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EQUALIZATION EFFECTS OF THE EXPANSION OF LABOR-INTENSIVE EXPORTS: THE CASE OF TAIWAN

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I. INTRODUCTION

THE late Harry Oshima is one of the few scholars who from early on foresaw the implications of employment expansion for reducing inequality in developing countries. He noted in a 1971 article,

> Not only does an increase in agricultural production (itself a labor-intensive industry) raise employment but the rise in aggregate demand of the agricultural population leads to increases in employment in the small industries, small stores, etc., of the nonagricultural sector. . . . A policy promoting the growth of the two labor-intensive sectors (in agriculture and in nonagriculture) may tend to reduce inequalities in the size distribution of family incomes. (Oshima 1971, p. 171)[1]

Now after two and a half decades, more evidence has surfaced, some of which had been collected by Oshima himself (see Oshima 1992, 1993, and 1994). Although data are still far from complete or ideal, with quality varying among countries and periods, from what is available, a pattern consistent with Oshima's observation above has emerged. Table I, which was compiled based on the information given in the reports of Oshima (1994), Ikemoto (1991), Mizoguchi-Terasaki (1992), Mizoguchi (1985), Medhi (1994), and Chen and Chu (1999), lists the Gini coefficients of six Asian countries with inequality data of reasonably good quality. The shaded areas in the table clearly show that Japan experienced a declining inequality

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[1] Oshima's main point in that article is that for many Asian economies, there had been a labor force "explosion" in the late 1960s due to the postwar baby boom. The sharp rise in the labor force would have led to large-scale unemployment, if employment expansion made possible by the growth of labor-intensive industries had not occurred.

TABLE I

GINI COEFFICIENTS FOR SELECTED ASIAN COUNTRIES

Source	Japan			Hong Kong	Singapore		Taiwan		Korea		Malaysia	
	Oshima (1994)	Mizoguchi (1985)	Mizoguchi & Terasaki (1992)	Oshima (1994)	Oshima (1994)	Ikemoto (1991)	DGBAS	This Study	Oshima (1994)	Ikemoto (1991)	Oshima (1994)	Ikemoto (1991)
1956		0.313										
1957				0.48								0.449
1958											0.45 (’57/58)	
1959		0.357										
1960												
1961												
1962	0.37	0.382	0.3864[a]									
1963		0.357										
1964		0.358		0.50(’63/64)	0.50	0.498	0.321					
1965	0.34	0.348							0.34	0.343		
1966				0.49			0.323					
1967		0.351	0.3474[a]							0.396		0.498
1968		0.349					0.326			0.425	0.48(’67/68)	
1969		0.357								0.425		
1970	0.41	0.355					0.294		0.33	0.355	0.51	0.505
1971		0.369		0.44						0.365		
1972		0.334	0.3783[a]		0.44	0.443	0.291					
1973		0.325				0.457					0.52	0.498
1974				0.42(’73/74)	0.43	0.434	0.287					
1975	0.36					0.448						
1976				0.44			0.280	0.3580[b]	0.39			0.509
1977			0.3430[a]									
1978							0.287					
1979					0.42			0.3547[b]			0.49	0.493

TABLE I (Continued)

Source	Japan			Hong Kong	Singapore		Taiwan		Korea		Malaysia	
	Oshima (1994)	Mizoguchi (1985)	Mizoguchi & Terasaki (1992)	Oshima (1994)	Oshima (1994)	Ikemoto (1991)	DGBAS	This Study	Oshima (1994)	Ikemoto (1991)	Oshima (1994)	Ikemoto (1991)
1980	0.33			0.40 ('79/80)			0.277	0.3539[b]				
1981				0.45				0.3494[b]				
1982							0.283	0.3489[b]	0.36			
1983								0.3526[b]				
1984					0.47		0.287	0.3439[b]			0.48	
1985	0.35							0.3404[b]	0.34			
1986				0.42			0.296	0.3463[b]				
1987							0.299	0.3389[b]				
1988							0.303	0.3406[b]	0.34		0.44	
1989					0.39		0.303	0.3376[b]				
1990	0.35						0.312	0.3366[b]				
1991				0.45			0.308	0.3191[b]	0.35			
1992							0.312	0.3307[b]				
1993							0.316	0.3354[b]				
1994								0.3371[b]				

Notes: 1. Based on total household income unless otherwise noted.
2. Refer to Oshima (1994) and Ikemoto (1991) for original sources.

[a] Based on per capita household income.

[b] Gini coefficient of disposable income among individual income recipients, calculated from DGBAS survey data.

during most of the 1960s, in both Hong Kong and Singapore, inequality fell from the mid-1960s to the early 1970s. In both Taiwan and the Republic of Korea, inequality fell from the late 1960s to the early 1970s.[2] In Malaysia, inequality fell during most of the 1970s and 1980s.

The shaded areas in Table I denote a "sequential" pattern, with Japan being the earliest, followed by Hong Kong and Singapore, which were in turn followed by Taiwan and Korea, and more recently by Malaysia. *These sequential periods of declining inequality coincided with the periods of rapid expansion of labor-intensive exports and sharp rises in employment in all of the six countries* as seen in the table. According to Oshima (1993, pp. 100–101), in Japan, the unemployment rate decreased from 1.7 per cent in 1960 to 1.1 per cent in 1969; in Singapore, it decreased from 9.0 per cent in 1966 to 4.5 per cent in 1973; in Hong Kong, it was 3.6 per cent in 1966 in spite of the continuing influx of numerous refugees from Mainland China. In Taiwan, the unemployment rate decreased from 4.3 per cent in 1964 to 1.3 per cent in 1973; and in Malaysia, 7.5 per cent in 1970 to 5.8 per cent in 1984.[3]

While more solid evidence for these and other countries is needed before one can draw any definitive conclusion on the causes of the changes in inequality, which usually involve a whole set of socioeconomic factors, the above findings are too much of a coincidence not to suggest a possible positive contribution of the expansion of labor-intensive industries and the resultant rise in employment to the reduction of income inequality.

In his 1993 report, Oshima also noted that for economies endowed with a sizable agricultural sector, full employment was achieved first through the increase of off-farm nonagricultural employment for farm households (Oshima 1993, p. 154). Indeed, in Japan, the ratio of nonagricultural to agricultural income for farm households rose from 28.3 per cent in 1950 to 166.7 per cent by 1970. In Taiwan, it was already as high as 105.9 per cent in 1970 and further rose to 305.6 per cent by 1980. In Korea, it rose from 16.9 per cent in 1970 to 32.4 per cent by 1980. In Malaysia, it rose from 15.5 per cent in 1973 to 39.2 per cent in 1979.

Oshima's findings are consistent with the studies conducted in many countries. Rao and Ramakrishnan (1980) and Rao (1988), for example, showed that Singapore

[2] See the later text for explanation of the series of Gini coefficient of disposable income among individual income recipients after 1976 for Taiwan. Also, the difference between the Gini coefficients from the two sources for the Republic of Korea (hereafter referred to as Korea) mainly reflects the lack of an integrated data set for that country and the fact that different scholars used different methods to describe nationwide income distribution; see Mizoguchi (1985, pp. 310–12) for details.

[3] The same phenomenon probably also occurred in Indonesia. According to Oshima (1993), the inequality in consumption expenditure measured by the Gini coefficient decreased from 0.51 in 1978 to 0.37 in 1987; at the same time, "underemployment" (see Oshima [1993, pp. 102–3] for definition) decreased from 45.0 per cent in 1977 to 12.7 per cent in 1986. Since the phenomenon is rather recent, it is preferable to wait for subsequent studies for confirmation.

between 1966 and 1972 experienced a fast rise in labor-intensive exports and employment, and consequently inequality fell. Chau (1978, 1980) showed that Hong Kong also experienced a dramatic expansion of exports and employment in the 1960s, and consequently the disparity between wages narrowed. Mizoguchi and Terasaki (1992), among others, showed that in Japan in the 1960s, the manufacturing sector moved into the countryside in search of cheap labor, employment expanded rapidly, and inequality fell (see also Oshima 1993, p. 212). In Malaysia, studies of Shari and Mat Zin (1990) and Shari (1996) have cited the shift to labor-intensive, export-oriented industrialization as one of the factors contributing to the fall in inequality from the 1970s to the early 1980s.[4]

Of all of the interesting Asian cases, Taiwan has been cited by Oshima (1993, 1994) and many others as one of the clearest demonstrations of the positive relationship between employment expansion and equitable growth. Perhaps as a result, there has been a sizable body of literature on the case of Taiwan. These studies generally indicate that inequality fell in the 1960s and 1970s, and that the expansion of labor-intensive industrialization contributed to the declining inequality.

However, in spite of the numerous studies, so far few have been able to establish a direct link between the changes in inequality and the expansion of labor-intensive manufacturing for exports. Most involved merely a comparison of time series. Among the few papers that adopted an in-depth analysis, most of them were concerned with specific issues in the general area of income distribution, and an integrated, holistic view is yet to be presented. This is what this paper hopes to accomplish: to conduct a step-by-step analysis based upon the existing literature in order to reach the core of the problem, then to rely on quantitative studies to try to establish a direct link between the movement in the core inequality indicators and export performance. The entire process would be like the peeling of an onion. The task is to explain why an onion takes the currently observed shape, and the way to do it is to peel off the external layers, one after another, and attempt to find the answer in the inner core.

The step-by-step analysis as well as the general, historical, or institutional background of the income distribution issue will be provided here in an itemized fashion, while quantitative studies will be presented in the subsequent sections.

(i) Taiwan was ruled by Japan during the period of 1895–1945, when the colonial government promoted capitalistic development of agriculture and the related industries. Immediately after World War II, Taiwan was returned to China, then under the rule of the Nationalists, which took over all the assets, private and public, formerly owned by the Japanese, and turned them into state-owned assets in the form of government properties or assets of the state-owned enterprises. Therefore, the state became the largest landlord as well as the largest capitalist at the time. The

[4] In Indonesia, the surge in non-oil exports in the 1980s has been cited by the World Bank (1990) as one of the reasons for declining inequalities.

issue of efficiency notwithstanding, such an institutional setting would be favorable to a more equal distribution of private wealth/income.[5] During the 1949–53 period, the Nationalist government carried out an extensive land reform, which further reduced the inequality of land ownership among the pepole.[6]

(ii) During the 1953–64 period, scanty evidence cited in the literature indicates that overall inequality of household income probably fell further (see Table II), although inequality was already low to start with, and inequality among farm household incomes fell as well. The income disparity between farm and nonfarm households narrowed somewhat during the same period. Fei, Ranis, and Kuo (1979) and Kuznets (1979) among others attributed the phenomenon to the fact that an increasing number of farm households (particularly the land-poor ones) were engaged in off-farm manufacturing (of the consumer goods, import-substitution type), the access to which was facilitated by the availability of rural infrastructure. Also, in line with the observation made by Oshima (1971), Taiwan's broadly based agricultural development coupled with a low level of farm household inequality created an environment favorable to the emergence and expansion of such domestic-market-oriented, small-scale-factory-based industrialization.[7]

(iii) Data are more available and much more reliable during the 1964–76 period, when the task of regular surveys was taken up by the government. They enable to analyze the situation in a more careful way.[8] One of the deficiencies of the pre-1964 data is that they were based on the total income of households, unadjusted for household size. In Taiwan, the average size of households changed over time, and, as Kuznets (1979; 1989, Chaps. 7–9) correctly points out, these changes were too significant to be ignored. One should therefore first ask: how did Taiwan's income distribution change during this period, and what role did changes in the household size play?

Table II shows that the Gini coefficient of (total) household income rose mildly from 0.321 to 0.326 during the 1964–68 period, and then subsequently fell to 0.294 in 1970 and 0.277 in 1980 (when the bottom was reached).[9] Among these years, the

[5] See Gold (1986, Chap. 3) and Ho (1978, Chap. 5).

[6] See, e.g., Yang (1970), Ho (1978, pp. 159–70), and Fei, Ranis, and Kuo (1979, pp. 38–46).

[7] See Ranis (1979, pp. 222–25), Galenson (1979, pp. 425–35) and Fei, Ranis, and Kuo (1979, Chap. 2). See also Chu (1996a), for a theoretical discussion. The importance of the farm/agricultural sector in shaping Asia's income distribution was emphasized in Oshima (1993, Chap. 9), which compared the situation in different Asian countries.

[8] But full access to the set of original questionnaire results was available only after 1976, when the Directorate-General of Budget, Accounting, and Statistics or DGBAS began to store them on magnetic tapes.

[9] The apparent fall in inequality between 1968 and 1970 should be interpreted with caution. Beginning in 1970, when Taipei City was established as a Special Municipality, surveys were conducted separately by that city and the Provincial Government of Taiwan, the DGBAS (belonging to the central government of the Republic of China) then compiled the results together. Only after 1974 did DGBAS itself begin taking up the task. Comparison of the figures for the pre-1970 and post-1974 periods, however, still shows a falling trend of inequality. In addition, although the general

TABLE II

INCOME DISTRIBUTION IN TAIWAN, 1953–96

	Inequality of Total Household Income		Inequality of Distributed Factor Income among Individual Income Recipients
	Gini Coefficient	Ratio of Income of the Richest 1/5 of the Households to that of the Poorest 1/5	Ratio of Income of the Richest 1/5 of the Households to that of the Poorest 1/5
1953[a]	0.558 (1)	20.47 (4)	
1959[a]	0.440 (2)	8.95 (4)	
1964	0.321 (3)[b]	5.33 (3)	
1966	0.323 (3)[b]	5.25 (3)	
1968	0.326 (3)[b]	5.28 (3)	
1970	0.294 (3)[b]	4.58 (3)	
1972	0.291 (3)[b]	4.49 (3)	
1974	0.287 (3)[b]	4.37 (3)	
1976	0.280 (3)	4.18 (3)	7.96 (3)
1978	0.287 (3)	4.18 (3)	7.38 (3)
1980	0.277 (3)	4.17 (3)	7.91 (3)
1982	0.283 (3)	4.29 (3)	7.69 (3)
1984	0.287 (3)	4.40 (3)	7.44 (3)
1986	0.296 (3)	4.60 (3)	7.87 (3)
1987	0.299 (3)	4.69 (3)	7.51 (3)
1988	0.303 (3)	4.85 (3)	7.47 (3)
1989	0.303 (3)	4.49 (3)	7.49 (3)
1990	0.312 (3)	5.18 (3)	8.05 (3)
1991	0.308 (3)	4.97 (3)	7.74 (3)
1992	0.312 (3)	5.24 (3)	7.78 (3)
1993	0.316 (3)	5.42 (3)	7.80 (3)
1994	0.318 (3)	5.38 (3)	8.10 (3)
1995	0.317 (3)	5.34 (3)	8.44 (3)
1996	0.317 (3)	5.38 (3)	8.45 (3)

Notes: 1. The numbers in the parentheses indicate the sources: (1) Chang (1956), (2) National Taiwan University (1959), (3) ROC, DGBAS (1996), and (4) Fei, Ranis, and Kuo (1979, pp. 92–93).
2. The figures for 1976–96 are based on ungrouped data.

[a] Based on small samples of dubious quality and therefore not directly comparable to the figures for the other years, see text for details.

[b] Based on data of decile groups.

quality of the data is considered to be good in comparison with that of the data collected in the other developing countries (Ho 1978, p. 142), the data are not completely problem-free: Kuznets (1979, pp. 103–6) indicated that the total incomes estimated in the DGBAS surveys for 1964–75 fell short of those in national income accounts by 17–27 per cent. However, as Kuznets noted, such a shortfall was not uncommon even for developed countries, and the discrepancy ratio he indicated followed a clearly falling trend during the 1968–75 period. It is also worth noting that although in Table III household inequality rose in 1964–68, the rise was perhaps too mild and too short as to indicate a persistent trade-off between growth and equality, an issue frequently raised in the literature and to be further discussed below.

fall in inequality between 1966 and 1972 was quite sizable and received a great deal of attention in Fei, Ranis, and Kuo (1979). It is possible to evaluate the effects of the distribution of the household size by performing an inequality decomposition by groups, in the manner described by Fei, Ranis, and Kuo (1979, pp. 226–31).[10] The process is omitted here, but it was found[11] that while the household size was an important factor contributing to inequality, in no way would it have altered the direction of change in inequality between 1966 and 1972.[12]

As for the question of between- and within-sector inequality for the farm/rural and nonfarm/urban households, suffice it to say that the fall in intra-sector inequalities among nonfarm households contributed the most to the fall in overall inequality, and that the *dominant factor underlying that change was the fall in wage income inequality* (see Fei, Ranis, and Kuo 1979, Chaps. 3 and 5).

(iv) As Taiwan entered the 1980s and 1990s, many events took place. Population growth slowed down significantly, as did the labor force. The share of employees' compensation (mostly wages from nonagricultural employment) in the total income of the households stopped increasing, as in most of the 1960s and 1970s, and started to slightly fall from the peak of around 62 per cent in 1981. The importance of property income gradually rose, from 12.00 per cent of the total household income to 14.56 per cent in 1985–92 (Directorate-General of Budget, Accounting and Statistics or DGBAS report [ROC, DGBAS 1993, p. 17]). In addition, Taiwan was able to maintain macroeconomic stability throughout most of the 1960s and

[10] Specifically, one can decompose the coefficient of variation of total household income into (i) the part that is attributable to the inequality among the average incomes of different groups of households, where grouping is based on the household size (number of persons in the household), and (ii) the part that is attributable to the within-group inequalities. Fei, Ranis, and Kuo's Table 5.23 contains data in which households are grouped into those with 1, 2, . . . , 9 and 10 or more members for 1966 and 1972. Therefore, such decomposition can be carried out. To determine which factors and how much they contributed to the change in inequality over the years, one can calculate the difference.

[11] Specifically, it was found that 40.52 per cent of the changes in household inequality between 1966 and 1972 could be attributed to the changes in between-group inequality during the period, and that the rest was attributable to the changes in intra-group inequalities. A more direct way would be to measure the inequality of per capita household income and compare it to that of total household income. Data do not, however, permit such a calculation.

[12] Using data of income of households grouped by the occupation of their heads, Kuznets (1979, 1980) observed that the between-group inequality of per capita household income did not change appreciably during the 1964–75 period. He also used data of quintiles of households (quintiles being defined by the magnitude of *total* household income) to calculate the inequality of per capita household income and found that the trend of falling inequality changed to that of slightly increasing inequality between 1964 and 1972 (Kuznets 1980). However, the latter method may involve quite a few complications as the quintiles are not defined on per capita household income; see Chu (1991) for details. Presumably that is one of the reasons why Kuznets himself would rather rely on the differentials between households grouped by occupation of heads as the basis for measuring inequality. That is also why in this paper the above reported method of group-wise decomposition was selected to evaluate the effects of the household size factor, which could not alter the trend of declining inequality.

1970s. In the middle and late 1980s, however, along with the NT dollar appreciation, monetary aggregates expanded sharply for about two years.[13] As asset prices rose markedly (see, e.g., Chu 1994), it was assumed that many of the factors which may have contributed to equality in the previous decades became either less significant or began to change directions in the 1980s and early 1990s. On an a priori ground, these changes were likely to exert some impacts, presumably adverse, on Taiwan's equality.[14]

On the surface they did. Table II shows that the income ratio of the richest one-fifth households to the poorest one-fifth rose from 4.18 to its peak of 5.42 from 1980 to 1993. Closer scrutiny reveals, however, that the nature of the rise in the official statistics of inequality was different from what it appeared. The official publications of DGBAS supply the inequality figures for the "distributed factor income" of both individual income recipients and of households.[15] Inequality of this distributed factor income among households showed the same obvious upward trend during the 1980–93 period. During the same period, however, inequality of this income among individual income-recipients measured by the ratio of the income of the richest quintile (among individuals) to that of the poorest fluctuated between 7.38 and 8.05 in 1976–93, precluding the indication of definitive trends (ROC, DGBAS 1993), as shown in Table II.[16] The implication is that the apparent

[13] This is coincided also with the period of rapid democratization in Taiwan, see, e.g., Fei and Chu (1999).

[14] See, e.g., Bourguignon (1992), for an interesting analysis of the effects of macroeconomic policies on income distribution.

[15] "Distributed factor income" is equal to employees' compensation plus proprietors' (self-employment) income plus net property income, or alternatively, it is equal to disposable income minus miscellaneous and net transfer income. Total distributed factor income of individual income-recipients accounts for around 95 per cent of the total household distributed factor income. Also, as in the definition of disposable income, distributed factor income of individual income-recipients does not include imputed rental of owner-occupied housing.

[16] As clearly indicated below, inequality of wage rates among *individual* wage-earners fell decisively in 1966–76, along with the fall in inequality of both household total and wage income. No similar parallel trends were present in the 1980s and early 1990s, at least for the distributed factor income. In addition, Chu and Lin (1995) indicated that when the income-recipients were grouped into socioeconomic classes, the between-group inequality did not show any definite trend either between 1982 and 1993. Between-group coefficient of variation of mean distributed factor income was 0.4016, 0.4168, 0.4074, and 0.3891, respectively for 1982, 1987, 1992, and 1993. It was also found that the order of rank in terms of mean (distributed factor) income of the group changed only slightly between 1982 and 1993. In 1993, groups in descending order of mean income were as follows (numbers in parentheses indicate the rank in 1982): nonagricultural employers (1), nonagricultural professionals and managers (2), military servicemen (4), agricultural employers (3), nonagricultural self-employed (5), nonagricultural clerical, sales, and service workers (6), nonagricultural laborers (7), agricultural employees (9), agricultural self-employed (8), and miscellaneous (10). Mean income of the top group was about five times that of the bottom group (or next-to-the-bottom group) in both years. It is also worth noting here that Chiou (1996) provided an interesting analysis of whether there have been significant changes in the Lorenz curves of household income distribution in Taiwan over the years. Table II also clearly shows that during the 1993–96 period,

rise in household income inequality after 1980 was due to the effects of the composition of households. In other words, the income inequality among the non-trivial income earners did not change appreciably (until very recently). Income inequality among households rose during the 1980–93 period as these income earners were grouped into households.[17] That is, there was no evidence of rising inequality among income recipients during the 1980s and the early 1990s.

In summary, the Taiwan experience definitely indicates that income inequality decisively fell from the mid-1960s to mid-1970s, and has remained stable since

although the inequality among households fell slightly (based on the Oshima index, i.e., the income ratio of the richest one-fifth to the poorest one-fifth) or at least stabilized (based on the Gini index), the inequality of distributed factor income among individual income recipients widened. Since this is a very recent phenomenon, more observations are needed before an in-depth analysis can be performed. However, the new trend, if confirmed, is a good indication for future studies, which should investigate among other hypotheses the impact of the rise of technology-intensive exports on wage disparities.

17 Chu (1996b) decomposed the inequality of household disposable income between 1981 and 1992 into the following factors: (i) household size, (ii) employment ratio among household members, and (iii) average disposal income of income recipients in the household. It was found that for both years, the third factor was dominant (accounting for about three-quarters of total inequality in each year), while the first effect was also significant (less than one-third). When the *change* in inequality between the two years was decomposed, the dominant factor was again factor (iii). This basically implies that while inequality among individual income recipients did not change appreciably, the highly paid recipients were now more likely to be grouped with the like, leading to a household inequality. The importance of the household composition in explaining the changes in household income inequality was also found in Schultz (1999) and Fields and Leary (1999). The former's Figures 7.5 and 7.6 clearly showed the disappearance of the rising trend when inequality was based on per adult or per member measure. The latter also found that "rising inequality must be attributable to changing household structure" (p. 216). They indicated the possible importance of two factors: "an increase in the number and share of older people living without grown children or other younger relatives, and an increase in the labor-market participation of the wives of prime-aged men" (p. 216). These two factors would not have been inconsistent with the above finding that disparity rose among the *average* incomes of income recipients within households. It is also worth noting that the DGBAS reports carry the data of deciles of households grouped by per capita household disposable income. The ratio of the richest deciles or quintiles to the poorest did not reveal any trend of rising (or falling) inequality in the 1980s and early 1990s. Fields and Leary (1999) observed that there was essentially no difference between the Gini coefficients of the distribution of per capita household income for 1980 and 1992, the coefficients being 0.322 and 0.324 for the two years, respectively. If these findings were to be further confirmed in follow-up studies in the future, the size of households would become the sole important factor to be reckoned with when one analyzes the effects of changes in household composition, which has been found to be the actual reason for the apparent rise in inequality of total household income (see also Lin [1994] that deals with the same problem but focuses on wage income only). In addition, Chu (1991) showed that inequality of per capita household gross (before capital expenditure and taxes) income expressed as coefficient of variation rose from 0.6802 in 1980 to 0.7241 in 1989, when the unit of calculation was the household, i.e., inequality was defined among the households. The coefficient of variation was 0.6283 and 0.6617 for the two years, respectively, when inequality was defined among the persons, each of whom got the per capita gross income of the household he or she belonged to. Chu (1989) indicated similar trends between 1980 and 1986 for the inequality of the per-adult-equivalent household distributed factor income.

then, at least until very recently. Therefore, emphasis should be placed on the period from the mid-1960s to mid-1970s, when income inequality fell and Taiwan's export-led economy grew most rapidly.

Our attention will be focused on wage income, which was found to be the most important source of income explaining the fall in income inequality during this period, as clearly indicated in Fei, Ranis, and Kuo (1979, Chap. 3) and other studies mentioned above. To address the problem of changing household size, the analysis will be centered upon the inequality of wage income among individual workers instead of that among households.

In what follows, Section II will give a plan of the analysis and then proceed to identify how the changes in wage inequality between 1966 and 1976 were accounted for by the wage premiums attached to the different skills of workers, with the latter being represented by their gender, age, place of work, and education. Section III will investigate the link between the changes in the premiums and the demand/supply conditions in the labor market. Finally, Section IV will include the summary and conclusion.

II. CHANGES IN WAGE INEQUALITY AND WORKERS' CHARACTERISTICS BETWEEN 1966 AND 1976

As indicated above, the major task is to explain why wage inequality among individual workers fell from the mid-1960s to mid-1970s. Many authors attributed this phenomenon to the above-mentioned rapid expansion of employment made available by export-driven labor-intensive manufacturing and the subsequent exhaustion of surplus labor resulting in the rise in wages of low-skilled labor (e.g., Fei, Ranis, and Kuo 1979, Chap. 1; Kuo 1983, p. 117; Little 1979; Liang 1978; and Chu and Tsai 1994).[18]

The trends in exports, wage rate and employment are consistent with this hypothesis. The value of manufactured goods in total exports rose from 32.3 per cent in 1960 to 84.6 per cent in 1972. Total employment rose from 3.518 million in 1965 to 5.257 million in 1974; meanwhile the share of the non-primary-sector employ-

[18] These observations indicated the inequality among individual workers, while the results of decomposition discussed above referred to the inequality of the wage income among households. Although the two approaches are different, Fei, Ranis, and Kuo (1979, Chap. 4) had already given a detailed account of the link between the two for 1966, for which year an in-depth analysis will be presented below. Basically, by using their equation (4.15), they decomposed the inequality of wage income into factors caused by the difference in the distribution of the number of (forty) different types of workers among the households and their weights, which is affected by the between-type disparity of wages. Their Table 4.13 and Figures 4.9–4.11 (see also the remark on their p. 180) indicated that both factors could explain the inequality of household wage in that year. In the discussion below, attention will be focused on the latter factor, namely the wage disparities among individual workers, an issue closely related to the labor market situation which should be analyzed for its own right.

ment rose from 50.82 per cent to 67.30 per cent. But only a few authors did more than referring to the time series.[19] Therefore, in the current paper attempts were made to establish a more direct link between exports and changes in inequality. The plan of the analysis is as follows:

To study wage inequality, it is important first to determine the size of the premiums attached to skills, which somehow have to be defined. While several methods can be applied in theory, data availability to achieve this objective is quite limited. In Taiwan, as indicated above, detailed data of the household surveys became available in magnetic form only after 1976. For the period of 1964–75, the only available official data were the printed tables in the annual reports. Unfortunately, these tables did not supply enough useful information about the individual wage-earners. Of all the data currently known to us, one set is probably the most informative, namely, Tables 4.24–4.27 in Fei, Ranis, and Kuo (1979, Chap. 4). These tables report the average wage rates and the size of different groups of individual workers, cross-categorized by location of work, sex, age, and education for 1966. Fei, Ranis, and Kuo (1979) calculated these tables from the DGBAS original survey results, to which they had access.

This is the best one can do for the 1960s. For the 1970s, a comparable set of data can be compiled for 1976 (the earliest possible year in the 1970s) without difficulty. Therefore, it should be explained how wage inequality changed among the grouped workers between 1966 and 1976, and whether this change was related to the change in premiums attached to skills (to be defined), which the different groups of workers were endowed with.[20]

Although skills cannot be directly evaluated, it is possible to assume that they are closely related to the individual characteristics of the workers. Specifically, it is assumed that the four different types of characteristics for which data are available in the above-referred-to 1966 tables, namely place of work (urban vs. non-urban), age,[21] gender, and level of education, represent four dimensions of skills. Therefore, the premiums attached to these four characteristics are proxies for the premiums paid for the represented skills.

[19] Chan, Chen, and Hu (1999) and Chen and Hsu (2001) are the few recent exceptions. See Section III below for details.

[20] Obviously, the change in inequality must be in the direction of a fall before any more analysis can be performed. That is, one first has to determine whether the wage inequality among the *grouped* workers actually fell between 1966 and 1976. If this were not the case, the implication would have been that the *within-group* inequality (rather than the observable *between-group* inequality) caused the fall in wage inequality among individual workers between the mid-1960s and the mid-1970s. Because there is no access to such within-group inequality data, no further analysis could be performed. Fortunately, as shall be shown below, this was not the case: wage inequality among grouped workers (as defined in the table of Fei, Ranis, and Kuo [1979]) fell decisively between 1966 and 1976.

[21] In standard human capital models, the variable "years of experience" is more often used than age. However, the grouped data available here did not permit us to calculate such a variable.

As a result, our first main task is to determine (i) the size of these premiums, (ii) whether and how the level of inequality in 1966 and 1977, respectively can be accounted for by the premium structure of the above-indicated skill proxies, (iii) whether and how the changes in inequality (among the grouped workers) between 1966 and 1976 were related to the changes in these premiums. This will be done in the current section.

The premiums represent only the market prices for the respective skills. As a result, if the premium structure were found to be important in accounting for the levels of inequality in 1966 and 1976, and/or that changes in inequality between 1966 and 1976 could be accounted for by the changes in the premium structure, it should be determined why such changes in the premium structure (relative market prices for different skills) took place between 1966 and 1976. This will be accomplished in the next section.

As for the first task, the method to be applied is to regress the wage rates on variables representing the four dimensions of individual characteristics. If the results are satisfactory, the regression coefficients can be interpreted as corresponding to the premiums attached to those skills that are represented by the explanatory variables. Specifically, adjusted[22] least squares analysis was performed on the two sets of grouped data (1966 and 1976, respectively), and the results are given in Table III.[23] As the table shows, for both years, real wages[24] of the workers could be accounted for by the dummy variables, *D-City* (equals one if the worker resides in the cities[25]), *D-Male* (equals one if the worker is a male), *D-Age 25–44* (equals one if the worker's age is between 25 and 44) and *D-Age 45+* (equals one if the worker's age is 45 or older[26]), and by the quantitative variable *Edu* (years of schooling).[27]

[22] Adjusted for heteroskedasticity; see, e.g., the analysis in Kmenta (1986, pp. 366–73).

[23] For 1976, data compiled included the wage income (employees' compensation) of individual income-recipients (persons earning non-trivial income, see the DGBAS, *Survey Handbook*, 1993 for a formal definition; but those whose wage income was zero were excluded).

[24] Defined as the average real wage rate of a group of workers. For 1966 it was calculated in NT$10,000. For 1976, a Laspeyres' index of wage increase was computed based on a basket of groups of workers using the average group size between 1966 and 1976 as weights, and since all the average wage rates were deflated by the index, the 1976 wage rates were expressed by the 1966 "prices" of wages.

[25] In 1966 "city" was defined as a basic administrative unit with a population of more than 40,000 and density of more than 2,000 persons per square kilometer, that satisfied a set of standards of minimum relative importance of industry and services in the economic activities. In 1977, the population criterion changed to more than 30,000 people while that for economic activities was tightened. See the DGBAS report (ROC, DGBAS 1964, 1976) for details.

[26] The use of the two age dummy variables indicates that the default group consists of workers less than twenty-five years of age. It is also worth noting that if workers are further classified into those aged forty-five to fifty-nine years and those aged sixty and above, the coefficients of the dummy for the eldest workers are no longer significantly different from zero. So these two groups were combined into one.

[27] Specifically, the regression can be written as $W = a_0 + a_1(D\text{-}City) + a_2 Edu + a_3(D\text{-}Male) + a_4(D\text{-}Age\ 24\text{–}44) + a_5(D\text{-}Age\ 45+) + Err$. It is worth noting that when the data of the two years were

TABLE III

REGRESSION ANALYSIS OF WORKERS' WAGE RATES IN TAIWAN, 1966 AND 1976

	1966			1976		
	Mean	Regression		Mean	Regression	
		Coefficient	Standard Deviation		Coefficient	Standard Deviation
Constant		–1.204*	0.193		–0.306*	0.085
D-City	0.273	0.804*	0.131	0.447	0.458*	0.060
Edu (in years)	7.490	0.195*	0.021	8.501	0.091*	0.007
D-Male	0.741	0.489*	0.137	0.713	0.505*	0.066
D-Age 25–44	0.538	0.480*	0.144	0.501	0.609*	0.071
D-Age 45+	0.215	0.648*	0.176	0.244	0.807*	0.085
Adj. R^2		0.926			0.938	
No. of non-empty groups		53			78	
No. of workers		2,777			11,757	

Note: The dependent variable is the real wage.
* Significant at 5 per cent level.

The inequality of the wage rates can then be decomposed according to the method described in Shorrocks (1982):

$$CV(W) = \sum_{i=1,\ldots,5} [(a_i/Avg(W)) \cdot Avg(X_i) \cdot p(W, X_i) \cdot CV(X_i)] + Cov(W, Err)/Var(W)^{1/2}, \quad (1)$$

where *CV* is the coefficient of variation, *W* is the real wage, the dependent variable, a_i is the regression coefficient of X_i, $Avg(X_i)$ is the mean value of X_i, $i = 1, \ldots, 5$, p is the Pearson correlation coefficient, *Cov* is the covariance, *Var* is the variance, *Err* is the error term in regression, and $X_1 = D\text{-}City$, $X_2 = Edu$, $X_3 = D\text{-}Male$, $X_4 = D\text{-}Age\ 25\text{–}44$, $X_5 = D\text{-}Age\ 45+$. Values of the six terms on the right-hand side of the equation (1) for the two years are given in columns (1) and (2) of Table IV. The table shows that the number of years of education was the variable accounting for the largest part of the inequality in both 1966 and 1976 (42.20 and 32.91 per cent, respectively). The dummies for age together accounted for the second (third) most important part in 1976 (1966), the sum of contributions being 23 (11) per cent. The dummy variable for the place of work was the second (third) most important variable for 1966 (1976). The importance of the gender dummy is the last in the row.

pooled and a test was performed to determine whether the differences in the coefficients of the explanatory variables were significant between the two years, it was found that the differences in all the coefficients were significantly different from zero at the 5 per cent level. It is also worth noting here that it may be desirable to consider the differences in earnings across industries (see, e.g., the interesting study by Bishop, Formby, and Thistle 1991) in addition to the variables chosen here; the 1966 data, however, did not permit the inclusion of that variable.

TABLE IV

DECOMPOSITION OF INEQUALITY OF REAL WAGES AMONG GROUPS OF WORKERS IN TAIWAN, 1966 AND 1976

			1966–1976					
	1966	1976		Further Accounted for by Changes in $a_i/Avg(W)$[a]	Further Accounted for by Changes in $Avg(X_i)$	Further Accounted for by Changes in $p(W, X_i)$	Further Accounted for by Changes in $CV(X_i)$	Sum[b]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CV of *W*	0.7444	0.4659	–0.2785[c]					
Accounted for by:	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
X_1 = *D-City*[d]	19.50	17.25	23.25	140.02	–91.34	–14.80	71.58	105.46
X_2 = *Edu* (in years)	42.20	32.91	57.72	141.41	–19.68	22.53	–43.63	100.63
X_3 = *D-Male*	9.41	16.34	–2.19	–221.33	–47.19	282.44	86.54	100.46
X_4 = *D-Age 25–44*	3.76	9.00	–5.00	5.19	–17.81	94.20	18.55	100.13
X_5 = *D-Age 45+*	6.85	13.57	–4.39	1.31	60.44	77.70	–39.24	100.21
Err = Error term[e]	18.29	10.92	30.61					
Sum	100	100	100					

[a] Refers to the *fall* in $(a_i/Avg(W)) \cdot Avg(X_i) \cdot p(W, X_i) \cdot CV(X_i)$ further explained by changes in $a_i/Avg(W)$, where $i = 1, \ldots, 5$. The same applies to the rest of the row.

[b] Does not equal 100.0 due to nonlinearity error.

[c] Value of 1976 minus value of 1966.

[d] Refers to the *fall* in *CV* of *W* between the two years explained by the *D-City* variable. The same applies to the rest of the column.

[e] See text for the definition of this term.

Taking the difference of equation (1), one obtains:

$$\mathrm{D}[CV(W)] = \sum_{i=1,\ldots,5} \mathrm{D}[(a_i/Avg(W)) \cdot Avg(X_i) \cdot p(W, X_i) \cdot CV(X_i)] + \mathrm{D}[Cov(W, Err) / Var(W)^{1/2}], \quad (2)$$

where D is the difference operator. Therefore, the change in the inequality of real wage between the two years was decomposed into the factors on the right-hand side. The percentage "contributions" of the various factors are given in column (3) of Table IV, showing that of the fall in the *CV* of *W* from 1966 to 1976, 57.72 per cent could be accounted for by the variable related to *Edu*, or $[(a_2/Avg(W)) \cdot Avg(X_2) \cdot p(W, X_2) \cdot CV(X_2)]$. Moreover, when further explored, the most important factor "contributing" to the fall in this item was the fall in the regression coefficient (deflated by the average real wage) in equation (1). That is, the fact that wage disparities (represented by their different premiums) between workers with different education levels (other things being equal) narrowed between 1966 and 1976, was the most important factor accounting for the changes in the *Edu* variable, which in turn, accounted for the largest part of the fall in inequality between 1966 and 1976.

Table III shows that in 1966, an additional year of education was able to raise the

worker's wage rate by 0.195 units (of NT$10,000), but that this premium shrank to 0.091 (measured in real wage rates of the same unit) in 1976. When these coefficients were deflated by the average real wage in the two years, the decrease was even larger: from 0.158 to 0.059.

The next section will analyze the factors in the labor market that were assumed to control the observed changes in the premium structure.

III. DEMAND AND SUPPLY FACTORS

The above analysis clearly indicated that wage premiums attached to the workers' education, age, gender, and place of work could account for a large part of the observed wage inequality in both 1966 and 1976, respectively, and that the shrinking wage premium attached to education (additional market price paid for additional years of education) could account for the largest part of the observed fall in wage inequality between these two years. In this section, an attempt will be made to explain these facts.

According to Katz and Murphy (1992) and Murphy and Welch (1992), we argue that wage disparities, which reflected the additional market prices paid for skills, were determined by demand and supply factors. To simplify the analysis, and according to Katz and Murphy (1992), we grouped workers with different individual characteristics into only two broad skill categories. We then attempted to determine why the relative wage rate between the two categories of workers narrowed between 1966 and 1976. Let us then designate the category of workers with relatively low skills (to be defined) as "group 1." and the other as "group 2." The task is now to analyze why relative wages between groups 1 and 2 narrowed between 1966 and 1976.

Because data about individual workers were limited for 1966, as explained earlier, and almost nonexistent for the years between 1966 and 1975, it was impossible to solve the problem by relying on the 1966 and 1976 data, because only two observations were made. The post-1976 data had to be used. In what follows, we will carry out the analysis by using the 1976–96 data, in such a way that the possible structural changes during this period are accounted for. We will then use the results to decompose the changes in wage inequality between 1966 and 1976, which is the primary objective of the study.

Let us now define the skill categories. In Katz-Murphy's report, the two skill categories, on the basis of which the relative wage disparity was defined, were divided according to the level of education (college vs. high school) alone. In this paper, the two categories were defined based on both education and age (primary school and under twenty-four years of age vs. the others).

Such a categorization was based on the following considerations:

(i) The reason for choosing education was obvious, given its strong effect in

both the separate 1966 and 1976 decompositions as well as in the analysis of changes in wage inequality between the two years given above. To decide which level of education should be the dividing line, different levels were examined to determine whether the change in wage disparity between 1966 and 1976 was substantial and correspond to the overall change in wage inequality. It was found that the dividing line should be primary school or less versus all others. It is worth noting here that in Chan, Chen, and Hu (1999), which investigated the demand and supply factors in wage dispersion from 1978 to 1995, education was also used as a means to differentiate skilled from unskilled workers. However, their dividing line was, not surprisingly, given the improvement in education over the years, defined on the basis of senior high school.[28]

(ii) The age factor was important in the separate decomposition of wage inequality for both 1966 and 1976, and we decided to incorporate it into the categorization. Although it was a significant factor in the analysis of the changes in wage inequality between the two years, we still decided to take account of it because in the current two-category analysis, it was essential to let group 1 represent the "low-skilled" group unambiguously. In the course of Taiwan's development, many people initially with a lower education level gradually moved up their career ladders and became business executives when they reached their fifties and sixties. Because the analysis below will use data covering a long period of time (1976–96), to use education as the sole dividing line would involve the risk of including a large number of middle-aged or older business executives with primary or lower education in the "low-skilled" category, especially for Taiwan where small- and medium-sized enterprises have been prevalent. To avoid such a risk, we defined group 1 as the people with primary or less education and between fifteen and twenty-four years of age.[29]

(iii) It is also possible to include the gender factor, as it somewhat plays an important role in the decomposition of both earning regressions for individual years and of changes in inequality. However, to define one category as young (twenty-four or below), female workers with a low level of education (primary school or less), and another category for the others would have resulted in reducing the size of the first category. And between age and gender, the regressions for both 1966 and 1976 clearly indicate that the age factor was more important.

(iv) It is also possible to include the place of work (city versus others). But unfortunately the official definition of "cities" had changed over time in Taiwan (as in many other rapidly developing countries). It would therefore be very difficult to interpret the results, if this variable were to be included. Moreover, if both the place

[28] In their paper, skilled labor is defined as the persons with college or higher education, while unskilled labor is defined as those with junior high school or lower education.

[29] In addition, micro-studies such as Harrell's (1982) accounts of the rise of Taiwan's labor-intensive industries indicated that fall in the wage disparity between young, entry-level workers and the others was instrumental in bringing down inequality.

of work and age were included, the two categories would once again have markedly unbalanced sizes.

The demand and supply model to be used will now be introduced.

Katz and Murphy (1992) assumed that producers adopted a CES production function with the above-mentioned two categories of workers as the two inputs. Under that assumption, they argued that it is possible to express relative wages as follows:

$$\ln(w_1(t)/w_2(t)) = (1/\sigma)[DD(\mathrm{t}) - \ln(x_1(t)/x_2(t))], \tag{3}$$

where σ is the elasticity of substitution between the two inputs, $w_1(t)$ and $w_2(t)$ are the average wage rate of group 1 (low-skilled) and 2 (high-skilled) respectively. $DD(t)$ is the time series of relative demand changes (in favor of low-skilled workers), and $x_1(t)$ and $x_2(t)$ are those of the quantities of the low- and high-skilled workers, respectively. They then assumed that $DD(t)$ is a linear function of time, and ran a regression estimate of the coefficients in equation (3). The assumption was that $x_1(t)/x_2(t)$ or the relative supply was exogenous to the model.[30]

A more general approach is not to assume that $x_1(t)/x_2(t)$ is exogenous, and express the reduced form of a simultaneous equation system determining the relative wages[31] as follows:

$$w_1(t)/w_2(t) = f(DD(t),\ Z(t)), \tag{4}$$

where DD and Z are the demand and supply changes exogenous to the system. The relevant variables reflecting exogenous changes which are representative of the actual economic situation in Taiwan during 1966–96 should be selected.

Let us consider the exogenous changes on the supply side first. In our analysis, $Z(t)$ was represented by the number of people aged fifteen to sixty-four with primary school or lower education level (referred to as "z_1") divided by that of the other potential labor force (referred to as "z_2").[32] Compared with x_1 and x_2, which Katz and Murphy used, the use of z_1 and z_2 has an obvious advantage in that it would be easier to argue that these variables are exogenous to the demand-supply system determining the relative wage rate in the current market. Because x_1 and x_2 actually correspond to the equilibrium quantities in the labor market, they themselves should be endogenous, and the direct estimation of equation (3) may involve

[30] They noted on p. 46 that their framework corresponded to a "partial equilibrium" in that they did not specify the determinants of relative factor supplies; they required that observed prices and quantities should be "on the demand curve."

[31] In the case of two inputs, the Walrasian law requires that the clearance of the demand and supply in one input market should automatically assure the clearance in the other market. Therefore, one of the prices could always be selected as a numeraire and attention could always be focused on one market alone.

[32] The definition implicitly assumes that the dependent variable in equation (4) is homogeneous of degree zero in z_1 and z_2. The data for (z_1/z_2) and (w_1/w_2) were computed from the Household Income and Expenditure survey data (DGBAS) stored on magnetic tapes.

a simultaneous equation bias.[33] The variables z_1 and z_2, on the other hand, represent what the potential-labor-force population is already endowed with; they are predetermined before the labor market operates in any period of time. Consequently, it seems reasonable to use them as supply changes exogenous to the current labor market for skills (represented by the level of education and age in our case).[34]

As for the exogenous changes on the demand side, export is an obvious choice. Taiwan's exports had largely been driven by low-skilled labor until very recently. Numerous authors have pointed the importance of exports in shaping Taiwan's income inequality, as indicated above, while recently some authors have begun to establish a direct statistical link between exports and income inequality.[35] Some of these recent analyses use the ratio of total exports to GDP, while others differentiate exports by their destinations. In the current analysis, in order to ensure as much as possible that the variable chosen to reflect exogenous changes in the demand represents the *labor-intensive* part of exports, we used the ratio of non-heavy-chemical[36] exports to GDP,[37] which may be as much close to labor-intensive exports as we can get.[38]

In summary, equation (4) in its testable form can be written as:

$$\ln(w_1/w_2) = b_0 + b_1 \cdot \ln(z_1/z_2) + b_2 \cdot \ln(nhce/gdp) + Error, \qquad (5)$$

[33] We thank an anonymous referee for pointing this out.

[34] There is a body of literature dealing with the choice of college enrollment, which is often considered to be dependent upon the expected wages in the future. But this is not inconsistent with the statement in the text that by the time the individuals had completed their chosen education, the level of education was already "predetermined" as far as the then current labor market was concerned. Moreover, several other aspects are worth mentioning: (i) In the current analysis, the dividing line was primary education, which is part of compulsory education; the next higher level was junior high school, which became compulsory in 1968 in Taiwan. Therefore, the changes in z_1/z_2 during 1976–96 should reflect more the shift in the age structure of population as well as the change in education policy, and should have much less to do with expected future wages. (ii) In Taiwan, the willingness to receive higher education is not equivalent to actual attainment, because access to higher education is limited (especially in the earlier period, which is more relevant to the current analysis), and is allocated according to the results obtained in strict entrance examinations. Therefore, individual choice would play a lesser role than the ability to do so. (iii) In the status attainment models and the parent consumption models, among others, variables such as the cost of education and the education attainment of the parents are more relevant than the expected future wages.

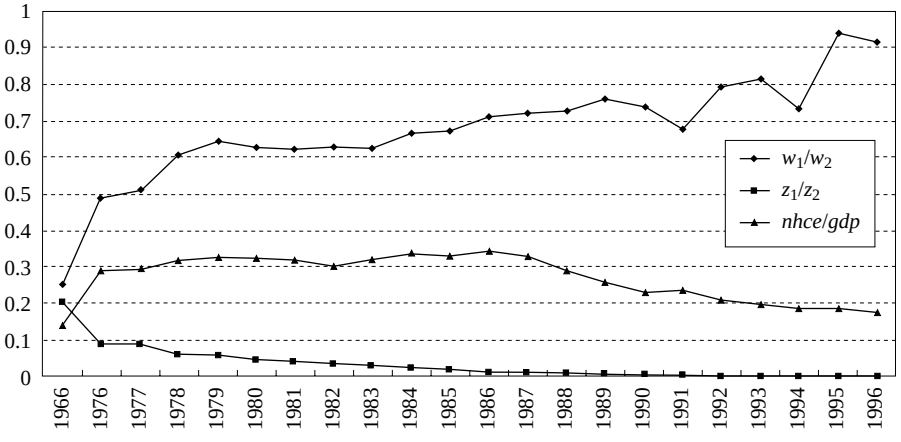
[35] See Chan, Chen, and Hu (1999) and Chen and Hsu (2001).

[36] The "non-heavy-chemical exports" and "heavy-chemical exports" are defined by the Ministry of Finance. Basically, the former includes such products as food processing, beverages, garments, textiles, paper products, wood products, plastics and other nonmetal products, and metal products (four-digit classification). These are predominantly labor-intensive consumers' commodities produced with low-cost labor. The latter (the other exports) corresponds mostly to producer's goods.

[37] Data were supplied by the Ministry of Finance.

[38] A classification of exports according to factor intensity was reported in the *Taiwan Statistical Data Book*, published by the CEPD (Council for Economic Planning and Development), but unfortunately since the time series began in 1982, the data could not be used for our analysis.

Fig. 1. Relative Wages and the Related Supply and Demand Factors in Taiwan



where *nhce*/*gdp* is the ratio of non-heavy-chemical exports to GDP. The time series of the dependent and two explanatory variables are given in Figure 1. The 1966 data are presented in the figure for reference but not used in the regression. The figure shows that clearly the relative wage disparity or w_1/w_2 displayed a decisively upward trend until 1989, after which it fluctuated. The exogenous variable on the supply side or z_1/z_2 displayed a decisively downward trend throughout the 1976–96 period as expected. The exogenous variable on the demand side or *nhce*/*gdp* moved upward from 1976 to 1986, slightly fell in 1987, and then fell decisively after 1988.

The problem of possible structural change may arise if we directly estimated equation (5) using the 1976–96 data. Taiwan's economic structure underwent important changes during these two decades. Of the most dramatic was the change occurring during the 1987–88 period, when Taiwan's currency appreciated sharply against the dollar, causing many previously labor-intensive export firms to lose their competitiveness in the global market, as is already evident in the time series of *nhce*/*gdp* shown in Figure 1. In addition, according to a set of officially reported statistics, the high technology contents in Taiwan's exports had remained stable between 1982 (the first year for which data were available) and 1987, but rose decisively afterwards.[39]

[39] See the aforementioned *Taiwan Statistical Data Book*, published by the CEPD. It is worth noting here that our definition of non-heavy-chemical exports was based on a basket of four-digit-classified commodities, as indicated earlier, so that it had already captured the changes in the export factor-intensity that can be reflected in the changes in commodity composition so defined. However, it is quite possible that for the same four-digit product, the method of production changed over time, particularly after 1987–88. Therefore, the consideration of possible structural change is still warranted.

For this reason, in the actual estimation of equation (5), two alternative approaches, which resulted in the construction of two different models, were used. In the first alternative, the data of 1976–96 were used in the estimation of equation (5), but we included three dummy-variable-related explanatory variables (the dummy variable, *D*, equals unity from 1987 onward and zero otherwise), each pertaining to the original three explanatory variables (including the constant term), and then removed one dummy-variable-related term which was found to be insignificant. As a result, an equation with five explanatory variables, two dummy-variable-related variables in addition to the original three explanatory variables, could be derived and is reported in Table V as "Model A."

In the second approach, we considered a priori that structural change occurred during the period 1987–88, that was sufficiently severe not to warrant the inclusion of the 1988–96 data at all. Therefore, we ran a regression of equation (5) using only the 1976–87 data. The results are given in Table V as "Model B."[40]

In Model A, all of the reported coefficients of the variables indicating exogenous changes in the demand and supply were significant. In Model B, the coefficient of the supply-related variable is significant at the 5 per cent level, while that of the demand-related variable is significant at the 10 per cent level. The variable indicating exogenous changes in the supply (relative number of people in potential labor force) had the expected negative signs in both models, while the variable indicating exogenous changes in the demand (ratio of non-heavy-chemical exports to GDP) had the expected positive signs also in both models. The constant-term dummy (*D*) for post-1987 was negative, reflecting a once-for-all change that was unfavorable to the relative wage of the unskilled workers versus the skilled workers (the dependent variable), which was somewhat modified[41] by the negative coefficient of the $D \cdot \ln(z_1/z_2)$ variable in Model A. The former was expected, as there were widespread efforts to utilize more technology- and capital-intensive modes of production in Taiwan after 1987–88. The latter most likely reflected the fact that the changes in the "quality" of z_1 and z_2 had reached such a level after 1987 that the original supply shift strength of $\ln(z_1/z_2)$, as reflected in the coefficient of –0.0842, should be strengthened. The suspected quality change was most likely related to the age structure: by the 1980s, since Taiwan had witnessed the emergence of a shrinking population growth rate and the related shrinking size of very young cohorts, the representation of the very young cohorts inside z_1 would have been much less conspicuous than before, resulting in the fact that the overall quality of z_1 became higher as distribu-

[40] The estimation of Model A was performed by the ordinary least squares method; the Durbin-Watson and White tests indicated that the null hypotheses of the absence of autocorrelation and heteroskedasticity, respectively could not be rejected. Model B was estimated by using the Cochrane-Orcutt iterative procedure to purge the first-order autocorrelation ($d.w. = 1.9944$ after the adjustment). Its White test similarly indicated the absence of heteroskedasticity.

[41] It is a modification because $\ln(z_1/z_2)$ showed a downward trend and therefore its effect on the dependent variable was positive, given its negative coefficient.

TABLE V

REGRESSION ANALYSIS OF WAGE DISPARITY IN TAIWAN

	Constant Coef. (*t*-value)	$\ln(z_1/z_2)$ Coef. (*t*-value)	$\ln(nhce/gdp)$ Coef. (*t*-value)	*D* Coef. (*t*-value)	$D \cdot \ln(z_1/z_2)$ Coef. (*t*-value)	Adj. R^2	*d.w.*	White's Chi-Square
Model A (1976–96)	0.4690 (0.8012)	–0.0842 (–2.0770**)	1.0734 (2.5271***)	–1.3449 (–2.1367***)	–0.3066 (–2.0688**)	0.8500	2.2251	11.0728
Model B (1976–87)	–0.0168 (–0.0388)	–0.085 (–2.5835***)	0.6323 (1.9089*)			0.8418	C-O (AR1) adjusted#	4.6188

* Significant at 10 per cent level.
** Significant at 6 per cent level.
*** Significant at 5 per cent level.
# Adjusted for autocorrelation (first-order) using the Cochrane-Orcutt method. See the related footnote in the text.

tion was tilted towards the higher-age people (closer to twenty-four years of age). Therefore, the (negative) supply shift effect was enhanced.

After obtaining the estimated equations, we returned to the period of 1966–76, which is of the greatest concern to us. Since the low-skilled labor-intensive products as a percentage of Taiwan's exports had remained quite stable before 1987, as indicated above, we considered that it would be possible to assume that the demand and supply factors determining the relative wage had remained the same as those in equation (5) for the 1966–76 period. Besides, it can be shown that, by subjecting the w_1/w_2 1976–96 series to a back test using ARMA, the 1966 value fell within the 95 per cent confidence interval. Therefore, we decided to apply the results in Table V to a decomposition of the changes in wage inequality between 1966 and 1976.

The results are presented in Table VI, for both Models A and B. They clearly showed that for Model A, the effect of the changes in the exogenous demand was overwhelmingly dominant in the explanation of the changes in the relative wage between 1966 and 1976 while the effect of the changes in the exogenous supply was much less conspicuous.[42] In Model B, the former effect was reduced to about 70 per cent, while the effect on the supply side remained negligible. The overall impression from Table VI is that the demand effect, represented by the ratio of non-heavy-chemical exports to GDP, had been instrumental in bringing down the wage disparity between young workers with a low level of education, and the others from 1966 to 1976.[43]

[42] In Chan, Chen, and Hu (1999)'s paper, which, as indicated earlier, investigated wage inequality during the 1978–95 period, the supply factor accounted for 2 percentage points of the total drop in wage disparity of 18 percentage points (p. 271). In addition, their paper seemed to endorse the concept that exports are skill-intensive and the fall in *net* exports contributed to the fall in inequality during the 1978–95 period. This is rather different from the findings in this paper showing that the *rise* in non-heavy-chemical exports contributed to the fall in inequality during the 1966–76 period, because exports were unskilled-labor intensive. Given that their coverage of time period and their source of data differ from ours, these different results were not surprising. Nevertheless, it is worth noting that their Table 10.3 (column 10.7) clearly shows that the export-to-GDP ratio failed to generate a significant effect on wage disparity for 1987–95, the period during which the fall in disparity was much larger compared with the earlier subperiod (see their Figure 10.2), and the rise in the proportion of skill-intensive exports in total exports began to emerge. It is also worth noting that the unskilled-labor contents of imports did not exceed the contents of exports until as late as the mid-1990s (their p. 273).

[43] There is no directly available figure of *nhce*/*gdp* for 1966, when the export classification was somewhat different. However, data from broader categories can be found and compared with the post-1976 ones, so that the ratio can be imputed with reasonable accuracy. Similarly, since the data for z_1/z_2 were not directly available for 1966 (but both x_1 and x_2 were available), they had to be imputed by using the trend of group-specific labor participation rates. We considered that both imputations were reasonably accurate, but to be cautious, a sensitivity analysis was performed where each and then both of the explanatory variables were given upward and downward 10 per cent adjustments. The results are not displayed here, but they showed that the decomposition results in Table VI were robust: for Model A, the contribution of the demand shifter was always dominant (between 91 and 133 per cent) and much larger than the error term; for Model B, similar results were obtained with the contribution of the demand shifter ranging from 59 to 78 per cent.

TABLE VI

DECOMPOSITION OF CHANGES IN WAGE DISPARITY BETWEEN 1966 AND 1976

	$\ln(w_1/w_2)$	b_0	$b_1 \cdot \ln(z_1/z_2)$	$b_2 \cdot \ln(nhce/gdp)$	*Error*
Model A					
1966	–1.3750	0.4690	0.1348	–2.0840	0.1053
1976	–0.7224	0.4690	0.2033	–1.3268	–0.0680
Difference	0.6525	0.0000	0.0685	0.7573	–0.1733
%	100.00[a]		10.5014	116.0553	–26.5567
Model B					
1966	–1.3750	–0.0168	0.1361	–1.2277	–0.2666
1976	–0.7224	–0.0168	0.2053	–0.7815	–0.1293
Difference	0.6525	0.0000	0.0692	0.4461	0.1372
%	100.00[a]		10.6015	68.3668	21.0316

[a] Actual sum may not be exactly 100.00 because of rounding.

This is a rather positive result, which is consistent with the assumption made earlier. Namely the rapid expansion of Taiwan's unskilled-labor-intensive exports from the mid-1960s to the mid-1970s, that rode on the wave of the booming world market for labor-intensive manufactured products, was the major factor responsible for the narrowing of the wage disparity between unskilled workers (young workers with a low education level as proxies), and the skilled ones.

These results should be examined against the background of a rapidly growing population during the same period. The human investment in education was very large—many more people were subjected to compulsory education which was extended from the sixth to the ninth grade in 1968. However, the sharp rise in employment generated by labor-intensive export-driven manufacturing was even more important—without it, there would probably have been substantial un- or underemployment, given the sharp increase in the working age population. What actually happened was that not only unemployment was negligible, according to many studies, but the phase of labor surplus was reported to have ended in Taiwan around 1968, which is considered to be the "turning point" from labor surplus to scarcity.[44] As can be expected, when the demand was derived from the labor-intensive industries which depended on relatively low-skilled, inexpensive labor for mass production of lower-technology, standardized products, and when it was so strong as to cause labor scarcity, not only did the average wage rate rise, but that of the lower-end workers rose even faster.[45] The latter, in turn, was the most important factor

[44] See, e.g., Fei, Ranis, and Kuo (1979, Chap. 1), Kuo, Ranis, and Fei (1981, pp. 12–21), Thorebecke (1979), and Hsu (1994, pp. 244–46).

[45] As the demand for low-skilled labor was the demand derived from labor-intensive exports, the phenomenon is consistent with the prediction of the well-known Stolper-Samuelson theorem. For a good anthropological study which observed a similar trend in one of the villages on the outskirts of Taipei basin, see Harrell (1982, Table 6). See also the statistics given in Galenson (1979, pp. 416–19).

contributing to the narrowing of the inequality between rich and poor households, as explained earlier.

Here one also sees the subtle relationship between growth and equality. During the 1964–80 period in Taiwan, both growth and equality were the results of one specific pattern of economic development: the massive use of an abundant resource. For Taiwan, that abundant, inexpensive resource was lower-level labor. What kinds of households supplied relatively more of such labor? The lower-income ones, almost by definition. That is, households had a lower income because the level of the labor which they supplied was relatively lower. Therefore, mass employment of low-level labor led to a lower inequality. In other words, *factors that were favorable to growth were also favorable to equality*.

The question of accessibility should have been important, as in the earlier periods. The labor market was fairly free and open and easy access in terms of both transportation (for commuters) and accommodation (for non-commuters) was important (see, e.g., Little [1979]).

Although larger enterprises became more prominent during the period, small- and medium-sized enterprises (SMEs) were still active.[46] With the state still controlling most of the key industries and services, the continuing strength of the SMEs resulted in the avoidance of too much concentration of private capital. This might explain the observation that concentration of property income among households not only did not increase but fell during the 1968–72 period (Fei, Ranis, and Kuo 1979, Table 3.2). This factor contributed 28 per cent to the overall fall in the Gini coefficient of income among households during the 1968–72 period (Fei, Ranis, and Kuo 1979, Table 3.5).

Here again, an interesting relationship might have existed between equality and growth. With low inequality and rising income, the majority of the households had accumulated some savings. With the capital market being quite imperfect, as it is in most of the developing countries, the availability of private savings within a large segment of the population would have been an important factor conducive to the emergence of a large number of entrepreneurs operating the SMEs dispersed throughout Taiwan. That in turn may have been favorable to a more efficient use of the abundant resource, labor. Consequently, growth accelerated.[47]

[46] According to the DGBAS's *Industry and Commerce Census*, in 1961, among the 51,567 manufacturing enterprises, 89.49 per cent employed less than ten workers and employment at enterprises with less than fifty workers amounted to 51.19 per cent of the total. See Ho (1978, p. 378). The role of SMEs was also emphasized in the World Bank discussion on the East Asian "institutional basis for shared growth." There it was pointed out that by as late as 1992, Taiwan's SMEs accounted for 60.49 per cent of all the manufactured exports (World Bank 1993, p. 162).

[47] In addition, in Taiwan, the individual SMEs did not act alone. For many industries in manufacturing, there had been a network of cooperation/subcontracting among the SMEs and between the SMEs and the larger enterprises. The lowest end of the network for some products was represented by the households that did simple processing work at home, referred to as the "putting-out" system.

IV. SUMMARY AND CONCLUSION

Taiwan's inequality of household income had been low during the past four decades compared with other countries. In the 1950s and early 1960s, it either declined or remained low. During the 1964–80 period, it decreased further decisively. In the 1980s and early 1990s, although inequality among households rose, that among individual income-recipients did not change appreciably, and the level of inequality of household income per se was still low by international standards.

In summary, the basic situation of the past four decades (from the 1950s to the 1980s) seems to have been characterized by fast growth and low or shrinking inequality. The significant drop in inequality of income occurred between the mid-1960s and mid-1970s, when Taiwan's exports began to increase rapidly. Similar forces are assumed to have been operating for other Asian economies as well. As shown in the Introduction, the periods when income inequalities in these economies appeared to have been shrinking coincided with the periods when their labor-intensive exports soared.

To test statistically whether there was really such a link, a decomposition/regression analysis was performed. The analysis was focused on wage inequality. And to avoid the problem of changes in household size, the inequality of wage among individual workers/income-recipients rather than among households was the variable selected for the analysis. It has been shown that such a wage inequality among workers (categorized by rather detailed groups, for which data were available in 1966) can be accounted for by the different premiums paid for the different dimensions of their individual characteristics, which were proxies for skills in both 1966 and 1976. The premiums paid for all four types of individual characteristics considered were significant, but those attached to education and to age were especially important. In addition, the fall in wage inequality between 1966 and 1976 was largely due to the fall in the disparity among the premiums attached to different levels of education, other things being equal.

To determine why the ramifications of premiums (market prices paid for skills) changed, a supply and demand model was constructed. Skills were simplified into two levels, and defined based on both education and age, the choice of which resulted from the above decomposition results for 1966 and 1976 (and the changes between the two years). Therefore, the dependent variable was represented by the relative wage disparity between the wage rates paid to young workers with a low education level and the others. The variable selected for exogenous changes in the supply was the ratio of the number of low-skilled people in the potential labor force

As a mixture of market and nonmarket organization, the system was very effective in absorbing surplus labor. For studies relating the issues, see, e.g., Harrell (1982).

to that of the others. The variable chosen to reflect exogenous changes in the demand was the ratio of non-heavy-chemical exports to GDP, which would be representative of the extent to which the economy was involved in low-skilled labor-intensive manufacturing. Regression analysis of the model yielded reasonably good results. When these results were plugged into a calculation of how wage disparity shrank between 1966 and 1976, the period of primary concern to us because it correspond to the time when household inequality unambiguously fell, it was found that exogenous changes in the demand had been instrumental in bringing down inequality. That is, during the period of rapid expansion of low-skilled labor-intensive exports, the demand for all types of labor rose fast, whereas the demand for low-skilled (young workers with a low education level being proxies) labor rose faster than that for the other types. Consequently, while the average wage rate rose, that of the young workers with a low education level rose faster, resulting in a narrowing of wage disparities.

In the literature, it is generally considered that there is a trade-off between growth and equality at the early stages of development.[48] Various reasons had been given. In one rather mechanical explanation, it was suggested that in a modern sector with a high average income and a traditional sector with a low average income, inequality first rises then falls as people move from the traditional to the modern sector (e.g., Robinson 1976; Knight 1976; Fields 1980; and Anand and Kanbur 1993). Such an effect, if important, would have been substantial in the inter-sectoral component of the group-wise decomposition of inequality previously described for the period of 1964–72 in Taiwan. But that component was negligible.

Some authors have used the changes in functional distribution to explain the process. In the classical (unlimited supply of labor) model of Bell (1979), disparity between capital income on the one hand, and labor and agricultural income combined on the other hand, rose when per capita capital increased during the process of growth; in the neoclassical model of Bell's paper, the disparity also had to rise at the initial stages of growth.[49] Observation of the changes in Taiwan's factor shares does not reveal the indicated trends.

Still other authors had attempted to explain the initial trade-off by the structure of segmented labor markets, migration, and unemployment. It is doubtful that the explanation could have been applicable to the case of Taiwan where labor markets have not been known to be segmented, nor was there serious unemployment.

[48] The argument initially put forward by Kuznets (1955), known as the inverted-U hypothesis, has been thoroughly tested and discussed. See, e.g., Adelman and Morris (1973), Paukert (1973), Ahluwalia (1976), Ahluwalia, Carter, and Chenery (1979), Loehr (1981), Saith (1983) and Anand and Kanbur (1993). See also, e.g., Ikemoto (1991, pp. 26–29) and Oshima (1992) for discussion of the Asian situation.

[49] In the single-sector, two-class neoclassical model of Chu's (1986), it was shown that changes in inequality may follow a variety of patterns, depending on the initial conditions and the value of elasticity of substitution.

This is not to say that the above discussion had confirmed the absence of trade-off in Taiwan at the early stages of its development. It is hard enough to determine which periods in the history of Taiwan's development belonged to the "early stages," because agricultural development and some industrial development had started in the prewar colonial period. But at least such trade-off was not obvious for the post-war era of rapid industrialization; even if it had existed, it would have been too short or too mild to be clearly and persistently detectable.[50]

The specific initial conditions and developments, which kept Taiwan off the obvious trade-off, were presented above. It is not a simple story. But if one were forced to emphasize one major factor in this process, popular participation definitely played a large role: as farmers in agricultural development, and as entrepreneurs and workers in industrial development. As a result, the most abundant and least expensive resource, low-skilled labor, was effectively mobilized, and finally became scarce. It is likely that the faster an economy reaches such a point, the faster and the farther it would distance itself from the inevitability of a trade-off between growth and equality.

[50] For the brevity of the period of rising inequality in Asia, see Oshima (1992, 1994).

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