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Urban Labor Force, Earnings Growth, and Earnings Inequality: Lessons from Taiwan's Experience

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Abstract

This paper emphasizes the transition from a rural to an urban labor force and the implications of that transition for economic growth and inequality. We approach this task by focusing on a single country case - Taiwan. Its experience is instructive, not because it is representative of Asia, but because its development experience has been so successful. The analysis is confined to a twenty-one year period from 1978 to 1998 and relies on the Survey of Family Income and Expenditure in Taiwan.

The paper provides detailed information about the effect on earnings growth and earnings inequality of changes in important features of Taiwan's labor force, including its urbanization, the relative growth in female employment, shifts in the returns to education and the educational attainment of the labor force, and changes in the age structure of the labor force. In the conclusion, we rely on these estimates to draw lessons from Taiwan's experience for other countries.

The emergence and ultimate dominance of the urban sector and the urban labor force are inextricable parts of the development process. In a traditional, low-income setting, most economic activity is directed at providing basic human needs - food, clothing, and shelter. Agriculture is the dominant sector. The work is decentralized, much of it carried out in family enterprise supplemented by landless agricultural workers. The labor force is primarily rural.

The urban sector begins to emerge as the economy becomes sufficiently productive to feed its population using only a portion of its available human and physical resources. Thus, workers and capital can be devoted to the production of manufactured goods and services. Freed from dependence on agricultural land, modern production can reap the efficiencies that arise by geographically concentrating economic activities. New opportunities for investment

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in human and physical capital arise. Of course, this is a small part of a more complex story, but structural change of the economy and the efficiency gains from urbanization are fundamental forces that drive the urbanization of the labor force and, in turn, drive economic development.

These processes have been studied by many scholars including Lewis (1954), Fei and Ranis (1961), Harris and Todaro (1970), Suits (1985), and more recently NRC (2003). In an economy unfettered by government regulation or distortionry taxes, transfer policies, or employment practices, the distribution of the labor force is a market outcome, determined by the demand for workers in the urban and rural sectors. In the simplest case, workers migrate between the urban and rural sectors solely in response to urban-rural wage differentials. Equilibrium is achieved when the urban wage and rural wage are equal and workers can achieve no additional economic gains by migrating.

This simple model abstracts from many important details and, in reality, a gap between urban and rural wages is a persistent feature of many, perhaps all, economies. A variety of explanations have been offered to explain this phenomenon. In part, the urban-rural wage gaps reflect differences in the productivity of urban and rural workers, the values workers attach to urban and rural amenities, the costs of migration, and the higher rates of unemployment that characterize urban sectors (Todaro 1969, Sjaastad 1962). To the extent that labor market rigidities and public policy impede a market-based urbanization process, not only may economic growth slow but inequality may increase.

The existence of large urban-rural wage gaps was one of the key features of developing countries that led Kuznets (1966) to hypothesize his famous relationship between development and inequality. He hypothesized that initially economic development leads to a rise in income inequality and subsequently to a decline. The rise in the early phase of development is due to rapid growth in the urban, nonagricultural sector. Because wages are higher in the nonagricultural sector than in the agricultural sector, growth in the nonagricultural sector causes inequality to rise as long as most workers are employed in agriculture. The effect of high urban wages on inequality is exacerbated by the fact that wage inequality is typically greater in the nonagricultural sector. Underlying the "Kuznets curve" is the uneven effect of technological innovation, which initially leads to huge productivity gains in manufacturing and transportation but largely by-passes agriculture. Kuznets attributed the subsequent reduction in inequality to a decline in the gap in output per worker between the agricultural and the nonagricultural sectors; to a shrinking entrepreneurial class; to the increased number of white-collar workers relative to blue-collar workers; to a decline in the size of the agricultural sector and property income; and to an increase in policies favoring public welfare (Oshima and Mason, 2001).

With this background in mind, our paper emphasizes the transition from a rural to an urban labor force and the implications of that transition for economic growth and inequality. We approach this task by focusing on a single country case - Taiwan. Taiwan's experience is instructive, not because it is representative of Asia, but because Taiwan's development experience has been so successful. Since 1960, Taiwan's economy has been among the most dynamic in the world. Its labor force has been transformed in many important ways. The workforce is almost entirely urbanized. Women are playing a much more important role in the formal sector than previously. The age structure has changed rapidly and educational

attainment has improved markedly. Thus, Taiwan is experiencing the same changes occurring elsewhere in the developing world, but at a much more rapid pace than is typical. Moreover, the fruits of development have been broadly shared. Inequality is very low, especially for an economy in the midst of such rapid structural change.

We focus on a twenty-one year period from 1978 to 1998 using the Survey of Family Income and Expenditure in Taiwan (FIES, also known as the Survey of Personal Income Distribution in Taiwan until 1993). The FIES was first conducted in 1964 and, then, every other year until 1970. Since then, the survey has been conducted annually and data are available for the 1976 and subsequent surveys. For technical reasons, we have confined our analysis to surveys conducted in 1978 and later. The number of households surveyed has varied over time, but the sample size is more than sufficient for our purposes. In 1998, about 0.4 percent of all households (14,031 households and 52,610 individuals) were covered. These are not panel data, but repeated cross-sections. Our analysis is confined to employed household members. The survey provides data on the demographic characteristics, educational attainment, and earnings of each household member. To facilitate comparisons across time, earnings data are deflated by the GDP deflator (1991=100).

The analysis in the paper provides detailed information about the effect on earnings growth and earnings inequality of changes in important features of Taiwan's labor force, including its urbanization, the relative growth in female employment, shifts in the returns to education and the educational attainment of the labor force, and changes in the age structure of the labor force. In the conclusion, we rely on these estimates to draw lessons from Taiwan's experience for other countries.

Taiwan's labor force, earnings, and earnings inequality

Since 1978, Taiwan's labor force has experienced four important changes. First, the labor force has become increasingly urbanized. By 1998, 90 percent of all earners lived in urban areas and they accounted for 92 percent of all earnings. Second, women became an increasingly important part of the labor force. Between 1978 and 1998, the percentage of urban earners who were women increased from 29 percent to 41 percent. Third, the female labor force aged. The mean age of urban female workers increased from 29.2 years to 35.6 years between 1978 and 1998. Rural female workers experienced very similar trends in age structure. Fourth, the labor force became increasingly educated. Using an educational index based on earnings-based productivity weight, urban men and women both experienced a 13 percent increase during the 20-year period; rural men and women experienced an increase of 19 and 20 percent respectively.

Women and men in both the urban and rural sectors experienced rapid earnings growth. Between 1978 and 1998, earnings of urban males, the highest income group in Taiwan, grew at an annual rate of 4.4 percent per annum. Other groups experienced even faster growth. The earnings of urban females and rural males grew at 5.4 percent annually, rural female earnings grew at 6.4 percent.

Despite the rapid growth in the average level of earnings, earnings inequality declined over much of the period under consideration. Between 1978 and 1983, the variance in log earnings varied between 0.45 and 0.47, but dropped to about 0.40 in 1984 and further a few years later. The variance remained at low levels and by the early 1990s had dropped to 0.36.

In 1995, however, inequality increased but not to the levels that prevailed in the late 1970s and early 1980s. Comparative data on earnings inequality are not widely available, but the levels reported for the U.S. and for Brazil by Lam (1997) are substantially higher than the values found in Taiwan.

Labor force characteristics, earnings determinants, and earnings growth in Taiwan

To what extent did the urbanization of Taiwan's labor force and key features of the urban labor force influence earnings growth and inequality? The next sections address this question, relying on the standard human capital model in which earnings depends on age (or experience), educational attainment, and other unmeasured factors that include unobserved features of individuals and aggregate characteristics of Taiwan's economy that vary over time but not across individuals at any point in time. Following Mincer (1974), earnings are assumed to be determined according to an equation of the form:

$$\ln Y = \eta + S\phi + A\kappa + \varepsilon$$

where lnY is the natural log of earnings and S and A are sets of dummy variables that take the value of one if the individual belongs to a particular education group (S: elementary, junior high, senior high, junior college, or college and over) or a particular five-year age group (A: 20-24, . . . , 70+) and zero otherwise. The base category of education is no schooling and the base category of age group is ages 15-19. The model is estimated separately for urban males, urban females, rural males, and rural females.

Estimated age-earnings profiles for urban males and urban females are plotted in Figure 1 for 1978, 1988, and 1998. The estimated coefficients are used to calculate the earnings of an individual in a five-year age group relative to the earnings of an individual aged 40-44 in the same year. The estimating procedure controls for educational attainment and, consequently, the age-earnings profiles do not reflect the substantially higher educational attainment of younger members of the workforce.

Figure 1. A. Age-Earnings Profile, Urban Males, Taiwan, 1978, 1988, and 1998

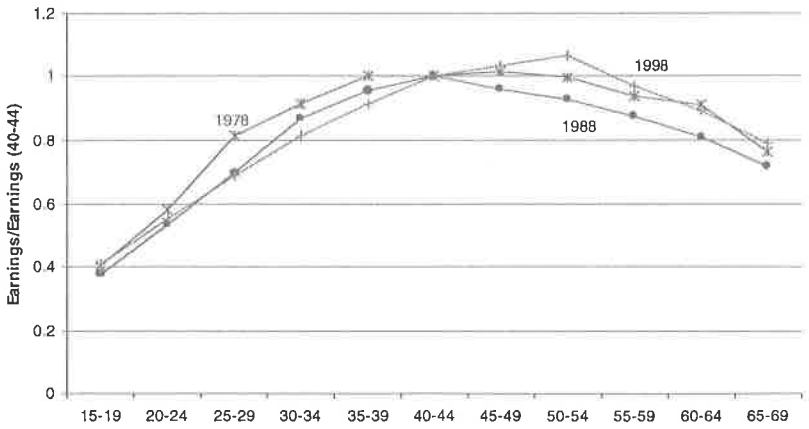
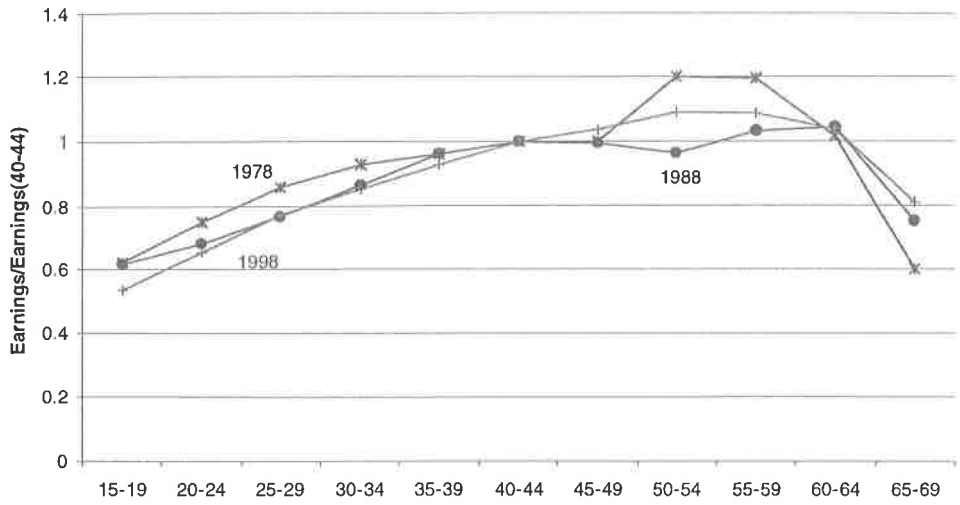


Figure 1. B. Age-Earnings Profile, Urban Females, Taiwan, 1978, 1988, and 1998



The inverted U-shape of the age-earnings profiles is similar to profiles found in other countries. The earnings of male workers aged 20-24 were about 60 percent or less than the earnings of those aged 40-44. The value for U.S. male workers was similar in 1985 (0.68) but much higher in Brazil in the same year (0.92) (Lam and Levison, 1992). The earnings of male workers aged 65-69 were, at most, 80 percent of those aged 40-44. The peak earning age for males has varied substantially in Taiwan. In 1978, the profile was very flat throughout the 35-54 age range. In 1988 and 1998, the peak was much more pronounced and in 1998 occurred at an older age. The age-earnings profile for female workers is similar to the profile for male workers, but rises more slowly at young ages.

Estimates of the returns to education are presented in Figure 2. In 1978, controlling for differences in age, an urban high school graduate earned about twice as much as a worker with no education. The returns to a high school degree were very similar for men and women. A male urban college graduate earned 29% more and a female urban college graduate 45% more than a high school graduate in 1978.

The returns to education changed between 1978 and 1998, particularly for urban males. The returns to schooling increased widening the gap between the earnings of the least and the most educated. By 1998, an urban male with a college degree was earning 54% more than a high school graduate. Moreover, the earnings of high school graduates had increased relative to the earnings of urban male workers with lower levels of educational attainment. The change is very similar to the U.S. experience where widening returns to schooling have led to widening inequality. As we shall see, however, the impact on inequality in Taiwan has been modest.

Figure 2. A. Returns to Education, Urban Males, Taiwan, 1978, 1988, and 1998

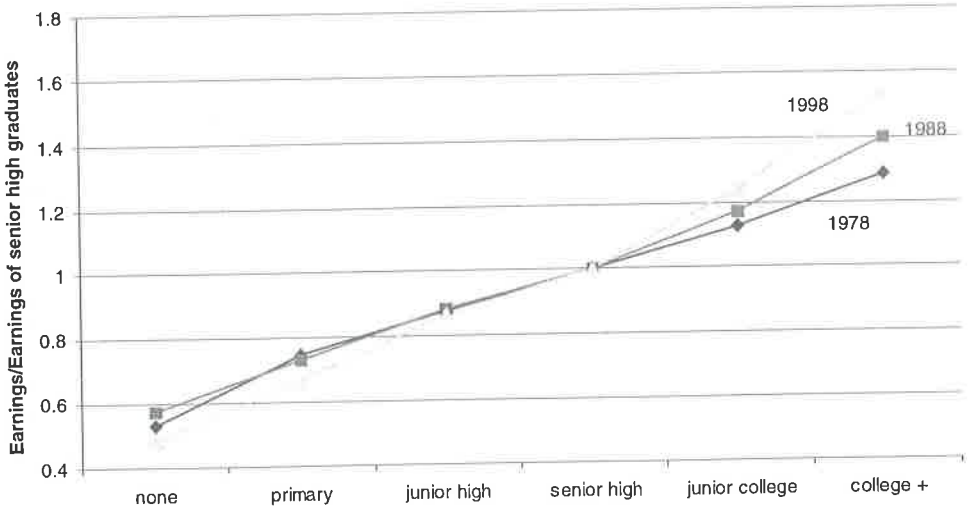
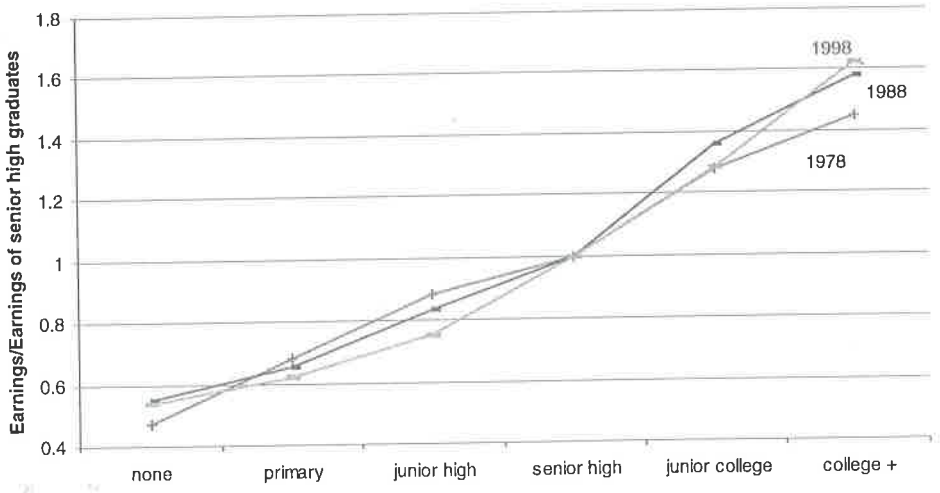


Figure 2. B. Returns to Education, Urban Females, Taiwan, 1978, 1988, and 1998



The trend in the returns to education for urban females is much less clear cut. The returns to college graduates were higher in 1988 and 1998 than in 1978. Senior high graduates gained relative to junior high and primary school graduates between 1978 and 1988 and between 1988 and 1998. But shifts for women with no education and with a junior college education ran counter to the trend.

Changes in age structure and rising educational attainment contributed to earnings growth

among men and women in both the urban and rural sectors of Taiwan's economy. A simple decomposition of earnings growth between 1978 and 1998 quantifies the importance of these attributes (Table 1)[1]. Increases in the educational attainment of the labor force had a favorable impact on earnings between 1978 and 1998. For urban men, educational improvements increased earnings by 10 percent[2] between 1978 and 1998, with three-quarters of the gain coming during the second half of the period. For urban women, education gains produced an increase of 14 percent during the twenty-year period. Again, most of the gain was concentrated after 1988. Educational improvements had an even more important impact on earnings in rural areas. Earnings for rural men increased by 25 percent and for rural women by 17 percent because of their educational gains. The impact was greater in rural areas, in part, because educational attainment increased more rapidly in rural areas and because, for rural men, the returns to education were particularly high.

Table 1. Components of Earnings Growth, 1978-1998

	Male				Female			
	Urban		Rural		Urban		Rural	
	1978-88	1988-98	1978-88	1988-98	1978-88	1988-98	1978-88	1988-98
Annual growth in earnings	4.7	4.1	4.7	6.1	5.2	5.6	6.3	6.5
Contribution of change in: Age composition	1.9	7.8	1.4	4.2	11.2	9.5	0.5	4.4
Educational attainment	5.6	17.8	10.0	28.7	3.8	21.0	7.2	18.3
Other factors	92.5	74.4	88.7	67.1	84.9	69.5	92.4	77.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Note: The decomposition of the earnings gap between any two years is obtained using the same methodology.

Changes in the age composition of the labor force also had a favorable effect on earnings in Taiwan, but the effects were rather modest with one exception. The rise in the average age of urban female workers caused an increase in earnings growth of about 0.5 percent per annum throughout the twenty-year period analyzed. The impact over the entire period was to raise average earnings of urban woman by about 12 percent.

Although changes in human capital factors - education and age - contributed to economic growth, other growth factors played a more important role. Between 1978 and 1988, changes in the educational and age characteristics of the labor force contributed 7.5 percent of the growth in urban male earnings and 15 percent of urban female earnings. During the second half changes in the age distribution and particularly educational attainment were more important contributing about one-quarter of the growth in earnings of urban men and 30 percent of the growth in the earnings of urban women.

[1] See Appendix for calculation details.

[2] This value and others in this paragraph are calculated using values reported in Table 1. They are not included in the table, however.

The "other factors" in earnings growth cannot be identified by analyzing only earnings data and labor force characteristics, but several studies have identified high rates of investment and productivity increases as being important. (See Bauer 2001 for a recent review of East Asian growth literature.) Some analysts have argued that there are "spillover" effects associated with improvements in education that are not captured by the micro-based analysis presented here. Huang (2001) presents some evidence for spillover effects in Taiwan. If so, improvements in educational attainment may have contributed more to earnings growth and economic growth than captured here.

Urbanization, the urban-rural earnings gap, and inequality

The trend in overall earnings inequality in Taiwan does not follow the Kuznets curve. At least since 1978, urbanization has been sufficiently advanced in Taiwan that further increases in the proportion urbanized has led to lower inequality in a manner that is very consistent with Kuznets' hypothesis. During the latter part of the period, however, other changes have dominated the influence of urbanization leading to a rise in inequality. Urbanization has led to lower earnings inequality for two reasons. First, contrary to the situation that typifies many countries, earnings inequality is lower in Taiwan's urban sector than in its rural sector. Second, the effect of the urban-rural earnings gap on overall earnings inequality has become less important as the rural sector's share of the labor force become increasingly small.[3]

Holding the urban and rural earnings distributions constant[4], urbanization had a pronounced impact prior to the 1990s when inequality was falling rapidly in Taiwan. Between 1978 and 1988, the cumulative impact of urbanization was to reduce the variance in the log of earnings by 0.045, about half of the actual decline during the same period. After 1988 the impact of urbanization was more modest contributing a further reduction in the variance in the log of earnings by about 0.01. This compares with an increase in the log-variance by 0.04 between 1989 and 1998.

The impact on urbanization on inequality was more modest during the 1990s because the urban-rural earnings gap had declined from levels that persisted during the 1980s and because the urban labor force had achieved such dominance. Consequently, the pace of urbanization was slower during the 1990s and the urbanization that did occur had a smaller impact on inequality.

The decline in the urban-rural earnings gap also contributed to lower overall earnings inequality. It reduced the variance of log earnings by about 0.01 between 1978 and 1988, and an additional 0.01 after 1998. The reasons for the decline in the urban-rural earnings gap are somewhat complex and surprising, but a detailed examination of the estimated earnings equations for Taiwan provides new insights.

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[3] See Appendix for a simple formal explanation.

[4] This is a strong assumption and to the extent that it is violated the effect of urbanization could differ substantially from the calculations presented here. The rural distribution of earnings will be affected by urbanization to the extent the rural to urban migration is selective on characteristics that influence earnings. The urban earnings distribution will be affected to the extent that earnings-related attributes of migrants differ from those who are already employed in the urban sector. We cannot say on *a priori* grounds whether migration will lead to shifts in the earnings distributions that reinforce or offset the compositional effects emphasized in these calculations. Empirical evidence on these points is insufficient to support strong conclusions (Lucas 1997).

The earnings gap between urban and rural workers in Taiwan was substantial in 1978. Rural men earned only 57% of their urban counterparts and rural women earned only 62% of what urban women earned. By 1998, rural men's earnings were 70% of urban men's; rural women's earnings had increased to 76% of urban women's earnings.

Analysis of the earnings equations estimates described above allows us to identify both the factors that account for the urban-rural labor gap in any period and the factors that account for the downward trend in the earning gap[5]. The results are presented in Table 2. The first row reports the difference in log earnings. The values are all positive, indicating that average urban earnings exceeded rural earnings for both males and females in each of the years for which estimates were calculated. The earnings gaps are larger for males than for females, and they declined for both males and females between 1978 and 1998. The factors that account for the earnings gap are grouped into those that capture differences in worker characteristics that influence earnings and factors that capture differences in the returns to worker characteristics.

Table 2. Decomposition of Log Urban/Rural Earnings Gap by Coefficients and Composition

	Male			Female		
	1978	1988	1998	1978	1988	1998
difference in ln w	0.565	0.563	0.364	0.486	0.368	0.278
Due to characteristics	0.196	0.205	0.172	0.225	0.174	0.164
Age composition	0.030	0.027	0.021	0.016	0.023	0.013
Education composition	0.166	0.178	0.152	0.209	0.151	0.151
Due to coefficient	0.369	0.359	0.191	0.260	0.194	0.114
Age composition	0.188	0.346	0.203	0.230	0.182	0.248
Education composition	-0.140	-0.240	-0.411	0.072	0.128	0.005
Constant	0.321	0.253	0.399	-0.042	-0.116	-0.139
% due to characteristics	34.7	36.3	47.4	46.4	47.2	59.1
% due to coefficient	65.3	63.7	52.6	53.6	52.8	40.9

In every period, both age and educational attainment favored urban workers, but educational attainment was by far the more important of the two. The advantage was similar for both urban males and urban females - urban workers earned between 18 and 25% more than rural workers because they were more educated or, to a lesser extent, concentrated in higher earning ages[6]. There was convergence in the characteristics of urban and rural workers between 1978 and 1998, because educational attainment improved more rapidly among rural than urban workers. Between 1978 and 1998, about 7% of the decline in the male earnings gap and 27%

[5] Analysis of the urban-rural earnings differential lies on a decomposition method similar to one proposed by Oaxaca (1973). See Appendix for details.

[6] These values are calculated as the exponential of the minimum and maximum coefficients reported in the "Due to characteristics" row of Table 2.

of the decline in the female earnings gap were due to the changes in educational attainment.

In 1978, about one-third of the earnings gap for males could be traced to difference in age and educational attainment and about two-thirds of the earnings gap was due to differences in the returns to worker characteristics and to differences in earnings unrelated to either the education or age of workers (the constant term). The returns to age were greater in the urban than the rural labor force in 1978, but the returns to education were not. Indeed, more educated workers in the rural labor force earned a particularly high premium. The "constant" in 1978, i.e., the difference between the urban and rural constants, is large and positive indicating that urban workers had a substantial earnings advantage that had nothing to do either with possessing either more productive characteristics or receiving great compensation as a consequence of those characteristics.

By comparing 1998 with 1978, we see that for males changes in the returns to age and the intercept both led to a larger earnings gap, with the shift in constant term substantially more important. However, the returns to education shifted in an even more favorable way for rural males. The change in the returns to education dominated the other factors that influence the urban-rural earnings gap for males.

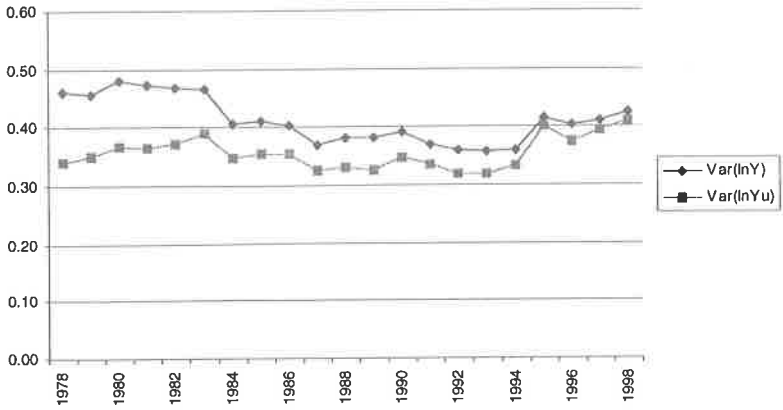
The situation for females was somewhat different. In 1978, differences in the returns to age were similar for male and females workers. The returns to education, however, tended to favor urban rather than rural women. Other factors were less important and favored rural women over urban women. By 1998, urban-rural differences in the returns to education became negligible for females and the constant term became substantially more negative. Combined these two changes were primarily responsible for the decline in the urban-rural earnings gap for females.

Despite the complexity and the differences between males and females, several important and consistent findings emerge. Convergence in the age and educational characteristics of workers did occur in Taiwan, but the gains by rural workers relative to urban workers are clearly a secondary explanation for the decline in the earnings gap. This is especially true in the case of men. A much more important phenomenon was the rise in the returns to education for rural workers relative to urban workers. Note, however, that at the same time that increases in the returns to education were reducing the urban-rural earnings gap they were raising earnings inequality within the rural sector. The influence on inequality of changes in the returns to education is an issue to which we return below.

Urban earnings inequality, the gender gap, and returns to education

Urbanization and convergence of the urban and rural sectors in Taiwan have contributed to lower earnings inequality, but as the urban sector has become increasingly dominant, inequality is increasingly a product of changes within the urban sector. In the late 1970s and early 1980s, urban inequality increased slightly at the same time that overall inequality was declining. But since that time, overall and urban earnings inequality have moved closely together, first declining and then rising in the early 1990s (Figure 3). Three important changes within the urban labor force - the rise of the female labor force, changes in the age composition of the labor force, and changes in the returns to schooling and the educational composition of the labor force - have been especially important.

Figure 3. Variance of log earnings, total and urban, Taiwan, 1978-1998



Female labor force participation and the gender gap in earnings

Taiwan's gender gap in earnings is similar in magnitude to the urban-rural earnings gap. In 1978, the average earnings of urban female workers were only 59 percent of urban male workers. The effect of the urban-rural earnings gap on inequality has been muted, however, because the rural percentage of the labor force is small and declining. In contrast, the importance of women in the urban labor force has been growing rapidly. The rapid increase in the proportion of women in the urban labor force has the potential of increasing earnings inequality significantly, particularly if the variance of earnings for women is greater than for men as is true in other countries.

Rapid growth in the urban female labor force has led to greater earnings inequality between 1978 and 1998, but the effect was smaller than might be expected because the variance of log earnings is lower for women than for men in the urban sector. During the twenty-year period, the variance in the log of earnings in the urban sector increased by 0.007 due to relative increase in the number of women in the labor force, as compared with a change from trough to peak of earning inequality of 0.09 shown in Figure 3.[7,8]

The decline in the gender gap in average earnings between 1978 and 1998 has had a very substantial impact on urban inequality. In the final year of our analysis, women were earning 69 percent of their male counterparts as compared with 59 percent twenty years earlier.[9] Although the remaining difference is large, the decline in the gender gap in earnings had a pronounced impact on inequality - reducing the variance of log earnings by about 0.039.[10]

[7] The methodology for obtaining these values is described in the Appendix.

[8] As first noted by Mincer (1974), the impact of increased female labor force participation for earnings inequality, where individuals are the unit of analysis, is quite different than the impact of increased female labor force participation for household income inequality. The impact on household income inequality has been studied extensively and, with a few exceptions, increased earnings by women are found to lead to a more equal distribution of household income (Lam 1997, Oshima and Mason 2001).

[9] Women working in the rural sector were neither more nor less advantaged than urban women. There, working women earned 59 percent of working men in 1978 and 71 percent in 1998.

[10] This is calculated using the same methodology employed to assess the impact of urban-rural earnings gap on earnings inequality.

Unlike the urban-rural gap, the gender gap in earnings does not reflect differences in educational attainment nor does the decline in the gap reflect convergence in educational attainment. As discussed above, urban and rural working women are as educated as working men. The gender gap is influenced, in part, by differences in age structure. In 1978, the average urban male worker was 8 years older than the average urban female worker. By 1998 the average urban male worker was only 3 years older.

Controlling for educational attainment and differences in age structure, the gender gap in earnings persists in Taiwan. In general, the gap is largest at lower educational levels and smallest at higher educational levels.[11] In 1978, controlling for age, urban women with a primary school education earned 46 percent less than urban men; those with a college education earned 33 percent less than their male counterparts. By 1998 the gap had declined at all levels but was still substantial - 33 percent for primary school graduates and 24 percent for college graduates.

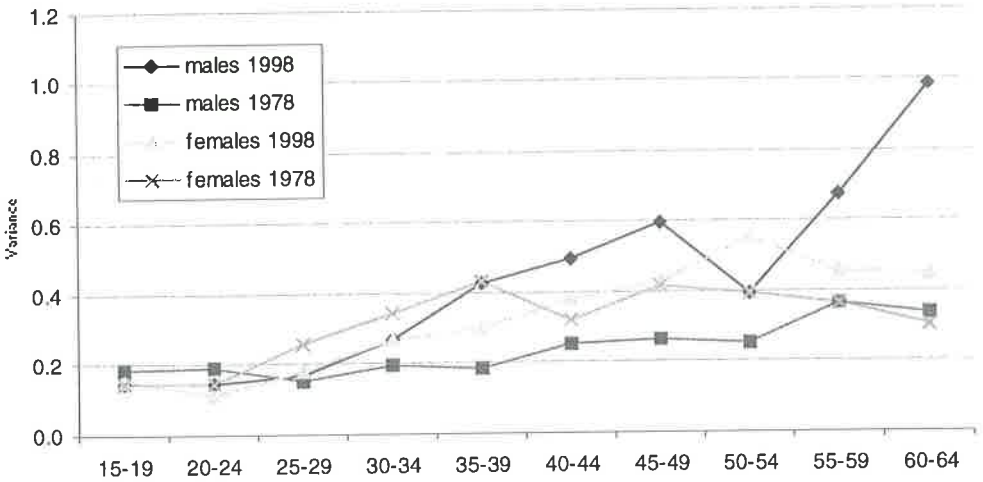
We cannot only speculate about why the gender gap in earnings declined to the extent that it did in Taiwan and why it remains as large as it does. During periods of rapid increase in labor force participation, such as those that have characterized women in Taiwan, the average experience of women at each age tends to decline. Consequently, part of the gender gap in earnings probably reflects differences in experience that are poorly measured by age. That the gender gap has declined in the face of this phenomenon, suggests that discriminatory employment practices may have declined in Taiwan. The remaining gap is consistent with a continued persistence of discriminatory labor markets, but the relative importance is difficult to judge.

Age structure and inequality

Changes in the age composition of the population influence earnings inequality because mean income varies by age and because income inequality is greater at some ages than at others. An increase in the proportion belonging to an age group with a high earnings variance and with either a high or low mean earnings relative to the overall mean earnings is dis-equalizing. As discussed above, age-earnings profiles, i.e., the relationship between age and mean income, are fairly similar in most countries. Taiwan's profile is not greatly different than the US profile, for example. The relationship between earnings inequality and age varies from country to country. In the U.S. earnings inequality is greatest at young ages and older ages and lowest at middle ages. In contrast earnings inequality in Brazil is highest at older ages and lowest at younger ages (Lam and Levinson 1992, Lam 1997). In Taiwan, the relationship between earnings inequality and age is closer to the pattern found in Brazil than the U.S. pattern. Earnings inequality for males is quite low at young ages and increases with age, modestly in 1978 and more precipitously in 1998. A similar pattern is found for Taiwan females; earnings inequality for females is low at young ages and increases with age (Figure 4).

[11] An exception to this generalization is the estimated gap for urban workers with less than a primary school education in 1998. A small percentage of workers had so little education, however, and the coefficients are not estimated with great reliability.

Figure 4. Variance of Log Earnings by Age, Urban Males and Females, Taiwan, 1978 and 1998



As discussed above, the age distribution for male earners became more concentrated at the middle ages between 1978 and 1998. Not surprisingly this reduced earnings inequality to a substantial extent. The change was concentrated during the first ten-year period during which the variance of log earnings for urban males was reduced by 0.028.[12] The aging of the urban female labor force has a very substantial dis-equalizing impact on earnings by urban women. Changes in the age composition urban female workers increased the variance of log earnings of urban women by 0.040 between 1978 and 1988 and by an additional 0.024 after 1988. Note that the calculated effect of changes in age structure depend on all factors that determine the age-earnings profile including educational differentials that are correlated with age.

Education and urban inequality[13]

Education is often looked to as an important source of economic growth, but it may also prove to be an important source of economic inequality. Earnings vary substantially with the educational attainment of workers, as documented above, and access to higher levels of schooling may be restricted by explicit government policy or by the lack of access to credit markets by those who would benefit financially from schooling but lack the resources to pay for their schooling. Increases in the returns to higher education in the United States are often cited as responsible for the rise in income inequality that has occurred there. But the situation is quite varied from country to country.

In Taiwan, changes in the returns to schooling also increased earnings inequality. Between 1978 and 1988, changes in the returns to schooling increased the variance of log earnings by

[12] See Appendix for calculation details.

[13] See Appendix for calculation details about the relationship between education and inequality.

0.008 for males and 0.002 for females and by 0.007 for males and 0.012 for females after 1988.

At the same time that increases in the returns to schooling were increasing inequality, changes in educational attainment were resulting in lower inequality. Among urban males, the log-variance of earnings declined by 0.019 between 1978 and 1988 and by 0.002 between 1988 and 1998 because of declining variation in the educational attainment of workers. The changes for women were similar with the log-variance of earnings declining by 0.018 between 1978 and 1988 and by 0.004 after 1988.

Taiwan's experience is an interesting contrast to South Korea's. In Korea, the college earnings premium increased rapidly until the late 1970s and then fell during 1980s in large part due to a rapid upgrading of educational attainment in the Korean labor force (Kim and Topel 1995). Likewise, in Kenya and Tanzania, the expansion of educated workers reduced the returns to schooling. Consequently, intra-urban earnings inequality declined even though inequality in educational attainment increased (Knight and Sabot 1983). Although the complex relationship among variables precludes a comprehensive approach, the contrast suggests that Taiwan may have more successfully avoided substantial distortions in their educational system thus allowing smoother responses to changes in the demand for educated workers.

Discussion and Conclusions

Taiwan and some of the other most successful Asian economies development have achieved a more balanced, inclusive development process that has facilitated rapid economic growth without the adverse effects on inequality anticipated by Kuznets and others. The relatively low and declining urban-rural income gap in Taiwan reflects, in part, the relatively low and declining urban-rural educational gap. More important, however, have been features of the economic structure and economic policy that have promoted strong economic growth in both the rural and urban sectors.

Taiwan's agricultural sector was relatively productive and well-positioned at the early stages of rapid economic growth. The agricultural infrastructure was well-developed, in part, a legacy of the colonial administration during Japanese occupation. Land was evenly distributed due to reform in the early 1950s. Rural workers were relatively well-educated as a consequence of the emphasis on education, especially primary education. Economic policy in Taiwan nurtured the agricultural sector in a number of important ways. Public support for agricultural research and extension services led to rapid increases in productivity. Import substitution policies during the 1950s and early 1960s were relatively mild and did not involve heavy taxes on the agricultural sector or other policies that inhibited the growth of the agricultural sector. Moreover, industrialization in Taiwan emphasized small- and medium-scale enterprise often located in rural areas that provided employment opportunities for rural workers. Taiwan also avoided labor practices, such as minimum wage legislation and high public-sector salaries, that have created large wage gaps between urban and rural workers in many other countries (Ranis 1995). Thus, development policy in Taiwan promoted a dynamic and integrated agricultural sector.

Balanced growth was also possible because of the remarkable success at creating jobs in manufacturing and service sectors through export-promotion policies and other economic measures. Taiwan's labor force grew very rapidly beginning in the 1960s both because the

working-age population was growing rapidly and because of the rise in female labor force participation. Had employment growth lagged two outcomes would have been possible. Agricultural wages could have stagnated with rapid growth in the agricultural workforce. Or, urban unemployment and underemployment could have increased creating rising urban and total earnings inequality. But employment in the non-agricultural sectors grew so rapidly, agricultural employment declined, the urban-rural earnings gap remained small, and urban inequality did not rise. That so much of Taiwan's industrial development was located in rural areas further facilitated a low degree of earnings inequality.

Taiwan's experience also highlights the role of education both to economic growth and to inequality. Taiwan and other East Asian economies have maintained or increased education's share of a rapidly increasing GDP even though the school age population has stabilized as a consequence of declining childbearing rates. As a consequence, spending per school age child has increased dramatically in Taiwan and other East Asian countries. Other features of Taiwan's educational system are also important. One is the reliance on examination systems that insured that the best-performing students receive the best education. Also, the emphasis of education has shifted as the human resource needs of the economy have changed. Early in its development, Taiwan emphasized literacy and a primary education. Next, secondary schooling became mandatory. In the 1970s vocational education was emphasized while more recently emphasis has shifted to science and engineering degrees.

Two aspects of education are particularly striking in the analysis presented above. The first is that Taiwan has experienced increasing returns to schooling similar to those in the US and some other countries that have increased earnings inequality. In Taiwan, however, changes in the educational composition of the labor force have changed - have become compressed - partially offsetting the effects of increasing returns to schooling (Birdsall, Ross, and Sabot 1995). The second important aspect of Taiwan's educational experience is the absence of any substantial gender gap in educational attainment of the workforce. Within the general population, as opposed, to the population of earners, men still have an educational advantage over women. The difference has declined substantially over time and has become quite small for young adults. The rapid improvements in educational attainment among women made it possible for female labor force participation rates to increase substantially while maintaining a female workforce with educational levels on par with men. This is an important part of the story of low inequality.

Operating in the background but nonetheless important are the substantial changes in Taiwan's demography. Rapid decline in rates of childbearing and increasing female labor force participation and school enrollment were mutually reinforcing trends. Rapid growth in the number of educated women in the urban labor force contributed significantly to economic growth in Taiwan. Although earnings inequality might have increased substantially as a result, this has proven not to be the case in Taiwan because the earnings inequality of women is relatively low.

Low birth rates and improvements in life expectancy are leading to population aging in many countries, Taiwan included, although the impact has been limited mostly to the female labor force at this point. The increase in the average age of female earners has contributed to a significant increase in earnings inequality in Taiwan. The welfare implications of changes in inequality due to shifts in age composition are subject to debate, however, to the extent that

differences in lifetime earnings are a better measure of inequality that differences in current earnings.

Although the factors influencing economic growth and inequality are diverse, there is a common thread. Taiwan appears to be less encumbered by rigidities and barriers than many other economies. Its labor markets are flexible. The educational system has responded smoothly to the demand for more skilled workers. Women workers have achieved educational parity and have rapidly increased their share of employment and earnings. Urban-rural differentials in education and earnings are modest. From all appearances, well-functioning markets have played an essential role in Taiwan's success at achieving growth with equity.

Appendix

1. Decomposition of variance of log earnings

When a society consists of many groups, the variance of log earnings can be decomposed into:

$$Var(\ln Y) = \sum_i W_i Var(\ln Y_i) + \sum_{j \neq i} W_i W_j (\overline{\ln Y_i} - \overline{\ln Y_j})^2 \quad \text{or}$$
$$= \sum_i W_i Var(\ln Y_i) + \sum_i W_i \overline{\ln Y}_i^2 - (\overline{\ln Y})^2 \qquad (1)$$

where $Var(\ln Y)$ and $\overline{\ln Y}$ represent the variance of earnings and the mean of log earnings respectively; W is the share of labor force of each group, and the subscripts i and j be groups. Wj is a function of all other Wi¹j.

The change in variance of earnings due to the change in the composition of labor force is:

$$\sum_i \frac{\partial Var(\ln Y)}{\partial W_i} dW_i = \sum_i Var(\ln Y_i) dW_i + \sum_i \overline{\ln Y}_i^2 dW_i - 2\overline{\ln Y} \sum_i \overline{\ln Y}_i dWi \quad (2)$$

In particular, when there are only two groups, for example urban and rural, then equation (2) is equivalent as:

$$\{Var(\ln Y_u) - Var(\ln Y_r)\} dW_u + (W_r - W_u)(\overline{\ln Y_u} - \overline{\ln Y_r})^2 dW_u \qquad (3)$$

The first terms capture the effect of urbanization on inequality due to the difference in inequality between the urban and rural sector. The second term measures the contribution to inequality of the urban-rural gap in average earnings. Given the positive earnings gap that exists in Taiwan and other countries, the second term is positive until the proportion urban (Wu) reaches 0.5. Once the urban sector becomes dominant, the second term turns negative.

Likewise, the impact of the change in the urban-rural earnings gap on inequality can be calculated using a formula:

$$\frac{\partial Var(\ln Y)}{\partial(\overline{\ln Y_u} - \overline{\ln Y_r})} d(\overline{\ln Y_u} - \overline{\ln Y_r}) = 2W_u(1 - W_u)(\overline{\ln Y_u} - \overline{\ln Y_r})\, d(\overline{\ln Y_u} - \overline{\ln Y_r}) \quad (4)$$

2. Decomposition of earnings gap between two groups

The impact of a change in age and education composition on earnings differential between any two groups or years can be calculated using a decomposition method similar to one proposed by Oaxaca (1973):

$$\bar{Y}^A - \bar{Y}^B = \sum \hat{\beta}^A \bar{X}^A - \sum \hat{\beta}^B \bar{X}^B$$

$$= \sum \frac{(\hat{\beta}^A + \hat{\beta}^B)}{2}(\bar{X}^A - \bar{X}^B) + \sum \frac{(\bar{X}^A + \bar{X}^B)}{2}(\hat{\beta}^A - \hat{\beta}^B) \qquad (5)$$

where represents average earnings, b coefficients, is the share of the education and age groups, and the superscripts A and B two subgroups or two years.

3. Effect of changes in returns to schooling on earnings inequality

The change in returns to schooling influence earnings inequality only through the differences in average of log earnings between groups. Since schooling status and age cohort are included as a set of dummy variables in our model, the log of earnings for education group i given age j can be written as ln Yij = a + bi + gj + eij (individual subscript is omitted, a, b, and g are estimated coefficients). It is easy to show that the partial derivative of Var (lnYi) with respect to b for any given g equals zero.

That is, the effect of the returns to schooling, b, on earnings inequality can be calculated as:

$$\sum_i \frac{\partial Var(\ln Y)}{\partial \beta_i} d\beta_i = \sum_i \sum_j W_i W_j (\overline{\ln Y_i} - \overline{\ln Y_j}) d\beta_i \qquad (6)$$

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