-10%	24%	10%	40%	21%	4%	-2%	3%
1983-87	-36%	-7%	-13%	28%	6%	22%	23%	13%	-1%	1%
1987-91	-41%	-57%	-13%	17%	23%	16%	15%	8%	-1%	2%
1991-95	-35%	-73%	-21%	10%	7%	23%	26%	24%	1%	-2%
1979-87	-59%	-46%	-23%	52%	16%	62%	45%	17%	-3%	4%
1987-95	-77%	-130%	-34%	26%	29%	39%	41%	32%	0%	0%

Panel B
% Change in Relative Earnings

	None	Self-Taught	Primary	Middle-Schl	acad. HS	voc. HS	Jr Coll	Univ+	Male	Female
1979-95	92%	90%	83%	76%	69%	71%	74%	78%	78%	77%
1979-83	15%	10%	12%	14%	17%	15%	19%	23%	16%	14%
1983-87	24%	23%	19%	15%	11%	15%	15%	19%	17%	17%
1987-91	36%	35%	37%	33%	31%	29%	31%	24%	33%	33%
1991-95	18%	22%	15%	14%	10%	12%	10%	11%	13%	14%
1979-87	39%	33%	31%	29%	28%	30%	34%	42%	33%	31%
1987-95	53%	56%	52%	47%	41%	41%	40%	36%	45%	47%

Panel A shows the percent change in the relative supply of labor by education type. Relative supplies are measured by aggregating sex-education-age cells using a fixed-weight scheme as described in the text.
Panel B shows the percent change in relative earnings by education type, where earning for each group are measured relative to earnings of the average demographic composition of the workforce over the 1979-95 period. See text for details.

Table 6

	Actual		Expected change in Ln(earn-ratio) sigma=							
	D ln(earn-ratio)	D ln(sup-ratio)	0.5	1	1.4	2	2.5	3	3.5	10
1979-87	0.13	-0.35	0.7055	0.3528	0.2520	0.1764	0.1411	0.1176	0.1008	0.0353
1987-95	-0.11	0.06	-0.1132	-0.0566	-0.0404	-0.0283	-0.0226	-0.0189	-0.0162	-0.0057
1979-83	0.08	-0.20	0.4076	0.2038	0.1456	0.1019	0.0815	0.0679	0.0582	0.0204
1983-87	0.05	-0.15	0.2980	0.1490	0.1064	0.0745	0.0596	0.0497	0.0426	0.0149
1987-91	-0.09	-0.09	0.1761	0.0880	0.0629	0.0440	0.0352	0.0293	0.0252	0.0088
1991-95	-0.03	0.14	-0.2893	-0.1446	-0.1033	-0.0723	-0.0579	-0.0482	-0.0413	-0.0145

The first column of the table shows the actual difference in the natural log of the ratios of earnings for university versus middle-school graduates. The second column shows the actual difference in the natural log of the ratio of the relative supplies of univeristy to middle-school graduates in the potential workforce. The remaining columns show the predicted value of the quantity in the first column, given the value of the quantity in the second column, and the indicated value of sigma.

Table 7

P-Values from an F-test for pairwise equality between cohorts of coefficients on university education.

Birth Yr	1930-34	1935-39	1940-44	1945-49	1950-54	1955-59	1960-64	1965-69	1970-74
1925-29	0.013	0.000	0.001	0.000	0.004	0.080	0.588	0.101	0.342
1930-34		0.009	0.420	0.110	0.978	0.093	0.001	0.000	0.007
1935-39			0.012	0.081	0.000	0.000	0.000	0.000	0.000
1940-44				0.237	0.138	0.000	0.000	0.000	0.001
1945-49					0.001	0.000	0.000	0.000	0.000
1950-54						0.000	0.000	0.000	0.004
1955-59							0.000	0.000	0.029
1960-64								0.000	0.150
1965-69									0.967

Note: The above tests were run on the coefficients from a regression of the natural log of real monthly earnings on dummy variables for birth cohort, fully interacted with a series of 7 education-level dummies (middle-school omitted), as well as terms for female, married, married and female, age, and age-squared. In each case, the null hypothesis is the equality of the coefficient on university education between the two cohorts.

**Figure 1:
Taiwanese Enrollment in Post-Secondary Education**

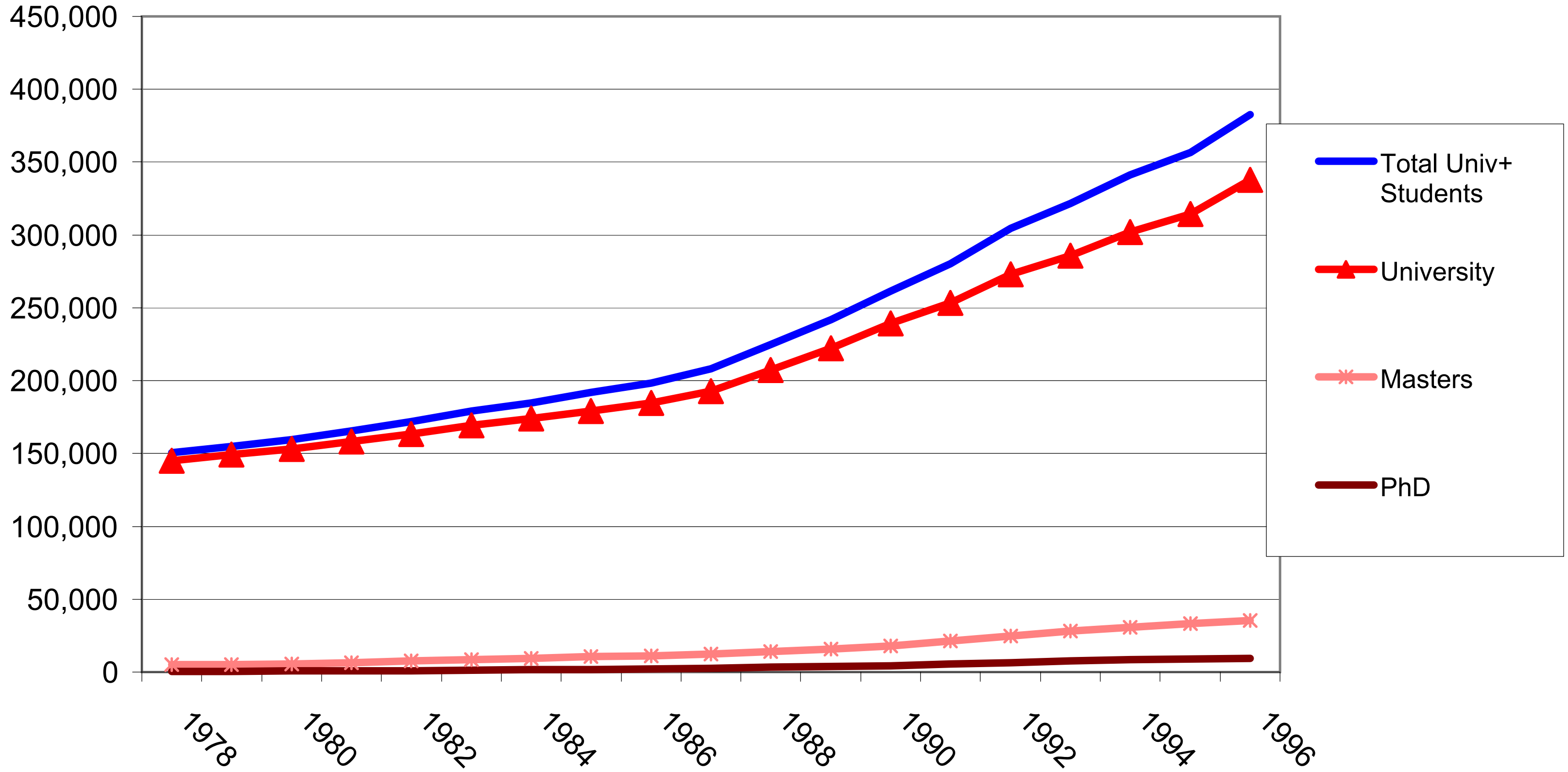


Figure 2:
Percentage of Potential Labor Force in Different Educational Categories

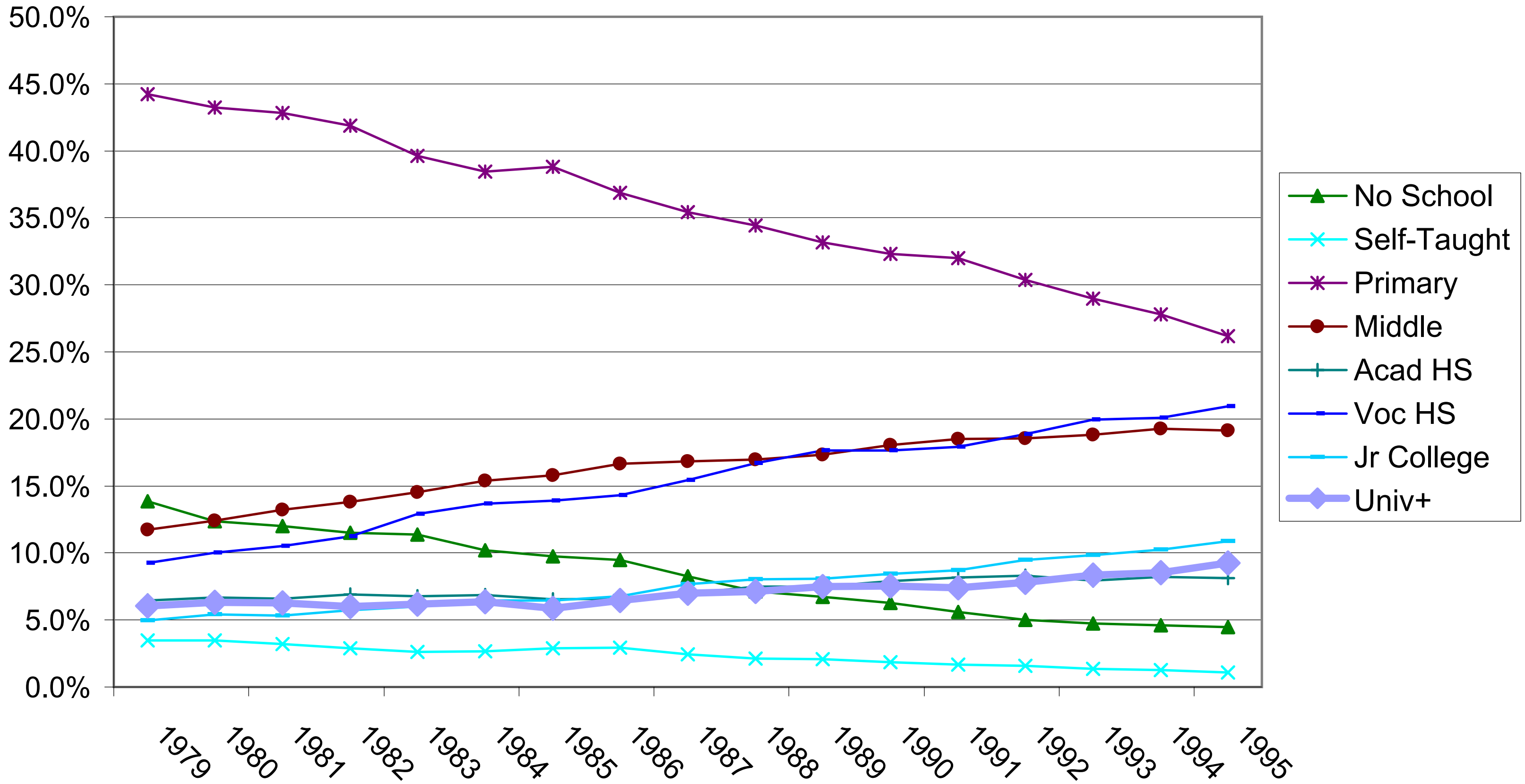


Figure 3:
Return to Education Level
(Relative to Middle School Graduates)
Covariates are a quadratic in age, and indicators for female, married, and their interaction.
Active Sample, Both Sexes

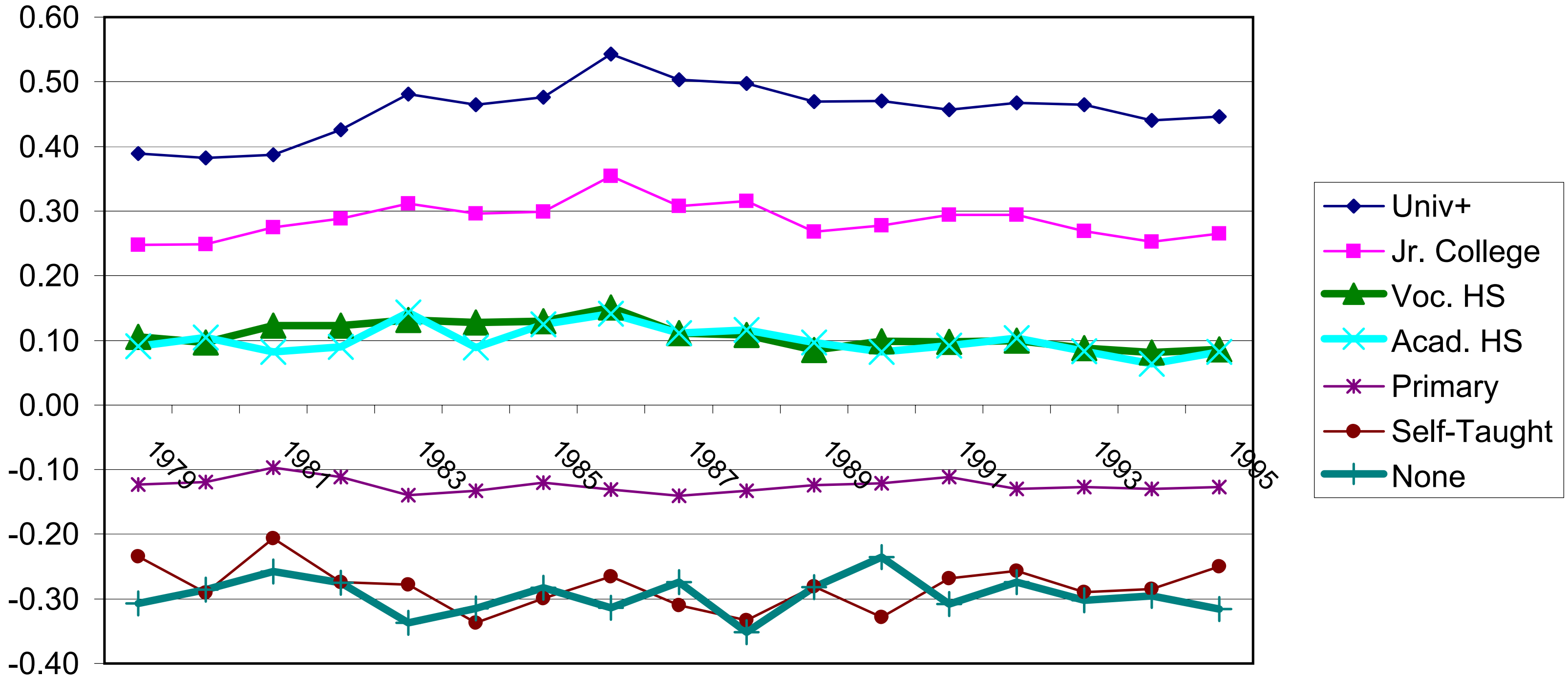


Figure 3a:
Return to Education Level - Females Only
(Relative to Middle School Graduates)
Covariates are a quadratic in age and indicator for married.
Active Sample

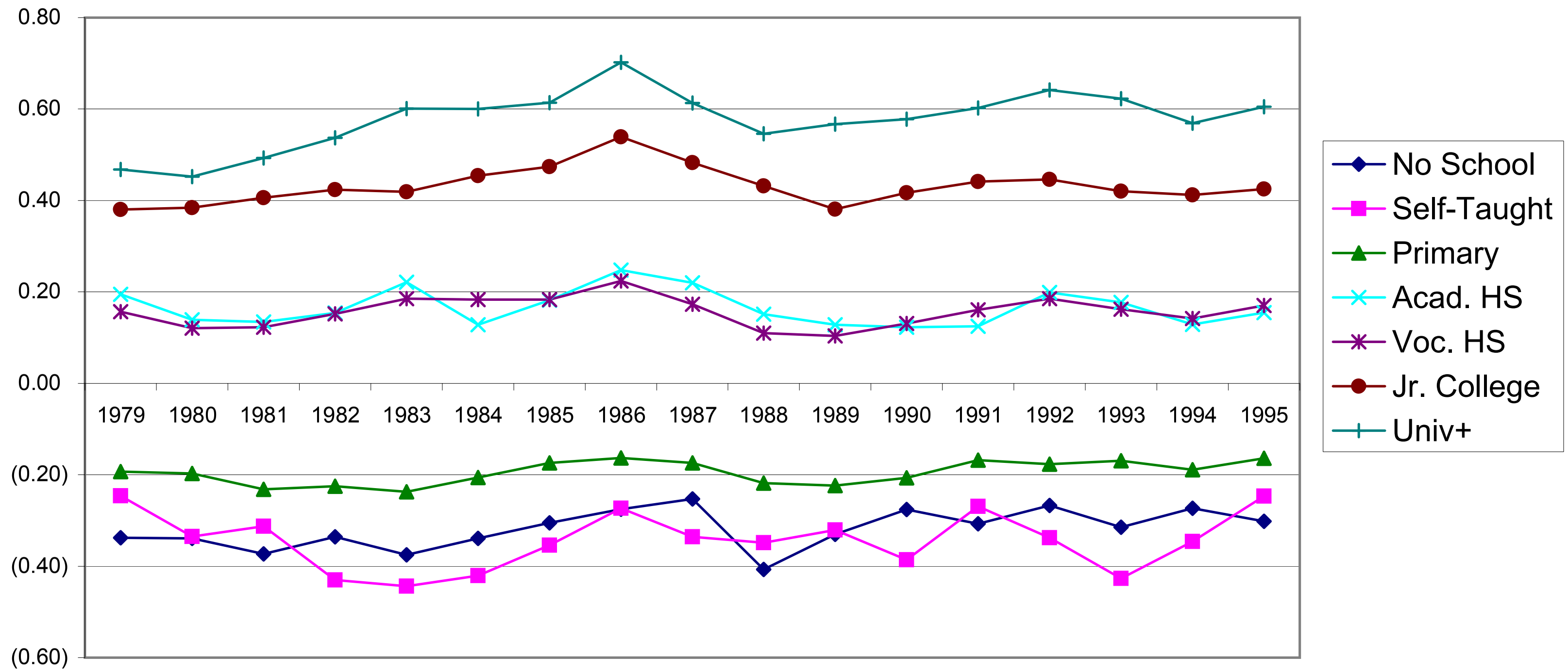


Figure 3b:
Return to Education Level - Males Only
(Relative to Middle School Graduates)
Covariates are a quadratic in age and indicator for married.
Active Sample

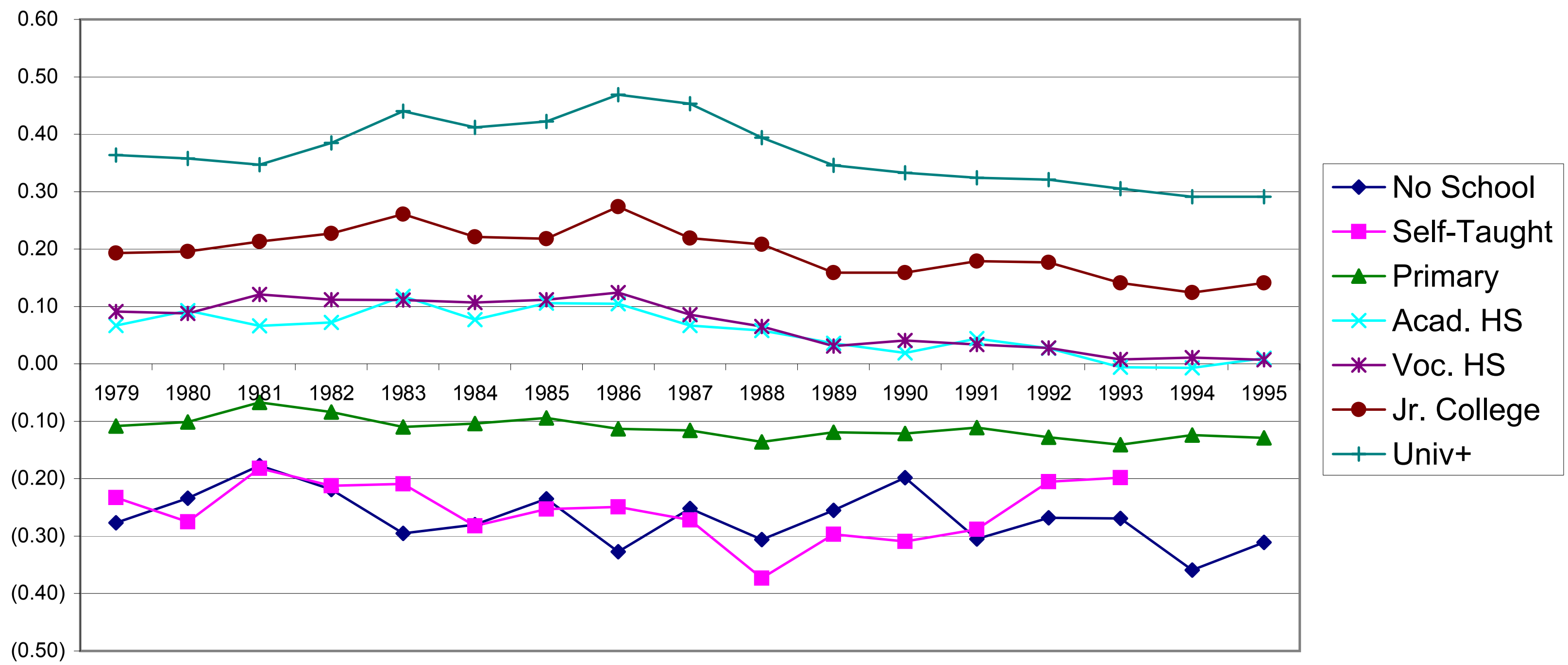


Figure 4:
Return to Education Level by Cohort
Separate Regressions by Birth Cohort
Covariates are quadradic in age, and indicators for married, female and their interaction.

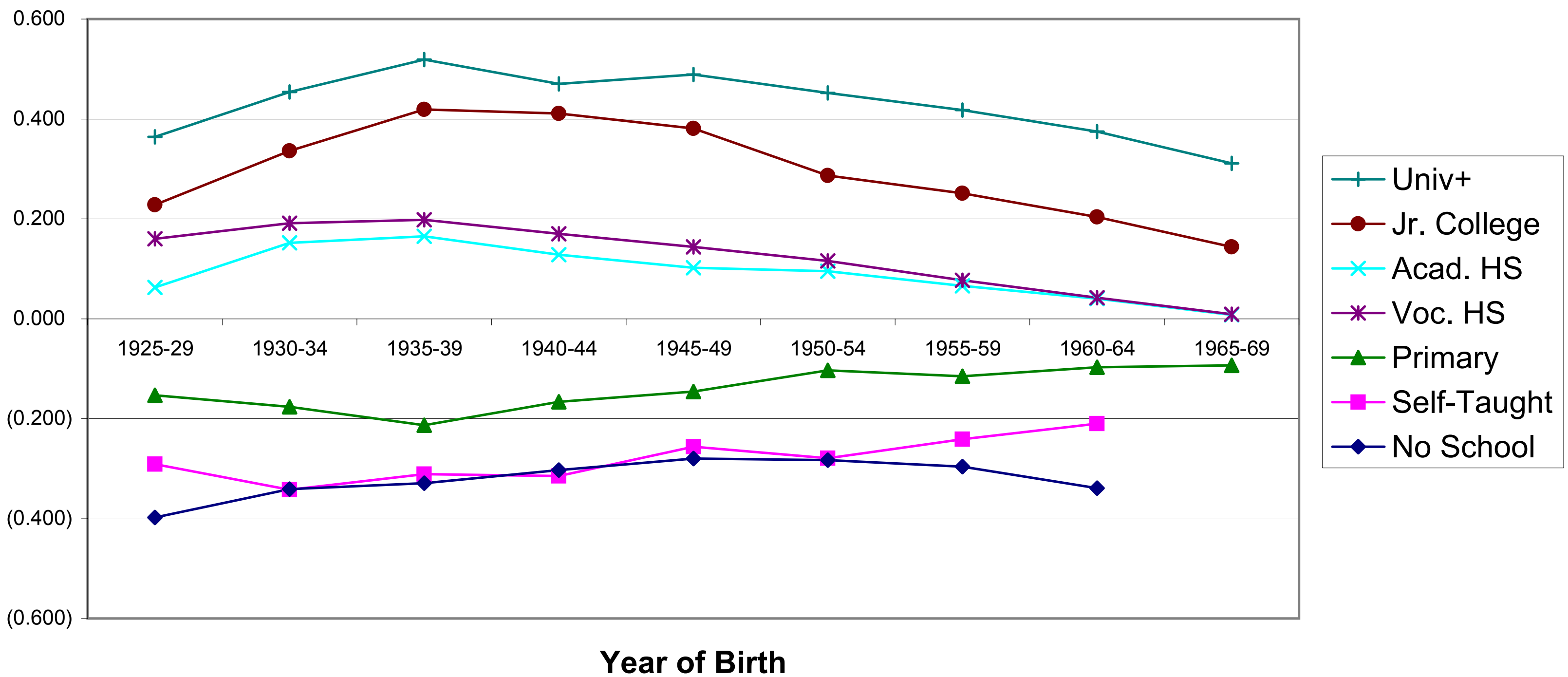
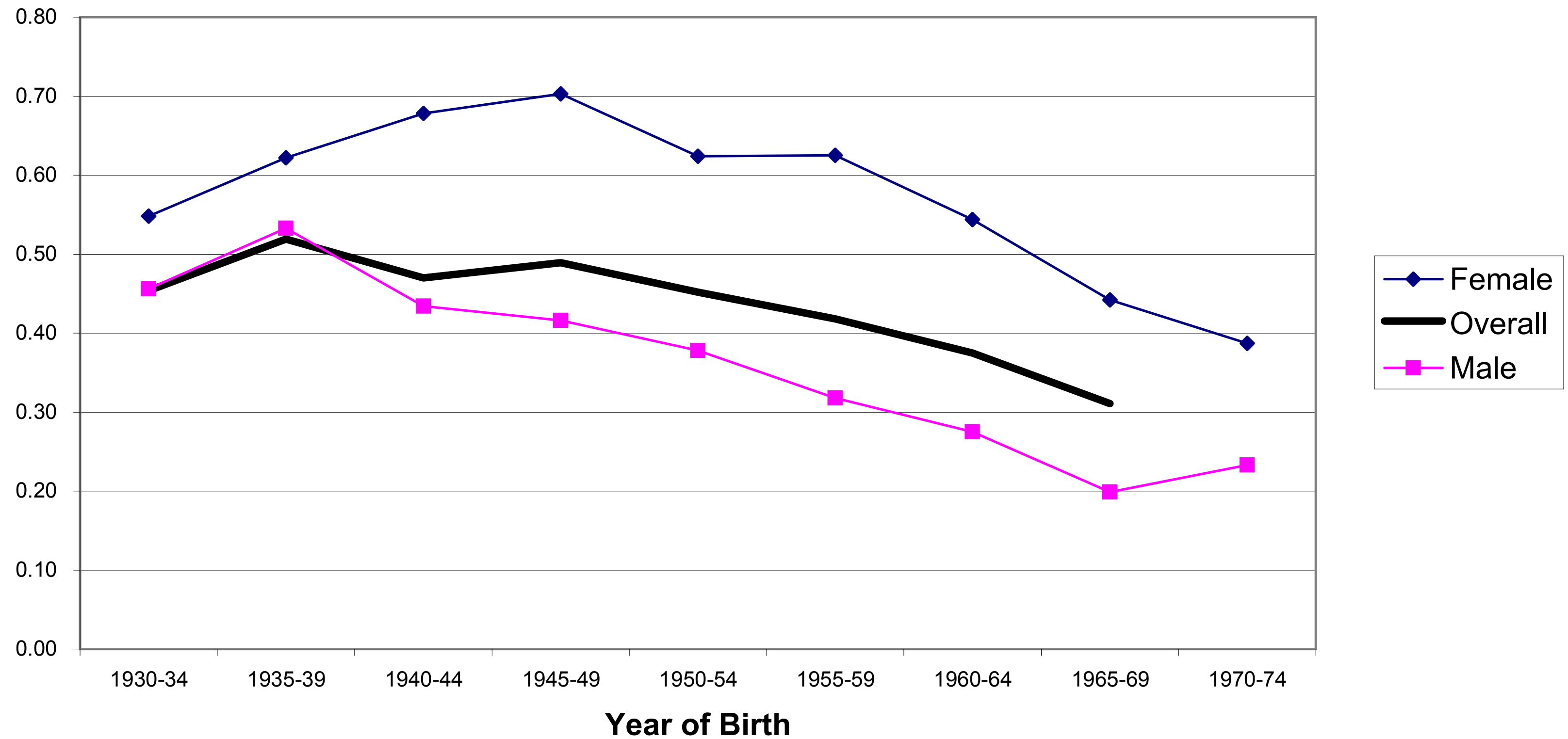


Figure 4b:
Comparison of Coefficient on University Education by Sex



Appendix A: Table 1

Returns to Education in Taiwan: 1979-95

Dependent Variable: Natural Log of Average Real Monthly Earnings from Primary Job

Omitted Category is Middle School

(robust standard errors in parentheses with p<0.05 = ~, p<0.01 = *)

Year:	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
# obs :	9,425	9,913	10,492	10,904	11,314	12,056	12,370	12,941	14,185	14,555	14,823	14,572	14,389	14,749	16,172	16,536	16,945
Intercept	8.402*	8.333*	8.582*	8.728*	8.316*	8.253*	8.263*	8.327*	8.361*	8.474*	8.653*	8.858*	9.102*	9.106*	9.298*	9.236*	9.238*
	(0.079)	(0.082)	(0.079)	(0.088)	(0.085)	(0.084)	(0.080)	(0.079)	(0.084)	(0.069)	(0.068)	(0.077)	(0.074)	(0.081)	(0.072)	(0.071)	(0.066)
Age	0.048*	0.052*	0.040*	0.035*	0.057*	0.062*	0.062*	0.060*	0.062*	0.060*	0.058*	0.050*	0.041*	0.041*	0.035*	0.040*	0.039*
	(0.004)	(0.005)	(0.004)	(0.005)	(0.005)	(0.005)	(0.004)	(0.004)	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)
Age-sq	-0.001*	-0.001*	0.000*	0.000*	-0.001*	-0.001*	-0.001*	-0.001*	-0.001*	-0.001*	-0.001*	-0.001*	0.000*	0.000*	0.000*	0.000*	0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Female	-0.268*	-0.284*	-0.289*	-0.302*	-0.302*	-0.262*	-0.232*	-0.241*	-0.265*	-0.265*	-0.302*	-0.301*	-0.291*	-0.256*	-0.293*	-0.285*	-0.270*
	(0.016)	(0.016)	(0.016)	(0.019)	(0.015)	(0.017)	(0.013)	(0.014)	(0.015)	(0.012)	(0.013)	(0.014)	(0.013)	(0.012)	(0.011)	(0.011)	(0.011)
Married	0.136*	0.151*	0.137*	0.132*	0.129*	0.145*	0.150*	0.166*	0.147*	0.144*	0.119*	0.140*	0.119*	0.133*	0.123*	0.123*	0.124*
	(0.010)	(0.011)	(0.011)	(0.015)	(0.010)	(0.011)	(0.011)	(0.010)	(0.010)	(0.009)	(0.009)	(0.010)	(0.009)	(0.009)	(0.009)	(0.008)	(0.009)
MrdXFem	-0.180*	-0.164*	-0.169*	-0.151*	-0.129*	-0.164*	-0.202*	-0.210*	-0.192*	-0.196*	-0.177*	-0.170*	-0.181*	-0.201*	-0.160*	-0.173*	-0.168*
	(0.019)	(0.019)	(0.020)	(0.020)	(0.018)	(0.019)	(0.017)	(0.017)	(0.018)	(0.015)	(0.016)	(0.016)	(0.016)	(0.013)	(0.013)	(0.013)	(0.013)
No School	-0.307*	-0.286*	-0.258*	-0.275*	-0.337*	-0.315*	-0.283*	-0.314*	-0.274*	-0.352*	-0.282*	-0.235*	-0.308*	-0.274*	-0.302*	-0.295*	-0.316*
	(0.018)	(0.021)	(0.021)	(0.022)	(0.024)	(0.023)	(0.026)	(0.024)	(0.022)	(0.024)	(0.025)	(0.030)	(0.036)	(0.035)	(0.035)	(0.033)	(0.043)
Self-Taught	-0.234*	-0.291*	-0.206*	-0.274*	-0.278*	-0.337*	-0.299*	-0.265*	-0.310*	-0.333*	-0.281*	-0.328*	-0.268*	-0.257*	-0.290*	-0.285*	-0.250*
	(0.024)	(0.025)	(0.026)	(0.038)	(0.045)	(0.038)	(0.034)	(0.031)	(0.034)	(0.031)	(0.033)	(0.047)	(0.041)	(0.059)	(0.050)	(0.056)	(0.054)
Primary	-0.123*	-0.119*	-0.097*	-0.112*	-0.140*	-0.133*	-0.120*	-0.131*	-0.141*	-0.133*	-0.124*	-0.121*	-0.112*	-0.130*	-0.127*	-0.130*	-0.127*
	(0.011)	(0.011)	(0.011)	(0.013)	(0.012)	(0.012)	(0.012)	(0.011)	(0.011)	(0.009)	(0.010)	(0.011)	(0.010)	(0.012)	(0.012)	(0.011)	(0.011)
Acad. HS	0.091*	0.104*	0.082*	0.090*	0.143*	0.089*	0.125*	0.141*	0.111*	0.116*	0.097*	0.082*	0.092*	0.103*	0.083*	0.064*	0.082*
	(0.016)	(0.017)	(0.015)	(0.016)	(0.016)	(0.017)	(0.014)	(0.014)	(0.016)	(0.013)	(0.012)	(0.013)	(0.012)	(0.011)	(0.012)	(0.011)	(0.012)
Voc. HS	0.105*	0.097*	0.123*	0.123*	0.131*	0.128*	0.130*	0.151*	0.111*	0.108*	0.085*	0.099*	0.098*	0.10*	0.088*	0.081*	0.086*
	(0.014)	(0.014)	(0.014)	(0.014)	(0.012)	(0.012)	(0.012)	(0.011)	(0.011)	(0.009)	(0.009)	(0.010)	(0.010)	(0.009)	(0.009)	(0.009)	(0.010)
Jr. College	0.248*	0.249*	0.275*	0.288*	0.312*	0.296*	0.299*	0.354*	0.308*	0.315*	0.268*	0.278*	0.294*	0.294*	0.269*	0.252*	0.265*
	(0.015)	(0.015)	(0.015)	(0.018)	(0.015)	(0.015)	(0.014)	(0.014)	(0.013)	(0.011)	(0.011)	(0.014)	(0.013)	(0.011)	(0.011)	(0.011)	(0.012)
Univ+	0.389*	0.382*	0.387*	0.426*	0.481*	0.464*	0.476*	0.543*	0.503*	0.497*	0.469*	0.470*	0.457*	0.467*	0.464*	0.440*	0.446*
	(0.016)	(0.017)	(0.016)	(0.016)	(0.016)	(0.017)	(0.017)	(0.016)	(0.017)	(0.015)	(0.014)	(0.016)	(0.015)	(0.012)	(0.015)	(0.015)	(0.014)
R-sq	0.372	0.347	0.330	0.331	0.406	0.376	0.404	0.440	0.393	0.441	0.432	0.400	0.402	0.410	0.401	0.408	0.384

Appendix A: Table 2

Female Returns to Education in Taiwan, 1979-95

Dependent Variable: Natural Log of Average Real Monthly Earnings from Primary Job

(robust standard errors in parentheses with p<0.05=~, p<0.01=*)

Year: # obs :	1979 2199	1980 2365	1981 2508	1982 2803	1983 3175	1984 3564	1985 3835	1986 4176	1987 4887	1988 4984	1989 5168	1990 5089	1991 5204	1992 5351	1993 5811	1994 6078	1995 6266
Intercept	7.978*	8.006*	8.524*	8.253*	7.993*	8.230*	8.125*	8.164*	8.218*	8.452*	8.362*	8.452*	8.884*	8.803*	9.086*	8.961*	8.957*
	(0.185)	(0.198)	(0.182)	(0.167)	(0.150)	(0.150)	(0.137)	(0.142)	(0.132)	(0.128)	(0.120)	(0.128)	(0.124)	(0.124)	(0.119)	(0.110)	(0.110)
Age	0.055*	0.054*	0.026~	0.044*	0.056*	0.045*	0.053*	0.052*	0.052*	0.046*	0.057*	0.054*	0.034*	0.038*	0.025*	0.036*	0.035*
	(0.011)	(0.011)	(0.010)	(0.010)	(0.008)	(0.008)	(0.008)	(0.008)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.006)	(0.006)
Age-sq	-0.001*	-0.001*	0.000	-0.001*	-0.001*	0.000*	-0.001*	-0.001*	-0.001*	0.000*	-0.001*	-0.001*	0.000*	0.000*	0.000~	0.000*	0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Married	(0.011)	0.022	0.015	0.017	0.032~	0.015	(0.025)	(0.009)	(0.011)	-0.025~	-0.033*	(0.005)	-0.029~	-0.039*	(0.012)	-0.027~	(0.018)
	(0.019)	(0.019)	(0.018)	(0.022)	(0.015)	(0.016)	(0.014)	(0.014)	(0.013)	(0.012)	(0.012)	(0.013)	(0.012)	(0.011)	(0.011)	(0.010)	(0.011)
No School	-0.338*	-0.339*	-0.373*	-0.336*	-0.375*	-0.339*	-0.305*	-0.275*	-0.253*	-0.407*	-0.330*	-0.276*	-0.307*	-0.267*	-0.315*	-0.273*	-0.302*
	(0.038)	(0.038)	(0.041)	(0.035)	(0.031)	(0.032)	(0.029)	(0.030)	(0.027)	(0.030)	(0.031)	(0.034)	(0.039)	(0.043)	(0.043)	(0.036)	(0.048)
Self-Taught	-0.246*	-0.335*	-0.313*	-0.430*	-0.444*	-0.421*	-0.354*	-0.273*	-0.336*	-0.349*	-0.321*	-0.386*	-0.269*	-0.338*	-0.427*	-0.346*	-0.247*
	(0.050)	(0.047)	(0.060)	(0.060)	(0.057)	(0.051)	(0.042)	(0.051)	(0.054)	(0.047)	(0.054)	(0.063)	(0.058)	(0.082)	(0.075)	(0.062)	(0.070)
Primary	-0.193*	-0.197*	-0.232*	-0.225*	-0.237*	-0.206*	-0.174*	-0.163*	-0.174*	-0.218*	-0.224*	-0.207*	-0.168*	-0.177*	-0.169*	-0.189*	-0.164*
	(0.033)	(0.030)	(0.035)	(0.028)	(0.026)	(0.023)	(0.021)	(0.021)	(0.019)	(0.020)	(0.021)	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)	(0.018)
Acad. HS	0.195*	0.139*	0.134*	0.154*	0.221*	0.128*	0.182*	0.248*	0.220*	0.151*	0.128*	0.123*	0.125*	0.199*	0.177*	0.129*	0.155*
	(0.044)	(0.038)	(0.042)	(0.035)	(0.033)	(0.049)	(0.029)	(0.027)	(0.028)	(0.027)	(0.026)	(0.025)	(0.026)	(0.022)	(0.023)	(0.021)	(0.021)
Voc. HS	0.157*	0.121*	0.123*	0.152*	0.185*	0.183*	0.183*	0.224*	0.173*	0.110*	0.104*	0.131*	0.161*	0.185*	0.162*	0.142*	0.170*
	(0.035)	(0.035)	(0.038)	(0.029)	(0.027)	(0.025)	(0.022)	(0.023)	(0.021)	(0.020)	(0.020)	(0.018)	(0.018)	(0.018)	(0.018)	(0.017)	(0.016)
Jr. College	0.380*	0.384*	0.406*	0.424*	0.419*	0.454*	0.474*	0.539*	0.483*	0.432*	0.381*	0.417*	0.441*	0.446*	0.420*	0.412*	0.425*
	(0.036)	(0.034)	(0.040)	(0.029)	(0.028)	(0.025)	(0.022)	(0.025)	(0.021)	(0.021)	(0.022)	(0.020)	(0.020)	(0.020)	(0.019)	(0.018)	(0.017)
Univ+	0.468*	0.452*	0.493*	0.537*	0.601*	0.60*	0.614*	0.702*	0.613*	0.546*	0.567*	0.578*	0.602*	0.642*	0.623*	0.569*	0.605*
	(0.038)	(0.042)	(0.037)	(0.030)	(0.027)	(0.025)	(0.023)	(0.025)	(0.023)	(0.021)	(0.023)	(0.020)	(0.022)	(0.020)	(0.019)	(0.019)	(0.018)
R-sq	0.33	0.30	0.31	0.33	0.39	0.35	0.37	0.38	0.32	0.33	0.31	0.30	0.30	0.32	0.29	0.29	0.30

Appendix A: Table 3

Male Returns to Education in Taiwan: 1979-95

Dependent Variable: Natural Log of Average Real Monthly Earnings from Primary Jol

(robust standard errors in parentheses with p<0.05=~, p<0.01=*)

Year: # obs:	1979 7226	1980 7548	1981 7984	1982 8101	1983 8139	1984 8492	1985 8535	1986 8765	1987 9298	1988 9571	1989 9655	1990 9483	1991 9185	1992 9398	1993 10361	1994 10458	1995 10679
Intercept	8.394* (0.087)	8.303* (0.090)	8.497* (0.087)	8.709* (0.091)	8.282* (0.087)	8.118* (0.087)	8.163* (0.085)	8.181* (0.084)	8.201* (0.091)	8.223* (0.082)	8.503* (0.079)	8.766* (0.086)	8.899* (0.082)	8.984* (0.081)	9.157* (0.076)	9.108* (0.072)	9.151* (0.074)
Age	0.049* (0.005)	0.054* (0.005)	0.044* (0.005)	0.036* (0.005)	0.059* (0.005)	0.070* (0.005)	0.069* (0.005)	0.069* (0.005)	0.072* (0.005)	0.076* (0.005)	0.069* (0.004)	0.058* (0.005)	0.055* (0.005)	0.051* (0.004)	0.046* (0.004)	0.051* (0.004)	0.048* (0.004)
Age-sq	-0.001* (0.000)	-0.001* (0.000)	-0.001* (0.000)	0.000* (0.000)	-0.001* (0.000)	-0.001* (0.000)	-0.001* (0.000)	-0.001* (0.000)	-0.001* (0.000)	-0.001* (0.000)	-0.001* (0.000)	-0.001* (0.000)	-0.001* (0.000)	-0.001* (0.000)	0.000* (0.000)	-0.001* (0.000)	-0.001* (0.000)
Married	0.131* (0.010)	0.144* (0.011)	0.127* (0.011)	0.122* (0.011)	0.122* (0.010)	0.134* (0.010)	0.141* (0.010)	0.153* (0.009)	0.133* (0.009)	0.128* (0.009)	0.105* (0.008)	0.130* (0.009)	0.10* (0.008)	0.123* (0.008)	0.116* (0.008)	0.116* (0.007)	0.115* (0.008)
No School	-0.277* (0.023)	-0.234* (0.029)	-0.177* (0.029)	-0.219* (0.027)	-0.295* (0.032)	-0.280* (0.030)	-0.235* (0.033)	-0.327* (0.036)	-0.252* (0.036)	-0.306* (0.039)	-0.255* (0.042)	-0.198* (0.051)	-0.305* (0.061)	-0.268* (0.062)	-0.269* (0.062)	-0.359* (0.041)	-0.311* (0.044)
Self-Taught	-0.233* (0.028)	-0.275* (0.030)	-0.182* (0.028)	-0.212* (0.032)	-0.209* (0.038)	-0.282* (0.046)	-0.253* (0.037)	-0.249* (0.032)	-0.272* (0.035)	-0.373* (0.039)	-0.297* (0.039)	-0.309* (0.046)	-0.288* (0.054)	-0.205* (0.048)	-0.198* (0.047)		
Primary	-0.108* (0.011)	-0.101* (0.012)	-0.067* (0.011)	-0.084* (0.012)	-0.110* (0.011)	-0.104* (0.011)	-0.094* (0.011)	-0.113* (0.011)	-0.116* (0.011)	-0.136* (0.011)	-0.119* (0.011)	-0.121* (0.011)	-0.111* (0.011)	-0.128* (0.011)	-0.141* (0.011)	-0.124* (0.010)	-0.129* (0.010)
Acad. HS	0.067* (0.016)	0.093* (0.019)	0.066* (0.016)	0.072* (0.018)	0.118* (0.016)	0.077* (0.015)	0.106* (0.015)	0.105* (0.015)	0.067* (0.018)	0.058* (0.013)	0.036* (0.013)	0.019 (0.014)	0.044* (0.013)	0.027~ (0.012)	(0.006) (0.012)	(0.007) (0.012)	0.010 (0.012)
Voc. HS	0.091* (0.015)	0.088* (0.015)	0.121* (0.015)	0.112* (0.014)	0.111* (0.013)	0.107* (0.012)	0.112* (0.012)	0.124* (0.011)	0.086* (0.011)	0.065* (0.010)	0.031* (0.010)	0.041* (0.010)	0.034* (0.010)	0.028* (0.009)	0.008 (0.009)	0.011 (0.009)	0.007 (0.009)
Jr. College	0.193* (0.017)	0.196* (0.017)	0.213* (0.015)	0.227* (0.021)	0.261* (0.015)	0.221* (0.014)	0.218* (0.014)	0.274* (0.013)	0.219* (0.012)	0.208* (0.012)	0.159* (0.011)	0.159* (0.014)	0.179* (0.012)	0.177* (0.011)	0.141* (0.010)	0.124* (0.010)	0.141* (0.010)
Univ+	0.364* (0.018)	0.358* (0.018)	0.347* (0.018)	0.385* (0.018)	0.440* (0.016)	0.412* (0.015)	0.422* (0.015)	0.469* (0.015)	0.453* (0.016)	0.394* (0.015)	0.346* (0.014)	0.333* (0.014)	0.324* (0.014)	0.321* (0.013)	0.305* (0.013)	0.291* (0.012)	0.291* (0.012)
R-sq	0.209	0.189	0.157	0.160	0.245	0.224	0.234	0.288	0.235	0.254	0.216	0.186	0.186	0.210	0.194	0.183	0.176

Appendix B

Mapping of education levels to years of education.

For years before 1988, there are only eight education levels provided, the highest being "B.A. or higher." Between 1988 and 1994, "Graduate School" is listed separately, and starting in 1995, Master's degrees and Ph.D.'s are listed separately.

For the lower levels of education, the mapping of education level to years of schooling is quite straightforward. For the higher grades (B.A. and above) where a single entry may represent several different completed degrees, I tried two different mappings. One was to estimate the year of graduation of persons in the data who have B.A.'s, and then adjust their estimated returns to schooling upward based on the percentage of post-secondary degrees awarded that year which were higher than a B.A.. This created a different years-of-schooling allocation for each year before 1988. The second was to use an ad-hoc method (based on results of the first method) which attributed slightly more schooling to those with B.A.'s in the early years, with the amount increasing over time (shown below). Neither method made a significant difference to the analysis.

Mapping of Education Levels to Years of Schooling
(cell entry is years of schooling)

Education Level	1979-84	1985-87	1988-94	1995
None (illiterate)	0	0	0	0
Self-Taught/Tutor	2	2	2	2
Primary School	6	6	6	6
Middle School	9	9	9	9
Regular High School	12	12	12	12
Vocational High School	12	12	12	12
Junior/Vocational College	14	14	14	14
B.A. or higher	16.1	16.3		
B.A.			16	16
Graduate School			18	
Master's Degree				18
Ph.D.				21

Appendix C: Table 1

Returns to Education by Cohort

Active Sample

(standard errors in parentheses with p<0.05=~, p<0.01=*)

Birth Yr:	1925-29	1930-34	1935-39	1940-44	1945-49	1950-54	1955-59	1960-64	1965-69
# obs :	3236	8654	15216	23648	27831	46933	48010	35671	16244
intcpt	9.976	10.906*	12.782*	8.630*	7.886*	7.891*	6.309*	2.321*	3.553*
	(13.362)	(1.739)	(0.501)	(0.200)	(0.138)	(0.078)	(0.098)	(0.202)	(0.802)
age	(0.057)	(0.088)	-0.179*	(0.003)	0.038*	0.046*	0.153*	0.452*	0.437*
	(0.511)	(0.070)	(0.021)	(0.009)	(0.007)	(0.005)	(0.006)	(0.014)	(0.059)
agesq	0.001	0.001	0.002*	0.001*	0.000~	0.000*	-0.001*	-0.007*	-0.007*
	(0.005)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Married	0.238*	0.205*	0.125*	0.127*	0.139*	0.107*	0.114*	0.099*	0.112*
	(0.021)	(0.015)	(0.013)	(0.011)	(0.009)	(0.005)	(0.004)	(0.005)	(0.007)
Female	-0.197*	-0.284*	-0.374*	-0.347*	-0.275*	-0.302*	-0.269*	-0.247*	-0.232*
	(0.047)	(0.028)	(0.020)	(0.015)	(0.013)	(0.007)	(0.006)	(0.006)	(0.006)
Married X	-0.227*	-0.145*	-0.082*	-0.126*	-0.197*	-0.159*	-0.174*	-0.167*	-0.162*
Female	(0.053)	(0.031)	(0.021)	(0.016)	(0.014)	(0.009)	(0.007)	(0.007)	(0.010)
No School	-0.398*	-0.341*	-0.329*	-0.303*	-0.280*	-0.283*	-0.296*	-0.339*	n/a
	(0.031)	(0.019)	(0.014)	(0.011)	(0.014)	(0.016)	(0.027)	(0.097)	
Self-Taught	-0.291*	-0.342*	-0.311*	-0.315*	-0.256*	-0.279*	-0.241*	(0.210)	n/a
	(0.034)	(0.023)	(0.017)	(0.014)	(0.023)	(0.031)	(0.058)	(0.194)	
Primary	-0.153*	-0.176*	-0.213*	-0.166*	-0.146*	-0.103*	-0.115*	-0.097*	-0.093*
	(0.022)	(0.014)	(0.012)	(0.008)	(0.007)	(0.005)	(0.005)	(0.007)	(0.014)
Acad. HS	0.063~	0.152*	0.165*	0.128*	0.102*	0.095*	0.066*	0.040*	0.008
	(0.030)	(0.021)	(0.018)	(0.013)	(0.010)	(0.007)	(0.006)	(0.007)	(0.009)
Voc. HS	0.160*	0.191*	0.198*	0.170*	0.144*	0.116*	0.077*	0.042*	0.009
	(0.034)	(0.022)	(0.016)	(0.011)	(0.009)	(0.006)	(0.005)	(0.005)	(0.006)
Jr. College	0.228*	0.336*	0.419*	0.411*	0.381*	0.287*	0.251*	0.204*	0.144*
	(0.036)	(0.022)	(0.017)	(0.012)	(0.010)	(0.007)	(0.006)	(0.006)	(0.007)
Univ+	0.364*	0.454*	0.519*	0.470*	0.489*	0.452*	0.418*	0.375*	0.311*
	(0.035)	(0.024)	(0.018)	(0.012)	(0.009)	(0.007)	(0.006)	(0.007)	(0.009)
R-sq	0.315	0.379	0.498	0.570	0.553	0.556	0.532	0.434	0.275

Appendix C: Table 2

Female Returns to Education by Cohort

Active Sample

(robust standard errors in parentheses with p<0.05=~, p<0.01=*)

Birth Yr:	2.00	3.00	4.00	5.00	6.00	7.00	8.00	7.00	10.00	11.00
# obs :	407	1727	4051	6926	8820	15148	16287	13173	6535	389
intcpt	40.49	9.022~	11.442*	8.859*	7.547*	7.514*	6.420*	2.105*	3.212~	9.731*
	(43.51)	(4.28)	(1.01)	(0.40)	(0.27)	(0.15)	(0.18)	(0.36)	(1.31)	(0.04)
age	(1.25)	(0.03)	-0.133*	(0.03)	0.039*	0.047*	0.126*	0.450*	0.441*	
	(1.67)	(0.17)	(0.04)	(0.02)	(0.01)	(0.01)	(0.01)	(0.03)	(0.10)	
agesq	0.01	0.00	0.002*	0.001*	0.000~	0.000*	-0.001*	-0.007*	-0.007*	
	(0.02)	(0.00)	0.00	0.00	0.00	0.00	0.00	0.00	(0.00)	
mrd	-0.037*	0.056*	0.033*	-0.006*	-0.048*	-0.022*	-0.025*	-0.039*	-0.032*	-0.013*
	(0.06)	(0.03)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.03)
educ1	-0.684*	-0.543*	-0.469*	-0.313*	-0.249*	-0.254*	-0.228*	-0.226~		
	(0.09)	(0.04)	(0.03)	(0.02)	(0.02)	(0.02)	(0.03)	(0.11)		
educ2	-0.558*	-0.611*	-0.489*	-0.354*	-0.266*	-0.267*	-0.170~	(0.24)		
	(0.11)	(0.06)	(0.03)	(0.03)	(0.03)	(0.04)	(0.07)	(0.36)		
educ3	-0.434*	-0.396*	-0.396*	-0.218*	-0.181*	-0.150*	-0.121*	-0.092*	-0.138*	(0.10)
	(0.10)	(0.04)	(0.03)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.02)	(0.09)
educ5	0.169~	0.196*	0.258*	0.236*	0.232*	0.181*	0.176*	0.134*	0.051*	0.06
	(0.12)	(0.06)	(0.04)	(0.03)	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)	(0.06)
educ6	0.355*	0.279*	0.283*	0.273*	0.266*	0.209*	0.183*	0.126*	0.052*	0.05
	(0.20)	(0.09)	(0.04)	(0.03)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.04)
educ7	0.291*	0.467*	0.544*	0.640*	0.629*	0.469*	0.447*	0.363*	0.243*	0.212*
	(0.15)	(0.06)	(0.04)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.05)
educ8	-0.028*	0.548*	0.622*	0.678*	0.703*	0.624*	0.625*	0.544*	0.442*	0.387*
	(0.15)	(0.09)	(0.06)	(0.03)	(0.02)	(0.01)	(0.01)	(0.01)	(0.02)	(0.05)
R-sq	0.32	0.35	0.45	0.50	0.52	0.49	0.44	0.35	0.22	0.23

Appendix C: Table 3

Male Returns to Education by Cohort

Active Sample

(robust standard errors in parentheses with p<0.05=~, p<0.01=*)

Birth Yr:	1920-24	1925-29	1930-34	1935-39	1940-44	1945-49	1950-54	1955-59	1960-64	1965-69
# obs:	2829	6927	11165	16722	19011	31785	31723	22498	9709	509
intcpt:	4.72	11.270*	13.270*	8.331*	7.812*	7.813*	6.044*	2.267*	3.544*	10.029*
	(13.84)	(1.87)	(0.57)	(0.23)	(0.16)	(0.09)	(0.11)	(0.24)	(1.00)	(0.03)
age	0.15	(0.10)	-0.201*	0.01	0.042*	0.050*	0.169*	0.454*	0.437*	
	(0.53)	(0.08)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.07)	
agesq	(0.00)	0.00	0.003*	0.000*	0.000~	0.000~	-0.002*	-0.006*	-0.007*	
	(0.01)	(0.00)	0.00	0.00	0.00	0.00	0.00	0.00	(0.00)	
mrd	0.243*	0.213*	0.138*	0.137*	0.148*	0.103*	0.103*	0.089*	0.104*	0.116*
	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)	(0.01)	(0.04)
educ1	-0.318*	-0.262*	-0.264*	-0.266*	-0.241*	-0.252*	-0.312*	-0.909*		
	(0.04)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.07)	(0.31)		
educ2	-0.266*	-0.274*	-0.247*	-0.282*	-0.179*	-0.232*	-0.257~	(0.18)		
	(0.04)	(0.03)	(0.02)	(0.02)	(0.03)	(0.05)	(0.11)	(0.22)		
educ3	-0.131*	-0.140*	-0.156*	-0.145*	-0.122*	-0.070*	-0.084*	-0.061*	-0.034*	(0.13)
	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.12)
educ5	0.042~	0.138*	0.143*	0.093*	0.061*	0.068*	0.029*	0.005*	-0.002*	(0.02)
	(0.03)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.05)
educ6	0.161*	0.198*	0.209*	0.148*	0.099*	0.079*	0.037*	0.012~	-0.002*	0.02
	(0.03)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.04)
educ7	0.220*	0.292*	0.363*	0.302*	0.257*	0.207*	0.167*	0.125*	0.092*	0.111*
	(0.04)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.04)
educ8	0.393*	0.456*	0.533*	0.434*	0.416*	0.378*	0.318*	0.275*	0.199*	0.233*
	(0.04)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.07)
R-sq	0.21	0.25	0.38	0.48	0.49	0.53	0.51	0.38	0.12	0.05