THE INCIDENCE AND WAGE EFFECTS OF OVEREDUCATION: THE CASE OF TAIWAN

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This paper, based on data from Survey of Family Income and Expenditure of Taiwan, shows that the recent trends of job match in Taiwan labor market have been marked by increasing proportion of overeducated workers due to the higher education expansion policy, while the incidence of undereducation continues to decline. Furthermore, workers' economic position is not completely determined by their educational levels. Working experience also plays an important role in workers' job placement and their wages. Workers with relatively less working experience are more likely to be overeducated, while workers with relatively more working experience are more likely to be undereducated. Overeducated (Undereducated) workers would earn more (less) than their co-workers with adequate education but less (more) than the workers having the same educational level with adequate education for jobs. However, the rewards (penalties) to adequate education and overeducation (undereducation) decline as more experience accumulated. Evidence also shows effect of bumping down from overeducation on the wages and employment of lower educated workers.

Keywords: Overeducation, Wage, Bumping Down, Labor Market, Taiwan
JEL classification: I21, J23, J31

1. INTRODUCTION

Human resource development has been the key characteristic on the high growth of Taiwan's economy for the past three decades in that knowledge and skills of workforce are generally recognized as one of the main driving forces in the process of economic growth (Lucas (1988)). Taiwan's continuous investment in schooling resources since 1968[1] has shown remarkable improvement in human capital accumulation and therefore

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[1] In 1968, the Taiwan government extended the basic schooling from six to nine years, which allowed primary school graduates to continue their education at junior high school level without any entrance examination. This policy was considered as the largest education expansion in Taiwan before the 1990s.

the average educational attainment for the whole population. Table 1 shows the time series of the percentage of educational attainment for population aged 15 years and older in Taiwan. The proportion of those with no formal education and those attending only primary schools was reduced from 58.71 percent in 1976 to 21.41 percent in 1999, while the proportion of those with higher education (at least junior college degrees) increased from 7.39 percent in 1976 to 24.64 percent in 1999. The speed of increasing high-educated workers was much faster after the late 1980s, when the Taiwan government started implementing a major higher education expansion policy which was to increase the number of two-year and four-year colleges. As a result, the number of higher-educated graduates increased dramatically each year since the policy took place (Table 2).

Table 1.   Educational Attainment (percentage) of Population Aged 15 Years and Older in Taiwan

year	Illiterate & Self-educated	Primary school	Junior high	Senior high	Junior college	College & above
1976	18.66	40.05	14.96	18.93	3.52	3.87
1977	17.78	39.12	15.50	19.75	3.78	4.07
1978	16.97	37.73	16.12	20.73	3.96	4.49
1979	16.35	36.68	16.64	21.57	4.20	4.56
1980	15.42	35.98	17.08	22.45	4.45	4.61
1981	14.72	34.84	17.45	23.44	4.71	4.83
1982	14.05	33.92	17.51	24.44	5.01	5.06
1983	13.49	32.95	17.69	25.38	5.34	5.15
1984	12.80	32.14	17.84	26.29	5.58	5.33
1985	12.09	31.25	17.86	27.55	5.86	5.39
1986	11.54	30.32	17.98	28.47	6.15	5.54
1987	10.82	29.59	18.00	29.43	6.43	5.74
1988	10.03	29.09	18.12	30.16	6.68	5.92
1989	9.54	28.48	18.06	30.83	7.01	6.07
1990	9.10	27.48	18.30	31.72	7.33	6.08
1991	8.56	26.56	18.38	32.38	7.77	6.36
1992	8.17	25.05	18.34	33.24	8.42	6.79
1993	7.90	23.91	18.2	34.07	8.84	7.07
1994	7.32	23.49	17.84	34.47	9.45	7.45
1995	6.94	22.85	17.49	37.82	10.08	7.81
1996	6.50	21.52	17.14	35.53	10.95	8.37
1997	6.13	19.43	17.08	36.19	11.95	9.22
1998	5.84	17.68	17.10	36.38	12.94	10.7
1999	5.43	15.98	16.76	37.18	13.34	11.30

Source: Ministry of Education, Executive Yuan, Taiwan (2000)

Table 2.   Numbers of Higher Education Graduates 1986-1999

	2-year and 4-year college graduates		Master degree and above graduates	
	number	growth rate (%)	number	growth rate (%)
1986	95,486	-	4,352	-
1987	97,245	1.84	4,997	14.82
1988	100,419	3.26	5,257	5.20
1989	108,129	7.68	6,184	17.63
1990	122,266	13.07	6,927	12.01
1991	136,058	11.28	8,296	19.76
1992	146,652	7.79	9,948	19.91
1993	161,593	10.19	11,256	13.15
1994	169,067	4.63	12,554	11.53
1995	175,815	3.99	13,702	9.14
1996	181,881	3.45	14,503	5.85
1997	199,984	9.95	15,428	6.38
1998	208,307	4.16	16,323	5.80
1999	229,678	10.26	18,212	11.57

Source: Ministry of Education, Executive Yuan, Taiwan (2000)

Along with the increase of higher-educated labor, demand for higher-educated labor was also growing in Taiwan for several reasons. Skill-biased technological changes within industries in favor of higher-educated workers, importing foreign low-skilled workers into Taiwan, and changes in structure of trade pattern toward high-tech goods and services for Taiwan are the major factors. More higher level jobs have been offered in the labor market due to the demand shift to higher-educated workers. The question is whether there are enough increased higher level jobs offered to those increased higher-educated workers. If a worker is forced to accept a job that requires fewer skills than he/she actually obtained, the worker will be classified as overqualified or overeducated. In general, if there is excess supply of qualified workers, *overeducation* in the labor market would likely appen.

Various studies have been trying to define and measure overeducation. Groot and Maassen van den Brink (2000) summarize most of the past literatures and distinguish four different ways of defining overeducation: two subjective and two objective definitions. The first subjective method is based on a worker's

self-assessment by providing the worker a question whether he/she is overeducated or undereducated for his/her current job. Instead of asking directly, the second subjective method asks the question what the minimal educational requirement is for the job. If the self-reported minimal educational level is below the worker's actual educational level, the worker is classified overeducated. Then the first objective method is based on the distribution of educational levels for each occupation. When a worker's educational level is above one standard deviation from the mean value for the occupation, the worker is considered overeducated. The alternative way (Kiker *et al.* (1997)) is to use the modal value of the distribution as adequately educated. A worker is said to be overeducated if his/her educational level is above the modal value. The second objective method relies on the professional job analysis, such as Dictionary of Occupational Titles (DOT) for the US, which specifies the required level of education for an occupation.

So far there is no evidence that which way of definition and measurement is over another. Hartog (2000) describes the advantages and drawbacks for each definition above. In practice, depending on the availability of data in research, different definitions would lead to divergent measurements in overeducation and undereducation.

The reasons that overeducation exists in labor market are found in many empirical studies for various countries. Job competition model by Thurow (1975) proposes that employers would like to hire the more educated workers in order to substitute the later investment in on-job-training for workers even the educational level of a worker is above the job's requirements. Overeducated workers are found with less experience and on-job-training, or having job interruption during their careers (Sicherman (1991); Groot (1993, 1996)). In the case of Taiwan, increasing growth of higher-educated workers in recent years would likely lead to more young overeducated workers. The other less unknown explanation is based on the speed of technological changes (De Oliveria *et al.* (2000)). Employers would like to hire overeducated workers in that the rapid progress in technology will make current employed workers look like undereducated later. This can also explain why younger workers are more likely to be overeducated than older workers in the labor market.

It is plausible that overeducation in the Taiwan labor market should increase after the higher education expansion policy has been implemented. As essentially studies of this issue for Taiwan are very limited in literature, this paper first investigates the time trend of incidences in overeducation, adequate education, and undereducation in the Taiwan labor market over the 1990s. We then explore the differences in overeducation and undereducation from the perspectives of gender, experience, and economic returns.

2.   DATA SOURCES

This study uses the 1993, 1996, and 1999 versions of "Survey of Family Income and Expenditure." The data base is collected by Directorate-General of Budget, Accounting and Statistics (DGBAS) of Executive Yuan, Taiwan. Most of the sample data are obtained by random face-to-face interview, with some supplemental mail interviews. The data set contains personal income, education level, working sector, type of occupation, age and gender. Self-employed and unemployed workers are excluded from our study. This reduces the sample to an average of 12,000 individuals aged 18-65 who are not in military service each year.

The definitions and descriptive statistics of the variables used in the analysis are showed in Tables 3 and 4. Due to the limitation of our data set, we use nine one-digit occupational codes to analyze the overeducation, adequate education and undereducation within each of these nine occupations.

As mentioned earlier, there are four possible ways to measure overeducation, adequate education and undereducation. However, the data set we collected in this study would only allow us to use the modal value of workers' educational distribution for each occupation as the adequate education level. Workers who have educational level higher than the modal value are considered overeducated. The number of years of overeducation then is the difference between the actual years of schooling and the years of schooling for the modal value. Similar calculation is constructed for the proxy of undereducation.

From the sample statistics, average number of years of adequate education increases from 10.830 in 1993 to 11.565 in 1999, implying rising demand for skills in the Taiwan labor market during the 1990s. We also see the average year of overeducation is about 3.032 in 1993 and increases to 3.057 in 1999. On the other hand, the trend of undereducation goes to opposite direction.

Table 3. Definition of Variables

Variable	Definition
LnY	Natural log of annual wages, in 1996 New Taiwan Dollar
EXP	Years of experience, equal (age-years of schooling*-6)
EXP^2	Square of EXP
EDU	Actual number of years of schooling for the worker
ADEDU	Number of years of adequate education for the occupation a worker is currently in
OVEREDU	Number of years of overeducation for the worker, equal (EDU - ADEDU) if EDU>ADEDU, 0 otherwise
UNDEREDU	Number of years of undereducation for the worker, equal (ADEDU - EDU) if EDU<ADEDU, 0 otherwise
Male	Dummy variable, equal 1 if the worker is male, 0 otherwise
OCCP1	Dummy variable, equal 1 if the worker is a legislator, government administrator, business executive or manager, 0 otherwise
OCCP2	Dummy variable, equal 1 if the worker is a professional, 0 otherwise
OCCP3	Dummy variable, equal 1 if the worker is a technician or associate professional, 0 otherwise
OCCP4	Dummy variable, equal 1 if the worker is a clerk, 0 otherwise
OCCP5	Dummy variable, equal 1 if the worker is a service worker or shop and market sale worker, 0 otherwise
OCCP6	Dummy variable, equal 1 if the worker is a agricultural, animal husbandry, forestry or fishing worker, 0 otherwise
OCCP7	Dummy variable, equal 1 if the worker is a production worker, 0 otherwise
OCCP8	Dummy variable, equal 1 if the worker is a machine operator, 0 otherwise
OCCP9	Dummy variable, equal 1 if the worker is a non-technician, 0 otherwise
MANUFAC	Dummy variable, equal 1 if the worker works in manufacturing, 0 otherwise
ELECTRI	Dummy variable, equal 1 if the worker works in electric, gas or water supply industries, 0 otherwise
CONSTR	Dummy variable, equal 1 if the worker works in construction, 0 otherwise
COMMERCE	Dummy variable, equal 1 if the worker works in wholesale or retail trade, 0 otherwise
TRANSPO	Dummy variable, equal 1 if the worker works in transportation, 0 otherwise
FIRE	Dummy variable, equal 1 if the worker works in finance, insurance or real estate, 0 otherwise
SOCIAL	Dummy variable, equal 1 if the worker works in social, personal and related community services and public administration, 0 otherwise
AGRICUL	Dummy variable, equal 1 if the worker works in agriculture, forestry, fishing or mining and quarrying, 0 otherwise

*: Years of schooling for workers with graduate school degree, 4-year college degree, 2-year college degree, senior high school diploma, junior high school diploma, primary school diploma are 18, 16, 14, 12, 9 and 6 respectively. For workers who are illiterate or self-educated, we consider they have zero year of formal education.

Table 4. Descriptive Statistics of Variables

Variable	1993 Mean	1993 s.d.	1996 Mean	1996 s.d.	1999 Mean	1999 s.d.
LnY	12.739	0.518	12.777	0.514	12.895	0.508
EXP	21.558	12.278	21.229	12.095	21.275	12.261
EXP^2	615.486	631.090	596.940	602.786	602.933	603.901
EDU	10.458	3.819	10.972	3.702	11.520	3.632
ADEDU	10.830	3.131	11.165	3.036	11.565	2.950
OVEREDU	3.032	1.136	3.039	1.198	3.057	1.237
UNDEREDU	3.544	1.938	3.396	1.837	3.357	1.840
MALE	0.622	0.485	0.593	0.491	0.589	0.492
OCCP1	0.052	0.222	0.057	0.232	0.062	0.242
OCCP2	0.081	0.272	0.086	0.281	0.086	0.280
OCCP3	0.156	0.363	0.179	0.383	0.202	0.402
OCCP4	0.128	0.334	0.137	0.344	0.143	0.350
OCCP5	0.090	0.286	0.100	0.300	0.103	0.303
OCCP6	0.033	0.179	0.019	0.138	0.017	0.129
OCCP7	0.210	0.407	0.161	0.368	0.133	0.339
OCCP8	0.159	0.366	0.175	0.380	0.183	0.386
OCCP9	0.092	0.289	0.086	0.280	0.073	0.259
MANUFAC	0.331	0.470	0.324	0.468	0.322	0.467
ELECTRI	0.011	0.103	0.013	0.112	0.010	0.102
CONSTR	0.152	0.359	0.133	0.340	0.106	0.308
COMMERCE	0.117	0.322	0.140	0.347	0.153	0.360
TRANSPO	0.061	0.239	0.064	0.246	0.057	0.232
FIRE	0.063	0.243	0.071	0.257	0.090	0.286
SOCIAL	0.228	0.419	0.231	0.421	0.242	0.429
AGRICUL	0.038	0.192	0.024	0.154	0.020	0.140

3.   INCIDENCE OF OVEREDUCATION, ADEQUATE EDUCATION, AND UNDEREDUCATION IN TAIWAN

Table 5 provides the incidence of overeducation, adequate education and undereducation by occupation in 1993, 1996, and 1999. The percentage of workers who are overeducated increases from 26.6 percent in 1993 to 35.0 percent in 1999. The proportion of adequately educated workers over the 1993-1999 period remains relatively constant. The percentage of inadequate education also differs in occupations.[2] For some occupations, the adequately educated workers do not necessarily represent the majority of workers. This could be due to the imprecise classification of occupations for the data we use in this study. However, it can also imply that education is not the only factor for employers to hire a worker to fit a job. Some other variables, such as workers' experience or potential ability, might compensate their inadequate schooling.

It is also clear from Table 5 that the incidence of overeducation has been dramatically increasing in every occupation, while it of undereducation shows a large decline from 1993 to 1999 in Taiwan. There is relatively little change in the incidence of adequate education. From our sample statistics in Table 4, we also find the mean of ADEDU1 for adequately educated workers has increased by 0.735 year (from 10.830 to 11.565), smaller than the increase of average schooling for the entire Taiwan labor market (from 10.458 to 11.520). This not only suggests a small increase in educational requirements for jobs (demand side), but also shows that the increase in educational requirements cannot quite keep pace with the rise in the average level of schooling (supply side) in Taiwan. Rapid expansion in higher education in the 1990s might be able to explain this phenomenon.

Compared to other western developed countries for the similar time period based on the results we find for Taiwan, using the summary of research on overeducation by Groot and Maassen van den Brink (2000), the incidences of overeducation and undereducation are much smaller in these countries (range from about 13 percent to 39 percent for overeducation; from about 10 percent to 30 percent for undereducation). However, according to Cohn and Ng's (2000) finding for Hong Kong, where is more similar to Taiwan culturally, the incidences of overeducation, adequate education and undereducation are about 34, 40 and 26 percent in 1991, compared to those for Taiwan, which are 35, 37 and 28 respectively in 1999.

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[2] Using the modal value of workers' educational distribution for each occupation as the adequate (required) education level, the adequate education level for occupations 1 and 3 is junior college (2-year); and university (4-year) for occupation 2; senior high school for occupations 4 and 5; junior high school for occupations 7 and 8; primary school for occupations 6 and 9.

We now look more detailed to the overeducation and undereducation among workers with different demographic characteristics. A multinomial logit model is used to find out the likelihood of being overeducated or undereducated by experience, gender and educational level, *ceteris paribus*. The model is as follows.

$$\ln(\frac{P_1}{P_0})_{it} = \alpha_{10t} + \alpha_{1t} X_{it} + Z_{it}\beta_{1t} + e_{i1t},$$ (1)

$$\ln(\frac{P_2}{P_0})_{it} = \alpha_{20t} + \alpha_{2t} X_{it} + Z_{it}\beta_{2t} + e_{i2t},$$ (2)

where P_0 is the probability for a worker being adequately educated, and P_1 and P_2 are the probabilities for a worker being overeducated and undereducated respectively. Therefore, the dependent variables, $\ln(\frac{P_1}{P_0})_{it}$ and $\ln(\frac{P_2}{P_0})_{it}$, will be the log odds of being overeducated and being undereducated rather than adequately educated for individual i at time t respectively. X_{it} is a vector of dummy variables indicating the individual's gender, occupational type and sector of employment. Z_{it} is a vector of other individual variables indicating the individual's years of schooling, years of working experience and its square.

Table 6 shows partial estimated results for the multinomial logit model in the years of 1993, 1996 and 1999. First, the model fits data quite well in that the percentage of correct prediction for a worker being overeducated, adequately educated or undereducated is at least 93 percent in each year. Then, the results imply substitutability between education and working experience. A worker with more years of experience would less likely be overeducated rather than adequately educated and more likely be undereducated rather than adequately educated for all of these three sample years. However, the substitutability could be temporary for overeducated workers (Rosen (1972)). Excess years of schooling can substitute for lack of working experience when a worker just enters job markets. As the worker acquires more job-specific experience, he/she will shift to a job that requires the educational level he/she possesses. Therefore the situation of overeducation will not last too long. On the other hand, excess years of working experience can substitute for lack of education when a worker stays in job markets long enough. Employers may want to hire job-specific experienced workers despite of their educational insufficiency. Thus, undereducation would last a long period of time throughout a worker's career. As a result, we would expect that the percentage of overeducated workers for the young will be higher, and the percentage of undereducated workers for the more experienced will also be relatively higher in the Taiwan labor market.

The results also show that male workers are more likely to be overedcated and less likely to be undereducated than female workers for all sample years.

Table 6.   Partial Results of Estimates of Multinomial Logit Model

variables	dependent variable			dependent variable		
	$\ln(P_1/P_0)$			$\ln(P_2/P_0)$		
	1993	1996	1999	1993	1996	1999
constant	5.799*	7.382*	6.575*	-10.782*	-8.998*	-9.899*
	(3.643)	(2.644)	(3.219)	(14.192)	(-10.980)	(-9.520)
EDU	0.989*	1.122*	1.233*	-0.597*	-1.277*	-1.542*
	(2.958)	(3.419)	(3.222)	(2.545)	(3.143)	(4.012)
EXP	-0.365*	-0.488*	-0.273*	0.328*	0.244*	0.205*
	(-7.154)	(-7.405)	(-2.620)	(14.833)	(8.103)	(4.948)
EXP^2	0.003*	0.005*	0.001	-0.002*	-0.0006	0.0003
	(3.819)	(5.254)	(0.669)	(-6.204)	(-1.332)	(0.475)
MALE	0.808*	0.995*	1.032*	-1.198*	-0.955*	-1.018*
	(4.246)	(4.516)	(3.996)	(-11.650)	(-7.494)	(-6.935)
number of observations	13,835	11,182	10,203	13,835	11,182	10,203
percentage predicted correctly	93.43%	94.35%	95.32%	93.43%	94.35%	95.32%

Notes: T-Statistics in parentheses. *: Significant at 5 percent level.

Dummy variables for occupation and working sector are also included in the regressions.

4.   THE WAGE EFFECTS OF OVEREDUCATION ADEQUATE EDUCATION AND UNDEREDUCATION IN TAIWAN

To investigate the role of schooling variables on earnings, we apply standard Mincerian wage equation plus adding variables of individual's years of overeducation, adequate education and undereducation, and their interactions with experience. The argument of substitutability between schooling and experience in the labor market is the explanation that we add interaction terms here (Duncan and Hoffman (1981)). Therefore, the wage equation becomes

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\begin{aligned}
\ln Y_{it} = \alpha_{0t} + Z_{it}\phi_t + \alpha_{1t} ADEDU_{it} + \alpha_{2t} OVEREDU_{it} + \alpha_{3t} UNDEREDU_{it} \\
+ \alpha_{4t} ADEXP_{it} + \alpha_{5t} OVEREXP_{it} + \alpha_{6t} UNDEREXP_{it} + e_{it},
\end{aligned}
\tag{3}
$$

where Y_{it} is the individual i's annual wage at year t. Z_{it} is a vector of individual i's

variables including dummy variables of gender, occupational type and working sector. ADEDU, OVEREDU and UNDEREDU are the individual's educational variables defined in Table 3. ADEXP, OVEREXP and UNDEREXP are the interaction terms just mentioned, which equal to the products of ADEDU, OVEREDU and UNDEREDU with EXP variable, respectively.

The interpretation of coefficients in above equation is well described by Kiker *et al.* (1997). α_1 is the average return to years of required education; α_2 is the return to an additional year of education beyond the educational requirement relative to co-workers who have the required education. Therefore, α_3 would be interpreted as the loss to a year of education below the required education relative to co-workers who have the required education. Based on human capital theory that usually uses educational attainment as an indication for workers' productivity thus their wages, we would expect the signs of estimated coefficients to be $\alpha_1 > 0$, $\alpha_2 > 0$, and $\alpha_3 < 0$. Moreover, $\alpha_2 < \alpha_1$ is also expected. It means although overeducated workers receive positive returns to an extra year of overeducation, they receive lower returns relative to those workers with the required years of education. People with higher qualifications than required for the jobs they have are not considered to waste their excess qualifications completely. With the assumption of wages reflecting productivity, a non-linear relationship between education and productivity is suggested. Extra years of schooling for an overeducated worker are still productive. However, the productivity would be lower than that of those workers having the same schooling as these overeducated workers but being adequately educated for jobs.

From the estimated results in Table 7, we observe the rates of return to a year of adequate education are 8.7, 9.9, and 9.8 percent in years of 1993, 1996, and 1999 respectively. It has been slightly increasing during the 1990s. The rates of return to overeducation are also positive but lower to above three figures. The results are consistent with our hypotheses but a little different from Hartog's (2000) observations in magnitude.[3] Moreover, the rates of return to undereducation are negative, showing penalty to educational insufficiency for undereducated workers. But the penalty is smaller than the returns to required education. Note that the rewards for overeducation and the penalty for undereducation have both increased from 1993 to 1999. All of these estimated results including interaction terms with experience are statistically significant.

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[3] Hartog (2000) reviewed most of overeducation literature for various countries and found the returns to overeducation are about half to two-thirds of the returns to required education. Here we show the result for Taiwan is larger than the findings for these countries.

Table 7. Partial Results from Log Wage Equation

Variables	1993	1996	1999
Constant	11.059*	11.028*	10.956*
	(141.55)	(122.09)	(107.61)
EXP	0.055*	0.053*	0.051*
	(25.27)	(21.41)	(19.97)
EXP^2	-0.00077*	-0.00070*	-0.00071*
	(-29.19)	(-23.40)	(-23.18)
MALE	0.272*	0.231*	0.182*
	(35.27)	(27.12)	(21.24)
ADEDU	0.087*	0.099*	0.098*
	(13.77)	(13.55)	(12.47)
OVEREDU	0.061*	0.071*	0.076*
	(11.25)	(12.45)	(13.61)
UNDEREDU	-0.079*	-0.094*	-0.092*
	(-16.51)	(-15.11)	(-14.41)
ADEXP	-0.00078*	-0.00075*	-0.00049*
	(-6.61)	(-5.56)	(-3.60)
OVEREXP	-0.00139*	-0.00172*	-0.00165*
	(-5.07)	(-6.36)	(-6.53)
UNDEREXP	0.00187*	0.00161*	0.00177*
	(12.04)	(8.93)	(8.82)
R^2	0.4367	0.4404	0.4551
# of observations	13,835	11,182	10,203

Notes: T-Statistics in parentheses. *: Significant at 5 percent level.

Dummy variables for occupation and working sector are also included in the regressions.


   Negative estimated coefficients are found for the interaction of years of adequate education and overeducation with years of experience, implying adequately educated and overeducated workers are penalized with a lower rate of return for more years of experience accumulated on the jobs. Experience, adequate education, and overeducation are not considered close substitutes in effect on earnings in the Taiwanese labor market.
  As adequately educated and overeducated workers stay the jobs longer, their rewards

on earnings decrease because they might not be able to keep pace with technological progress and use more current and efficient know-how in their production. This is exactly what happens in the Taiwanese labor market after the 1990s. As more and more young highly educated workers enter the labor market, many Taiwanese companies, especially in public sector, provide more beneficial retirement programs for workers with at least 25 years of working experience to encourage them to retire earlier. Employers would like to hire those young overeducated workers since they believe excess schooling is a good substitute for experience.

On the other hand, positive coefficient on the UNDEREXP variable implies undereducation and experience are complementary in their effect on earnings. The penalty for undereducation declines as the undereducated workers accumulate more working experience.

5. BUMPING DOWN EFFECT AND POLICY IMPLICATION

In this section, we continue the analysis of overeducation to ask the question: what happens to lower educated workers who are competing with those overeducated high-skilled workers in Taiwan labor market? We look at the consequences from the respects of their wages and unemployment rate after the education expansion policy took place. It was shown earlier that a substantial number of high-skilled workers are overeducated. The "bumping down" effect claims that these overeducated high-skilled workers taking the jobs below their educational level will also force the lower educated workers to accept jobs below their educational level or even become unemployed. As a result, the relative wages of lower educated workers will decrease.
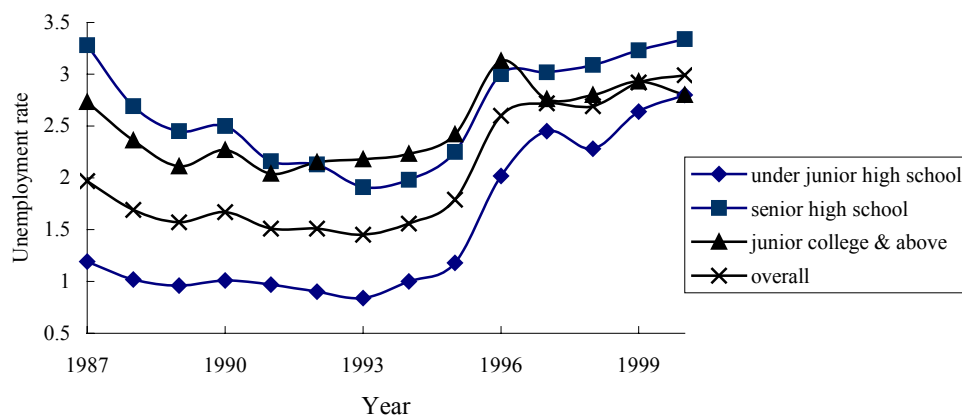
Figure 1. Unemployment Rates by Education in Taiwan 1987-2000
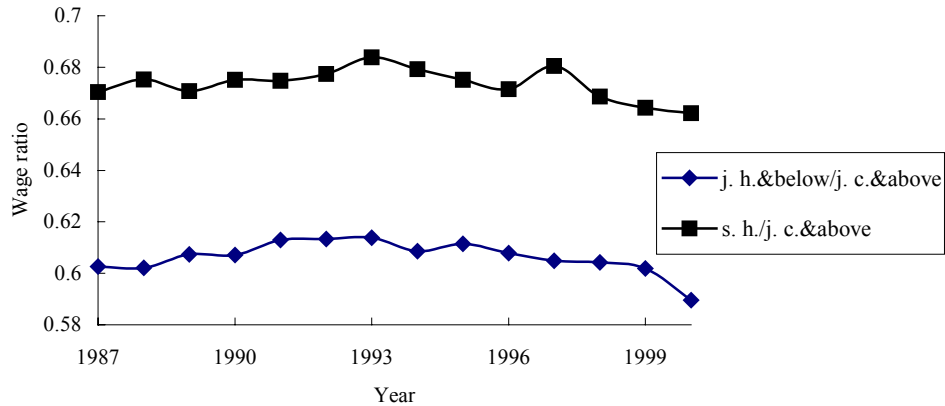
Figure 2.   Wage Ratios (junior high school & below / junior college & above and senior high school / junior college & above) 1987-2000

Figure 1 shows the time trend of unemployment rates for three different skills workers and for the Taiwan labor market as a whole. The trends are quite similar before 1996. However, the evidence indicates that after 1996, when bumping down took effect on employment, the unemployment rate increased more rapidly for lower educated (under junior high school and senior high school) workers, while the unemployment rate for higher educated workers remained little changed. Figure 2 further justifies the effect of bumping down on wages. This leads to a widening wage differential between lower educated and higher educated workers. Despite of the increasing supply of college graduate workers in the labor marker, the bumping down effect could be one of the factors to offset the supply shock which tends to make relative wages of higher educated workers to fall.

The above argument should challenge the education expansion policy which was intended to offer more opportunities for people to have higher education and therefore improve the distribution of earnings in the labor market. However, the policy so far actually deteriorates the economic position of lower end workers and also causes more and more overeducated high- skilled workers who can not fully utilize their skills. It leaves us a question that should government continue to open the door for new establishments of higher education. The government may need some additional complementary policies to overcome the bumping down effect.

6.   SUMMARY AND CONCLUSIONS

Taiwan has been experiencing rapid growth in the share of highly educated labor over the 1990s. Such relative labor supply shifts appear to have impacts, including employment and earnings, on the structure of Taiwan labor market. Nevertheless, several factors affecting labor demand toward skilled labor also play important roles in determining these highly educated workers' economic position. In this paper, we try to answer the question whether the strong higher education expansion has outpaced the skill biased shifts in labor demand during the 1990s in Taiwan from the perspective of *mismatch* (overeducation and undereducation) in the labor market.

We find a significant proportion of Taiwanese workers enter the labor market educated inadequately. The percentage of overeducated workers continues to rise over the 1990s, while the percentage of undereducated workers goes to opposite direction. The evidence suggests that the supply shock might have more impact than the skill biased demand shift. Our results further show the trade-off between education and working experience. Extra years of education can substitute for lack of experience when a young graduate enters the job market. However, the substitutability is only temporary. Insufficient education can also be supplemented by accumulated working experience. This could last a long period of time in a worker's career. In this case, workers with relatively less working experience are more likely to be overeducated, while workers with relatively more working experience are more likely to be undereducated.

In their effects on earnings, we find a positive rate of return to adequate education and a smaller but still positive return to overeducation, and a negative return to undereducation, as expected. Overeducated (Undereducated) workers would earn more (less) than their co-workers with adequate education but less (more) than the workers having the same educational level with adequate education for jobs. Furthermore, according to the results from interaction terms in wage equation, we find the rewards (penalties) to adequate education and overeducation (undereducation) decline as more experience accumulated.

We are also able to demonstrate the bumping down effect from overeducation by investigating the time trends of unemployment rate of lower educated workers and wage differential between lower educated workers and higher educated workers. This result would challenge the education expansion policy of Taiwan government.

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Table 5. Incidence (%) of Oereducation Aequate-Eucation and Udereducation by Ocupation

	1993			1996			1999		
	overeducation	adequate-education	undereducation	overeducation	adequate-education	undereducation	overeducation	adequate-education	undereducation
occup1	30.96	23.99	45.05	38.15	22.45	39.40	43.40	23.43	33.17
occup2	10.31	48.34	41.35	16.58	46.22	37.20	20.85	52.35	26.80
occup3	20.34	31.33	48.33	19.58	31.60	48.82	24.94	33.82	41.24
occup4	32.39	57.29	10.32	38.21	52.41	9.38	44.38	47.81	7.81
occup5	13.78	43.27	42.95	13.97	43.87	42.16	17.11	45.41	37.48
occup6	21.22	59.96	18.82	29.96	54.38	15.66	40.70	50.58	8.72
occup7	31.43	28.58	39.99	36.61	29.00	34.39	42.16	28.77	29.07
occup8	32.08	27.67	40.25	34.94	28.38	36.68	42.40	27.11	30.49
occup9	34.93	54.50	10.57	40.47	50.26	9.27	45.81	44.19	10.00
All	26.61	38.60	34.79	29.81	37.51	32.68	35.01	37.09	27.90