Male-Female Wage Differentials in Taiwan: A Human Capital Approach*

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I. Introduction

During the past 3 decades, male-female wage differentials have attracted much attention in all countries for which there are data. The usual approach is to decompose gender wage differentials into two parts: one attributable to an individual's characteristics holding reward structure constant, and the other attributable to a different reward structure holding characteristics constant.[1] The latter part is usually defined to represent discrimination. Using this approach with data from the 1967 Survey of Economic Opportunity, Ronald Oaxaca found 80% of the observed gender wage differential to be ascribed to labor market discrimination. Mary Corcoran and Greg J. Duncan, using the Panel Study of Income Dynamics, which provides detailed work histories, found a 56% discrimination figure, implying that productivity-related characteristics accounted for 44% of the observed male-female wage differentials.

Because of inherent biases, particularly with regard to measuring human capital, Solomon W. Polachek proposed an alternative way to determine one's characteristics.[2] He measured expected human capital, then embedded this measure in a wage regression on pooled male and female data. Over 90% of the male-female earnings gap was explained by gender differences in human capital. Claudia Goldin and Polachek applied Polachek's technique to the 1980 U.S. Census data and accounted for about 80% of the male-female earnings gap.

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This article applies this approach to Taiwan, which is well-known for its economic growth. But, in part, its continued economic growth is dependent on national policies with regard to gender wage differentials. If lower female wage and occupational status results from unequal opportunities, the economy might be failing to utilize fully its highly productive employees, thus yielding macroeconomic inefficiencies that could justify government intervention. In contrast, if unequal economic outcomes result from differing individual choices, government intervention could lead to a distorted allocation of resources, thus hampering future growth. Consequently, an understanding of gender differences is important to the development of appropriate policies for future growth.

In the literature, K. Gannicott, Jin-Tan Liu and Jin Long Liu, and Chung-Cheng Lin have used micro wage data of Taiwan to examine male-female wage differentials.[3] One problem, however, is that these studies do not consider sex differences in lifetime work caused by the expected division of labor at home.[4] In this article, we use Polachek's human capital approach to account explicitly for those lifetime work expectations that cause gender differences in human capital accumulation. Our results yield a far greater "explained" wage differential, implying the need for a reduced direct government role in equal pay legislation.[5]

Section II provides an overview of trends in female employment and the gender wage gap over the past 2 decades in Taiwan. Section III outlines the theory of life-cycle human capital accumulation underlying male-female wage differentials. This theory is applied in Section IV to generate a technique for measuring expected human capital stock, a variable needed to estimate earnings. These estimated human capital stock measures are then used to explain male-female wage differentials.

II. Trends in Female Employment and the Gender Wage Gap in Taiwan

Taiwan has experienced one of the most rapid rates of economic growth in the free world during the past 3 decades. Its labor force has been a crucial factor in this growth.[6] While the overall labor force participation rate increased from 58% in 1965 to 60% in 1989 (table 1), men and women have opposite movements in these participation rates. The males' labor force participation rate in general has declined from 82.6% to 74.8% while the females' rose from 33.1% to 45.4%. The large increase for married women (table 2)—from 27.2% in 1967 to 43.7% in 1987—has been especially significant.

For females, the participation rates increased among all age groups, except for the group aged 15–19 from 1965 to 1987 (table 3). The M-shaped life cycle labor force participation, typically attributable to women's withdrawal from the labor force because of marriage and

TABLE 1

SELECTIVE LABOR STATISTICS

	1965	1975	1985	1989	1965–89 Annual Growth Rate
Overall population aged 15 and over (thousands)	6,689	9,712	12,860	13,955	3.1
Labor force (thousands)	3,891	5,656	7,651	8,390	3.3
Total LFPR (%)	58.17	58.24	59.49	60.12	. . .
Employment (thousands)	3,764	5,521	7,428	8,258	3.4
Unemployment rate (%)	3.27	2.39	2.91	1.57	. . .
Male population aged 15 and over	3,388	4,894	6,440	6,989	3.1
Labor force	2,798	3,798	4,860	5,231	2.6
Male LFPR (%)	82.59	77.61	75.46	74.84	. . .
Employment	2,735	3,719	4,719	5,149	2.7
Unemployment rate (%)	2.25	2.08	2.90	1.57	. . .
Female population aged 15 and over	3,301	4,818	6,420	6,966	3.1
Labor force	1,093	1,858	2,790	3,159	4.5
Female LFPR (%)	33.11	38.56	43.46	45.35	. . .
Employment	1,029	1,802	2,709	3,110	4.7
Unemployment rate (%)	5.86	3.01	2.90	1.56	. . .

SOURCES.—Directorate-General of Budget, Accounting and Statistics, Executive Yuan (DGBAS), Republic of China (ROC) *Yearbook of Labor Statistics* (Taipei: DGBAS, ROC, various years); and DGBAS, ROC, *Yearbook of Manpower Statistics Taiwan Area* (Taipei: DGBAS, ROC, 1989).

NOTE.—LFPR = labor force participation rate.

childbearing, has become less prevalent since 1965. Compared to 1965, females' labor force participation rates are higher and more stable in 1987, and the share of married women in the total female labor force increased from 47% in 1965 to 58% in 1987. Nevertheless, the participation rate for married women still remains below that of the never married.

Despite the rapid growth in their employment, the relative pay for women changed minimally. In 1989, as in 1978, women earned 36% less than men. This earnings gap varies by marital status, schooling, and age (table 4). As indicated in the first section of table 4, female relative earnings are smaller for marrieds (.59) than for singles (.78). Education has a strong positive effect on the earnings of both gender groups, but it takes considerably more years of schooling for women to achieve the same earnings as men (table 4). For instance, in 1989,

TABLE 2

GENDER DIFFERENCES IN LABOR FORCE PARTICIPATION RATE BY MARITAL STATUS (%)

MARITAL STATUS	MALE		FEMALE		FEMALE/MALE RATIO	
	1967	1987	1967	1987	1967	1987
Total	80.89	74.41	33.72	45.79	41.69	61.54
Single, never been married	65.39	56.61	57.33	56.40	87.67	99.63
Married, spouse present	90.12	86.60	27.15	43.74	30.13	50.51
Other, once married (separated divorced, and widowed)	57.23	49.71	18.86	26.23	32.95	52.77

SOURCES.—Yu-lain Liu, *The Utilization of the Female Labor Force in Taiwan: Retrospective and Prospective* (Taipei: Manpower Planning Committee, Council for Economic Planning and Development, 1985), table 2-1; and *Monthly Bulletin of Labor Statistics* (Taipei: Directorate-General of Budget, Accounting and Statistics, Executive Yuan, Republic of China, January 1988).

TABLE 3

GENDER DIFFERENCES IN LABOR FORCE PARTICIPATION RATE BY AGE (%)

AGE	MALE		FEMALE		FEMALE/MALE RATIO	
	1965	1987	1965	1987	1965	1987
Total	82.59	75.24	33.11	46.54	40.09	61.86
15–19	61.73	31.12	56.48	33.08	91.49	106.30
20–24	80.77	72.87	43.49	66.88	53.84	91.78
25–29	96.62	94.49	30.00	56.31	31.05	59.59
30–34	98.35	97.61	29.67	55.06	30.17	56.41
35–39	97.42	98.27	37.10	57.29	38.08	58.30
40–44	95.38	97.54	32.51	55.56	34.08	56.96
45–49	92.22	96.21	30.91	49.43	33.52	51.38
50–54	88.93	90.35	25.26	40.36	28.40	44.67
55–59	74.85	79.05	14.19	31.02	18.96	39.24
60–64	48.38	57.75	6.19	19.32	12.79	33.45
65 and over	21.62	16.61	2.15	3.77	9.94	59.84

SOURCES.—Yu-lain Liu, *The Utilization of the Female Labor Force in Taiwan: Retrospective and Prospective* (Taipei: Manpower Planning Committee, Council for Economic Planning and Development, 1985), table 2-1; and *Monthly Bulletin of Labor Statistics* (Taipei: Directorate-General of Budget, Accounting and Statistics, Executive Yuan, Republic of China, January 1988).

TABLE 4

GENDER DIFFERENCES IN EARNINGS BY MARITAL STATUS, EDUCATION, AND AGE, 1978 AND 1989 (Current NT$)

	1989		Female/Male Earnings Ratio	
	Male (1)	Female (2)	1989 (Col. 1/Col. 2) (3)	1978 (4)
Overall	20,472	13,081	.639	.643
By marital status:				
Single, never been married	16,494	12,780	.775	N.A.
Married, spouse present	22,540	13,399	.594	N.A.
Other, once married (separated, divorced, and widowed)	19,498	12,421	.637	N.A.
By education:				
Illiterate and self-educated	18,641	10,392	.557	.562
Primary school	17,367	11,489	.662	.606
Junior high school	19,413	12,576	.648	.688
Senior high school	20,514	13,550	.661	.714
Vocational school	23,612	17,643	.747	.647
College and graduate school	31,663	21,981	.694	.597
By age:				
15–19	11,170	10,150	.909	.953
20–24	15,911	12,008	.755	.742
25–29	18,823	13,907	.739	.761
30–34	22,085	14,190	.643	.637
35–39	23,866	14,451	.606	.600
40–44	23,996	14,085	.587	.589
45–49	23,138	13,296	.575	.579
50–54	21,808	12,342	.566	.621
55–59	20,779	12,400	.597	.473
60–64	19,142	10,107	.528	.488
65 and over	18,342	7,190	.392	.511

SOURCE.—Directorate-General of Budget, Accounting and Statistics, Executive Yuan (DGBAS), Republic of China (ROC), *The Manpower Utilization Survey in the Taiwan Area* (Taipei: DGBAS, ROC, 1989).

NOTE.—N.A. = not available.

males with only primary school education earned more than female high school graduates; male senior high school graduates had higher earnings than women who had graduated from vocational school (i.e., junior college). The earnings gap narrows with increases in education, with the exception of college and postcollege graduates.

Life-cycle earnings profiles are also given in table 4. Female age-earnings profiles are lower and flatter, implying that the gender earnings gap widens over the life cycle. For example, in 1989 the earnings

difference is only 9% for the youngest group, but 44% for those between the ages of 50 and 54.

If men and women are equally productive but discrimination against women causes men to receive wage premiums, growth can be hampered because of higher costs of production (i.e., due to inefficiency). To assess the extent of economic efficiency, we analyze gender pay differences by demographic groups, paying particular attention to possible anomalies.

III. Work Expectations and Human Capital Investment

Human capital represents acquired worker skills obtained not only from formal schooling and postschool training but also from family care in preschool years, health, and job search. Higher levels of investment increase productivity, which, in turn, generates higher earnings. The production of human capital is a continual process. An individual invests until the marginal cost equals the present value of marginal returns. Returns depend both on expected wage gains and on lifetime labor force participation. Accordingly, given the marginal cost of producing human capital, if one expects to participate less, one has lower expected wage gains and hence invests less.

To illustrate this, labor force participation is explicitly introduced into the human capital investment decision. Continuous lifetime labor force participation implies an individual's marginal return (MR) at age t equal to[7]

$$\mathrm{MR}_t = \int_0^{T-t} W_0 \exp(-r\tau)d\tau, \tag{1}$$

where T is the working life span, W_0 is the rental unit price of human capital, and r is the rate of discount including depreciation. Intermittent labor force behavior, manifested by dropping out from t_i to t_j, yields marginal revenue:

$$\mathrm{MR}_t = \int_0^{t_i - t} W_0 \exp(-r\tau)d\tau + \int_{t_j - t}^{T-t} W_0 \exp(-r\tau)d\tau. \tag{2}$$

The greater the duration of zero participation, the lower is the marginal revenue. But because current investment costs do not change, the marginal cost is unaffected by a future absence from the labor force. Accordingly, present investment is lower if one expects future intermittency. Traditional residual approaches of assessing male-female wage differences generally do not account for the effects of expected intermittent labor force behavior and hence overestimate the magnitude of discrimination.[8]

IV. Empirical Analysis

To account for the above bias, we incorporated work expectations into the earnings function: first by computing the human capital stock a worker expects to accumulate, given his or her future labor market work expectations, and second by incorporating this expected human capital stock as a variable in the earnings function. Incorporating omitted expected human capital stock, as we computed it, helps alleviate the omitted variable bias that occurs when expectations are neglected.

A. The Computation of Expected Postschool Investment

As noted earlier, an individual invests until the current marginal cost of the investment equals the present value of the marginal wage gains in each time period. The expected marginal return, shown in equation (2), is essentially the present value of expected wage gains to be received over one's lifetime. Hence, marginal revenue at each age (MR_t) is

$$MR_t = W_0 \sum_{\tau=0}^{T-t} \frac{N_\tau}{[1 + (r + \delta)]^{(T-\tau)}}, \tag{3}$$

where W_0 is the rental rate per unit of human capital; T is one's expected work life; N_τ is one's expected labor force participation in years τ; and r and δ are discount and depreciation rates, respectively. To normalize, we assume that the rental rate of human capital (W_0) equals unity and that individuals form expectations of work participation on the basis of their elders' experiences.[9] Labor force participation (N_τ) is calculated according to the conventional definition, which is based on whether or not one is in the labor force during the survey week.[10] The discount rate (r) is assumed to be 10%.[11] The rate of depreciation (δ) is computed as the ratio of net investment in the final year of work to the stock of capital accumulated until that year.[12] This is assumed to be constant and independent of age or the rate of labor force participation.

The marginal cost of investment (MC) depends on a person's capacity to produce human capital, which to a great extent is determined by past investment behavior. The cost of investment is composed of the opportunity cost, or forgone earnings, as well as the direct costs of purchased goods and services. Empirically, the marginal cost schedule is not directly observable. However, it can be measured if the amount of gross investment and the marginal returns of investment are known. By applying the Mincer earnings function, investment net of depreciation (I_n) and then the gross investment (I_g) can be computed.

Given Mincer's quadratic earnings function—

$$\text{Ln } Y_t = Y_0 + rS + \beta_1 t + \beta_2 t^2 \tag{4}$$

—the net investment in dollar terms (DI_{nt}) is[13]

$$\begin{aligned} DI_{nt} &= r^{-1}\left[\frac{d\text{Ln } Y_t}{dt} - \frac{d\text{Ln}(1 - kt)}{dt}\right]\frac{Y_t}{(1 - k_t)} \\ &= r^{-1}\left[(\beta_1 + 2\beta_2 t) + \frac{d\text{Ln}(1 - k_t)}{dt}\right]\frac{Y_t}{(1 - k_t)}, \end{aligned} \tag{5}$$

where Y_t is observed income at time t; r is the rate of return to schooling; S is years of schooling; T is years of exposure to the labor force; and k_t is the gross investment ratio.[14]

The procedure for estimating net investment (DI_{nt}) is first to estimate equation (4) for married males. By substituting these results into equation (5), net investment is obtained. Gross investment in each time period can be measured by adding the depreciation (computed depreciation rate times the total stock of capital) to DI_{nt}. In principle, human capital investment can be measured by this method for all gender–marital status–education groups. However, since we wish independent gross investment estimates for the other marital status–gender groups, the above investment estimates are computed only for married males and then used to derive other groups' human capital investments.[15]

The procedure is as follows. (i) For each education level, equate married male marginal gains and marginal costs of investment. (ii) Assume equal male and female ability so that similarly educated individuals have identical human capital production functions and marginal cost curves. (iii) Obtain gross investment for each education–marital status–gender group's investment by equating returns and costs. (iv) Obtain net investment by subtracting depreciation from gross investment. (v) Finally, the estimates of net investment per period (including the value of education) are summed to obtain expected human capital stock measures.

Table 5 presents the estimated results of postschool investment across gender–marital status–education groups.[16] We note that gross investment levels differ across marital status–gender groups. In most cases, married females have a distinctly lower level of investment than either males or single females, and married males have the highest level of investment among all groups. Furthermore, single males and females have similar investment patterns except that the single male investment profile is slightly higher than the single female investment profile. Due to the greater labor force commitment of the more edu-

cated, expected gross investment rises consistently with education. Table 5 also provides the expected net investment for each group, which is computed by subtracting depreciation from gross investment.[17] These results are consistent with Polachek's finding that the married female investment profile is not a monotonically declining function of potential labor force experience.[18] We also found that the quantity of investment differs across gender–marital status–schooling groups. For individuals with the least labor force commitment, investment is least monotonic and smallest in magnitude.

Although the results (table 5) provide sufficiently robust evidence that human capital investments differ according to gender and marital status, these estimates are not beyond reproach. For example, it might be inappropriate to assume that the human capital production functions are identical for both sexes. If one believes differing lifetime work affects the quality of education so that females tend to specialize in the type of education that raises home productivity, then investment in schooling need not be Hicks neutral with respect to home versus market production. This implies that assuming an invariant marginal cost function within each education group underestimates the females' marginal cost schedule and, hence, ceterus paribus, overestimates their expected investment. In contrast, if the males' marginal cost schedule rises over time, or if the cost of time increases more rapidly for males, the outlined computation scheme underestimates female expected investment.

Many other examples show that computed human capital investment could be misestimated.[19] Since each bias gives different and opposite effects, the net effect is impossible to disentangle. The results presented in table 5 nevertheless are consistent with the life-cycle human capital theory: that human capital investments differ among gender–marital status groups with the degree of labor force commitment.

B. Expected Human Capital Investment as a Determinant of Male-Female Wage Differentials

According to convention, the proportion of male-female earnings differences unexplained by individual characteristics constitutes discrimination. Past studies (e.g., Oaxaca, n. 1 above) fit two wage functions, one for males and one for females. To evaluate what females would earn if they had male characteristics one substitutes male characteristics into the female equation. The difference between this and male earnings is one estimate of the unexplained wage gap. Alternatively, one could substitute male characteristics into the female equation.

Most models regress the natural log of individual i's (Ln Y_i) earnings on years of schooling (S_i), potential market experience (E_i, defined as age minus years of schooling minus six), and a set of other standard-

TABLE 5

COMPUTED GROSS AND NET INVESTMENT AT 5-YEAR INTERVALS BY EDUCATION, GENDER, AND MARITAL STATUS (Current NT$)

YEARS OF EDUCATION/AGE	EXPECTED GROSS INVESTMENT				EXPECTED NET INVESTMENT			
	Male		Female		Male		Female	
	Single	Married	Single	Married	Single	Married	Single	Married
6 or less:								
20	3,120	5,157	3,362	881	2,090	3,748	2,262	388
25	3,571	5,441	2,644	881	2,034	3,172	1,107	302
30	3,362	5,470	2,152	1,161	1,377	2,487	391	515
35	3,120	5,144	1,623	1,161	841	1,633	−199	400
40	2,644	4,481	1,161	889	222	665	−544	78
45	2,409	3,571	661	661	−50	−310	−897	−145
50	1,428	2,409	889	459	−912	−1,298	−492	−286
55	459	1,161	450	222	−1,603	−2,198	−781	−417
60	0	0	0	0	−1,653	−2,759	−1,034	−506
6–9:								
20	8,288	9,693	7,431	1,252	6,231	7,359	5,541	638
25	9,064	10,873	6,036	1,699	5,440	6,693	2,991	913
30	8,288	11,160	4,573	1,699	3,435	5,373	995	700
35	7,431	10,534	3,107	2,159	1,799	3,538	−511	973
40	5,553	9,064	3,107	1,699	−318	1,374	−413	374
45	3,107	6,978	1,252	819	−2,377	−836	−1,987	−484
50	1,699	4,573	819	401	−3,117	−2,813	−1,956	−768
55	1,252	2,159	401	0	−2,841	−4,332	−1,838	−950
60	0	0	0	0	−3,346	−5,263	−1,734	−729

9–12:								
20	7,817	8,732	7,817	2,299	7,215	8,077	7,215	1,871
25	9,429	9,952	7,817	2,299	7,450	7,808	5,946	1,549
30	9,161	10,421	7,009	2,299	5,917	6,886	4,198	1,282
35	8,539	10,044	5,203	2,299	4,352	5,336	1,795	1,061
40	7,009	8,864	4,243	2,299	2,150	3,309	611	878
45	4,726	7,009	2,299	1,289	−377	1,009	−1,296	−265
50	2,299	4,726	1,821	1,289	−2,615	−1,287	−1,532	−219
55	1,289	2,299	1,289	437	−3,068	−3,319	−1,816	−977
60	0	0	0	0	−3,740	−4,876	−2,672	−1,230
12–16:								
25	13,999	16,876	13,172	6,777	11,286	13,197	10,281	4,863
30	13,176	18,890	10,518	7,715	7,545	11,591	5,239	4,515
35	9,591	18,863	6,777	7,715	2,514	8,566	470	3,364
40	4,934	16,812	4,934	7,715	−2,277	4,518	−1,246	2,506
45	4,934	13,176	4,037	6,777	−1,735	96	−1,543	935
50	2,324	8,655	738	4,037	−3,528	−3,971	−4,124	−1,695
55	2,324	4,037	0	1,513	−2,762	−7,071	−3,811	−3,421
60	0	0	0	0	−4,126	−8,852	−2,839	−3,895
16 and over:								
25	24,295	28,142	14,738	14,738	22,352	25,681	13,231	13,167
30	28,175	32,181	18,064	13,069	21,814	24,799	13,774	9,153
35	25,685	32,333	16,407	13,069	15,668	20,444	9,787	7,522
40	21,287	29,253	11,439	9,789	8,736	13,878	3,620	3,082
45	13,069	22,825	5,179	5,179	−500	5,418	−2,751	−1,784
50	8,200	14,738	1,170	1,170	−4,975	−3,048	−5,966	−5,168
55	2,427	6,660	1,170	2,427	−9,472	−9,973	−4,946	−3,130
60	0	0	0	0	−9,941	−14,335	−5,065	−4,729

izing variables ($\mathbf{X}_i$), such as industry, occupation, region, and hours worked, resulting in the following conventional specification:

$$\text{Ln } Y_i = \text{f}(S_i, E_i, \mathbf{X}_i) + \epsilon. \tag{6}$$

To examine the importance of postschool human capital investment differentials, we replace S_i and E_i with K_i, human capital values as computed in the previous section to obtain equation (7):

$$Y_i = a + \text{b}K_i + \mathbf{X}_i\mathbf{c} + \epsilon, \tag{7}$$

where K_i is the expected human capital stock and $\mathbf{X}_i$ is the same as before. The coefficient b can be interpreted as the rate of return on expected human capital stock. The coefficient vector **c** is a measure of individual deviations from expected labor market activity as well as the returns to the variables not used in computing K. Since K_i is measured in dollars, instead of Mincer's time-equivalent investment, Y_i is now in dollars instead of logarithms. Equation (7) is estimated separately for men and women.

Mean male wages (Y_m) can be computed by substituting mean male values of K (or S and E) and $\mathbf{X}$ values into the male version of equation (7); similarly, mean female wages (Y_f) results from using female means in the female equation. Thus, the percent difference between male and female wages is $1 - Y_\text{f}/Y_\text{m}$. Substituting female values into the male equation yields estimates of what females would earn if their earnings were generated by the same process as males (Y_fm). Accordingly, in percentage terms the unexplained wage gap (i.e., a measure of discrimination after adjusting for observed differences in male and female characteristics) is $1 - Y_\text{fm}/Y_\text{m}$.

Variable definitions for this analysis are given in table 6, and sample means are contained in table 7. The regression results are presented separately for men and women (table 8), and also further by marital status (table 9 for singles; table 10 for marrieds). Each of these tables has three specifications: (1) no controls for traditional human capital variables; (2) control for the expected human capital (EHC) measure (the human capital measure derived to capture work expectations); and (3) controls for traditional human capital variables.[20] To capture the unexplained earnings ratio, we follow the decomposition technique just outlined. The explained and unexplained wage gaps derived from the regression results (reported in tables 8–10) are summarized in table 11. It shows (row 4) that the unadjusted male-female earnings differences are NT$7,472 for singles and marrieds combined, NT$3,972 for singles, and NT$9,760 for marrieds. It is significant that those models that explicitly incorporate work expectations (regression [2]) explain

TABLE 6

VARIABLE DESCRIPTIONS

Variable	Description
Y	Monthly wages in current NT$
EDU	Years of schooling completed
Market experience variables:	
EXP	Age minus EDU minus 6
EXP2	Squared term of EXP
HR	Weekly working hours
EHC	Expected human capital
DMR	1 if married; 0 otherwise
Occupational dummies:*	
DOC1	1 if professional workers; 0 otherwise
DOC2	1 if managerial workers; 0 otherwise
DOC3	1 if clerical workers; 0 otherwise
DOC4	1 if sales workers; 0 otherwise
DOC5	1 if service workers; 0 otherwise
Industry dummies:†	
DIN1	1 if mining, quarrying, and agricultural sector; 0 if otherwise
DIN2	1 if manufacturing; 0 otherwise
DIN4	1 if transportation and communication; 0 otherwise
DIN5	1 if construction; 0 otherwise
DIN6	1 if commerce; 0 otherwise
DIN7	1 if finance and insurance; 0 otherwise
Dummy variables for survey job location:‡	
DAR1	1 if northern region; 0 otherwise
DAR2	1 if central region; 0 otherwise
DAR3	1 if southern region; 0 otherwise
DRE	1 if working in an urban area; 0 otherwise
Firm-size dummies:§	
DFR1	1 if large size (with no. of employees greater than 500); 0 otherwise
DFR2	1 if medium size (with no. of employees less than 500 but greater than 100); 0 otherwise
DFR3	1 if small size (with no. of employees less than 100 but greater than 30); 0 otherwise

* The manual workers group is used as the reference group.
† The personal and other services group is used as the reference group.
‡ The eastern region is used as the reference group.
§ Firm size with no. of employees less than 30 is used as the reference group.

a far greater proportion of the wage gap (row 10) than the other two specifications (i.e., regression [1] and regression [3]).

A closer inspection indicates that the proportion of the unadjusted male-female wage differential that can be explained by the expected human capital stock is higher for marrieds (84%) than either for singles and marrieds combined (72%) or for singles alone (23%). We note also that the dollar wage differential between men and women is larger for marrieds NT$7,437 (NT$8,084) with (without) adjustments made for

TABLE 7

SAMPLE MEANS

	TOTAL		SINGLE		MARRIED	
	Male	Female	Male	Female	Male	Female
Observations	9,659	6,623	3,725	3,163	5,934	3,460
EDU	9.7396	9.6778	10.4811	11.2245	9.2587	8.2639
EXP	17.7396	14.2396	9.4419	6.2450	22.9484	21.5480
EXP2	453.1213	336.0439	145.1868	66.8716	646.4237	582.1110
HR	49.0452	47.5171	49.2609	48.8922	48.9198	46.2601
DMR	.6143	.5224	. . .	. . .	. . .	. . .
DFR1	.0592	.0675	.0421	.0661	.0699	.0688
DFR2	.1323	.1795	.1119	.1834	.1451	.1760
DFR3	.1728	.1961	.1705	.2144	.1743	.1795
DIN1	.0432	.0237	.0295	.0035	.0517	.0422
DIN2	.4851	.5772	.5095	.4878	.4698	.6590
DIN4	.1757	.0322	.1332	.0161	.2024	.0468
DIN5	.1288	.1484	.1562	.2077	.1116	.0942
DIN6	.0604	.1065	.0400	.0177	.0731	.0153
DIN7	.0322	.0578	.0373	.0778	.0290	.0396
DOC1	.0522	.0571	.0585	.0809	.0482	.0353
DOC2	.0122	.0014	.0011	.0009	.0192	.0017
DOC3	.1075	.2451	.0856	.3364	.1212	.1616
DOC4	.1040	.0788	.1205	.1065	.0935	.0535
DOC5	.0426	.0849	.0502	.0911	.0377	.0792
DAR1	.4851	.4862	.5227	.5033	.4616	.4705
DAR2	.2063	.2072	.2075	.2033	.2056	.2107
DAR3	.2858	.2861	.2526	.2792	.3067	.2925
DRE	.4381	.4424	.4870	.5365	.4075	.3564

TABLE 8

REGRESSION RESULTS (Singles and Marrieds) DEPENDENT VARIABLE: MONTHLY WAGES IN CURRENT NT$

	REGRESSION (1)				REGRESSION (2)				REGRESSION (3)			
	Male		Female		Male		Female		Male		Female	
	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE
INTERCEP	10,918.20	651.02	5,324.29	510.42	7,050.91	622.00	1,944.63	490.57	−1,272.47	847.31	−4,984.65	690.95
EDU	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	756.16	33.56	611.53	30.22
EXP	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	738.42	26.32	334.63	20.84
EXP2	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	−12.90	.51	−5.31	.43
HR	83.55	10.90	99.80	8.08	97.36	10.26	110.24	7.57	82.62	10.36	101.15	7.70
DMR	4,572.48	151.10	846.93	126.52	2,225.68	156.78	1,981.56	124.17	2,102.18	188.07	−170.31	165.26
DFR1	−2,276.69	197.38	−1,864.01	143.05	−1,324.34	187.59	−1,562.62	134.30	2,207.49	314.63	2,325.22	236.21
DFR2	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	1,236.32	226.95	2,233.32	161.54
DFR3	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	368.81	198.87	1,871.43	155.29
DIN1	327.88	451.94	−552.33	459.24	910.57	425.42	−152.77	430.18	691.07	433.74	450.35	445.24
DIN2	−33.25	298.76	192.00	240.70	348.35	281.23	407.80	225.48	−215.33	286.15	−389.10	232.25
DIN4	3,176.80	334.36	3,602.33	394.33	3,599.25	314.72	3,801.19	369.26	3,094.89	318.60	3,971.70	375.10
DIN5	1,017.71	373.27	1,019.54	263.59	1,095.48	351.11	1,139.15	246.83	792.54	353.38	1,036.41	249.57
DIN6	4,103.03	405.29	2,670.07	505.57	4,185.18	381.22	2,431.17	473.43	3,392.47	385.34	2,236.76	478.58
DIN7	2,389.58	492.75	2,457.17	325.48	2,316.18	463.49	2,919.89	305.12	1,973.43	466.94	2,104.93	309.29
DOC1	7,738.26	346.22	5,826.16	315.89	4,735.30	336.49	3,884.35	302.54	5,087.71	349.93	3,433.91	318.58
DOC2	18,924.87	662.17	20,997.36	1,600.74	13,438.03	641.79	19,208.93	1,499.91	15,255.13	645.10	18,816.61	1,517.43
DOC3	4,627.86	254.48	2,987.23	180.25	2,020.04	250.42	1,770.12	173.42	2,121.88	262.75	986.23	194.92
DOC4	2,550.81	318.99	2,546.58	299.12	1,148.16	302.64	1,513.85	282.11	946.19	309.31	1,123.83	290.00
DOC5	−1,269.52	394.29	1,510.79	279.32	−1,141.14	370.89	1,336.10	261.59	−1,034.67	375.67	1,150.61	265.17
DAR1	1,350.45	146.86	1,421.48	120.10	1,178.40	138.22	1,160.36	112.77	−964.09	471.02	1,975.99	405.96
DAR2	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	−1,938.72	480.33	1,501.45	412.23
DAR3	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	−2,574.31	476.96	332.10	410.87
DRE	1,238.88	154.30	672.39	130.59	882.01	145.49	397.62	122.61	1,200.66	151.89	598.52	129.08
EHC	. . .	. . .	. . .	. . .	.04576	.00129	.07538	.00247	. . .	. . .	. . .	. . .
Adjusted R^2	.2814		.2307		.3642		.3256		.3571		.3120	
Observations	9,659		6,623		9,659		6,623		9,659		6,623	

TABLE 9

REGRESSION RESULTS (Singles Only) DEPENDENT VARIABLE: MONTHLY WAGES IN CURRENT NT$

	Regression (1)				Regression (2)				Regression (3)			
	Male		Female		Male		Female		Male		Female	
	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE
INTERCEP	4,323.16	675.45	10,108.25	752.15	2,293.49	657.29	6,351.49	720.17	−1,659.31	1,121.73	−1,479.99	1,046.10
EDU	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	775.56	43.43	644.91	42.08
EXP	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	767.55	30.47	493.66	33.28
EXP2	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	−14.22	.76	−10.35	1.22
HR	144.48	10.27	−5.77	12.89	148.63	9.84	20.13	12.05	51.44	14.04	25.61	12.12
DFR1	−1,904.45	203.12	−1,147.82	192.38	−1,671.13	195.04	−997.37	179.13	1,737.90	427.25	1,521.67	314.83
DFR2	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	550.49	284.34	1,304.31	214.08
DFR3	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	688.41	235.07	1,026.93	199.82
DIN1	−625.61	582.75	542.53	1,337.56	−44.07	559.26	630.62	1,244.55	2,206.83	567.38	414.22	1,244.26
DIN2	−457.76	405.28	987.52	282.73	88.84	389.51	848.20	263.14	295.56	307.18	246.74	273.20
DIN4	4,087.30	544.26	1,930.65	658.75	4,546.82	522.07	1,651.64	613.07	3,177.74	361.39	1,533.49	612.02
DIN5	704.12	441.54	1,552.48	308.27	916.61	423.17	1,419.55	286.89	561.81	374.25	1,234.17	286.46
DIN6	2,005.06	761.59	3,158.86	633.90	2,030.79	729.61	2,731.34	590.14	3,480.11	497.42	2,485.02	590.31
DIN7	3,320.02	561.19	1,923.13	372.96	3,968.39	538.89	2,078.36	347.09	1,549.66	518.26	1,596.30	347.50
DOC1	8,859.76	561.03	3,712.67	359.82	4,980.64	580.95	3,053.73	336.16	3,024.22	396.11	1,854.07	356.12
DOC2	24,331.81	2,018.99	13,347.23	2,521.99	22,272.62	1,937.76	12,537.73	2,346.91	14,609.98	2,487.20	10,905.45	2,343.94
DOC3	4,177.61	287.59	1,629.15	223.36	2,659.81	288.71	962.15	210.00	710.73	340.42	−50.37	234.25
DOC4	4,320.02	504.06	1,137.65	354.74	3,312.94	486.28	426.33	331.64	324.35	340.40	−163.44	337.44
DOC5	500.54	427.57	2,258.24	352.22	741.64	409.85	1,862.75	328.21	341.64	426.03	1,494.98	329.34
DAR1	1,315.43	172.02	1,544.01	157.02	1,135.82	165.11	1,259.76	146.67	737.44	647.99	1,883.62	623.96
DAR2	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	390.51	657.62	1,485.56	632.35
DAR3	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	−349.65	655.56	36.13	633.27
DRE	548.47	188.55	768.92	169.33	310.53	181.14	520.88	157.96	633.37	178.68	616.94	164.86
EHC	. . .	. . .	. . .	. . .	.07141	.00406	.06858	.00310	. . .	. . .	. . .	. . .
Adjusted R^2	.3475		.1288		.4012		.2458		.3010		.2504	
Observations	3,725		3,163		3,725		3,163		3,725		3,163	

TABLE 10

REGRESSION RESULTS (Marrieds Only) DEPENDENT VARIABLE: MONTHLY WAGES IN CURRENT NT$

	REGRESSION (1)				REGRESSION (2)				REGRESSION (3)			
	Male		Female		Male		Female		Male		Female	
	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE
INTERCEP	14,983.77	879.88	11,947.18	881.18	9,102.66	869.14	8,144.92	830.99	598.13	1,266.64	−4,259.30	1,000.45
EDU	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	720.18	46.41	464.12	42.68
EXP	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	725.78	43.40	213.30	33.02
EXP2	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	−12.48	.80	−3.05	.63
HR	102.37	14.41	44.60	15.50	117.26	13.72	52.18	14.36	101.00	13.95	131.62	10.02
DFR1	−2,772.43	268.53	−1,352.71	264.29	−1,651.31	259.27	−914.37	245.56	2,415.06	424.91	2,333.83	337.93
DFR2	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	1,677.03	317.98	2,503.29	233.52
DFR3	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	168.19	287.57	2,227.84	230.17
DIN1	−637.19	637.53	3,086.43	612.81	147.84	607.11	2,665.29	568.17	416.34	620.53	438.64	576.14
DIN2	−730.37	466.78	1,141.62	333.14	−82.64	444.67	373.79	309.16	−369.10	453.09	−611.86	394.22
DIN4	2,726.05	506.53	4,311.24	395.76	3,418.63	482.51	3,510.46	368.20	3,282.71	490.83	4,877.76	529.66
DIN5	1,138.28	586.02	1,159.20	413.22	1,269.17	557.34	787.49	383.23	1,189.32	564.66	999.07	427.41
DIN6	3,417.71	579.14	5,572.17	543.18	3,827.78	551.01	4,343.17	505.84	3,480.48	557.92	2,198.50	736.20
DIN7	2,872.33	742.31	2,460.71	571.91	2,674.27	705.99	1,921.77	530.45	2,766.40	714.78	2,937.75	545.26
DOC1	9,373.28	518.59	5,535.04	406.30	5,721.30	514.32	3,458.54	385.79	6,851.53	529.35	6,537.88	577.15
DOC2	18,958.35	749.10	19,366.21	2,741.53	13,933.96	740.14	15,743.24	2,544.89	15,613.47	751.85	22,899.70	1,955.43
DOC3	5,368.78	341.80	2,959.53	351.07	2,460.74	345.20	1,362.69	331.70	2,954.45	361.84	2,410.67	317.91
DOC4	3,117.28	483.00	1,798.75	366.82	1,421.05	646.32	850.93	342.10	1,587.07	475.60	3,156.79	497.46
DOC5	−2,295.83	577.79	264.88	468.92	−2,099.47	549.55	255.73	434.56	−1,938.42	561.32	571.41	414.48
DAR1	1,622.10	207.27	528.86	283.64	1,452.20	197.23	742.00	170.35	−1,534.51	630.00	1,718.84	525.12
DAR2	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	−2,909.17	644.16	1,163.39	534.08
DAR3	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	−3,487.45	638.03	175.93	529.83
DRE	1,627.38	218.84	620.14	191.36	1,165.94	208.93	471.21	177.44	1,554.84	220.42	618.47	190.00
EHC	. . .	. . .	. . .	. . .	.04059	.00162	.06332	.00256	. . .	. . .	. . .	. . .
Adjusted R^2	.2457		.1431		.3178		.2641		.3024		.3920	
Observations	5,934		3,460		5,934		3,460		5,934		3,460	

TABLE 11

DECOMPOSITION OF EARNINGS (NT$/Month) DIFFERENTIALS

	SINGLES AND MARRIEDS			SINGLES ONLY			MARRIEDS ONLY		
	Regression (1)	Regression (2)	Regression (3)	Regression (1)	Regression (2)	Regression (3)	Regression (1)	Regression (2)	Regression (2)
$\bar{Y}_m$	19,538	19,538	19,538	16,358	16,358	16,358	21,534	21,534	21,534
$\bar{Y}_f$	12,066	12,066	12,066	12,386	12,386	12,386	11,774	11,774	11,774
$\bar{Y}_{fm}$	12,501	17,458	13,254	11,874	13,305	12,552	13,450	19,985	14,097
$\bar{Y}_m - \bar{Y}_f$	7,472	7,472	7,472	3,972	3,972	3,972	9,760	9,760	9,760
$\bar{Y}_f - \bar{Y}_m$	.6176	.6176	.6176	.7572	.7572	.7572	.5468	.5468	.5468
$1 - (\bar{Y}_f/\bar{Y}_m)$	.3824	.3824	.3824	.2428	.2428	.2428	.4532	.4532	.4532
$\bar{Y}_{fm} - \bar{Y}_f$	435	5,392	1,188	−512	919	166	1,676	8,211	2,323
$\bar{Y}_{fm}/\bar{Y}_m$	.6398	.8935	.6784	.7259	.8134	.7673	.6246	.9281	.6546
$1 - (\bar{Y}_{fm}/\bar{Y}_m)$	.3601	.1065	.3216	.2741	.1866	.2327	.3754	.0719	.3454
$(\bar{Y}_{fm} - \bar{Y}_f)/(\bar{Y}_m - \bar{Y}_f)$	.058	.722	.159	−.128	.231	.042	.172	.841	.238

SOURCES.—For singles and marrieds: table 8; for singles only: table 9; for marrieds only: table 10.

NOTE.—Regression (1) figures do not include human capital variables. Regression (2) figures include expected human capital measures (i.e., the human capital measure derived to capture work expectations; see text). Regression (3) figures include traditional human capital variables only. $\bar{Y}_m$ = mean male earnings; $\bar{Y}_f$ = mean female earnings; $\bar{Y}_{fm}$ = mean female earnings if a woman had a male earnings structure; $\bar{Y}_m - \bar{Y}_f$ = observed gender earnings gap; $\bar{Y}_f/\bar{Y}_m$ = observed gender earnings ratio; $1 - (\bar{Y}_f/\bar{Y}_m)$ = proportion of unexplained unadjusted gender differences in observed earnings; $\bar{Y}_{fm} - \bar{Y}_f$ = gender earnings gap after adjusting for differences in male-female characteristics; $\bar{Y}_{fm}/\bar{Y}_m$ = gender earnings ratio after adjusting for differences in male-female characteristics; $1 - (\bar{Y}_{fm}/\bar{Y}_m)$ = proportion of earnings gap unexplained after adjusting for differences in male-female characteristics; $(\bar{Y}_{fm} - \bar{Y}_f)/(\bar{Y}_m - \bar{Y}_f)$ = proportion of the gender earnings gap that is explained after adjustments are made for observed differences in male-female characteristics.

traditional human capital variables. But when the expected human capital stock variable is taken into account, the adjusted gender wage differential is smaller for marrieds (NT$1,549) than for singles and marrieds combined (NT$2,080).

The above findings indicate that the bulk of wage differentials can be explained by differences in human capital stock accumulation based on differences in expected lifetime labor force participation. That is, females on average earn less than males because they invest less. Since expected human capital measures were obtained by assuming the same investment costs for all gender–marital status–education groups, the differences in human capital investments are primarily determined by differences in marginal gains of investment, which in fact depend on differences in life-cycle labor force participation. Thus, male-female wage differentials can largely be attributed to differences in expected lifetime labor force participation.

It is interesting to compare our Taiwan results with those of other countries. Attention is focused on the United States because very few other empirical results can be found that are comparable to ours. For the United States in 1984, the average white female worker earned roughly 63% of what her male counterpart earned. Taiwan exhibited a similar pattern for 1989: female workers, on the average, earned 36% less than male workers.

Table 12 presents some previous studies from which we note that part, but not all, of the unadjusted male-female wage differentials is attributed to market discrimination. As shown for the United States, Oaxaca found that 80% of the male-female wage gap, unexplained by productivity-related characteristics, can be ascribed to labor market discrimination. When a control for occupation is included, the proportion decreases to 63%. The empirical results in Taiwan, which are comparable with the United States, are given by Gannicott.[21] By applying Oaxaca's technique, Gannicott found that 60% of the unadjusted male-female wage differentials can be attributed to market discrimination.[22] Similar empirical results were found for Canada, Malaysia, and Sweden (table 12).

When Corcoran and Duncan, as well as Jacob Mincer and Polachek, include detailed work history measures (actual labor market experience) for workers, the unexplained portion of the unadjusted male-female wage differentials further decreases to 54% and 56%, respectively, suggesting that a more appropriate measure of the labor market experience is relevant to sex-wage differentials. To take account of the differing work expectations, Polachek explicitly introduced expected lifetime labor force participation into the computation of the expected human capital, as we have done.[23]

By using the human capital approach with 1989 micro wage data for Taiwan, we find results consistent with the 1960 U.S. results ob-

TABLE 12

SUMMARY OF SELECTIVE STUDIES ON GENDER-WAGE DIFFERENTIALS

Country/Year	Source	U_r	A_r	U_x	Data Base
United States:					
1972	Corcoran and Duncan	.72	.85	.54	White employed household heads and employed spouses aged 18–64
1967	Mincer and Polachek	.66	.81	.56	Married white wage and salary workers, aged 30–44
1967	Oaxaca	.65	.72	.80	White urban employees, aged 16 and over
1967	Oaxaca	.65	.78	.63	White urban employees, aged 16 and over, controlling for occupation
Taiwan:					
1982	Gannicott	.64	.84	.56	Nonfarm workers
Malaysia:					
1973	Chua	.59	.73	.66	Civilian workers
Canada:					
1972	Gunderson	.60	.82	.45	Civilian workers working 35 hours and over per week, 49 weeks and over per year
Sweden:					
1974	Gustafsson	.67	.80	.61	White-collar workers in private sector

SOURCES.—D. Treiman and H. Hartmann, eds., *Women, Work and Wages: Equal Pay for Jobs of Equal Value* (Washington, D.C.: National Academy Press, 1981), tables 4 (pp. 20–21) and 10 (pp. 36–37); Mary Corcoran and Greg J. Duncan, "Work History, Labor Force Attachment and Earnings Differentials between Races and Sexes," *Journal of Human Resources* 14 (Winter 1979): 3–20; Jacob Mincer and Solomon W. Polachek, "Family Investments in Human Capital: Earnings of Women," *Journal of Political Economy* 82, no. 2, pt. 2 (March/April 1974): S76–S108; Ronald Oaxaca, "Male-Female Wage Differentials in Urban Labor Markets," *International Economic Review* 14 (October 1973): 693–709; K. Gannicott, "Women, Wages, and Discrimination: Some Evidence from Taiwan," *Economic Development and Cultural Change* 34 (July 1986): 721–30; Yee Yen Chua, "Wage Differentials in Peninsular Malaysia" (Ph.D. diss., University of California, Santa Barbara, 1984); Morley Gunderson, "Male-Female Wage Differentials and the Impact of Equal Pay Legislation," *Restat* 57, no. 4 (November 1975): 462–69; Siv Gustafsson, "Male-Female Life Time Earnings Differentials and Labor Force History," in *Studies in Labor Market Behavior: Conference Report*, ed. Gunnar Eliasson, Bertil Holmlund, and Frank Stafford (Stockholm: Industrial Institute for Economic and Social Research, 1981), pp. 235–68.

NOTE.—U_r (the unadjusted earnings ratio) = Y_f/Y_m and A_r (the adjusted earnings ratio) = Y_{fm}/Y_m, where Y_m and Y_f are the mean male and female earnings, respectively, and Y_{fm} is the average earnings of women if they had the average male worker characteristics. Furthermore, U_x (i.e., the proportion of unexplained gender wage gap that can be explained by the differences in male-female characteristics) is equal to $(1 - A_r)/(1 - U_r)$.

tained by Polachek and the 1980 results of Goldin and Polachek.[24] Among married males and married females, 84% of the unexplained male-female wage gap can be explained by differences in expected human capital stock. For single males and single females, the corresponding proportion is 23%. These findings are also consistent with the argument that the anticipated market discrimination may manifest itself by influencing the sex differences in market and nonmarket work.[25]

Several points can be drawn from the comparisons between the United States and Taiwan. First, Taiwan's patterns are comparable to those in the United States. Gender wage differentials vary by marital status and age and are also roughly of the same order of magnitude as in the United States. Second, our findings are consistent with the human capital theory prediction that lifetime work expectations are important in determining wage rates. Accordingly, when appropriate adjustments are made for these expectations, a greater proportion of the gender wage gap is explained, as compared with previous studies.

V. Summary and Concluding Remarks

This article investigates male-female wage differentials for Taiwan based on life-cycle human capital theory. Following the previous work of Polachek, as well as that of Goldin and Polachek, we illustrate that when individuals maximize the present value of lifetime earnings a relation emerges among one's expected lifetime labor force participation, postschool investment, and earnings. This relationship implies that human capital investment is crucially dependent on expected lifetime labor force participation.

To address the effect of lifetime work expectations on market earnings, we incorporate expected lifetime labor force participation rates to compute expected human capital investments. The estimated results provide sufficiently robust evidence that both the quantity of investment and its rate of accumulation vary among gender–marital status groups according to the degree of expected labor force intermittency. Specifically, married females with the least labor force commitment have a distinctly lower level of investment than either males or single females. Married males display a strong labor market attachment and hence provide a relatively greater human capital investment, leading them to accumulate more human capital over the life cycle than either single males or both single and married females.

Once these estimated human capital measures are embedded in wage regressions, then up to 84% of observed gender wage differentials can be explained. Although it is incorrect to say that such findings indicate a virtual absence of discrimination in Taiwan, nevertheless the hypothesis generated seems to yield results strongly supporting

the human capital approach—namely, that lifetime work incentives are largely responsible for observed wage differences. As such, male and female wage differences will narrow without government intervention, given that labor force participation rates among females are secularly increasing relative to those of males. Accordingly, accelerating gender wage convergence by mandating quotas or equal pay for comparable work could lead to an inefficient allocation of resources and tend to diminish growth in the long run.

Notes

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1. Ronald Oaxaca, "Male-Female Wage Differentials in Urban Labor Markets," *International Economic Review* 14 (October 1973): 693–709; Mary Corcoran and Greg J. Duncan, "Work History, Labor Force Attachment and Earnings Differentials between Races and Sexes," *Journal of Human Resources* 14 (Winter 1979): 3–20; Solomon W. Polachek, "Differences in Expected Post-School Investment as a Determinant of Market Wage Differentials," *International Economic Review* 16 (May 1975): 451–70; Claudia Goldin and Solomon W. Polachek, "Residual Differences by Sex: Perspectives on the Gender Gap in Earnings," *American Economic Review Papers and Proceedings* 77 (May 1987): 143–51.

2. Polachek, "Differences in Expected Post-School Investment as a Determinant of Market Wage Differentials." Regarding inherent biases, traditional discrimination estimates, e.g., may be biased upward or downward due to incomplete information. Another example is that differences in productivity-related attributes may be caused by past or current discrimination, leading to underestimation of the discrimination measure. For detailed discussion, see Francine D. Blau and Marianne A. Ferber, "Discrimination: Empirical Evidence from the United States," *American Economic Review Papers and Proceedings* 77 (May 1987): 316–20; and Glen G. Cain, "The Economic Analysis of Labor Market Discrimination: A Survey," in *Handbook of Labor Economics,* ed. Orley Ashenfelter and Richard Layard (Amsterdam: North-Holland, 1986), 1:693–785.

3. K. Gannicott, "Women, Wages, and Discrimination: Some Evidence from Taiwan," *Economic Development and Cultural Change* 34 (July 1986): 721–30; Jin-Tan Liu and Jin Long Liu, "Sex Wage Differentials in Taiwan" (in Chinese), in *The Chinese Economic Association Annual Conference Proceedings* (Taipei: Chinese Economic Association 1987), pp. 107–29; Chung-Cheng Lin, "Sex Differences in Hourly Earnings at Entry Levels: The Case of Taiwan" (in Chinese), *Taiwan Economic Review* 16 (September 1988): 305–22.

4. Gary S. Becker, "Human Capital, Effort, and the Sexual Division of Labor," *Journal of Labor Economics* 3 (January 1985): S1–S32; and Solomon W. Polachek, "Potential Biases in Measuring Male-Female Discrimination," *Journal of Human Resources* 10 (Spring 1975): 205–29. Both of these papers theoretically established the possible link between division of labor at home and the resulting sex differences in work effort.

5. Also see Feng-Fuh Jiang, "A Study on the Sex Wage Differentials of Junior High in Taiwan: A Human Capital Approach" (in Chinese), *Taiwan Economic Review* 16 (September 1988): 323–47. Even though Jiang applied an augmented human capital model to micro data from Taiwan, his sample consisted of individuals with only junior high education.

6. For a good review of the growth of the female labor force, see Ching-Hsi Chang, "Determinants of Female Labor Force Participation in Taiwan: A Micro Cross-Sectional Analysis," *Economic Essays* 9 (February 1980): 89–131; and Paul K. C. Liu, "Trends in Female Labor Force Participation in Taiwan: The Transition towards Higher Technology Activities," *Academic Economic Papers* 11 (March 1983): 293–323.

7. Y. Ben-Porath, "The Production of Human Capital over the Life Cycle," *Journal of Political Economy* 75 (August 1967): 352–65. Note that in this formulation marginal returns are independent of the amount of human capital. These returns are a declining function of time because of the finite lifetime horizon.

8. For a fuller explanation and also for a diagrammatic demonstration of this scenario, see Goldin and Polachek.

9. According to the model presented in Polachek, "Potential Biases in Measuring Male-Female Discrimination," differences in the wage rates (W_0) per unit of embodied human capital would not affect the amount or rate of postschool investment because wage increases raise the costs and gains of investment by equal amounts, and thereby offset each other. This assumption is made so as to isolate the implicit discrimination effect of differing wages for the same stock of human capital. However, if males and females have different wages, then this would only reinforce our result. Based on our assumption concerning the formation of work expectations, we use older cohort's labor force participation rates as the individual's expected future labor force participation. This assumption could be criticized because the labor force participation rate for each age group is not unchanged over time. For instance, for males between ages 30 and 64, the expected labor force participation rates obtained on the basis of this assumption would be underestimated because the actual rates are higher (shown in table 2). For age groups between 15 and 29, however, overestimates would be obtained.

10. To analyze the effects of differing male-female labor force participation patterns on earnings, overall life-cycle labor force commitment would be the more relevant variable. However, comprehensive data are not available.

11. The discount rate is taken as 10%, the rate of return on schooling, because various studies have yielded such values. See, e.g., Jacob Mincer, *Schooling, Experience, and Earnings* (New York: National Bureau of Economic Research, 1974). Experimentation with other discount rates had little effect on the results.

12. Computing the depreciation rate is based on assuming that individuals maximize the present value of their lifetime earnings. This assumption implies that the gross investment remains positive until the MR from investment falls to zero. Assuming that gross investment at one's retirement age is zero and assuming that depreciation is a constant function over time implies that one's net investment in the final year of work would represent the amount of depreciation. In accord with Taiwan's Labor Standards Law, we assume employed workers in the private sector are forced to retire at the age of 60.

13. For the logic behind this derivation, see Mincer, chaps. 4 and 5.

14. If human capital investment declines linearly with age, we can utilize Mincer's technique and specify $k_t = k_0 - (k_0/T) \cdot t$, where k_0 is the investment ratio during the initial period of experience, $t = 0$. The variable T is the total

period of positive net investment, i.e., the span of one's working life; K_0 and T can be solved from the estimated parameters of an earnings equation. For more information, see ibid., pp. 85–89.

15. To avoid a possible spurious relationship, investment for married males is computed using an earnings function computed from 1985 data. The estimated coefficients are then used to compute married male net investment for 1987.

16. The human capital measures are estimated from the *Manpower Utilization Survey* of Taiwan (Taipei: Directorate-General of Budget, Accounting and Statistics, Executive Yuan, May 1987). The data set originally contains 59,666 observations, from which we select preretirement age individuals who are currently employed in the private sector. This gives us 17,326 observations. The regression results presented in tables 8–10 are based on 1989 data from the same source. Description and sample means are provided in tables 6 and 7. Also see Solomon W. Polachek and Charng Kao "Lifetime Work Expectations and Estimates of Gender Discrimination," in *New Approaches to Economic and Social Analyses of Discrimination,* ed. Richard R. Cornwall and Phanindra V. Wunnava (New York: Praeger, 1991), for a different specification using 1987 data.

17. Depreciation is calculated by multiplying the computed rate of depreciation by the total capital stock, where the depreciation rate δ is the ratio of net investment at age 60 divided by total stock of investment for married males. Depreciation rates for each schooling group were computed to be .0489, .0516, .0371, .0571, and .0384, respectively, from the lowest to the highest schooling group. The depreciation rates for the other marital status groups are assumed identical to the married male depreciation for the same education level.

18. Polachek, "Differences in Expected Post-School Investment as a Determinant of Market Wage Differentials" (n. 1 above).

19. For example, it is implicitly assumed that, while in the labor force, females work comparable hours to men. Since in reality females work less hours, their marginal returns would be overestimated causing an overestimate of gross investment. Further, if the rate of depreciation depends not only on the amount of capital stock but also on age and labor force participation, then depreciation may be misestimated as would net investment.

20. Note that all the three specifications have controls for weekly working hours, firm size (dummies), industry (dummies), occupation (dummies), region (dummies), and location of work (i.e., urban dummy).

21. Gannicott (n. 3 above).

22. Oaxaca (n. 1 above).

23. Polachek, "Differences in Expected Post-School Investment as a Determinant of Market Wage Differentials." Goldin and Polachek (n. 1 above) also applied the same technique for the most recent U.S. data. Based on the 1980 census, they found that unexplained gender wage gap can be reduced by 78% for marrieds and 43% for singles.

24. Polachek, "Differences in Expected Post-School Investment as a Determinant of Market Wage Differentials"; and Goldin and Polachek.

25. Jacob Mincer and Solomon W. Polachek, "Family Investments in Human Capital: Earnings of Women," *Journal of Political Economy* 82, no. 2, pt. 2 (March/April 1974): S76–S108; Solomon W. Polachek, "Occupational Segregation among Women: Theory, Evidence and a Prognosis," in *Women in the Labor Market,* ed. Cynthia B. Lloyd, Emily Andrew, and Curtis Gilroy (New York: Columbia University Press, 1979), pp. 137–57.