Further Evidence of Cohort Size Effects on Earnings:
The Case of Taiwan*

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I. Introduction

Recently Berger (1983), Freeman (1979), and Welch (1979) have discussed the effects of changes in labor force age composition on age-earnings profiles for the United States. They present evidence which supports the idea that rapid increases in the proportion of young workers, due to the entry of peak baby-boom cohorts into the labor market is associated with a reduction in their relative earnings, especially for college graduates in the United States. Martin (1982) also finds that, in Japan, the size of young workers relative to old workers would affect their relative wage ratio.

A possible and plausible explanation of these findings is that, as far as production is concerned, workers with different attributes such as educational attainment and work experience are not perfect substitutes for each other, therefore the earnings of a certain type of labor will be adversely affected by its size, relative to those of the others. Another possible explanation is offered by Welch (1979), who argues that the abrupt now-you-are-in-now-you-are-out implication of the imposed rigid age demarcations in production function's analysis is unappealing from the point of view of human capital theory. He points out that a work career

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consists of a series of more or less distinct career stages. A labor market entrant begins his career as a raw recruit or trainee, then achieves a junior position, and only later on a senior position in his occupation. This could be a result of organizational job hierarchy influenced by the seniority system, or it could result from an individual's sequential choices and investment in job mobility, depending on different labor market institutions. Then the substitutability of one group of workers for another may primarily come from the fact that workers in different career stages do different jobs or tasks, and these are not perfect substitutes. The productiveness of members in different occupational stages will then be influenced by the size of a certain age group because the latter will affect the size distribution, or structure, of these relative occupational stages.

Whatever might be the explanation, the depression effect on earnings of the size of certain age groups is itself an interesting topic worth further pursuing. Moreover, it would also be interesting to know how the phenomenon fares in third world countries, particularly those fast growing countries which experienced continuous improvement in technology and rapid changes in the structure of production. We have therefore chosen Taiwan as our target of study. We intend to answer three questions in this paper based on the empirical evidence from Taiwan:

(i) Do the cohort size effects on earnings exist?

(ii) If they do, are they temporary or persistent? How persistent?

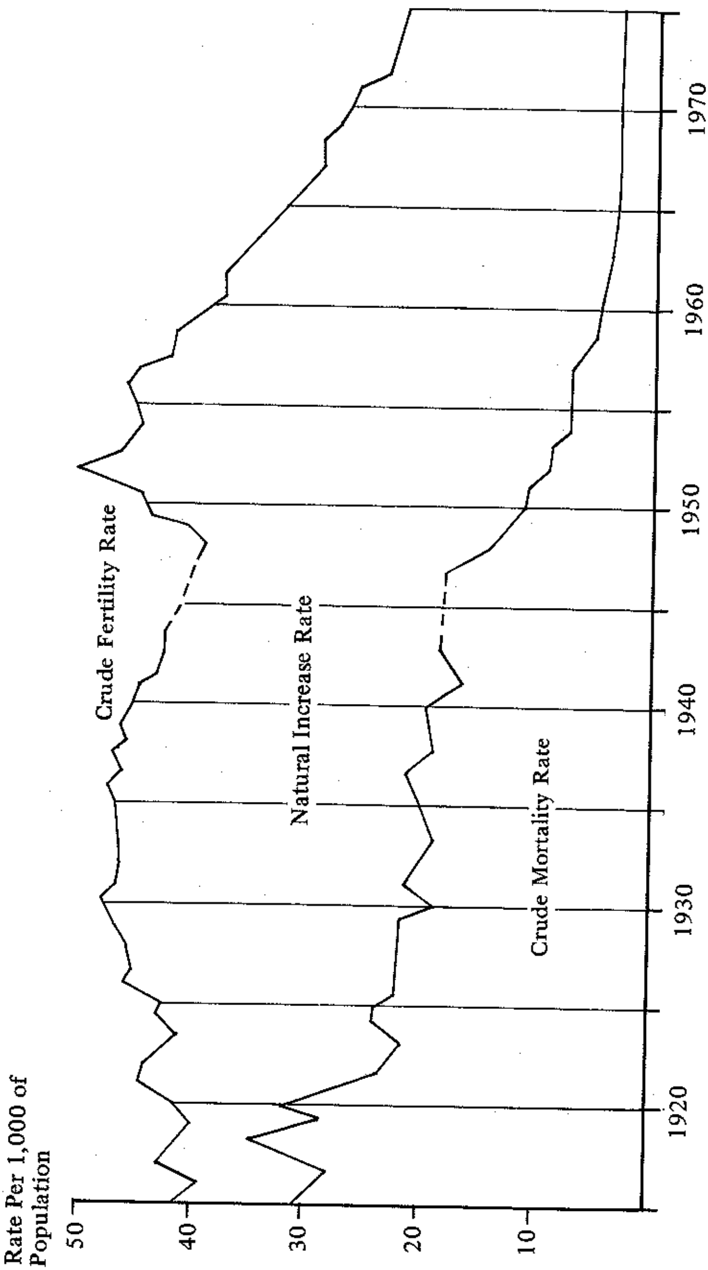
(iii) Will the process of rapid economic development affect the duration of the effects?

In sections II and III below, we will first give the background information of Taiwan's labor force and labor market. Then in section IV, the statistical method is introduced, and in section V, the empirical evidence will be presented. Finally, section VI summarizes the findings.

II. Demographic Changes and the Labor Force Age Composition in Taiwan

In Taiwan, the rapid demographic transition in this century from high fertility and mortality to low fertility and mortality has

Figure 1
VITAL RATES IN TAIWAN, 1915-74



Source: Cho (1979), p. 118.

resulted in considerable changes in the size of population, as well as its age composition. Concurrent with these changes, the labor force of Taiwan has grown and varied rapidly in the last three decades and will continue to change for some future decades.

Both size and age composition of a population are results of such factors as fertility, mortality, and migration. The vital rates of Taiwan's population are presented in Figure 1. Before 1920, the relatively slow growth rate of Taiwan's population was the result of a stable and high crude death rate (around 30.0/1,000).

Between 1920 and 1945, improvement of medical care and steady economic and social development under Japanese colonization resulted in a higher natural rate of population growth in Taiwan. Specifically, there was a fairly steady decline in mortality rate, especially the infant mortality rate, and a slight increase in fertility.

After World War II, two critical population changes occurred. First, in the late 1940s, when it became apparent that the nationalist government's position on the mainland China was unstable, a large number of mainlanders took refuge in Taiwan. From 1946 to 1950, more than one million mainlander refugees (military and civilian) arrived in Taiwan. This sudden influx contributed to an increase in population from 6 to 7 millions over a short period of time.

Second, a large number of babies were born after the war. This "baby boom" lasted for over 15 years and is in sharp contrast to the size of earlier cohorts. Despite unfavorable economic conditions (production in 1945-46 was below one-half the peak reached in the colonial period; in addition, the Taipei wholesale price index increased 26 percent in 1946, 360 percent in 1947, 520 percent in 1948, and 3,500 percent in 1949 (Ho, 1978)), the fertility rate started to increase rapidly in 1946. The crude fertility rate rose from 38.1/1,000 in 1947 to a peak of 50.0/1,000 in 1950 and thereafter declined gradually in the years 1950-75 to about 23.0/1,000. The total fertility rate (TFR) was as high as 7.04, i.e., 7 children per mother, in 1951. By 1965, the fertility rate gradually declined to about 5 children per mother (TFR = 4.83). In the years 1965-75, the fertility rate decreased further to about 3 children per mother (TFR = 2.77).

Since the mid-1970s, more and more women born during the post-war "baby boom" period have reached child-bearing age. This ripple from the high post-war fertility rate significantly affects the current population age distribution. The total fertility rate suddenly rose to 3.08 in 1976, and the rate of decline in fertility has slowed down thereafter.

Selected age composition data of the male population ages 15-65 are presented in Table 1. The figures in the table indicate the dynamic impact of the high post-war fertility rate on the age composition of the population. For instance, the proportion of males 15-19 in the male population of working age, 15-65 years, started to grow in 1964; reached its peak around 1969, sustained a high ratio of 0.22 in the years 1969-74, and then declined. Thus, the entry of "baby boom" cohorts into the working age category reached its zenith around 1969 and was sustained to 1974.

Table 1

AGE COMPOSITION OF MALE POPULATION OF AGES 15-65 IN TAIWAN, 1969-79

Unit: %

Ages	1960	1964	1969	1974	1979
15-19	16.7	16.7	22.6	22.1	18.8
20-24	10.8	9.5	7.3	10.4	11.0
25-40	39.7	39.7	35.1	32.3	34.0
40-54	25.1	25.7	25.5	25.8	24.9
55-59	4.7	4.9	5.6	5.2	6.6
60-65	3.1	3.6	3.9	4.1	4.6
Total	100.0	100.0	100.0	100.0	100.0

Source: Directorate-General of Budget, Accounting & Statistics, Executive Yuan, the Republic of China, *Quarterly Report on the Labor Force Survey in Taiwan*, various issues.

III. Taiwan's Labor Market Institutions

Some economists argue that large labor cohorts would tend to depress their earnings within a system that generates jobslots or positions that are arranged institutionally by different seniority levels. Taiwan's labor market, however, is not characterized by such a system of seniority in the determination of wages and promotion. Taiwan differs from many developing countries in that there has been little government intervention in the determination of wages, and, additionally, the impact of trade union on wages has been minimal in the labor market.

In general, Taiwan's employers have good information about wages and benefits offered by their competitors and thus a considerable degree of standardization prevails, despite the absence of any significant trade union influence (Galenson, 1976). However, wage administration varies a great deal; some have formal systems, some operate informally. Merit seems to be the primary factor in determining wage increases among employees, even though some firms have begun to pay attention to seniority in order to retain their skilled workers.

Thus, Taiwan does not practice any system comparable to that of the life-employment commitment model in Japan. Even so, the lay-off of employees has been rare if the employees' performance in production is reasonable. This seems to be attributed to the rapid growth of firms in Taiwan, rather than the practice of a permanent employment system.

There are only a few large firms in Taiwan. By 1980, enterprises with less than 100 employees hired 90 percent of the total labor force in the private sector. Furthermore, about 70 percent of the labor force in the private sector was employed by those firms with only 1 to 9 workers. As a result, the demand side of Taiwan's labor market seems to be highly competitive.

On the supply side of the labor market, trade unions are entitled to enter into collective agreement with management on conditions of work *other than wages* by law. Also, strikes have been forbidden by law. However, trade unions are still capable of exerting a substantial influence on the working conditions in industries. This influence is likely due to the labor shortage since the mid-1970s. The definitive answer to the question of whether the trade union is dominated or heavily influenced by their employers or the government under the present law awaits further study.

In general, Taiwan is very much a market economy in terms of the manner in which job placements and wage determinations are made. Thus, institutional factors in Taiwan's labor market seem to be less important in the determination of wages, as compared to Japan's labor market.

Thus, it can be seen that Taiwan is a developing country nicely appropriate for an analysis of demographic effects on the earnings structure, as it has experienced the peak entry of large post-war birth cohorts into the labor market from the mid-1960s to the mid-1970s. Our data for the analysis are mainly drawn from the government-conducted Survey of Family Income and Expenditures, which is a systematic, stratified, and random sample of all households and household members in Taiwan area. The sampling ratio was 3/1,000 for 1976 and 1/1,000 for 1966 and 1981 with a sample error of less than 5 percent.

IV. Specification of Regression Analysis

Here we estimate the labor earnings for the male workers in each education group based on the earnings data of 1966, 1976 and 1981, in order to examine the relation between the age-earnings profiles and the labor force age composition across education groups at different stages of development in Taiwan. The equation is specified as follows.

$$\ln W_x = a_0 + a_1 \ln L(x) + a_2 S \cdot \ln L(x) + a_3 x + a_4 x^2 + a_5 DA$$

$$+ a_6 DM + a_7 X \cdot DA + a_8 X \cdot DM + \text{errors}$$

where

W_w = annual labor earnings in New Taiwan Dollars (NT$) for those who have x years of potential working experience.

x = years of potential labor market experience including military experience = age-schooling years-6.

L(x) = weighted cohort size of workers having x years of potential labor market experience, to be explained.

S = 0 if $x \geqslant \bar{x}$

= $(1-x/\bar{x})$ if $\bar{x} < \bar{x}$, where x will be explained later.

DA = 1 if a worker is employed in agriculture

= 0 otherwise.

DM = 1 if a worker is employed in manufacturing industries

= 0 otherwise (The reference group would be those who are employed in service industries, as DA = DM = 0).

An additional dummy variable D_c (that equals 1 if a worker only received junior college education and 0 if a worker received 4-year college education) and the interaction with experience, $D_c x$, are also introduced into the equation for the college educated group to control for possible differences between its two subgroups.

Given the educational attainment, the cohort size here refers to the number of workers with same years of potential work experience in the labor market. It is convenient for inter-group comparison to normalize absolute cohort sizes by the total number of workers in each education group. Furthermore, Welch (1979) points out that the wages of a particular cohort may be affected not only by its own size but also by surrounding cohorts, since they might be highly substitutable for each other in production. There is also the possibility of sampling errors resulting from the calculation of proportions of cohorts within each education group, because age was not treated as a continous variable in the survey.

Hence, the proportion of group members at each work experience level is smoothed by computing a moving average with inverted V weights. That is,

$$L(x) = \sum_{i=-2}^{2} (w_i n_{x+i})$$

where n_x is the fraction of those in the group who are in their x-th year of potential working experience. The *w* weights are assigned as: w = (1/9, 2/9, 3/9, 2/9, 1/9), except for recent entrants where succeeding cohort fractions are not defined. In this case, the *w* distribution is truncated, and remaining weights are scaled accordingly so as to sum to 1 (see Welch, 1979).

In order to allow the elasticities of earnings with respect to cohort size to vary over experience levels, the interaction term between S, the early career spline function, and (lnL (x)) is included in the equations, since the effect of cohort size of very young workers in their early careers could be greater. That is, their substitutability for older workers in production might increase as their experience grows. The wage elasticities with respect to relative cohort size hence are formulated as follows:

$$\frac{\partial \ln W_x}{\partial \ln L(x)} = \begin{cases} a_1 + a_2 S & \text{if } x \leqslant \bar{x} \text{ (early career stage level)} \\ a_1 & \text{if } x > \bar{x} \text{ (persistent level)} \end{cases}$$

where S is the early-career spline function and is equal to max $(0, 1-x/\bar{x})$. The elasticity begins with a value of $(a_1 + a_2)$ at the entry level $(x=0)$ and then declines linearly at a rate of $(-a_2/\bar{x})$ to the permanent level of a_1 in the x-th year of experience. The spline function captures the differences in the wage elasticities for different career stages, which otherwise would have to be represented by a number of dummy variables. After trying alternative values of $\bar{x}$ (the duration of the initial effects of cohort size) for the five education groups of Taiwan's male labor force, we have chosen particular values of $\bar{x}$ which maximize the value of R^2 (one degree of freedom is lost as a result). The chosen $\bar{x}$'s are 4, 6, 9, 10 and 10 (rounded to integers) for primary school, junior high school, senior high school, senior vocational school, and college groups respectively, for 1981. For 1976, the figures are 4, 6, 8, 9, 11 , and for 1966, 4, 4, 4, 4, 5. These findings of $\bar{x}$'s values apparently indicate that economic development indeed extends the initial training period for most labor market entrants as the production technology gradually upgrades. If the effects of cohort size on earnings are statistically significant for young workers in the early career stage, the increased $\bar{x}$ values imply that the duration of initial effects of cohort size has been prolonged by the progress of economic development.[1] The empirical evidence in the

[1] To say that duration of cohort size effects has been prolonged over time can mean two different things. One is that the x's have increased over the years, another is that the cohort size effects at the persistent level (i.e., when x x) were not significant for earlier years but became significant later. Here we are only referring to the first meaning.

next section actually confirms this point for the senior vocational school group.

Dummy variables for industry, and their interaction with experience are introduced to control for industrial structure in the economy. In order to capture the importance of the industrial structure in the determination of the age-earnings profiles, two types of regression equations are used for comparison. The first one does not include industrial variables, and the second includes all these variables in the analysis.

V. Empirical Results

The regression results are displayed in Table 2.[2] All equations are estimated by using the ordinary least squares method and pass the F-text at the 5 percent significance level. Related statistics and estimated standard errors of the coefficients are also included in the table. Significant (two-tailed test at various levels, see Table 2) coefficients are indicated with an asterisk. The relative, i.e., the "perentage," effect of dichotomous variables on earnings is expressed in brackets.[3] Finally, the estimated cohort size elasticities at the "early career stage" and the "persistent" level are shown in Table 3 for all three years.[4]

What do one reads from these tables? First, from Table 3, the cohort size effects on earnings at the early career stage are significant for all five education groups in 1981, for four groups (all except the college group) in 1976, and for two groups (primary and senior vocational school) in 1966. This suggests that the cohort size effects on earnings at the early career stage do exist for some education levels but not for others in 1966, but as the economy

[2] The regressions without the industrial dummies are not presented here as they give much lower R^2's in most cases.

[3] Kennedy (1981) demonstrates that it is incorrect to measure the relative effects of a dummy variable on earnings by the size of the regression coefficient in semi-logarithmic equations. Thus he suggests that the correct measure of the relative effect is $\exp(a_i-(1/2)\,\mathrm{Var}(a_i))-1$ if a_i is the estimated coefficient of the dummy variable and $\mathrm{Var}(a_i)$ is its estimated variance.

[4] The elasticities at the early career stage are simply the sum of the coefficients for $L(x)$ and $S\,L(x)$. The standard error of this sum is then computed and the significance tests are performed.

Table 2

EFFECTS OF COHORT SIZE ON THE EARNINGS STRUCTURE (Dependent Variable = Ln (earnings))

Explanatory Variables	Primary School 1966	1976	1981
X	0.0843*** (0.0093)	0.0649*** (0.0101)	0.0194*** (0.0034)
X^2	−0.0014*** (0.0002)	−0.0013*** (0.0002)	−0.0004*** (0.0001)
L(x)	0.1068 (0.0905)	−0.1449** (0.0703)	−0.1495*** (0.0235)
S·L(x)	−1.2775*** (0.4558)	−0.1200*** (0.0271)	−0.2864*** (0.07349)
DM	0.0454 (0.1256) [0.0382]	−0.2175*** (0.0537) [−0.1966]	−0.0677*** (0.0180) [−0.0656]
DA	−0.7743*** (0.1263) [−0.5426]	−0.7389*** (0.0595) [−0.5232]	−0.5180*** (0.04340) [−0.4048]
X·DM	0.0007* (0.0004)	0.0070*** (0.0020)	0.0012** (0.0005)
X·DA	−0.0076* (0.0043)	−0.0085** (0.0021)	0.0001 (0.0011)
Constant	8.5282	11.0721	10.9425
R^2	0.4612	0.4146	0.2486
F	174.7839	351.1898	349.8200
n	1625	3956	8433

* Significant at 10% level
** Significant at 5% level
*** Significant at 1% level

Table 2 (Continued)

Explanatory Variables	Junior High School 1966	1976	1981
X	0.0983*** (0.0171)	0.0621*** (0.0074)	0.0518*** (0.0040)
X^2	-0.0016*** (0.0004)	-0.0011*** (0.0002)	-0.0009*** (0.0001)
L(x)	-0.0557 (0.0873)	-0.0507 (0.0426)	-0.0433** (0.0208)
S·L(x)	0.0386 (0.3563)	-0.0690*** (0.0262)	-0.08511** (0.01016)
DM	0.1725 (0.01551) [0.1740]	-0.0459 (0.0627) [-0.0467]	-0.0065 (0.0136) [-0.0066]
DA	-0.5788*** (0.2000) [-0.4505]	-0.5378*** (0.0983) [-0.4183]	-0.3690 (0.0524) [-0.3095]
X·DM	0.0001 (0.68)	-0.0011 (0.0027)	-0.0016** (0.0007)
X·DA	-0.0074 (0.0099)	-0.0167*** (0.0043)	-0.0050*** (0.0021)
Constant	8.7266	10.5383	11.59589
R^2	0.5010	0.4326	0.3743
F	35.8077	133.1106	261.7656
n	276	1387	3488

Table 2. (Continued)

Explanatory Variables	Senior Vocational-High School		
	1966	1976	1981
X	0.0617***	0.0689***	0.0246***
	(0.0183)	(0.0090)	(0.0085)
X^2	−0.0011***	−0.0013***	−0.0006***
	(0.0004)	(0.0003)	(0.0001)
L(x)	0.0143	0.0190	−0.1045***
	(0.0937)	(0.0962)	(0.0369)
S·L(x)	−2.9753**	−0.0771***	−0.1662***
	(1.517)	(0.0300)	(0.0382)
DM	−0.0157	−0.0159	−0.1139***
	(0.1481)	(0.0623)	(0.0441)
	[−0.0263]	[−0.0177]	[−0.1085]
DA	−0.0954	−0.3233**	−0.5849***
	(0.3495)	(0.1518)	(0.1196)
	[−0.1047]	[−0.2845]	[−0.4468]
X·DM	0.0076	0.0020	0.0036*
	(0.0087)	(0.0035)	(0.0021)
X·DA	0.0213	−0.0180*	0.0070
	(0.0207)	(0.0096)	(0.0047)
Constant	9.4718	10.5348	12.3170
R^2	0.4243	0.3660	0.2161
F	14.3077	60.7534	45.8739
n	237	829	1303

Table 2. (Continued)

Explanatory Variables	Senior High School		
	1966	1976	1981
X	0.0971***	0.0607***	0.0325***
	(0.0166)	(0.0076)	(0.0078)
X^2	−0.0017***	−0.0012***	−0.0006****
	(0.0004)	(0.0002)	(0.0001)
L(x)	−0.0326	−0.0836	−0.0692*
	(0.1148)	(0.0609)	(0.0413)
S·L(x)	0.4963	−0.1949***	−0.0941***
	(0.4941)	(0.0405)	(0.02210)
DM	0.4733***	−0.0199	−0.0367
	(0.1531)	(0.0599)	(0.0290)
	[0.5866)	[−0.0215)	[−0.0364]
DA	−0.1363	−0.5202***	−0.2764***
	(0.2820)	(0.1690)	(0.0592)
	[−0.1614]	[−0.4140]	[−0.2428]
X·DM	−0.0092	0.0002	0.0009
	(0.0073)	(0.0028)	(0.0018)
X·DA	−0.0239	−0.0352**	−0.0104***
	(0.0161)	(0.0125)	(0.0029)
Constant	9.4718	10.9363	12.0462
R^2	0.3894	0.3930	0.31596
F	17.4091	69.2959	137.6640
n	206	845	2368

Table 2. (Continued)

Explanatory Variables	College		
	1966	1976	1981
X	0.0541*** (0.0141)	0.0575*** (0.0106)	0.0283*** (0.0048)
X^2	−0.0008*** (0.0002)	−0.0011*** (0.0002)	−0.0006*** (0.0001)
L(x)	−0.1561 (0.1361)	0.0905** (0.0423)	−0.0376* (0.0212)
S·L(x)	0.9247 (0.8321)	−0.0500 (0.0422)	−0.0572*** (0.0149)
DM	0.6665*** (0.1654) (0.9210]	0.1542** (0.0644) [0.1643]	−0.0222 (0.0157) [−0.0221]
DA	N.a.	0.8777 (0.9337) [0.5555]	−0.2351** (0.1099) [−0.2143]
X·DM	−0.0108 (0.0085)	−0.0024 (0.0036)	0.0037*** (0.0009)
X·DA	N.a.	−0.2722* (0.1623)	−0.0031 (0.0060)
DC	−0.1440 (0.1786) [−0.1478]	−0.1493*** (0.0607) [−0.1403]	−0.1935*** (0.0287) [−0.1763]
X·DC	−0.0003 (0.0087)	−0.0010 (0.0030)	0.0006 (0.0014)
Constant	9.7922	11.2273	12.3185
R^2	0.2871	0.1554	0.21369
F	19.2980	21.2836	60.5737
n	254	1214	2189

Table 3

Estimated Elasticities of Annual Earnings with Respect to Cohort Size

	Year	Primary School	Junior High School	Senior Vocational School	Senior High School	College
Early Career Stage	1966	-1.1707***	-0.0171	-2.9610***	0.4636	0.7686
	1976	-0.2650***	-0.1198**	-0.0581**	-0.2786***	0.0404
	1981	-0.4359***	-0.1285***	-0.2706***	-0.1633***	-0.0948***
Persistent	1966	0.1068	-0.0557	0.0143	-0.0326	-0.1561
	1976	-0.1449***	-0.0507	0.0190	-0.0836	0.0905**
	1981	-0.1495***	-0.0433**	-0.1045***	-0.692*	-0.0376*

* Significant at 10% level
** Significant at 5% level
*** Significant at 1% level

rapidly grows, (the average annual growth rae of real GNP has been 9.7 percent for 1966-1976, and 8.3 percent for 1977-1981), the effects have apparently spreaded in their scope of coverage.

Secondly, from the lower part of Table 3 which indicates the persistent effects of cohort size on earnings, it is clear that the effects are not significant for any of the five groups in 1966. The situation changes a little bit in 1976 when the elasticity for the primary school group becomes significant, although that for the college groups becomes significant with a wrong sign. In 1981, however, all elasticities are significant with the correct signs.

Thirdly, we learn earlier that the values of $\bar{x}$'s have increased a great deal between 1966 and 1976. We are interested of course only in the significant coefficients of the term $S \cdot \ln L(x)$ in the regression. From Table 2, in 1966 only the primary and the senior vocational school groups have significant cohort size effects for this term. Since the value of $\bar{x}$ remains the same for the former, but it increases from 4 to 9 for the later group from 1966 to 1976, we see that for the senior vocational school graduates, the duration of cohort size effects has been prolonged in the sense that $\bar{x}$ becomes higher.[5]

An over-all picture has therefore emerged. It seems that in Taiwan, the effects of cohort size on earnings are shorter in duration and significant only for lower education groups at its earlier stage of development. Then, as the economy grows, the effects become longer in duration and applicable to workers at all education levels.

This interesting and significant phenomenon certainly deserves economists' major attention. A full explanation may not be forthcoming without great efforts in future studies. We do not intend to solve the puzzle here but will offer a conjecture. Could the phenomenon be a result of the dynamic gap between labor demand and supply? That is, in the 1960s, when the Taiwanese economy was growing at its fastest, the demand for all types of labor must have been very strong. The supply of labor undoubtedly was quickly increasing during this same period of time but

[5] As a possible test of whether the increase in x is "significant," we re-run the 1966 equation with x set at 9 (the 1976 level) for this education group. It turns out that the coefficient is no longer significant. This method is suggested to us by an anynomous reader.

perhaps was not in the same relative proportions among its different age and education groups as those of labor demand. The supply of younger and better educated labor is in relative shortage compared to demand, despite that the size of the younger cohorts was larger than that of the older ones of the same education level. When this kind of gap exists, the positive demand pull effect offsets the negative supply push effect, making the elasticities insignificant. The opposite is true for the older workers, particularly for the better educated groups. That is, even though their size was relatively smaller than that of the younger ones, thus casting a favarable influence over their earnings, this advantage is largely wiped out by the unfavarable demand factor. *Ceteris paribus*, firms prefer using younger people of the same education level. As the economy enters the 1970s, however, the situation became different. By now most of the prime time workers were born after the World War II, the difference between younger and older workers of the same education level was no longer as acute as before, particularly for the higher education groups, because these workers went through basically the same post-war educational system. The cohort size effect then took its toll.

If the above conjecture is true, an increased (decreased) cohort size will not necessarily have unfavorable (favorable) effects on earnigs if it happens that the increases (decreases) in the supply of these age groups are fully absorbed (offset) by increases (decreases) in the demand for them. If, however, in spite of the rapid increases in demand, the supply rises even faster, such as the result of a baby-boom, the cohort size effects would still be felt. Let us then see what Taiwan's baby-boom does to relative earnings.

As noted earlier, Taiwan's baby-boom lasted for 15 years, from 1947 to 1962. If we take the middle point, 1955, as a reference year, a baby born in 1955 would in 1967 enter the market if he belongs to the primary school group. Our empirical result (Table 3; row 1, column 1) does show that the cohort size effect is significant in 1966 for this education group at their early career stage. Next, for the junior high school group, a baby born in 1955 would become a market entrant in 1970, and since the early career stage lasts for 6 years for this education group (for which $\bar{x} = 6$ in 1976), this person would still be within his early career stage in 1976. There, too, the cohort size is confirmed

(Table 3; row 2, column 2). Applying similar reasoning, we see that the baby-boom effect is significant for all education groups (Table 3; rows 2 and 3, columns 3 and 4; row 3, column 5) for the early career stage.

Next we come to the persistent level as these baby-boom cohorts moved on. Here, too, the effects are significant for the primary and junior high school groups (Table 3; rows 5 and 6, column 1; row 6, column 2). For the senior and vocational high school groups, by 1981 the baby-boom cohorts were just about to pass their early career stage, so the elasticities at row 6 and columns 3 and 4 at least partially give support to the cohort size effects. Finally, for the college group, it is still too early to tell whether the effects exist at the persistent level.

So we have seen that the baby-boom cohorts do carry with them a series of cohort size effects for all education groups. This observation further strengthens the importance of cohort size and is consistent with our conjecture.

Two additional points are worth making before we leave this section.

First, in 1976 at the persistent level, the cohort size effect of the college group is significantly positive. This can also be explained by the dynamic gap phenomenon referred to above. Given that the early career stage lasts for about ten years for college graduates, people who by 1976 have passed this stage are those who were born in around 1944 and entered primary school in about 1950. They are therefore among the first batch of college level elite workers who accepted a complete set of post-war, post-colonial modern education from the primary school and on. It seems that the increases in the demand for them, relative to that for the older college graduates, more than offset the increases in their supply. Not as fortunate are their successors, because only three years later in 1947, the baby-boom age started and the crude fertility rate quickly reached its climax in 1952 (Fig. 1). No wonder by 1981 at the persistent level, the cohort size effect is already significantly, though weakly, negative for college graduates.

Secondly, Table 2 shows that the dummy variables of labor market characteristics are more likely to be significant for groups with lower educational attainments. In particular, agricultural employment and its interaction with experience have large and significant negative effects on earnings of people in the primary and junior high school groups for all three years, and in the senior vocational and senior high school groups for both 1976 and 1981. Moreover, the magnitudes of the coefficients indicate that the depressing effect of agricultural employment is increasing for the vocational high school group, and remains fairly high for the high school group even as late as 1981. This has no doubt contributed to the continuous emmigration of the young workers from the agriculture sector in Taiwan.

VI. Conclusion

Our empirical study of the earnings of workers in Taiwan for the years 1966, 1976 and 1981 shows that the effects of cohort size on earnings are shorter in duration and significant only for lower education groups at Taiwan's earlier stage of development. Then, as the economy continuously grows, the effects become longer in duration and applicable to workers at all education levels. Changes in the relative strength between labor demand and supply are suspected to be one of the important factors behind the scene.

The baby-boom effects on earnings are astonishingly significant for all education groups, and at both the early career stage and the persistent level for all three years in our study. However, many of the baby-boom college graduates have not passed their early career stage by 1981, our latest sample year, it remains therefore to be seen in future studies whether the cohort size effects would be significant for this particular baby-boom group at the persistent level. If indeed the effects are not rejected, it can be said that the whole generation of baby-boom in Taiwan, regardless of the education levels, has suffered from its own size at both the early career stage and the persistent level. To this generation both of the authors of this paper unfortunately belong to.

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