Information Society and Inequality: Wage Polarization, Unemployment, and Occupation Transition in Taiwan since 1980

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Abstract:

This paper examines whether Taiwan's economic inequality has worsened as Taiwan has evolved into an information society and an economy concentrated on information and communications technology (ICT), a transformation underway since about 1980. We investigate three specific research questions: first, has there been a rise in wage inequality in Taiwan since 1980; and if so, what are the sources of this rise in inequality? Second, has the transition to an information economy contributed to a rise in unemployment rates? Third, what transformations of the occupational structure occurred during this transition? The paper shows that both economic inequality and unemployment have severely deteriorated in Taiwan since 1980. Further, the reasons seem closely related to the relative growth of information-intensive and ICT-relevant industries.

Key words: information society, wage inequality, ICT industries, information intensive industries, unemployment, occupational transformation

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Introduction

Researchers have often pointed out that the development of an information economy entails increasing economic inequality and polarization of social classes (Castells, 2004; Machin, 2003; Victor & Stephens, 1999). This paper seeks to identify these changes during the transition to an information economy in Taiwan.

Information economies are defined as those that highly stress the production, distribution, application, consumption, and trade of ICT products as well as information and knowledge itself (Dordick & Wang, 1993; Hearn, 2004; Machlup, 1962; Porat, 1977). Taiwan has been investing heavily in information and communications technology (ICT) since the late 1970s, to seize global opportunities and to counter competitive threats (Chou, 1998; Wang, 1999; Zhang & Wang, 1994). It is said to have entered the group of global information and high-tech economies soon after 1980 (Ho & Lo, 2002; Lin, 2004; Tsai, 2005).

This paper focuses on labor market transformation issues regarding inequality in

Taiwan since 1980. Three main questions are stressed. First, was there a rise in wage inequality? If so, what initiated the increase? Second, did unemployment rates go up in the transition to an information economy? And third, has any occupation structure transformation occurred, that can be traced to the transition? In short, by examining labor market variations, this paper will investigate whether and how the transformation to an information society has actually affected economic inequality in Taiwan.

The Information Economy of Taiwan

According to the Department of Industrial Technology, the Executive Yuan, R.O.C. (2006), the rate of automatic production in Taiwan was 75% in 2006 and the use of computers in all business sectors was 93.50% in 2004. In manufacturing, usage was 93.70%; in finance and insurance, 98.40%; in professional, scientific, and technical services, 97.40%; in transportation, storage, and communication, 91.1%; and in trade, 92.5%. The average percentage of Internet use in all sectors was 81.10% in 2004. In manufacturing, Internet use was 79.10%; in finance and insurance, 96.70%; in

professional, scientific, and technical services, 92.50%; in transportation, storage, and communication, 74.80%; and in trade, 78.90%. An analysis of corporate level data shows that 86.10% of all companies were connected to the Internet. For large enterprises (more than 30 employees), the connection rate was 96.20%; for mid-size enterprises (between 5 to 30 employees), 85.60%; and for small enterprises (less than 5 employees), 76.50%. As for company websites, 35.7% of all companies have had their own websites. The percentage among large enterprises has reached 70%. Furthermore, by 2004, 12.2% of all companies had adopted online purchasing, and 7.6% of them now provide online selling.

According to the 2007 Information Technology Industry Competitiveness Index of the Economist Intelligence Unit (EIU) (2007), Taiwan's overall scores rank it 6th in the world for IT competitiveness. Taiwan's IT labor productivity ranks 1st, IT research and development environment, 3rd; IT human capital, 7th; broadband penetration, 8th; and governmental support for IT industry development, 18th. Another important indicator, the World Economic Forum's (2007) Networked Readiness Index 2007, ranks Taiwan 13th in the world, one place behind Hong Kong but one place before

Japan, and three places before Germany. Similarly, on the International Telecommunication Union's (ITU) "Digital Opportunity Index" (DOI) (as cited in "Telecommunications statistics," 2007) in 2005, Taiwan ranked 6th in the world; and in ITU's 2004 "Digital Access Index" (DAI), Taiwan ranked 9th. According to the ITU data (as cited in "Telecommunications statistics," 2007), Taiwan scores high across the board on all measures of the deployment of ICTs. Taiwan's global rankings for ICT service penetration rate in 2003 were as follows: mobile telephony, 2nd; Internet access, 5th; broadband access, 5th; and local telephony, 17th. Taiwan places in the top two or three NICs for the extent of informationalization and compares very favorably to even very high income countries. Taiwan's penetration rates of mobile, Internet, broadband, and local phone services are all higher than the averages for developed countries. In 2003, Taiwan had a mobile telephony penetration rate of 110.99%, while the average for developed countries was 71.03%. The comparable numbers for the other categories were as follows: Internet access, 34.56% and 24.51%; broadband access, 13.35% and 8.80%; and local telephony, 59.08% and 56.36% (as cited in "Telecommunications statistics," 2007). As measured by the penetration of ICTs and by information economy indexes, Taiwan has clearly made the transition to

an information economy. The penetration of ICTs is broad across the economy and deep within most industries and corporations.

The Information Economy and Labor in Taiwan

According to a 2005 survey of the Directorate-General of Budget, Accounting and Statistics, Executive Yuan, R.O.C. (DGBAS) (2005), the average percentage of workers' use of computers at work in Taiwan was 75.6%. The highest use rate was for professional workers (93.60%), and the second and third highest were for clerks (91.40%) and managers (83.8%). Among service workers, 54.8% used computers. Workers in agriculture, forestry, and fishing had the lowest rate (25.10%); and the second lowest ranking was held by elementary workers and machine operators (37.40% and 37.60%, respectively). If we analyze these data by industry, public administration was the highest, with a usage percentage of 95.80%; and finance and insurance was second with a rate of 95.20%. The lowest rate was in the field of agriculture, forestry, and fishing, at 32.90%; and the field of accommodation and eating had the second lowest rate, 41.40%.

If we analyze computer use rate at work by monthly income, there is a positive relationship; that is to say, the higher the income, the higher the rate of computer use at work. A correlation reveals that income level and computer use were significantly related, with r =+0.935, n=10,177, p<.01, two tails. The only exception was the group with the highest income (monthly income>$3030) whose computer use rate (83.20%) was lower than that of the second highest income group (monthly income between $2424 and $3030), whose computer use rate was the highest (90.10%). The lowest use rate was found in the group with the lowest monthly income (<$480), whose average rate was 49.80%.

The rates for Internet use at work were quite similar to those for computer use. The average rate of use for all workers was 59.50%. Professional workers and clerks remained the two groups with the highest rate of use (use rates of 79.10% and 73.90%, respectively). Agriculture, forestry, and fishing workers; machine operators; and elementary workers were again the groups with the lowest rate of use (with use rates of 14.00%, 15.30%, and 21.10%, respectively). Analyzing data by industry, we see that the three groups of public administration, finance and insurance, and education

are again the sectors with the greatest use of Internet at work, with Internet use rates of 83.20%, 81.20%, and 79.60%, respectively. Additionally, the two groups of agriculture, forestry and fishing; along with accommodation and eating were again the sectors with the lowest use rates, which were 23.10% and 26.20%, respectively. Analyzing by income, the results for Internet use were identical to those for general computer use: the higher the income, the greater the use of the Internet at work. A correlation for the data revealed that the level of income and Internet use were significantly related, with $r = +0.965$, $n=9,942$, $p<.01$, two tails. Again, the only exception was that the group with the second highest income had the highest use rate (79.00%), while the group with the highest income had the second highest rate.

Increasing Wage Inequality

Some studies have claimed that wage structures will be polarized as knowledge and technologies, especially microcomputers, raise the productivity of skilled workers relatively more than that of less skilled workers, shifting labor demand toward more skilled workers while boosting their wages (Autor, Levy, & Murnane, 2002; Krueger,

1993; Steelman & Weinberg, 2005). This school of thought claims that automation is most easily applied in the elimination of low-skill jobs; that the operation of new technology often requires more skill, and that cheapening labor is not the primary criterion in decisions to implement new technology (Attewell, 1987; Welch, 1970).

However, other scholars question whether the contribution of ICTs to changes in wage structure and increased economic inequality runs through increased demand for "skill" (Galbraith, 2000; Galbraith & Berner, 2001; Gittleman, 2003). In the case of the U.S., Galbraith (2000) argues that a causal association between computer usage and wage level is unclear, because the main income gainers were not those with the greatest increase in ICT use, and the timing of the increase in inequality and the introduction of computers did not match. Furthermore, the adoption of ICTs has not noticeably contributed to increased productivity. Galbraith points out that the causality may run from inequality to the use of computers, rather than the reverse.

What can we observe about Taiwan's wage trend since entering an information economy, from 1980 to the present day? This paper presents the calculation of a

single annual index of inequality in the wage structure, using the lower-bound, between-group estimate of Theil's T statistic. For a group structure, we use wage and employment data from the main employment sectors in Taiwan. Thus, the main sectors the paper calculates include manufacturing; mining and quarrying; electricity, gas and water; construction; trade; transportation and telecommunication; finance and insurance; real estate, rental and leasing; accommodation and food services; professional, science and technical services; health care; cultural, sporting and recreational services; and other services. Sectors such as agriculture are not included because they still belong to an unofficial employment sector in Taiwan and do not have wage and employment data. The raw data come from measures and survey data gathered by the Taiwanese government, mainly the Directorate-General of Budget, Accounting, and Statistics, Executive Yuan, Republic of China (GBAS).

The group-wise decomposability of Theil's T measure of inequality permits us to use these data to compute an estimate of the evolution of inequality in the wage structure over time. It produces a measure of changing relative wage dispersion that is weighted by the relative size of the working population in each of the underlying classes of

economic activity (Berner & Galbraith, 2001; Conceição & Ferreira, 2000; Ferguson & Galbraith, 2001).

Theil's Index of Income Inequality:

$$T = \sum_{j=1}^{m} Pj \log Rj + \sum_{j=1}^{m} PjRjTj$$

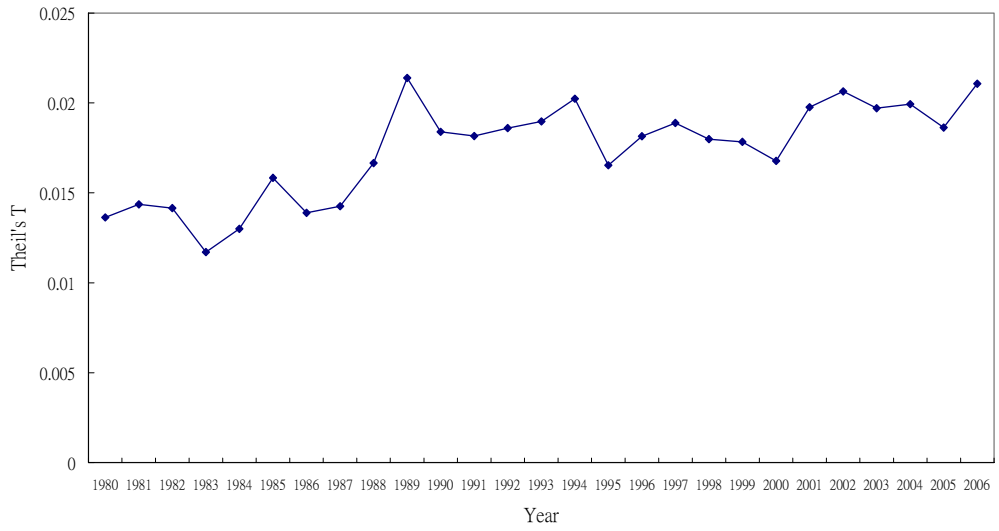
$$T' = \frac{1}{n} \sum_{j \in gj} ri \log ri$$

$$Pj = \frac{nj}{n} \qquad Rj = \frac{\mu j}{\mu}$$

n: employment μ : average income j: subscript denoting group

As we can see from Figure 1, wage inequality (T') by economic sector has increased unevenly since 1980, the earliest year with a complete set of available data. From 1980 to 2006, wage inequality increased from 0.013637 to 0.01889, reaching its two highest points in 1989 and 2006. The main reason for the increase of wage inequality may be attributed to Taiwan's dramatic industrial transformation from labor intensive manufacturing to ICT-centric (technique intensive) manufacturing and information intensive service industries. But to prove this, we must go deeper, to analyze the sources of the rise in inequalities.

Figure 1. Wage Inequality Between Major Sectors, 1980-2006



1980	1981	1982	1983	1984	1985	1986	1987	1988
0.013637	0.014364	0.014153	0.01171	0.013001	0.015835	0.013888	0.014259	0.01666
1989	1990	1991	1992	1993	1994	1995	1996	1997
0.021388	0.018398	0.018157	0.018605	0.01897	0.020235	0.01653	0.018149	0.01889
1998	1999	2000	2001	2002	2003	2004	2005	2006
0.017991	0.017843	0.016783	0.01977	0.020641	0.019706	0.019935	0.018628	0.02107

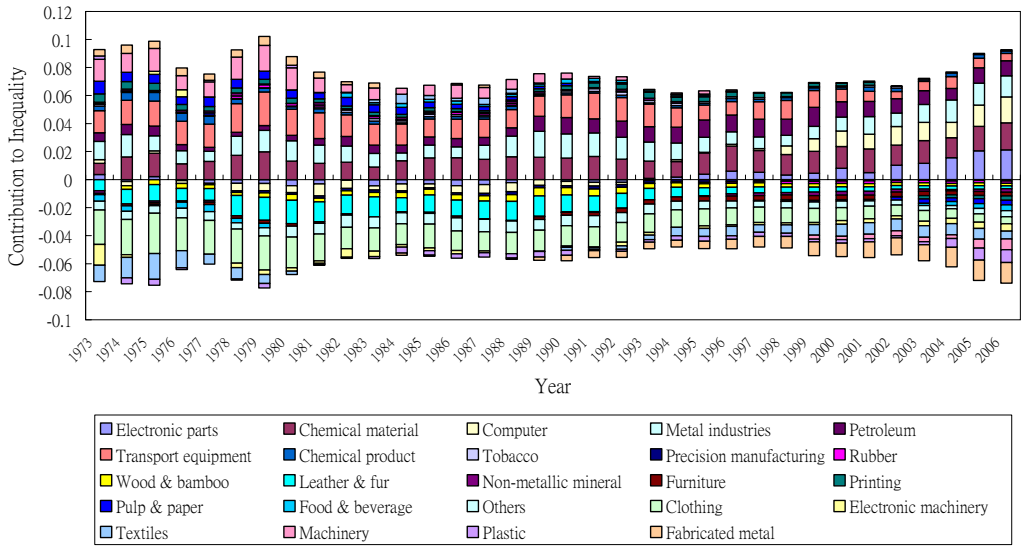
Source: Author's calculation according to GBAS data

Figure 2 provides evidence of the particular pattern of manufacturing industry-specific wage gains and losses in Taiwan between 1973 and 2006. The figure offers a series of stacked bar graphs, one for each year, where each color block within a bar represents the "Theil element" or weighted contribution to overall inequality of each manufacturing industry in that year. Industries whose average income is above the population average contribute a positive value to overall inequality; those whose average income is below the population average contribute a negative value. From this figure we can see that computers and electronic parts, two important and representative manufacturing industries in an information economy, appear to be two of the main high-wage contributors to the gradually increasing wage inequality in Taiwan after around 1994. For example, in 2006, the electronic parts industry was the highest contributor to wage inequality, at 0.021, and the computer industry was the third highest contributor, at 0.018. Note that the second highest wage inequality contributor, the chemical materials industry, had the strongest influence on wage inequality starting in 1973 and was replaced by the electronic parts industry in 2004.

Furthermore, the below-average wage earners in the manufacturing sector at around

the same time include industries such as clothing and textiles, leather, plastics, and fabricated metal products, all of which are primarily categorized into the traditional labor-intensive (as opposed to information and technique intensive) industries. From the above calculations and data, we indeed find that ICT (technique intensive) industries have been gradually replacing other industries, becoming the primary factors of wage polarization in Taiwan.

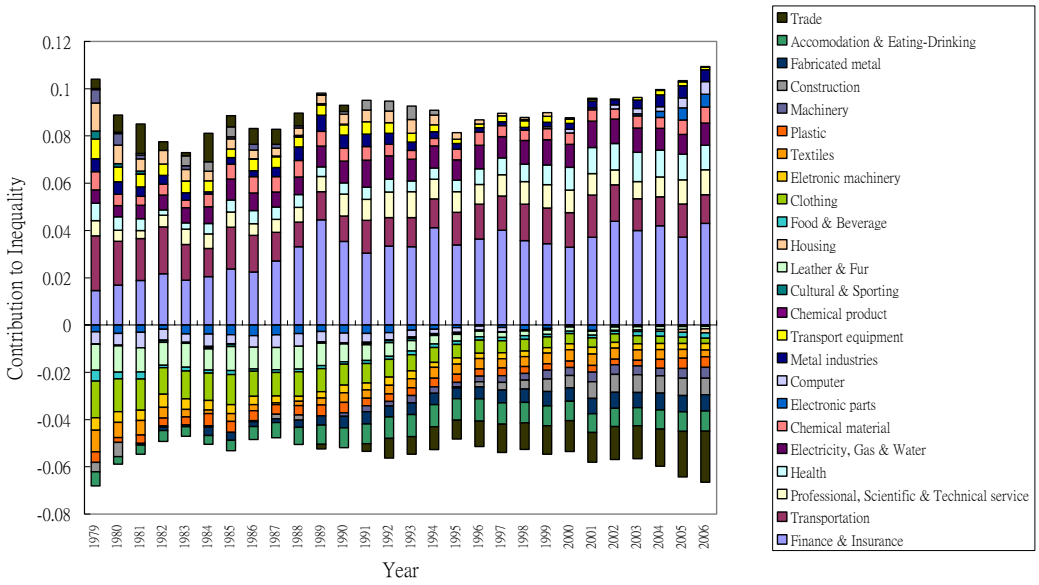
Figure 2. Theil Elements--By Manufacturing Sector



Source: Author's calculation and GBAS data

If we extend this analysis to all industries in manufacturing and service sectors in Taiwan, as Figure 3 shows, the financial sector stands out as having generated the largest wage inequality in Taiwan's information economy age. Finance is not only representative of the information intensive industries but also one of the most computerized and informationalized industries. Moreover, if we put the computer and electronic parts industries together, they take third place in contributions to increasing wage inequality, just after another information-intensive industry, transportation and telecommunication. As for the below-average wage earners, the trade and accommodation industries have become the main actors from around 1993 on, and before that the clothing industry was the main negative contributor.

Figure 3. Theil Elements-By Main Industries in Service and Manufacturing



Source: Author's calculation and GBAS data

From the above observations, we find that the information intensive and ICT relevant industries, such as the industries of finance; transportation and telecommunication; electronic parts; computers; and professional services have actually become the primary sources of Taiwan's increasing wage inequality after 1980. In contrast, industries which are less information-intensive and with less ICT adoption, such as

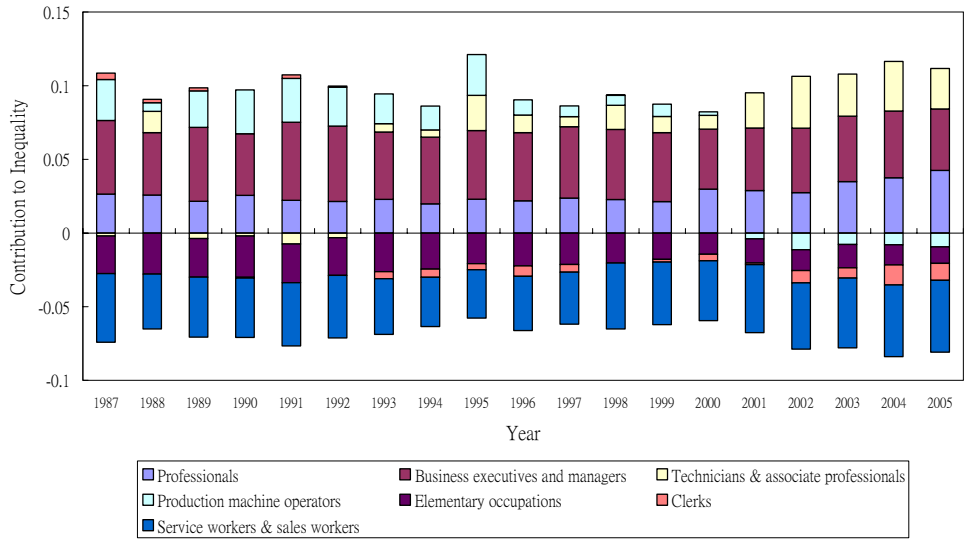
accommodation and food services, clothing, construction, plastics, trade, and fabricated metal have become the sectors with the largest below-average contributions to inequality after 1980.

The following paragraphs examine the issue of economic inequality based on occupation; they are coincident with the information economic arguments that workers of higher skills and knowledge do enjoy higher payments and their contribution to wage inequality do keep increasing.

In Figure 4, we can see that from the 1990s on, production machine operators started losing their earning advantage and became below-average earners in 2001; by contrast, technicians and associate professionals largely replaced machine operators, increasing their wage privilege from around 1993 on and contribute more and more to wage inequality. As for the below-average earners, service workers and sales, elementary workers (physical labor workers), and clerks occupy the most disadvantageous positions in the labor market. Beside, we also see that in 2006 for the first time, professional occupations exceeded business executive and managerial occupations,

becoming the highest wage earners and the largest contributors to wage inequality, which confirms the supposition that an information economy leads to the declining importance of managers and the increasing importance of professionals (Martin, 1998; Williams, 2007).

Figure 4. Theil Elements by Occupation, 1987-2005

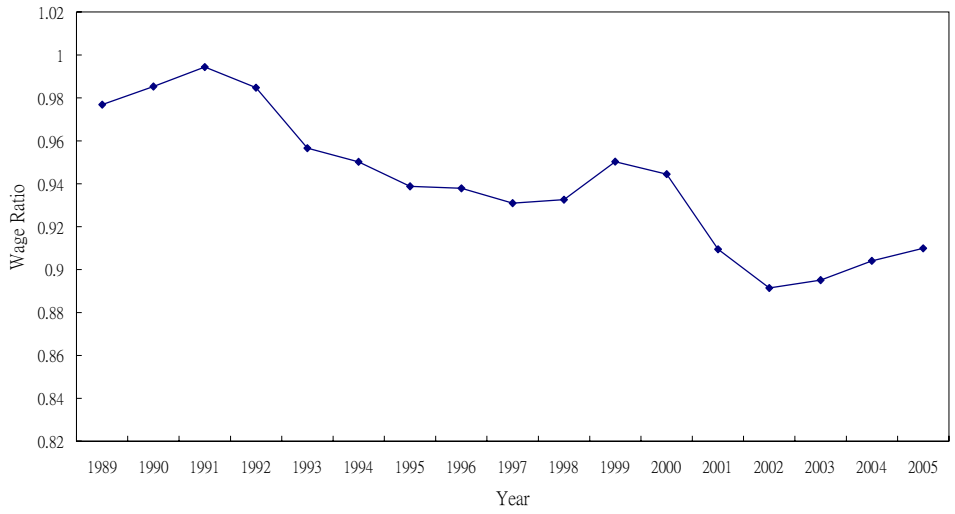


Source: Author's calculation and GBAS data

Figure 5 shows the ratio of blue to white-collar workers' average monthly wages.

From the earliest data available (1989), there is a clear trend of uneven decline of this ratio, from around 0.979 in 1989 to 0.909 in 2005, with the lowest point in 2002, at 0.891. This means that compared to white-collar workers, blue-collar workers' wages continue to fall. The declining of labor intensive manufacturing and the blooming of IT and information intensive service sure led to this phenomenon because they hire much less blue collar workers. Other possible reasons include Taiwan's open immigration policies and the relocation of labor intensive sectors to mainland China. Both these three factors resulted in the wage improvement of workers with professional knowledge/skills (mainly white-collar), especially computer professionals or financial workers and the wage decrease of workers who could be replaced by Southeast Asia's immigrant and mainland Chinese workers, such as machine operators and some elementary (physical labor) workers (mainly blue-collar).

Figure 5. Monthly Wage Ratio, 1989-2005, Blue-Collar to White-Collar Workers

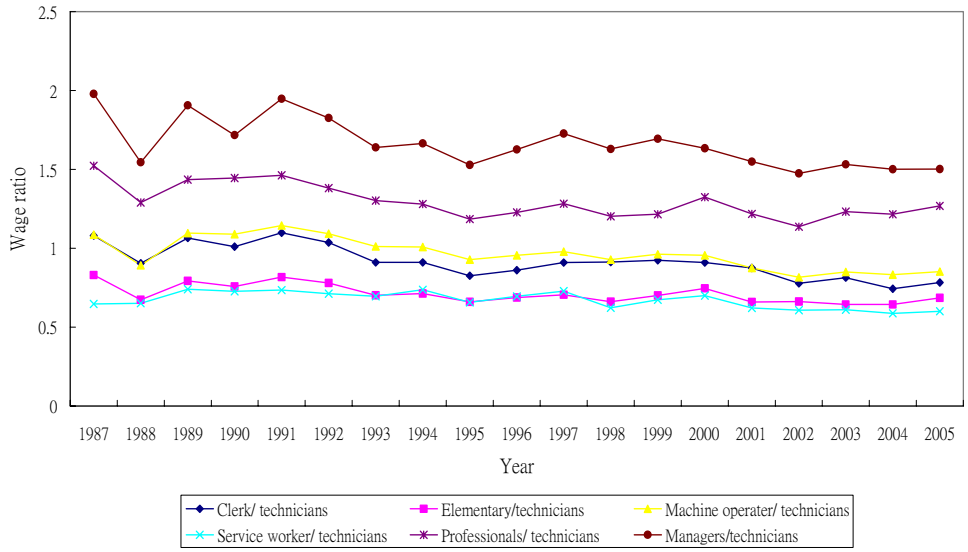


Source: Author's calculation according to GBAS data

Figure 6 reveals the phenomenon of rising wages for professional skilled workers. The figure displays wage ratios over time, comparing other occupations to technicians or associate professionals. As we can see in this figure, the machine-operators-to-technicians-monthly wage ratio continually dropped from 1.09 in 1987 to 0.85 in 2005. The elementary-workers-to-technicians monthly wage ratio fell from 0.83 to 0.68. Similarly, the clerks to technicians and service workers to

technicians wage ratios decreased from .08 to 0.78 and from 0.65 to 0.60.

Figure 6. Monthly Wage Ratio, 1987-2005, Other Occupations to Technicians

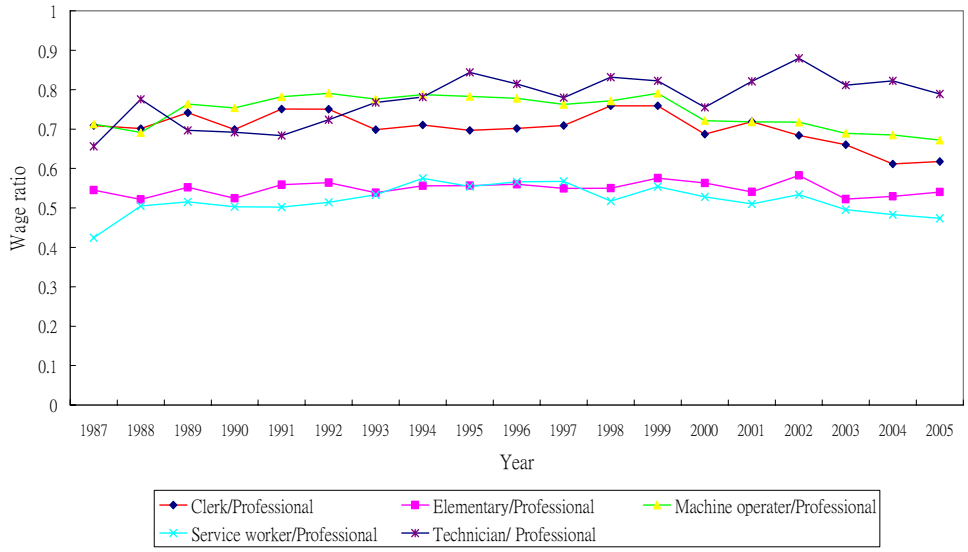


Source: Author's calculation and GBAS data

Figure 7 offers a slightly different perspective, displaying a wage ratio comparison of other occupations to professional positions, enabling us to further understand wage inequality in Taiwan. As we can see, the wage ratio of machine operators to professionals rose substantially at the end of the 1980s and peaked in 1992; but from

1992 on, it continued declining from 0.79 to only 0.67 in 2005. The clerks-to-professionals wage ratio fell gradually and unevenly, from 0.709 in 1987 to around 0.617 in 2005. The wage ratios of elementary workers to professionals reveal greater fluctuations, with change rates as wide as 6% even over one year (such as 2001 to 2002, as well as 2002 to 2003), although from 1987 to 2005 the overall change was less than 0.5%, which seems to indicate no change. A wage comparison of service and sales workers with professionals reveals minor differences, although service and sales workers' wages were the lowest on average among all occupation categories. The wage ratio hit the highest point in 1994, reaching 0.575, but then slowly declined to 0.473 in 2005.

Figure 7. Monthly Wage Ratio, 1987-2005, Other Occupations to Professionals



Source: Author's calculation and GBAS data

From the above wage ratio comparisons, we can observe an apparent deterioration in occupations requiring lower professional and technical skills, as compared with more professional or semi-professional jobs. Although this shift is a gradual rather than dramatic one, it has worsened Taiwan's economic inequality since 1980s, especially after 2000.

Information Economy and Unemployment

When considering the dynamic relationships between ICTs and unemployment, scholars have diverse observations, viewpoints, and explanations. These arguments can be generally categorized into four different groups.

a. Enhancement of Employment and International Competitiveness

The adoption of new production technologies such as ICTs is often claimed to improve productivity and accordingly to stimulate market demand, which in turn generates higher output and employment. Another more convincing explanation transforms this idea by deploying a global competitive viewpoint. Some believe that new technology, rapidly accepted, will increase productivity and thereby a country's competitive edge, which will be translated into market growth and in turn more employment (Jennie, 1983). Furthermore, the emergence of ICT industries, such as hardware and software industries, Internet service providers (ISPs), and the

online-game industry, has also created a great number of jobs (OECD, 2002). Additionally, Soete (2001) indicates that the increased number of jobs created by the development of ICTs in the service sector is able to “absorb” the decreased number of employees in the manufacturing and agriculture sectors replaced by new technologies, resulting in an increase in employment.

b. Reduction of Employment Due to Automation

Some scholars oppose the argument of employment enhancement due to ICT adoption; by contrast, they report that there is a correspondence between technological use (improved productivity) and an increase in unemployment (Aghion & Howitt, 1998; Cyert & Mowery, 1989; Mills, 1938). For example, Webster and Robins (1986) state that ICTs will bring about further unemployment due to five factors: first, even in areas of economic growth, employment does not necessarily expand; second, ICTs are being introduced overwhelmingly to save on expenditures in order to increase profitability and/or efficiency rather than to increase employment; third, in all advanced capitalist societies the new technology is being introduced to meet the threat

of other nations, possibly resulting in cheaper production, less employment, and no overall economic change; fourth, service sector employment is not increasing at the moment and is likely in future to decline in significant areas because of the application of ICTs; and finally, demographic trends exacerbate the unemployment problem brought on by ICTs.

c. Long-term Balance of Employment and Unemployment

Some researchers maintain an argument that an employment equilibrium will be achieved in the long term. They believe that the market price mechanism will ensure that demand and supply of labor eventually adjust to one another, and therefore long-term unemployment caused by technologies will be impossible. Moreover, the employment impact of ICTs will be one of swings and roundabouts, with job loss here and job gain there, but in the end some sort of equilibrium will be achieved (Sleigh et al., 1979).

d. Differences by Region, Industry, or Occupation

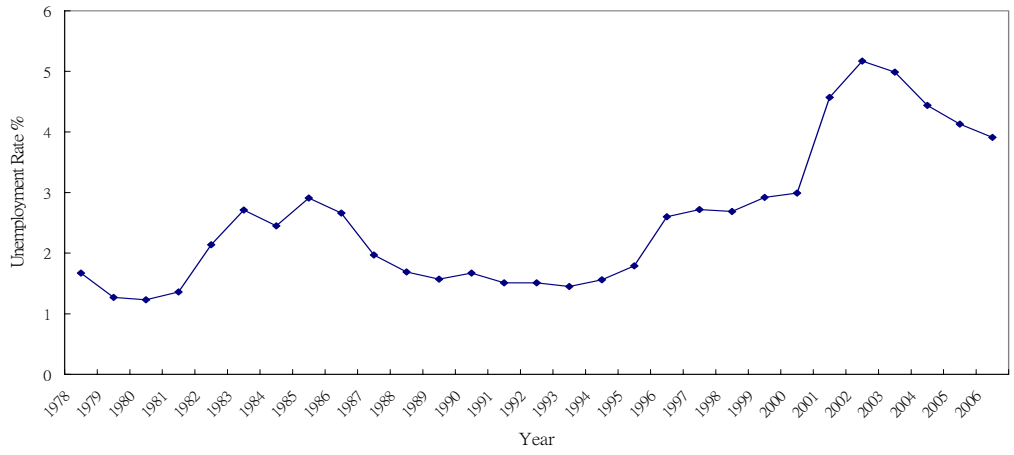
Castells (1996) maintains there is no systematic structural relationship between the diffusion of ICTs and the evolution of employment levels in the economy as a whole. He indicates that ICT's impact on employment varies in different countries, regions, and industries, because of the mediation of macro-economic factors. Similarly, Galbraith (2000) divides the economy into different sectors. He first points out that the technology/worker relationship in the capital sector is more complementary and interdependent. Thus, workers in the capital sector are more difficult to replace with machines. However, in the consumer goods sector, technology and machines can take the place of workers because the technology/worker relationship is more interchangeable. And finally, the hardest hit by technologies is the service sector. Workers in the service sector are lower-skilled and are the easiest to replace with technology (Galbraith, 2000).

Figure 8 shows us unemployment trends in Taiwan from 1978 to 2006. Before 1980, Taiwan had a very low unemployment rate because of its strong labor intensive manufacturing such as clothing and textiles. But in the 1980s, Taiwan's labor

intensive industries lost their international competitive capacity due to rising labor costs and the severe challenge from other Asian countries, such as (and mainly) China. Most of these traditional industries moved to China and Southeast Asia, resulting in the rise in unemployment in the 1980s. After the 1980s and in the first half of the 1990s, Taiwan gradually completed its industrial transformation and successfully built its role as a major manufacturer for international ICT brands, gradually building its ICT industries. This helped to alleviate the unemployment problem of the 1980s. However, after 1995, the trend reversed again with a sharp rise in unemployment, continuing until 2003. Possible reasons for this dramatic increase in unemployment include the following: first, although Taiwan had become a crucial player in information industries and ICT hardware production in the global market, the Taiwanese ICT industries are mainly capital and technique intensive and their labor intensive sectors were mostly transferred to China and Southeast Asia, detracting from Taiwan's employment enhancement in the long run (Cheng, 2003; Tsay, 1999). Second, the importation of immigrant labor from Southeast Asia since 1991 has continually worsened Taiwan's unemployment problem (Tsay, 1999). Third, the world recession of ICT industries from 2000 to 2003 seriously impacted Taiwan's

economy; in 2001 Taiwan's first ever negative economic growth occurred and worsened Taiwan's unemployment problem significantly. After 2003, however, the economy steadily returned to normal; we can see a gradual decline in the unemployment rate, although the rate was still as high as 3.91% in 2006, much higher than in the 1980s, at 1.23 %. Thus, in Taiwan's case we can observe that the post-1980 information economy and ICT industries have not appreciably enhanced Taiwan's employment levels. On the contrary, they might have worsened Taiwan's unemployment since labor intensive jobs have declined, creating a situation which is expected to deteriorate Taiwan's social and economic inequality problems.

Figure 8. Unemployment Rate, Taiwan, 1978-2006



Source: GBAS data

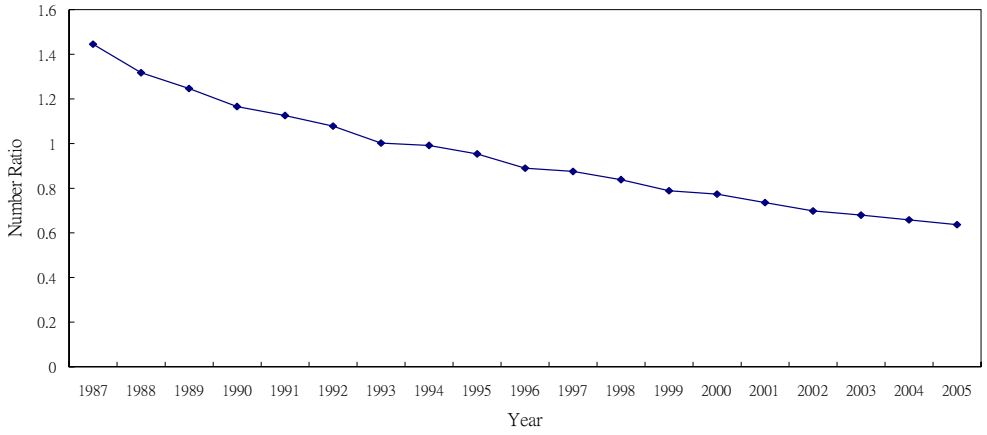
Information Economy and Occupational Transformation

Some occupational transitions can be linked to the heavy application of ICTs and to the information economy. They include the decline of blue-collar/manual/ routine workers (or, the increase of white-collar/knowledge/non-routine workers) and the decrease in population and importance of middle managers.

Machlup (1962) was among the first to observe a transition from a majority employment in manual work (primarily blue-collar and agricultural) to a majority employment in knowledge work (primarily white-collar). Bell (1980) follows this track and argues that the new economy will increase the importance of occupations with a high information and knowledge content in their activity. He believes that people will see a growing percentage of white-collar workers in the work force, and the most significant occupational categories will be the professionals, engineers, technicians, and scientists. Martin's (1998) research also focuses on the shift in employment patterns in the U.S. She indicates a transition from a majority employment in manual work (primarily blue-collar and agricultural) to a majority employment in knowledge work (primarily white-collar).

In Taiwan's case, as Figure 9 shows, the decreasing trend of the blue/white-collar employment ratio is readily apparent. The ratio has continued to decline along an almost straight line, from 1.44 in 1987 to 0.636 in 2005.

Figure 9. Employment Ratio, Blue-Collar Workers to White-Collar Workers, 1987-2005

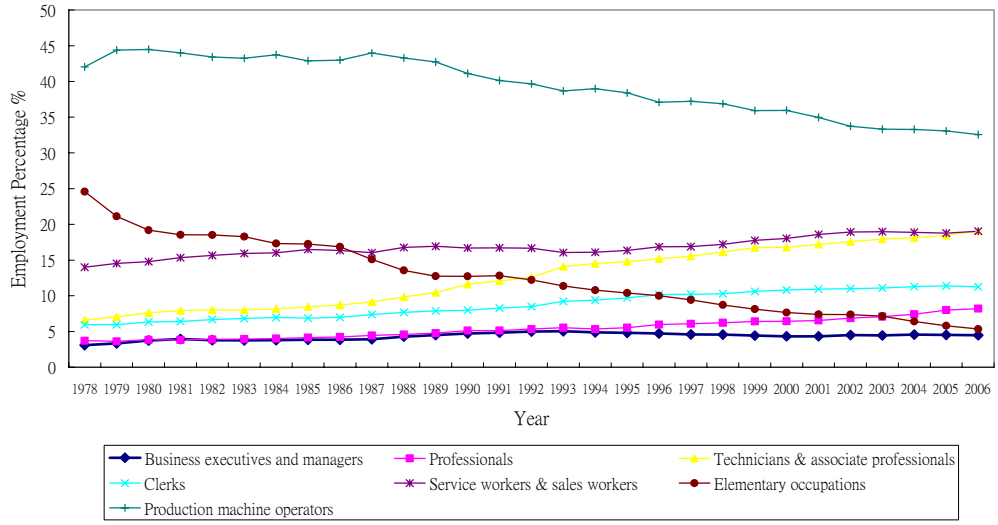


Source: Author's calculation and GBAS data

Figure 10 displays percentages of total employment for all occupations. For example, the percentage of total positions filled by managers and executives in all occupations first increased from 3.09% in 1978 to 5.04% (the highest) in 1993 and then declined to 4.47% in 2006. Declining occupations also include elementary workers and machine operators. From 1978 to 2006, elementary worker positions fell considerably from 24.58% to 5.35%, and machine operator positions declined from 42.04% to

32.56%. As predicted in the literature on information economies, the occupations of professionals and technicians were enhanced; professional occupations as a percentage of total occupations increased from 1978 at 3.71% to 2006 at 8.22% and technician and associate professionals increased greatly from 1991 at 6.63% to 2006 at 19.08%. Overall, the percentage of lower level, less skilled jobs (including clerks, service workers, elementary workers, and machine operators) declined from 77.94% to 68.22% and that of higher level, more skilled jobs grew from 22.06% to 31.78%. Nevertheless, the population of lower level workers is still comparatively larger than the higher professional and managerial class.

Figure 10. Employment Percentages of All Occupations



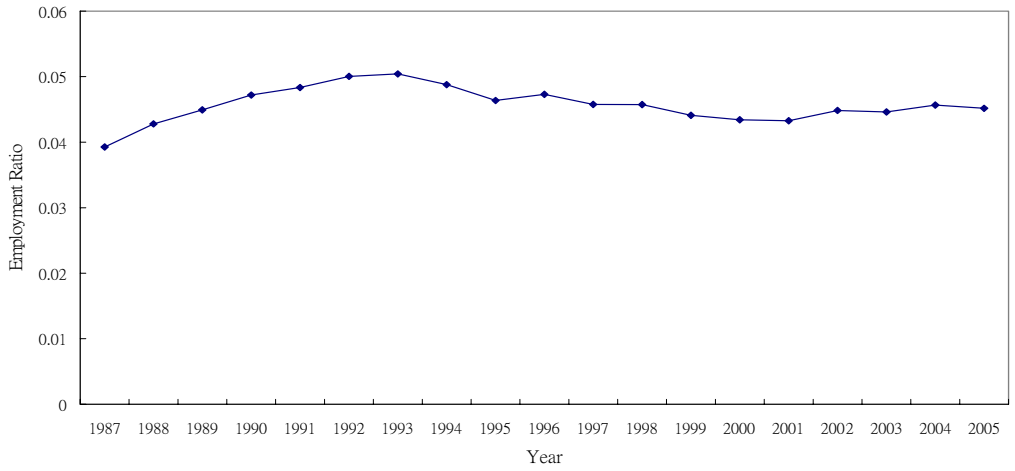
Source: Author's calculation and GBAS data

Another crucial aspect of occupational transformation is the decline of managerial occupations. Information economy scholars claim that ICTs are facilitating the narrowing and flattening of managerial structures; ICTs render information more controllable on the one hand and work processes more visible on the other. In combination, this means that the function of middle management (to analyze and distill information from the shop and pass it up the managerial chain) is largely taken

over by ICTs (Dawson, 1988; Fulk & DeSanctis, 1999; Zuboff, 1988). Moreover, not only are managerial hierarchies flattening, but they are narrowing at the same time, which means the ratios among types of workers may change (Martin, 1998).

Figure 11 reveals the change in importance of managerial occupations. We can first see a climbing trend in the ratio of management to other occupations from 1987 to 1992; however, during the time of increasing informationalization, the ratio did gradually decline from the peak in 1992 at 0.050 to 0.045 in 2005; however, the movement was slight rather than substantial.

Figure 11. Employment Ratio of Managers to Other Occupations



Source: Author's calculation and GBAS data

Conclusion

Several observations and conclusions can be reached. First, there are positive and significant correlations between level of income and computer/Internet use. Second, Taiwan's wage inequality has continued to rise unevenly since 1980. The main contributors to the increase in wage inequality after 1980, according to the calculation

of Theil's T statistics, are ICT related and information intensive industries. Third, wage differences between blue-collar and white-collar workers and between professional and less professional occupations continue to expand. Professional workers, managers, and technicians become the main contributors to increasing economic inequality and the main winners of wage earning, with technicians being a more recent contributor; while service workers, elementary workers, and clerks are below-average wage earners. Fourth, Taiwan's unemployment rate has grown steadily since 1980. This is mainly because, although Taiwan has successfully transformed itself from a traditional industrial economy to a high technology and information economy, these new industries are mainly technique and information intensive and their labor intensive sectors have mostly moved to China and Southeast Asia, worsening Taiwan's unemployment. Sixth, the blue/white-collar employment ratio continues to fall, signifying that, compared to numbers of white-collar workers, the employment of blue-collar workers has declined a great deal. We can see this trend especially in the employment ratios of machine operators and elementary workers, whose employment levels have both fallen considerably. Seventh, it is worth noting that the biggest advancement in wages and employment comes not from the

professional sector, but from the employment of technicians and associate professionals. Eighth, just as information society researchers have predicted, the importance of managers has declined but only to a slight extent; the employment percentage of managers declined from 4.84% in 1991 to 4.47% in 2006.

Overall, economic inequality has clearly worsened in Taiwan since 1980 and the suppositions of information society scholars about labor market transformations are to some extent played out in Taiwan's situation. However, we need to be careful not to over-simplify the relationship between the information economy or ICTs and economic inequality; other important social economic factors, such as neo-liberalist free trade and free market policies, industrial transformation, the state's promotion of some industries, immigrant worker policies, and business cooperation among Taiwan, China, and Southeast Asia all influence changes in economic inequality.

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