Returns to Schooling of Increasingly-Educated Cohorts

in Taiwan*

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ABSTRACT

This paper analyzes the within-cohort relative wages of differently-educated workers in Taiwan. In a development context, the educational composition of a population often changes more rapidly than its age composition. Younger cohorts entering the labor force in Taiwan between 1979 and 1998 received far more education than older cohorts. As a result, the return to education within younger cohorts declined dramatically. Therefore, in a development context, it is important to take educational composition into account when analyzing the relative wages of different cohorts.

INTRODUCTION

Ever since Easterlin (1966) contrasted the fortunes of the American baby boom generation and the sparser generation that preceded it, researchers have noted that one's economic prospects are directly related to the number of one's peers. The reasons for this are manifold. For one, resources tend to remain fixed; for example, it is more likely that a large generation will find places in college or professional school more difficult to attain than the generation that preceded it. For another, many jobs are part of a fixed "career ladder," with a certain amount of experience required for promotion, which makes it difficult for members of the large cohort to compete with members of other cohorts for employment (Easterlin 1980). Macunovich (2000) notes that this has been well-documented empirically with respect to relative wages in developed countries (Berger 1984, Freeman 1979, Welch 1979).

In a development context, however, the labor market experiences of different cohorts are more difficult to compare. This is because the average educational attainment in a developing country's population is often increasing rapidly, so the experience of one cohort may be far different from even the experience of those born a decade earlier. Therefore, in studying the relative wages of different cohorts in developing countries, it makes sense to stratify by education in addition to age. In this context, educated people from more well-educated cohorts should receive less of a return to their education than similarly-educated people from a cohort where their peers are fewer.

In many ways, Taiwan presents an ideal case with which to shine light on the effects of increased educational attainment on the wage structure of a developing country. In Taiwan, since younger cohorts received more and more schooling under Taiwan's education policy,

the educational composition of Taiwan's population changed substantially between 1979 and 1998. Moreover, detailed microdata on Taiwan's labor force are available throughout this time period.

This study is not the first to take note of this and seek to measure changes in the return to education in Taiwan. For example, using data from the May supplement of Taiwan's Labor Force Surveys through 1991, Gindling, Goldfarb, and Chang (1995) observe a generalized decline in the wage return to education for graduates with a lower secondary qualification or higher. Further, they observe that the tertiary returns to education exceeded the secondary returns to education in Taiwan, which is an unusual finding for a developing country (c.f. Psacharopoulos 1989). They speculate that these trends resulted from a combination of an increased supply of educated graduates and skill-biased technical change increasing the demand for these graduates, but call for further research on the subject.

Clark and Hsieh (2000) study Taiwan's compulsory education policy with similar data and an eye toward using year of birth as an instrument to measure the return to a year of schooling in Taiwan. They find that doing so generates IV estimates of the return to education that are significantly lower than the corresponding OLS estimates, which they argue is because of the significantly greater supply of educated graduates in Taiwan after the compulsory education policy in Taiwan took effect.

This paper substantiates and extends these findings by exploring differences in the return to education within cohorts. First, it describes the education policies of Taiwan leading up to this time period and Taiwan's industrial development policies for these two decades, paying particular attention to the outcomes of these policies across different birth cohorts. The second section uses regression analysis to quantify changes in Taiwan's wage structure

from 1979 to 1998 among birth cohorts and educational groups. Including year variables permits filtering out distortions due to economic shocks and skill-biased technical change. The results of this regression show a clear pattern of diminishing returns to education within well-educated cohorts.

TAIWAN'S EDUCATION POLICY

Historical Background and Implementation

By the middle of the 1950's, it became evident in Taiwan that the structure of Taiwan's educational system, in which a very high proportion of school-age children attended primary school, but far fewer went beyond that, was in need of reform. For example, for the cohort born in 1944, 88.4% of these Taiwanese completed primary school, but only 34.7% went on to complete any higher level.[1] Though opportunities for attending lower secondary school were relatively few at the time, the demand for such education had accelerated to the point where the stresses imposed on children by the competitive entrance examination system had begun to reach an extreme level. To have a chance at one of the coveted places in lower secondary meant, at the very least, long hours of private supplementary classes and even longer hours of extra study.

In the face of such strong demand by parents for more education for their children, the Taiwanese Ministry of Education responded by constructing large numbers of lower secondary schools with the overarching goal of removing the examination requirement. The

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[1]From author's calculations, using data from the May supplements of Taiwan's Labor Force Surveys.

intent was to provide a place in the local lower secondary school for all students who wished to attend. Though the Ministry of Education had hoped to construct enough schools by 1955, and kept up its school construction project until well past then, by 1965 the widely-criticized examination system for lower secondary places still persisted. At the same time, membership requirements of the International Labor Organization forbade the use of workers under the age of fourteen, so what to do with the island's children aged twelve through fourteen had become a growing social problem.

In this climate, the Taiwanese government under Chiang Kai-shek ordered the Ministry of Education to continue its school-building project with the goal of implementing nine years of compulsory education by 1970. This date was later revised to two years earlier, and the extension of compulsory education from six to nine years became law in 1968.

Outcomes

Effects on Educational Attainment. The Taiwanese education policy had dramatic effects on the educational composition of Taiwan's population. The most direct indication of the policy's effects is a dramatic increase in the proportion of primary school students advancing to a place in lower secondary school over time, as Table 1 indicates. Though there is a substantial spike in promotion levels immediately after implementation of compulsory education, enrollment in lower secondary schools did not truly become universal in Taiwan until about 1986.

The effects of this policy on the educational composition of Taiwan's population become immediately apparent when examining the proportions of people in Taiwan with the required

level of compulsory education (lower secondary) or more by year of birth. Figure 1 shows these proportions for all of Taiwan. Labor force surveys taken from 1979 to 1998 allow observation of the educational attainment of cohorts born from 1879 through those born in 1983. The vertical line on the right is drawn for the year 1956, the year of birth for the first cohort to be affected by the compulsory education law. Students turning 12 in 1968 would have graduated from primary school that year and then been the first compelled to attend lower secondary under the new regulation. The vertical line on the left is drawn for 1938; students turning 12 in 1950 were the first to benefit from the Ministry of Education's continuing school construction plan.

It is clear that educational attainment in Taiwan had been on the rise even before the compulsory education policy. The rising trend in educational attainment before then is attributable to policies of Japanization undertaken during Japan's colonial rule of the island from 1895 to 1945. It had been the view of the Japanese colonial government that using the educational system to improve literacy and promote cultural assimilation would be the best strategy for the colony's long-term stability and economic success (Hermalin, Liu, and Freedman 1994, Tsurumi 1977). The dip in educational attainment immediately to the left of the 1938 line is attributable to chaos caused by World War II and the Nationalists' closing of Japanese schools and repatriating Japanese teachers upon taking power in 1945. Some of the bulge immediately prior, however, represents immigration from the mainland with the arrival of the Nationalist army, who tended to be born in between 1920s. About a million in number, and many of them soldiers and officials, they had more education than the local Taiwanese who were born at about the same time (Zimmer, Liu, Hermalin, and Chuang 1998).

Overall, the date of beginning the school construction policy seems to be more important than the date of the compulsory education law in terms of the shift in Taiwan's educational attainment. That said, the Ministry of Education had been ordered to continue its school construction policy for the express purpose of preparing for the implementation of the compulsory education law, so the absence of a sharp jump in educational attainment at the point of the law's passage should not be taken as evidence that the law's effect was only marginal given that the school construction policy was already underway.

Effects on Labor Force Composition. Table 2 summarizes changes in the composition of Taiwan's labor force between a number of different demographic groups, both over time and by birth cohort. The quantities given are the percentage each group represents of the total number of people in the labor force. A number of trends are apparent; the labor force became both more highly educated and more gender-balanced. Taiwan's labor force also became more aged over this time period, with the age of the median worker rising from 32 years in 1979 to 37 years in 1998.[2]

The relative proportion of workers with only a primary education declines sharply over time, accounting for 43% of the total labor force in 1979 but only 19% of the labor force in 1998. This is to be expected, since most entrants to the labor force over this time period were young people completing their schooling and most of those exiting were older retirees.

Most of the new workers entering the labor force, however, did not stop at merely the level of education they were required to attain. The proportion of lower secondary workers entering the labor force increased in successive birth cohorts through 1961, and then

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[2]Calculated using data from Taiwan's Labor Force Surveys.

decreased in favor of workers opting either for vocational training (representing at least 12 years of education) or a university degree. As a result, the proportions of workers in the labor force from higher educational groups all posted strong increases over time, with the proportion of workers graduating from vocational and technical colleges increasing the most swiftly from 1979 to 1989. From 1994 to 1998, however, the proportion of workers with university degrees and higher qualifications was the one that grew the most rapidly.

In summary, there were profound and rapid changes in the educational attainment of Taiwan's population across birth cohorts. While only a third of students born in 1944 went on to any education past primary school, for the cohort born twenty years later, three years of secondary education had become universal and almost three quarters of students exceeded this mark. Accordingly, the supply of educated graduates, particularly young educated graduates, in Taiwan's labor force increased rapidly from 1979 through 1998.

MEASURING CHANGES IN TAIWAN'S WAGE STRUCTURE

Methodology

In order to measure changes in Taiwan's wage structure over this time period, data are used from the May supplements of Taiwan's monthly Labor Force Survey, which has been administered by Taiwan's Directorate-General of Budgeting, Accounting and Statistics every year since 1979. The survey is in the form of a household survey and asks detailed questions on wages earned, hours worked, and job held in addition to demographic information such

as highest level of education attained and place of residence. The survey is limited to those

aged fifteen and higher. Every year, the survey is given to approximately 19,000 households,

which at an average household size of slightly more than three members over 15 years of

age translates into approximately 60,000 observed people each year, of whom about half

participate in the labor force. In all, the data sets from 1979 to 1998 comprise a substantial

merged dataset with 1,144,471 individuals observed in total.

At first blush, one might try to measure the changing return to education in Taiwan by

estimating a standard wage equation with the form

$$W_i = \beta_0 \text{ x } gender + \beta_1 \text{ x } age + \beta_2 \text{ x } age^2 + \beta_3 \text{ x } Y_{ei} + \epsilon_i \tag{1}$$

where W_i represents the individual's log hourly wage, and Y_{ei} is a vector of education in-

dicators interacted with a complete set of year indicators. ϵ_i is a normally, independently

distributed error term with mean zero and standard deviation σ. This would allow compar-

ing the relative wages between different types of educated labor from year to year by simply

comparing the estimated coefficients within β_3. However, this assumes that, after allowing

for some difference in productivity due to varying years of experience, workers are perfectly

substitutable across birth cohorts.

A specification more consistent with imperfect substitutability by birth cohort is

$$W_i = \beta_0 \text{ x } gender + \beta_1 \text{ x } age + \beta_2 \text{ x } age^2 + \beta_3 \text{ x } Y_{ei} + \beta_4 \text{ x } B_{ei} + \epsilon_i \tag{2}$$

where the additional term B_{ei} is a vector that interacts education states with the birth

cohort of the individual. This allows one to think of the wage for individuals with a certain educational level as being made up of two components: a fixed component that they carry throughout life along with other members of their birth cohort who have obtained this level of education, and a variable component they share with everyone of that educational level but which changes over time. The variable component, Y_{ei}, absorbs any shock that affects everyone of that educational level in that year, which includes skill-biased technical change or shocks affecting macroeconomy as a whole.

It should be noted that there are other decompositions possible from the one specified, since cohort effects are not identifiable separately from a series of changes in the age-earnings profile over time. This model in particular assumes that the age-earnings profile is quadratic and constant over time, except for any level effects enjoyed by one who is a member of a particular cohort. Nevertheless, in an analysis focused on differences across cohorts, these estimates are a useful way to summarize the data.

Results

Figures 2 through 11 show an estimation of the varying returns to education across birth cohorts, along with the changes in the proportion of each cohort in the labor force with a certain educational level. The wage levels shown are the parameter estimates of β_4 in equation (2) above, relative to the wages paid to those with a lower secondary education. These can be thought of as cohort-education fixed effects. The proportions are shown for each cohort when that cohort is between 30 and 50 years of age, inclusive, which is the period of highest labor force participation for men and women in Taiwan. This age range

was selected to avoid distorting the proportions because of differing times of individuals' entering into the labor force or retiring from it, both of which are systematically related to the ultimate level of education attained.

The striking finding is that, even after controlling for age, there are large, significant differences in the returns to different educational qualifications across birth cohorts. For example, for men, in Figure 2, the return to a primary education for someone born in 1961, a cohort in which less than 10% of its members stopped school at the primary level, is almost 30% higher than the return for someone born on 1933, a cohort in which almost 60% stopped at the primary level. Similarly, in Figure 5, someone who attained a vocational college degree born in 1933, a cohort in which less than three percent attained such degrees, typically earned almost 30% more than someone born in 1961, to a cohort in which more than 10% attained such degrees.

For women, there are similar trends; looking at Figure 7, the return to a primary education for a woman born in 1961 is more than 30% higher than that for a woman born in 1933, but looking at Figure 10, the return to a vocational college education for a woman born in 1961 is more than 40% lower. This is strong evidence for the cohort effects argued to exist by Clark and Hsieh (2000). These findings are particularly significant in the light that they represent a difference in earnings workers will carry with themselves throughout their time in the labor force, directly having an impact on total lifetime income.

CONCLUSION

It is well-established that the wages of large cohorts will be low relative to the wages of smaller cohorts, for reasons of Easterlin's (1980) "career ladder" or imperfect substitutability of labor across cohorts. It is less well-established that this is true when stratifying by education as well as by birth cohort, and the extent to which this can be expected to hold in a developing country. Since this is the case, however, the educational composition of a cohort as well as its size is of substantial importance in determining the wages of its members.

Taiwan's population between 1979 and 1998 underwent significant change in terms of its educational composition; for Taiwanese born in 1945, more than half have six years of education or less, but for Taiwanese born in 1965, almost three quarters have nine years of education or more. As a result, the return to education within younger cohorts plummeted. For example, the wage premium for a university education over nine years only dropped by nearly two-thirds, and the premium for nine years of education over six disappeared entirely.

This paper has largely abstracted form changes in the wage structure attributable to industrial development, which often implies skill-biased technical change. When such development is taking place, the wages of young, skilled people will increase relative to their unskilled counterparts, but this will be mitigated when education policy assures that the supply of educated workers increases. In fact, reducing the cost of skilled labor in this way is often seen as a way to encourage industrial development to take place. That said, industrial development may not automatically follow; in at least one case, Indonesia, an increase in the educational attainment of the population did not prompt such development (Duflo 2000).

This paper has presented a method of measuring the effects of increased educational attainment on relative wages across cohorts independent of any changes that might be due to skill-biased technical change. However, since the cohorts studied participated in the labor force throughout the time period studied, such change would not affect one cohort differently from another, leaving the calculation of their relative wages within educational groups intact. Further studies of this type should examine any compositional changes in the population among groups that are not readily substitutable. Particularly, in a developed country, when educational composition is not undergoing significant change, cohort size may be an acceptable proxy for labor supply. But in a development context, it is unlikely to be sufficient.

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Table 1: Percent Primary School Students Promoted to Lower Secondary School, by Year

Year	Percent Promoted
1950	31.78
1956	47.75
1961	53.79
1966	59.04
1971*	80.85
1976	90.41
1981	96.77
1986	99.04
1991	99.28
1996	98.89

* first measured year under the compulsory education policy
Source: Education Statistical Indicators, Republic of China, Ministry of Education, Taiwan, April 1999.

Table 2: Gender and Educational Composition of Taiwan's Labor Force, by Year and Birth Cohort

Percent of Total, By Year	79	84	89	94	98
Men	67.20%	63.86%	62.40%	61.63%	60.38%
Women	32.80%	36.14%	37.60%	38.37%	39.62%
Total	100.00%	100.00%	100.00%	100.00%	100.00%
Illiterate	7.97%	6.09%	4.11%	2.59%	2.11%
Self-Educated	3.07%	2.36%	1.75%	1.02%	0.49%
Primary	42.96%	36.14%	30.43%	24.55%	18.86%
Lower Secondary	17.96%	19.28%	19.80%	20.68%	19.05%
Upper Secondary	6.58%	7.24%	8.11%	8.90%	9.27%
Senior Vocational	11.69%	16.78%	20.76%	23.53%	25.61%
Vocational/Technical College	4.84%	6.42%	8.33%	10.94%	13.98%
University and Higher	4.92%	5.70%	6.71%	7.80%	10.64%
Total	100.00%	100.00%	100.00%	100.00%	100.00%

Percent of Total, By Cohort	29	33	37	41	45
Illiterate	15.15%	13.72%	13.00%	8.77%	4.04%
Self-Educated	6.08%	5.62%	7.02%	4.11%	1.27%
Primary	52.54%	58.23%	55.39%	53.62%	50.62%
Lower Secondary	10.52%	8.75%	7.97%	10.91%	12.84%
Upper Secondary	4.76%	4.16%	3.51%	4.88%	6.50%
Senior Vocational	4.26%	4.04%	5.94%	8.13%	10.50%
Vocational/Technical College	3.30%	2.74%	3.25%	4.14%	5.93%
University and Higher	3.39%	2.75%	3.92%	5.45%	8.31%
Total	100.00%	100.00%	100.00%	100.00%	100.00%

Percent of Total, By Cohort	49	53	57	61	65
Illiterate	2.25%	0.85%	0.08%	0.00%	0.00%
Self-Educated	0.48%	0.17%	0.01%	0.00%	0.00%
Primary	45.67%	37.05%	18.60%	8.90%	3.40%
Lower Secondary	13.82%	15.04%	25.65%	28.44%	23.59%
Upper Secondary	7.30%	9.07%	9.90%	9.35%	9.97%
Senior Vocational	12.99%	18.72%	24.27%	28.03%	32.07%
Vocational/Technical College	8.63%	10.32%	11.68%	13.83%	17.96%
University and Higher	8.85%	8.78%	9.81%	11.45%	13.02%
Total	100.00%	100.00%	100.00%	100.00%	100.00%

Source: Taiwanese Labor Force Survey (Taipei: Directorate-General of Budget, Accounting and Statistics, Taiwan), various years.

Figure 1: Proportion of Men and Women in Taiwan with Nine Years of Education or More, by Year of Birth
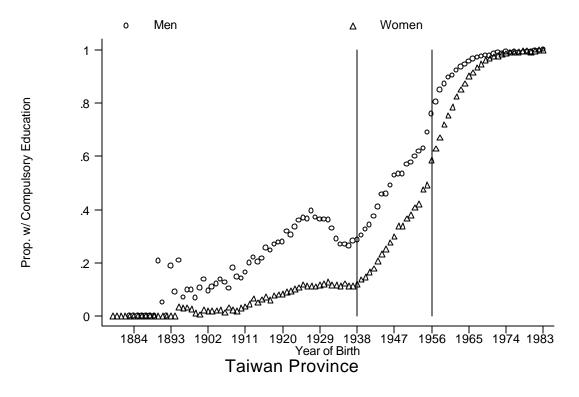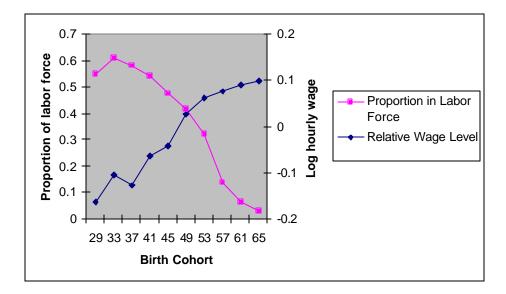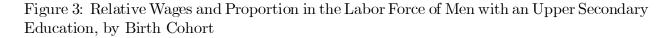

Figure 2: Relative Wages and Proportion in the Labor Force of Men with a Primary Education, by Birth Cohort
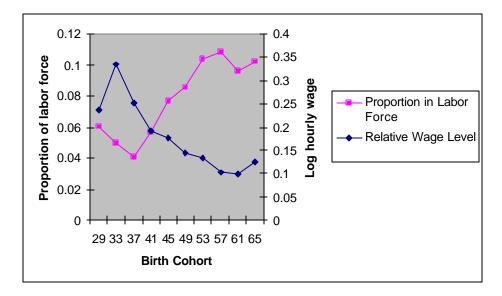

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Figure 3: Relative Wages and Proportion in the Labor Force of Men with an Upper Secondary Education, by Birth Cohort

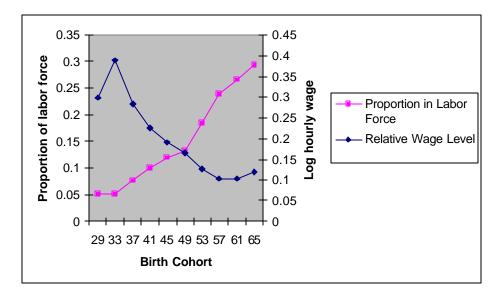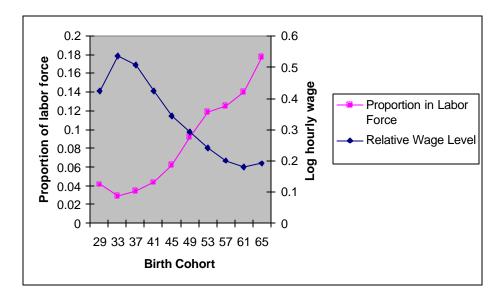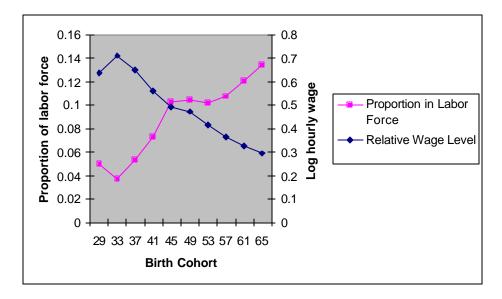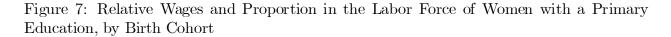Figure 4: Relative Wages and Proportion in the Labor Force of Men with a Senior Vocational Education, by Birth Cohort

Figure 5: Relative Wages and Proportion in the Labor Force of Men with a Vocational College Education, by Birth Cohort

Figure 6: Relative Wages and Proportion in the Labor Force of Men with a University or Higher Education, by Birth Cohort
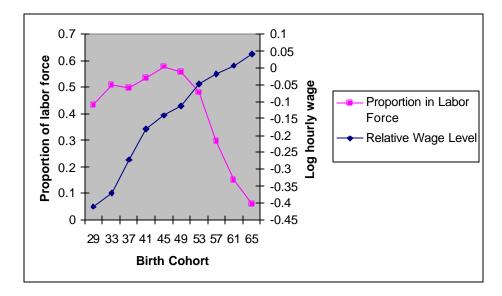

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Figure 7: Relative Wages and Proportion in the Labor Force of Women with a Primary Education, by Birth Cohort

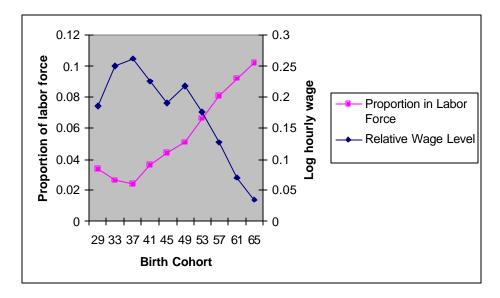Figure 8: Relative Wages and Proportion in the Labor Force of Women with an Upper Secondary Education, by Birth Cohort

Figure 9: Relative Wages and Proportion in the Labor Force of Women with a Senior Vocational Education, by Birth Cohort
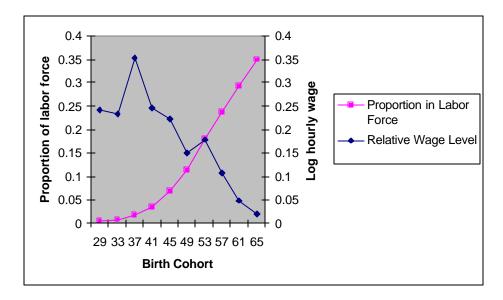

Figure 10: Relative Wages and Proportion in the Labor Force of Women with a Vocational College Education, by Birth Cohort
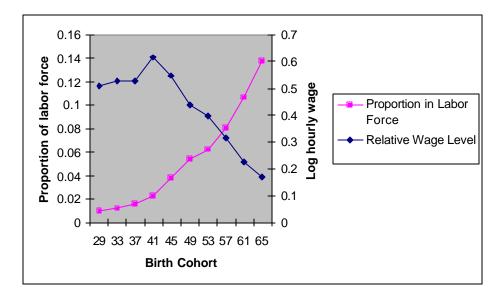
Figure 11: Relative Wages and Proportion in the Labor Force of Women with a University or Higher Education, by Birth Cohort