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Labor Market Flexibility in East Asia: Lessons from Taiwan*

Yana van der Meulen Rodgers
College of William and Mary

Sita Nataraj
Stanford University

Recent turbulence in East Asian financial markets has already spilled over into the region's real economy, with significant effects on growth and unemployment. The ability of East Asian economies to adjust to the crisis depends critically on labor market flexibility. Specifically, a decline in real wages may dampen the increase in unemployment that results as firms restructure in response to changing market conditions. Thus, all else being equal, an economy in which real wages are flexible downward should experience a lower unemployment rate than an economy with downward-sticky real wages. Limited downward flexibility of real wages may exacerbate the effect of the current crisis on unemployment.

This discussion suggests that the relationship between wages and unemployment in East Asia's labor markets will play a key role in determining how these economies respond to the crisis. Underlying this issue are two conflicting theories of pay determination. According to early theoretical work by J. Harris and M. Todaro, wages and unemployment are positively related.[1] In their two-sector development model, higher unemployment in urban centers, caused largely by migrants from other regions and new labor market entrants, is associated with a compensating-wage differential. However, models of pay determination by C. Shapiro and J. Stiglitz, and D. Blanchflower and A. Oswald, suggest that there is a negative relationship between wages and unemployment.[2] In these models, workers will be discouraged from shirking if their employers pay wages that exceed the market-clearing level and threaten to dismiss workers who are caught shirking. An increase in the unemployment rate raises the cost of shirking to workers, thereby enabling employers to pay

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lower wages. Hence, competitive forces and efficiency-wage considerations lead to higher wages in low-unemployment conditions and lower wages in high-unemployment conditions.

Numerous empirical studies since the late 1980s have confirmed this negative relationship between the level of wages and local unemployment.[3] The magnitude of the unemployment elasticity of wages, about −0.10, is uncannily similar across countries and stable over time. Most of these estimations are based on labor market data for industrialized countries. Our objective is to examine how well the downward-sloping wage curve can describe labor markets in newly industrializing economies. Hence, we utilize an extremely rich, individual-level data set for Taiwan to characterize the wage-unemployment relationship and to make conclusions about labor market flexibility. Although Taiwan has experienced tight labor market conditions in recent decades, unemployment rates have varied substantially across regions and skill groups. For example, during the 1980s, while the unemployment rate averaged close to 7% in the east, the urban north had an average unemployment rate of only 4%. Also, severe shortages of unskilled labor toward the end of this period were accompanied by high unemployment and underemployment among college graduates.[4]

We use data from the period 1978–92 to perform earnings-equation estimations that control for a wide range of worker-productivity characteristics. Overall, we find that controlling explicitly for permanent location and occupation effects consistently yields a positive unemployment elasticity, while excluding these local fixed effects produces a negative relationship. These full-sample results suggest that, while there may be a longer-run wage-curve relationship in Taiwan, the transitory elements of wages and unemployment are positively correlated. Hence, the compensating-differentials framework is a better description of shorter-term pay determination in Taiwan. However, modest wage-curve effects are present for particular groups such as women and less-educated workers, even when we control for permanent region and occupation effects. We conclude that the wage-curve mechanism may indeed operate in certain settings, although it fails to describe Taiwan's short-run relationship between wages and unemployment in the overall labor market.

Our results are in contrast with Blanchflower and Oswald's finding of a consistently negative relationship between wages and industry unemployment in Korea during the 1970s and 1980s.[5] A potential explanation for this discrepancy is that Korea's tradition of lifetime employment during that period left firms with less maneuvering room in the labor market, forcing them to use real wage cuts to respond to contractionary conditions. Taiwan's firms, less bound to this tradition of lifetime employment, appear to have used layoffs, rather than real wage cuts, as the adjustment mechanism. In a study using firm-level data, B. Aw, X. Chen, and M. Roberts find that Taiwan's flexible economy facilitates a surpris-

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ingly high frequency of company upstarts and failures.[6] This evidence is consistent with our claim of relatively high turnover rates in Taiwan.

I. Aggregate Unemployment

The analysis begins with the construction of aggregate unemployment rates from 1978 to 1992. We use repeated cross sections of household survey data from Taiwan's Manpower Utilization Survey, conducted annually since 1978.[7] About 55,000 individuals were surveyed in each year. From this survey, we draw a labor force sample and construct unemployment rates that are weighted to reflect population means. The first panel of figure 1 compares four alternative definitions of the unemployment rate. In the "Traditional Rate," the labor force is defined as all civilians 15–65 years old who are working, holding a job but not yet working, or searching for work. The unemployed are those individuals who do not have a job and are either searching for work or waiting for the results of previous searches. The unemployment rate is the percent unemployed in the labor force. The traditional unemployment rate ranges from a low of 1.0% in 1981 to a peak of 2.5% in 1985.

S. Kuo has criticized Taiwan's survey method for underestimating the true rate of unemployment. Kuo claims that the unemployment rate should also include people who are willing to work but not actively seeking work, because many people in this category are rural residents who do not know where to look for jobs.[8] Consequently, the second definition, labeled "Plus Discouraged Workers," includes among the unemployed those individuals who are thinking of working but have not yet looked for a job, as well as those who would be able to start work immediately if they had the opportunity. In calculating the unemployment rate, these individuals are also added to the labor force. Including discouraged workers raises the unemployment rate by an average of almost 1 percentage point per year. Under this second definition, the unemployment rate ranges from 1.5% to 3.4%.

Another common criticism of the traditional unemployment rate is that it excludes the underemployed. Individuals who work part-time even though they desire full-time employment fall into this category.[9] This criticism may be particularly appropriate in countries such as Taiwan that report extremely low official unemployment statistics. Taiwan's Manpower Utilization Surveys do contain information on desired working hours for those individuals who work fewer than 40 hours per week. The third definition, labeled in figure 1 as "Plus Underemployed," includes as unemployed those individuals who work part-time and want to work more. Various reasons are given for their underemployment, including job requirements, pace of business, and the effects of weather or natural disaster. Adding underemployed workers raises the unemployment rate by an average of over 2 percentage points every year. Under this third definition, the unemployment rate ranges from 2.4% to 6.1%.

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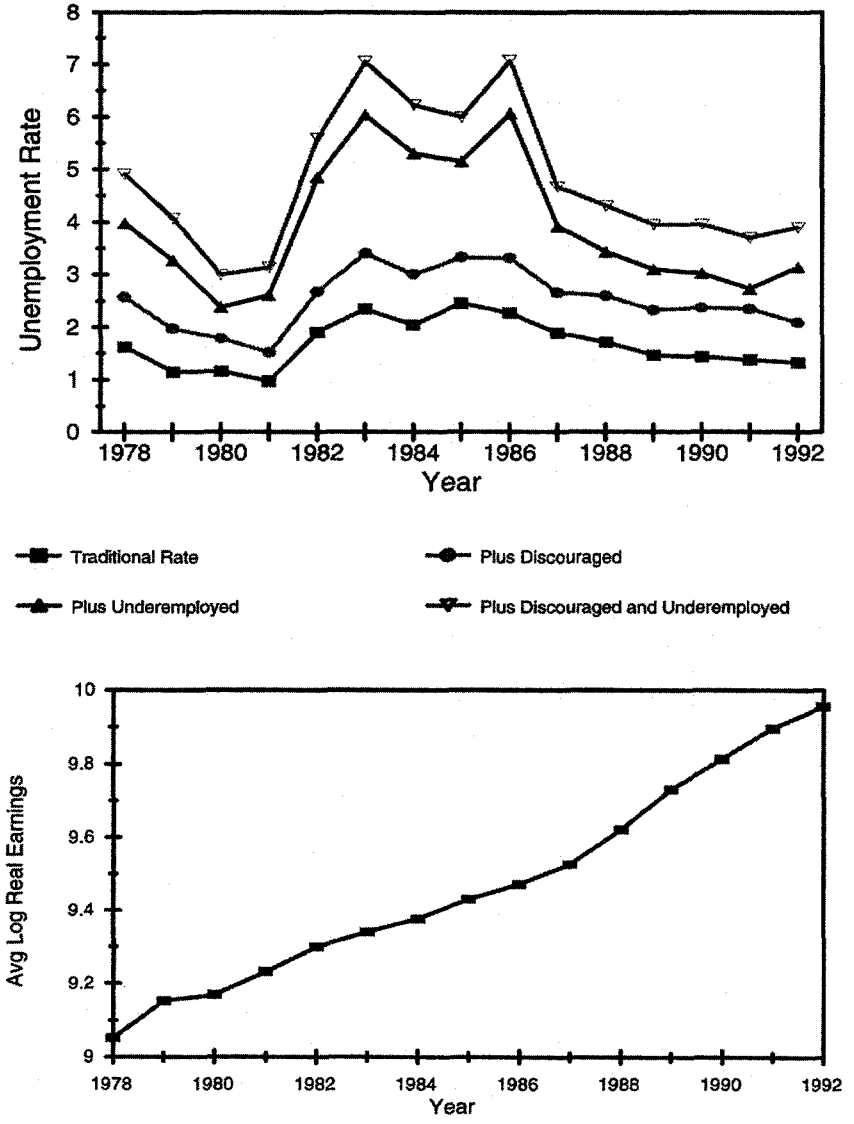

FIG. 1.—Aggregate unemployment and earnings in Taiwan (1978–92)

The final definition illustrated in figure 1 includes both discouraged and underemployed workers. Adding these categories to the traditional rate raises unemployment an average of 3 percentage points per year. Under the fourth definition, the unemployment rate exhibits the greatest variation, ranging from 3.0% to 7.1%. Regardless of definition, figure 1 shows that unemployment remained low and even declined from 1978

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to 1981, and again from 1987 to 1992. In 1982, however, unemployment jumped dramatically and remained at a relatively high level until 1987. The higher unemployment during this period was accompanied by a slowdown in gross domestic product (GDP) growth and by government attempts to restructure the economy in favor of high-tech industries.[10]

To construct the second panel of figure 1, we calculated mean log real monthly earnings for all nonfarm paid employees from the labor force sample. The figure shows that although unemployment fluctuated substantially between 1978 and 1992, real earnings rose steadily. The aggregate unemployment rate appears to have no relationship with aggregate earnings. However, figure 1 provides no information about possible labor market segmentation across regions and sectors. This evidence suggests that a closer examination of spatial and sectoral variation in unemployment and earnings is needed to determine whether a wage curve exists.

II. Spatial and Sectoral Variation in Unemployment and Earnings

Although Taiwan is a very small geographical entity, there may be structural reasons for regional variation in unemployment. Also, differentiated supply and demand effects may cause labor market segmentation across sectors and skill groups. We therefore consider both a locational and an occupational disaggregation of the unemployment rate in the next stage of the analysis. For the locational disaggregation, we construct local unemployment rates for seven geographical regions in each year. The location groups and labor force distributions are nonurban north (21% of the labor force), urban north (21%), nonurban central (20%), urban central (5%), nonurban south (17%), urban south (14%), and east (3%).[11]

Figure 2 illustrates the average unemployment rates and average real earnings for all nonfarm employees across the seven locations. The averages are based on pooled samples for the entire 1978–92 period, and the unemployment rate includes both discouraged and underemployed workers. The figure shows that there is considerable variation in both local unemployment rates and real earnings. For example, average unemployment is as low as 4% in the urban north and urban central, while it reaches almost 7% in the east. It is also clear from the figure that urban locations have lower unemployment and higher earnings than nonurban locations. In fact, a scatter plot of the average unemployment rate and average log earnings for each region yields a strong wage curve, with an elasticity of −0.10. This value is exactly what Blanchflower, Oswald, and others have found for numerous industrialized countries; it also agrees with Hoddinott's finding for Côte d'Ivoire.

For the occupational disaggregation, we construct unemployment rates for nine occupation groups in each year. The occupation groups and labor force distributions are professional and technical workers (6% of

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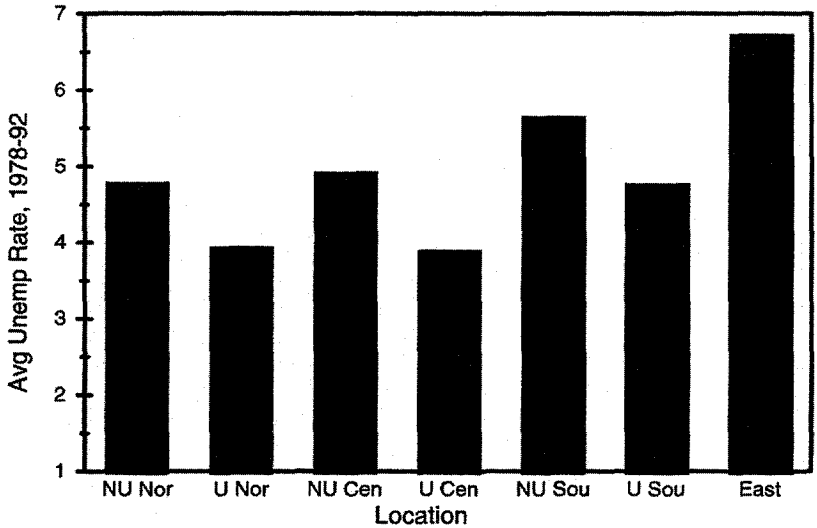

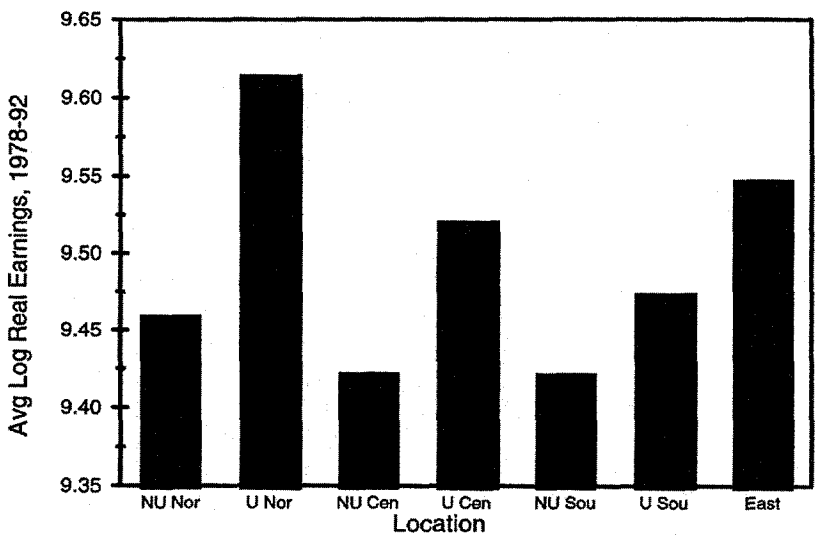

FIG. 2.—Average unemployment rates and earnings by location (1978–92)

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the labor force), supervisors (13%), clerical workers (9%), sales workers (8%), service workers (7%), agricultural workers (17%), light-manufacturing workers (10%), heavy-machinery operators (10%), and specialty-machinery operators (19%).[12] The disaggregation by occupation captures all unemployed and underemployed individuals, regardless of their previous experience. Unemployed workers with previous experience report their last occupation, unemployed workers with no previous experience report their desired occupation while searching, and underemployed workers report their current occupation. Because discouraged workers report their last occupation only if they were employed in the previous calendar year, the occupational disaggregation captures about one-half of all discouraged workers.

An alternative construction of the sectoral unemployment rate, which Blanchflower and Oswald used to examine the Korean case, is based on an industrial classification.[13] This method has two major problems for the case of Taiwan. First, every year, an average 35% of the unemployed are new entrants into the labor market. These new entrants report neither a previous industry of employment nor a desired industry. Also, discouraged workers do not report an industry from previous employment. Consequently, there is a sample bias in the industry-specific unemployment rate, even in the traditional definition. Second, many job skills are hardly industry specific, particularly for a nation like Taiwan that relied so heavily on unskilled labor during much of this period. For example, it would probably be quite easy for a secretary in one industry to find a job in another industry. This conjecture about interindustrial mobility implies that industry-specific unemployment rates do not capture a substantial part of the action in Taiwan's labor market.

Figure 3 reports average unemployment rates and real earnings for the 1978–92 period across the nonagricultural occupation categories. Again we see considerable variation in both the disaggregated unemployment rates and average earnings. Figure 3 also illustrates a striking negative relationship between unemployment and real earnings, and a simple scatter plot of the data points supports this conclusion. Professionals, technical workers, and supervisors experience the lowest average unemployment and the highest real earnings, while specialty-machinery operators, heavy-manufacturing workers, and service workers have the highest average unemployment rates and the lowest real earnings. Overall, the data points in figures 2 and 3 support a wage-curve description for Taiwan's national labor market. However, this descriptive analysis did not control for workers' observed productivity characteristics. The 15-year averages presented in figures 2 and 3 may also be misrepresenting the shorter-run relationship between fluctuations in unemployment and fluctuations in earnings.

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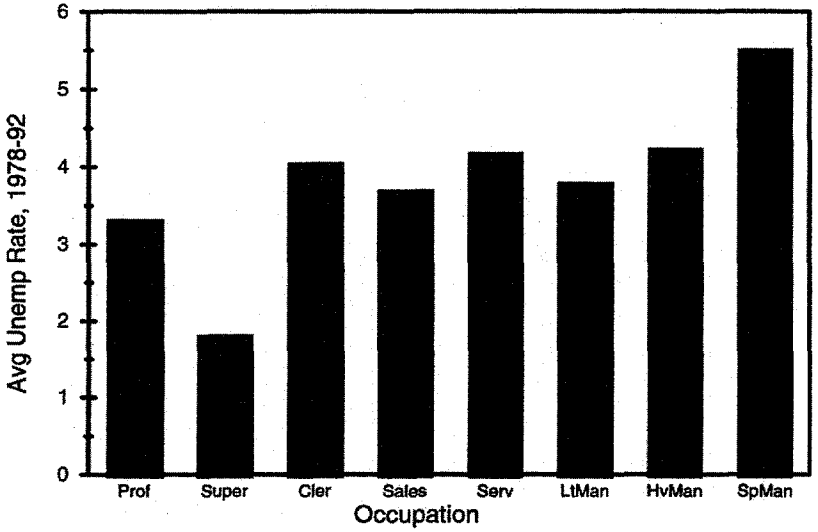

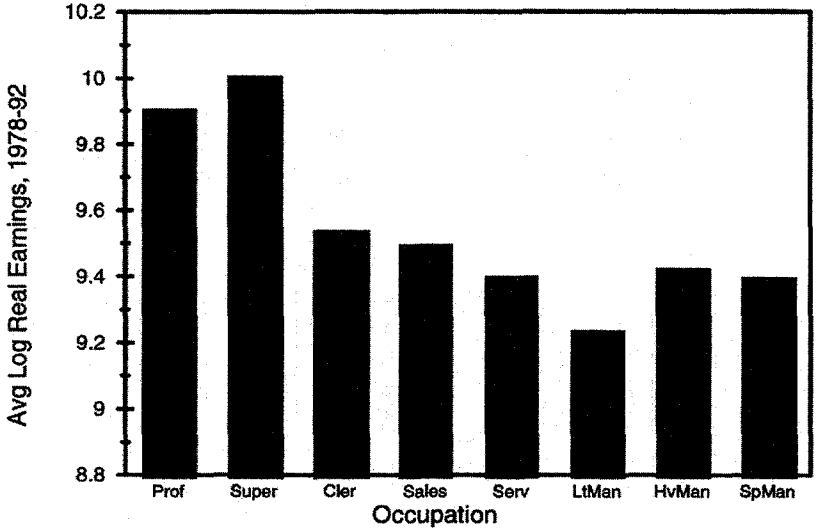

FIG. 3.—Average unemployment rates and earnings by occupation (1978–92)

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III. Empirical Analysis

The next step is a more formal estimation of the relationship between earnings and local unemployment rates. We estimate the following augmented log-earnings equation for individual workers i in location (or occupation) l in year t:

$$\log E_{ilt} = \alpha_1 X_{ilt} + \alpha_2 \log U_{lt} + \alpha_3 L_t + \alpha_4 T_t + \nu_{ilt}. \qquad (1)$$

The notation E_{ilt} is monthly earnings, X_{ilt} denotes a set of observed characteristics, U_{lt} is the local unemployment rate classified by location or occupation, L_t is a set of locality dummy variables classified by location and occupation, T_t is a set of time-specific dummy variables, and ν_{it} is a white-noise error term assumed to be normally distributed with variance σ^2_{it}. The functional form is consistent with the conclusion of Blanchflower and Oswald, and Card, that the log-linear form fits the wage-curve relationship well.[14] We do try alternative specifications and report these results in the next section. Observed characteristics include log monthly hours worked; a dummy variable for part-time work (less than 40 hours per week); dummy variables for education level attained and major field of study; potential experience and its square; enterprise-specific tenure and its square; percent female within an occupation; dummy variables for government employee, marital status, and female; and dummy variables for 10 nonagricultural industries. The fixed-effects variables include dummies for four geographical regions, urban location, and eight nonagricultural occupations.

We use a pooled sample of nonfarm paid employees from the period 1978–92 that contains about 278,000 observations. To test whether the wage curve is stable over time, we also divide the period into thirds and construct pooled subsamples for 1978–82, 1983–87, and 1988–92. The endpoints of each subperiod correspond roughly to the periods of low, high, and again low unemployment illustrated in figure 1. We also pool across all years and perform tests for samples broken down by gender, education, experience, and sector of employment. To provide an indication of how much variation is created by the inclusion of discouraged and underemployed workers in the unemployment rate, the regressions are alternatively performed using two unemployment rates: traditional, and traditional plus underemployed and discouraged workers. Also, both the locational and the occupational disaggregations of the unemployment rate are used. Finally, to increase the amount of variation in the unemployment variable and the effective degrees of freedom, we further disaggregate by gender and by age groups (age <25 and age ≥ 25). On average, 67% of the unemployed are male and 33% are female. The age breakdown shows that on average, 67% of the unemployed are mature and 33% are young.

An important specification issue is whether the earnings equation

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includes local fixed effects. The underlying assumption of specifications that exclude the local dummy variables is that earnings respond by the same amount to temporary and permanent elements of local unemployment. When the earnings equation includes local fixed effects, then the unemployment elasticity is based only on movements in earnings and unemployment relative to their average values. In other words, adding the local dummies controls for permanent location effects in the estimated unemployment elasticities. Although earlier tests of the Harris-Todaro framework may have excluded these fixed effects, the recent wage-curve literature has emphasized their importance. For most countries, including the regional dummies makes little difference, suggesting that transitory movements in earnings and local unemployment are complementary to permanent patterns. For the United States, however, only the transitory elements of wages and unemployment are highly negatively correlated. Hence, the unemployment elasticity is only strongly negative when local dummy variables are included to capture permanent location effects.[15]

In Taiwan, just as in the United States, local fixed effects do matter. But, in contrast to the U.S. case, it appears that the wage-curve effect in Taiwan is strong only when location and occupation fixed effects are excluded. The results presented in table 1 are all based on regressions that omit local fixed effects. Across periods, Taiwan appears to have a strong wage-curve effect in the labor market. The estimated unemploy-

TABLE 1

UNEMPLOYMENT ELASTICITY OF EARNINGS
(Excludes Fixed-Location and Occupation Effects)

	1978–82	1983–87	1988–92	1978–92
Unemployment by location:				
log U_l^g	−.050***	−.075***	−.082***	−.064***
	(.005)	(.006)	(.004)	(.003)
log U_l^a	−.057***	−.070***	−.072***	−.063***
	(.004)	(.005)	(.003)	(.002)
log U_l	−.110***	−.112***	−.126***	−.117***
	(.007)	(.007)	(.005)	(.003)
Unemployment by occupation:				
log U_o^g	−.070***	−.079***	−.119***	−.087***
	(.004)	(.003)	(.004)	(.002)
log U_o^a	−.033***	−.081***	−.062***	−.056***
	(.003)	(.003)	(.003)	(.002)
log U_o	−.126***	−.203***	−.174***	−.163***
	(.004)	(.004)	(.004)	(.002)

NOTE.—Standard errors are given in parentheses. Superscript g denotes the local unemployment rate by gender, superscript a denotes age group (age < 25 and age ≥ 25), subscript l denotes location, and subscript o denotes occupation. The unemployment rate includes underemployed and discouraged workers. Regressions include detailed worker characteristics, 10 industries, 7 locations, 8 occupations, and year (but the first panel excludes fixed-location effects and the second panel excludes fixed-occupation effects).

*** Significant at the .01 level (two-tailed test).

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ment elasticities are all negative and precisely estimated. Moreover, their magnitude is quite close to that found in previous studies. These results are robust to different definitions of the unemployment rate. The table also indicates a remarkable stability in the wage-curve relationship across the three time intervals.

However, the results in table 1 might be misleading. Specifically, excluding local dummies might have created omitted variable bias, since local characteristics (such as opportunities outside the wage labor market) would certainly affect the relationship between unemployment and earnings.[16] Table 2 shows how the elasticities change when the earnings equation does control for local fixed effects. Controlling separately for these other permanent location or occupation effects causes the wage-curve relationship to disappear. Most of the unemployment elasticities are positive, and of the positive coefficients, most are precisely estimated. Their magnitudes range from 0.01 to 0.12. While these results are not overwhelming, they do suggest that Taiwan's labor market is better described by the Harris-Todaro framework. Higher rates of unemployment across localities and occupations are associated with compensating-wage differentials. The finding that location and occupation dummies matter in this way implies that in Taiwan, the transitory elements of wages and unemployment are highly positively correlated, while the permanent elements are negatively correlated. Hence, the unemployment

TABLE 2

UNEMPLOYMENT ELASTICITY OF EARNINGS
(Includes Fixed-Location and Occupation Effects)

	1978–82	1983–87	1988–92	1978–92
Unemployment by location:				
log U_l^g	.019***	.034***	.013**	.021***
	(.006)	(.007)	(.006)	(.003)
log U_l^a	−.013***	.004	−.015***	−.006**
	(.005)	(.005)	(.004)	(.003)
log U_l	−.009	−.020**	−.004	.001
	(.009)	(.008)	(.009)	(.004)
Unemployment by occupation:				
log U_o^g	.052***	.123***	.040***	.049***
	(.005)	(.005)	(.006)	(.003)
log U_o^a	.026***	.025***	.014***	.017***
	(.003)	(.004)	(.004)	(.002)
log U_o	.011	.010	.061***	−.010**
	(.007)	(.011)	(.010)	(.004)

NOTE.—Standard errors are given in parentheses. Superscript g denotes the local unemployment rate by gender, superscript a denotes age group (age < 25 and age ≥ 25), subscript l denotes location, and subscript o denotes occupation. The unemployment rate includes underemployed and discouraged workers. All regressions include detailed worker characteristics, 10 industries, 7 locations, 8 occupations, and year.

** Significant at the .05 level (two-tailed test).

*** Significant at the .01 level (two-tailed test).

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elasticity is only strongly negative when separate controls for the permanent effects are excluded. If there is a wage-curve relationship in Taiwan, it is a longer-run relationship that incorporates other permanent effects.

In table 2, the elasticities are considerably higher for the occupational classification compared with the locational classification. Compensating-wage differentials should be more pronounced across occupations than locations if workers are less mobile across skill groups than they are across regions. This result suggests that labor market segmentation in Taiwan is based more on skill than on location, which is reasonable given Taiwan's small size. The magnitude and precision of the unemployment-earnings relationship increase when the local unemployment rate is further disaggregated by gender; on the contrary, disaggregating by age weakens the positive relationship considerably. This finding probably reflects Taiwan's rather extreme occupational segregation by gender, as well as the relative lack of mobility across occupations for gender groups compared with age groups. The subsample results in the first three columns indicate that the compensating-wage-differential effect tends to rise until 1987 and fall thereafter. Finally, the results in table 2 are based on an unemployment rate that includes underemployed and discouraged workers. Results based on a traditionally defined unemployment rate are quite similar.[17]

Other variables in the various specifications have coefficients with the expected signs and magnitudes.[18] There are increasing returns to higher levels of education; the returns to experience and tenure increase at a decreasing rate; there is a large earnings penalty for being female and for working in a female-dominated occupation; and there is a sizeable earnings premium for holding a supervisory or professional position. The regression coefficients also show an earnings premium for working in the north, where Taipei is located, and for working in an urban location. Several of the service industries, particularly business services, transport, and communications, carry the highest earnings premiums among the various industry classifications.

Table 3 reports unemployment elasticity estimates for various subgroups of workers based on gender, education, establishment-specific tenure, and sector of employment. The estimations are all performed using unemployment rates that include underemployed and discouraged workers, and the unemployment rates are alternatively disaggregated by location and occupation. We pool each of these employee subsamples across all years. The regression for women adds a dummy variable for married women with preschool children present, which is not included in earlier regressions. All regressions include region and occupation dummies, since the wage-curve literature stresses that they should be included. When the sample is broken down in this way, there is a negative relationship between unemployment and earnings for some groups. This

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TABLE 3

UNEMPLOYMENT ELASTICITY OF EARNINGS FOR DISAGGREGATED GROUPS, 1978–92

	U_l	U_o
Males	.008	−.009*
	(.005)	(.005)
Females	−.015**	−.018***
	(.007)	(.006)
Junior high and below	−.006	−.036***
	(.006)	(.006)
Senior high and vocational	.006	.013*
	(.007)	(.007)
Junior college and above	−.002	.035***
	(.011)	(.011)
Tenure <5 years	−.004	−.004
	(.006)	(.005)
5 ≤ tenure <10	.018*	−.018**
	(.010)	(.009)
Tenure ≥ 10 years	.011	−.025***
	(.010)	(.009)
Public-sector employees	.009	.034***
	(.008)	(.008)
Private-sector employees	−.001	−.014***
	(.005)	(.005)

NOTE.—The notation U_l denotes the unemployment rate by location, and U_o denotes the unemployment rate by occupation. The unemployment rate includes underemployed and discouraged workers. All regressions include detailed worker characteristics, 10 industries, 7 locations, 8 occupations, and year.

* Significant at the .10 level (two-tailed test).

** Significant at the .05 level (two-tailed test).

*** Significant at the .01 level (two-tailed test).

result suggests that the wage-curve mechanism may indeed operate in certain settings, even in the short run. However, the magnitude of the wage-curve effect in these cases is smaller than that found in previous studies. As with the full-sample results, the occupational elasticities tend to be more precisely estimated and larger in absolute value than the locational elasticities, suggesting that workers are less mobile across skill groups than regions.

The occupational elasticities in table 3 could be explained by the main idea underlying the wage curve, namely, that workers will lose their jobs if they are caught shirking. When local unemployment is higher, this threat is more credible, and firms have less need to pay efficiency wages to motivate their workers. Nevertheless, it becomes more costly for firms to fire those senior workers with greater amounts of education and firm-specific experience. Because highly educated and senior workers are less likely to be fired, firms will continue to pay them efficiency wages even when unemployment is high. Thus, if the wage-curve

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effect is present, one would expect it to be stronger for workers with lower levels of education and firm-specific human capital. This conjecture is partially supported by the results in table 3. The wage-curve effect is present for workers with a junior high school education and below and disappears for more educated workers. This pattern of elasticities suggests that it is more costly for firms to fire their highly educated employees. However, the opposite story holds as the length of tenure grows. The estimates also indicate that unemployment, whether it be across locations or occupation groups, is more negatively related to earnings for women than for men. This result implies that firms invest more in their male workers than in their female workers, making male workers less susceptible to the threat of unemployment. Finally, the wage-curve effect is present for public-sector employees but absent for private-sector employees, reflecting the lower risk of being fired from a government job compared with a job in the private sector.

IV. Specification Tests

We perform a battery of sensitivity tests, the results of which are reported in table 4 (for unemployment by location) and table 5 (for unemployment by occupation). The top row in each table contains the baseline estimates from table 2, where the unemployment rate includes underemployed and discouraged workers and is further disaggregated by gender.[19] All specification tests include region and occupation dummies. First, we control for the possibility that unemployment is jointly determined with earnings, leading to an upward bias on the estimated unemployment elasticity. We use two procedures, both discussed by Hoddinott, to control for this endogeneity bias. First, we replace the unemployment rate with its 1-year lag.[20] Second, we estimate the earnings equation using two-stage least squares. Instruments for the current unemployment rate are the lagged unemployment rate and shocks in international transfers. These shocks are defined as percentage changes in private unrequited transfers interacted with local dummies.[21] Results in the second row indicate that replacing the current unemployment rate with the lagged rate yields estimates that tend to be slightly smaller, while the two-stage least-squares estimates tend to be slightly larger. With only one exception, the estimates corrected for endogeneity bias remain positive, and most are precisely estimated.

The next specification test controls for problems created by using hours worked as an independent regressor. The baseline regressions formally control for hours worked by including log hours worked as an independent variable. This approach is followed because the survey reports earnings on a monthly basis, while hours worked are reported on a weekly basis. If we construct hourly wages from these data by assuming that all employees worked $4^1/_3$ weeks during the month, then the hourly-wage measure could be biased. However, using hours worked as an inde-

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TABLE 4

UNEMPLOYMENT ELASTICITIES: SPECIFICATION TEST RESULTS (By Location)

	1978–82	1983–87	1988–92	1978–92
Elasticity from baseline specification	.019***	.034***	.013**	.021***
	(.006)	(.007)	(.006)	(.003)
Baseline replacing log U_l with log lagged U_l	.011	.008	.018***	.018***
	(.007)	(.006)	(.006)	(.003)
Baseline using TSLS for log U_l	−.030*	.006	.062***	.033***
	(.017)	(.020)	(.016)	(.012)
Baseline replacing earnings with hourly wage	.023***	.034***	.017***	.025***
	(.006)	(.007)	(.006)	(.003)
Baseline using TSLS and hourly wage	−.036**	.012	.074***	.041***
	(.017)	(.021)	(.017)	(.013)
Baseline plus selectivity correction	.018***	.030***	.011*	.023***
	(.006)	(.007)***	(.006)	(.006)
Elasticity calculations from alternative functional forms, replacing log U_l with:				
$U_l + U_l^2$	.019	.035	.018	.024
$\log U_l + (\log U_l)^3$	.017	.032	.012	.017
U_l	.016	.030	.009	.016
$1/U_l$	.018	.030	.010	.017

NOTE.—Standard errors are given in parentheses. Subscript l denotes location. The unemployment rate includes underemployed and discouraged workers and is further disaggregated by gender. The elasticities from alternative functional forms are evaluated at the sample means of the unemployment rates using estimated coefficients that are almost all significant at the .01 level. All regressions include detailed worker characteristics, 10 industries, 7 locations, 8 occupations, and year. TSLS = two-stage least squares.

* Significant at the .10 level (two-tailed test).

** Significant at the .05 level (two-tailed test).

*** Significant at the .01 level (two-tailed test).

pendent variable could introduce endogeneity bias if hours worked is a choice variable. We control for this bias by constructing a direct measure of the hourly wage as the dependent variable and find results that are quite similar to the baseline estimates. The unemployment elasticities are all positive and precisely estimated, and they do not differ from the baseline estimates by more than one-tenth of a percentage point. In the next row we combine tests by using the hourly wage as the dependent variable and instrumenting for unemployment. Relative to the baseline, there is no clear trend in terms of magnitude, but several coefficient estimates do lose their precision. In the next specification test, we control for selectivity bias with a two-step Heckman correction procedure, using as the identifying variables a dummy for a business owner within the household and a dummy for school as the major activity within the reference week.[22] As tables 4 and 5 show, correcting for selectivity bias changes the unemployment elasticities by at most one-half of a percentage point.

The remainder of tables 4 and 5 report unemployment elasticities from alternative functional forms for the earnings equation. These

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TABLE 5

UNEMPLOYMENT ELASTICITIES: SPECIFICATION TEST RESULTS (By Occupation)

	1978–82	1983–87	1988–92	1978–92
Elasticity from baseline specification	.052***	.123***	.040***	.049***
	(.005)	(.005)	(.006)	(.003)
Baseline replacing log U_o with log lagged U_o	.056***	.112***	.014**	.042***
	(.006)	(.005)	(.006)	(.003)
Baseline using TSLS for log U_o	.037**	.166***	.053***	.070***
	(.017)	(.008)	(.015)	(.006)
Baseline replacing earnings with hourly wage	.059***	.130***	.044***	.057***
	(.005)	(.005)	(.006)	(.003)
Baseline using TSLS and hourly wage	.028	.173***	.061***	.082***
	(.017)	(.008)	(.016)	(.006)
Baseline plus selectivity correction	.054***	.121***	.039***	.044***
	(.005)	(.005)	(.006)	(.005)
Elasticity calculations from alternative functional forms, replacing log U_o with:				
$U_o + U_o^2$	.044	.150	.045	.062
$\log U_o + (\log U_o)^3$	.055	.134	.027	.050
U_o	.046	.113	.034	.035
$1/U_o$	.026	.041	.035	.022

NOTE.—Standard errors are given in parentheses. Subscript *o* denotes occupation. The unemployment rate includes underemployed and discouraged workers and is further disaggregated by gender. The elasticities from alternative functional forms are evaluated at the sample means of the unemployment rates using estimated coefficients that are almost all significant at the .01 level. All regressions include detailed worker characteristics, 10 industries, 7 locations, 8 occupations, and year. TSLS = two-stage least squares.

** Significant at the .05 level (two-tailed test).

*** Significant at the .01 level (two-tailed test).

functional forms are used to test for varying degrees of nonlinearity in the unemployment-earnings relationship. The elasticities are evaluated at the sample means of the disaggregated unemployment rates using the estimated coefficients. Almost all of them are significant at the 0.01 level. Overall, these regressions yield unemployment elasticities that do not differ substantially from the baseline estimates. As the table shows, when log U is replaced by U and U^2, the elasticities tend to be higher in magnitude compared with the baseline. When either U or $1/U$ replaces log U, the elasticities are lower. Alternatively, replacing log U with log U and $(\log U)^3$ yields elasticities that are similar to the baseline. We conclude that the baseline log-linear functional form provides a reasonable representation of the nonlinearity in Taiwan's unemployment-earnings relationship.

To control for the aggregation bias that may result from combining individual-level data and locality-level data in a single regression, we perform a final set of specification tests using aggregated locality-level data. The presence of individual and aggregated right-hand-side regressors causes a downward bias in the estimated standard errors, which

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leads to an upward bias in the precision attributed to coefficient estimates. A common level of aggregation in all regressors eliminates this problem. We run ordinary least squares, fixed-effects, and random-effects regressions in which the new dependent variable is mean hourly wages by location or occupation, and the independent variables are the mean unemployment rate, mean years of education, and mean age by location or occupation.[23] The fixed- and random-effects models include location (occupation) effects and period effects. Overall, most of the unemployment elasticities are statistically insignificant. Only the random-effects estimator in the occupation aggregation is precisely estimated, and it indicates a positive relationship between unemployment and wages. However, a Hausman specification test yields a significant χ^2 statistic, suggesting that the random effects and the regressors are correlated. Assuming that the equation is correctly specified, the fixed-effects estimator may be more appropriate than the random-effects estimator, but the fixed-effects estimate is statistically insignificant. Hence, we cannot make much of these specification test results using the aggregated locality-level data.

V. Conclusion

Our results suggest that Taiwan's labor market exhibits a longer-run "wage-curve" relationship that incorporates other permanent effects. In full-sample regressions that exclude controls for local fixed effects, we obtain strongly negative unemployment elasticities that are surprisingly similar to those found for other economies. Estimations based on disaggregated samples, which produce negative unemployment elasticities for women, workers with less education, and private-sector employees, provide further support for the wage-curve framework. The negative relationship between wages and unemployment implies that employers in Taiwan pay efficiency wages when the risk of becoming unemployed is low. The need to pay efficiency wages falls when an increase in local unemployment discourages workers from shirking.

However, full-sample earnings equations that explicitly control for permanent-location effects yield a positive relationship between wages and unemployment. This positive relationship is robust to a battery of specification tests. We conclude from these results that the transitory elements of wages and unemployment are highly positively correlated, while the permanent elements are negatively correlated. Hence, in the short run, a compensating-differentials framework may be a more appropriate description of pay determination in Taiwan. In such a framework, localities and occupations with higher unemployment rates need to offer higher wages to attract workers. For Taiwan, the bargaining and efficiency-wage channels underlying the wage curve may not operate as effectively in the short run. Our results suggest that if other East Asian economies have similar labor market structures, firms will face increased

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pressure to use layoffs rather than real wage cuts as an adjustment mechanism during contractionary conditions.

Notes

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4. See Walter Galenson, *Labor and Economic Growth in Five Asian Countries: South Korea, Malaysia, Taiwan, Thailand, and the Philippines* (New York: Praeger, 1992).

5. Blanchflower and Oswald, *The Wage Curve.*

6. Bee Aw, Xiaomin Chen, and Mark Roberts, "Firm-Level Evidence on Productivity Differentials, Turnover, and Exports in Taiwanese Manufacturing," Working Paper no. 6235 (National Bureau of Economic Research, Cambridge, Mass., 1997).

7. The data have been collected annually since 1978 by the Directorate-General of Budget, Accounting, and Statistics, an agency of the Executive Yuan, Taiwan, Republic of China; and by the Council for Economic Planning and Development, Taiwan, Republic of China. The Chung-Hua Institution for Economic Research provided the data for 1978–92.

8. Shirley Kuo, *The Taiwan Economy in Transition* (Boulder, Colo.: Westview, 1983).

9. Another form of underemployment observed in developing countries occurs when individuals who lose their manufacturing jobs find work in services but continue to seek employment in manufacturing. The data for Taiwan do indicate whether workers are considering a job change and have already begun to search. However, there is no information on the industry in which they are searching or other definitive indicators that they are underemployed.

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10. See World Bank, *The East Asian Miracle: Economic Growth and Public Policy* (New York: Oxford University Press, 1993).

11. This spatial distribution includes discouraged and underemployed workers in the labor force. The same is true for the occupational distribution of the labor force.

12. Because the earnings-equation sample is nonfarm employees, the occupational unemployment rate for agriculture is dropped during the merging process.

13. Blanchflower and Oswald, *The Wage Curve* (n. 2 above).

14. Ibid.; and Card (n. 3 above).

15. Card.

16. Hoddinott (n. 3 above).

17. To limit the size and number of tables, we only report tests with the adjusted unemployment rates. Results based on the traditional unemployment rate are available on request.

18. Complete regression results are not reported but are available on request.

19. We choose the local unemployment rates broken down by gender rather than age because Taiwan's local labor markets are more segmented by gender than they are by age groups. Nevertheless, we also performed every specification test with the unemployment rate further broken down by age groups. In this case, the coefficient estimates tend to have the same sign, but they are smaller in magnitude and less precisely estimated.

20. Hoddinott uses data on the labor market status of survey respondents in the last 12 months in order to construct the lagged unemployment rate. The Taiwan surveys do not ask this question, so we cannot construct last year's unemployment rate using the survey from the current year. Instead, we map in unemployment rates from the previous year at the cost of dropping the regression analysis for 1978.

21. These data were obtained from the Economic Research Department, Central Bank of China, *Balance of Payments, Taiwan District, Republic of China* (Taipei: Central Bank of China, 1981, 1984, 1991, and 1993).

22. The survey asks for major activity in the previous week, and students have the option of choosing "school and working" or "school and not working." Hence, some students are in the labor force, and a variable for student status is an appropriate identifying variable. Due to computer memory constraints, we extract a 35% random subsample to perform the selectivity correction for the pooled 1978–92 sample.

23. The panel has 105 observations when we aggregate by location (seven locations times 15 years) and 120 observations when we aggregate by occupation (eight occupations times 15 years). To maximize degrees of freedom, we keep three right-hand-side regressors.

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