

2 The Effects Of Outsourcing On Unemployment and Changes In Relative Wages

2.1 Debating Issues

A natural consequence of globalization is to make domestic industries moving offshore, that is, “the new global job shift”. Depending on the lower wage rate, plenty of natural resources, and a vast market for domestic selling, Mainland China has become the key product-development center of the world. Facing with such a strong “*sucking sound*”, Taiwan businesses invest in Mainland China consequently leads to a series of unemployment and relative wages questions.

Actually, the policy of “no hast, be patient” mainly limited Taiwan businesses to invest in Mainland China, which had been first declared by President Lee in 1996 and formally became a legislative regulation regulated by M.O.E.A in 1997. In order to comment on this policy, we have to understand what’s the background behind it. In the 1980s, due to NT dollars appreciated relatively to US dollars, domestic wage-cost and land-cost had increased in a large extent and therefore increased operation-cost of traditional industries that are labor-intensive before. As the economic dependence on Mainland China got larger and larger, Present Lee therefore claimed to practice “no hast, be patient” policy in order to prevent from the risk of trade. Generally speaking, business moving offshore may cause unemployment in quantity, widening in wage inequality, and risk of technological exporting. Let’s see these problems of Taiwan briefly:

Unemployment

According to the Investment Commission, MOEA, Taiwan approved investment to Mainland China accumulated 29,113 cases from 1991 to the end

of December 2003, which totaled US\$31.20 billion. Up to 44.65% of Taiwan total foreign investment was attracted by Mainland China such that it becomes the foremost destination of foreign investment for Taiwan. At the same time, the unemployment rate in 2003 was up to 4.99% and nearly 500.3 thousands labor force were unemployed. Trends of unemployment rate are listed as Table 2.1. Among this table we can find a dramatic growth in unemployment rate, which was due to lay-off and businesses moves out since 1996.

Table 2.1 Trends of Unemployment Rate

Year	A (%)	B (%)	C(%)	Year	A (%)	B (%)	C (%)
1991	1.51	16.1	9.52	1997*	2.72	27.7	35.82
1992	1.51	12.4	21.78	1998*	2.69	27.8	31.55
1993*	1.45	14.0	40.71	1999	2.92	32.1	27.71
1994	1.56	13.5	37.31	2000	2.99	30.8	33.93
1995	1.79	17.5	44.61	2001	4.57	45.9	38.80
1996	2.60	28.2	36.21	2002*	5.17	48.1	45.12

Notes: 1. Column A is the unemployment rate of the whole country.
 2. Column B is the unemployment rate due to lay-off and business moving out.
 3. Column C is the share of investment in Mainland approved by M.O.E.A to total foreign investment. (* means registration of previous unregistered investment is not included)

Data Sources: 1. Directorate General of Budget Accounting and Statistic Executive Yuan.
 2. Huang (2003)

Wage Inequality

In the long run, the trend that Cross-Strait economies are going to get closer is inevitable. According to factor-price equalization theory, liberalization between Cross-Strait trade will lead to decreasing in wages of unskilled workers, which is because that importing a large quantity of labor-intensive goods from Mainland China will decrease the demand for unskilled workers in Taiwan. On the other hand, wages of skilled workers will increase due to shifting demand toward skilled workers and therefore widen the wage inequality.

Technological Exporting

After reaching the regulated production scale of 12” wafer, the Taiwan Semiconductor Manufacturing Company (T.S.M.C) was approved to export the whole equipment of 8” wafer to Mainland China. No example of semiconductor firms before T.S.M.C was allowed to the exodus of the whole factory. What M.O.E.A.I.C considered is not only the possible problem of unemployment, but also including of the crisis of technological exporting.

Technological exporting is one of the spillover effects of FDI/outsourcing/ multinational firms in the host country. Caves (1974) distinguished such spillover effects into three kinds: allocative efficiency, technical efficiency, and technological transfer. Technological transfer (exporting) , which can make firms in host country obtain the new technology to increase their productivity, profit and competitiveness, usually comes with transferring equipment, facilities and technicians, etc.

Once Mainland China obtains the equivalent level of technology or even advanced one, it stands to reason that the technological dependence of Mainland China on Taiwan will consequently reduce and lead Taiwan to lose its competitiveness gradually. Suffering this competitive crisis, Taiwan competitiveness can maintain only through industrial transition and upgrading. As a result, notice how to stay new, high-technological industries in Taiwan should be an important issue in economic policies.

2.2 Literatures Survey Are These Due to Outsourcing?

There are mounting related literatures that attributed the wage differentials to technological changes, educational distribution, and international trade. Actually, it is believable that all the factors above are one candidate of the causes, in other words, we cannot exclude anyone from the candidates for possible explanations.

2.2.1 Technological Progress/Changes

Several studies about increases in relative demand for skilled workers and widening wages-gap between skilled and unskilled workers ever concluded that: high productivity and technological progress should be the most possible explanations for shifting demand, while international trade and outsourcing does not bear the significant responsibility.

Such studies are Krueger (1993), Krugman and Lawrence (1994), Berman, Bound and Griliches (1994) and Johnson (1997). Krueger (1993) considered that introducing computer revolution into production activities was the main cause of skilled-biased technological changes. Workers who use the computer on their jobs have the higher earning than those who do not, other things being equal. Krugman and Lawrence (1994) adopted a descriptive illumination that the widening wage gap could be mostly attributed to changes in pattern of domestic consumption and rapid growth of skilled labors' productivity. So they have proposed the view of "blaming foreign competition for U.S. economic ills is ineffective, the real problems lie at home". They recognized that even if the world markets had not become so integrated, differences of relative demand and wages would also exist. Berman, Bound and Griliches (1994) used both time series regressive model and cross-sectional regressive model to prove that technological change and domestic consumption has been the main, most important contributors to changes in relative demand for skilled workers.

International trade and imports are not the significant factors. In Johnson (1997), the author tried to find out the possible explanations responsible for increasing wage inequality. What might shift demand towards more skilled workers he thought were increase in relative supply of high-skilled workers, increased openness, and technological changes. Johnson (1997) pointed out that because change in relative demand for skilled workers was more than that in relative supply of skilled workers, extensive-technological changes played the key role of the wage differentials the author considered. Increased openness was too small to produce relative demand to shift. Took Danish T&C industry for instance, Bjerring Olsen, Ibsen and Westergaard-Nielsen (2004) found that although GDP in Denmark decreased, however, GDP per labor in Danish T&C industry increased. So they concluded that industrial outsourcing does not directly induce unemployment of unskilled workers, but it is only the result of natural phase-out in each industry.

2.2.2 International Trade/Outsourcing

Feenstra and Hanson (1995) designed a theoretical model to find out that 15-33% of the increase in the relative wages of skilled workers is influenced by rising imports. Further more, they also discovered that widening wage inequality would happen *both* in outsourcing and outsourced countries. The same finding was found in Markusen and Venables (1995) and Feenstra (1998). Next, Feenstra and Hanson (1996) further enlarged the definition of outsourcing and found that 30.9%-51.3% of the increase in skilled workers' wage share can be explained by outsourcing. Feenstra and Hanson (1999) added technological change into their analysis and found that both factors can explain rise in relative wages of skilled workers significantly, each is 35% by technological change and 15% by outsourcing. Wood (1995) considered that trade and outsourcing will affect the relative demand and wages through two ways: the first is import price and second is importing labor-intensive goods that would displace more unskilled workers. Besides that, conventional

estimates of the trade/outsourcing effect on relative demand almost ignoring the contribution of trade to technological progress, therefore the influence of trade/outsourcing on wage differential were almost understated. A modified calculation method of factor content in Wood (1995) roughly found out the effect of trade/outsourcing on wage inequality is twice more than previous studies did. Shachs and Shatz (1996) is a paper about discussing trade-wage linkages. They first used a simple theory to illuminate that even if relative price of unskilled labor -intensive goods does not change (exactly what H-O theory says), wage differential will also occur due to outsourcing, monopolistic strategy, and R&D innovation. They also found the timing consistent in declining labor demand in less-skill sectors and declining import-competing sectors. In Slaughter (1998), he found that rise in wage differential has occurred both *between* workers of different skill levels and *within* a given skill level. Both international trade and technological biased toward skilled workers were two possible explanations in his research. Slaughter (1998) also thought that the H-O theory and Stolper-Samuelson theorem were not perfect frameworks to explain the situation of widening wage inequality. That is, there are limitations inside and outside the H-O model, which is over-simplified.

Make a comprehensive survey of these literatures, some are mostly emphasized the effect of technology on shifting demand and wage inequality, while others stress the importance of international trade and outsourcing on those. Basically, we have to understand that technology and trade effects that both matter the results. (Feenstra and Hanson, 1996; Sachs and Shatz, 1996). Outsourcing, which is inclusive of importing intermediate inputs and all production procedures that done by others, is seen as a non-neutral technological progress toward skilled workers (Feenstra and Hanson, 1995, 1996), therefore we can combine these two possible candidates of technology and trade/outsourcing and employ a model designed by Feenstra and Hanson (1996) to make some explanations and findings.

2.2.3 Basic Story of Feenstra and Hanson (1995)

In a North-South trade environment, the North has abundant skilled worker and capital. There is only a final good Y that is produced from a series of continuum intermediate input in Cobb-Douglas production function. The intermediate input z is manufactured by capital, skilled workers and unskilled workers (which is Leontief relation in two types of workers) in Cobb-Douglas technology.

Now assume capital moves from the North to the South for higher capital return rate. No matter what kinds of capital flow takes, there are several findings discovered. First, because of differences in countries' endowment, capital flow propels the North to be the outsourcing country and the South to be the outsourced country. Outsourcing results in changes in relative employment and wage share. When outsourcing happens, relative labor demand for skilled workers in both North and South *increase*, while that for unskilled workers *decrease*. Such trends also reflect on the changes in their wage shares.

Second, outsourcing will increase the technological level in both countries. Therefore outsourcing holds the same effects on unemployment and changes in relative wages as technological and industrial upgrading do.

Regressing the increasing trends in skilled workers' relative employment and relative wage share, Feenstra and Hanson (1995) found that these phenomenons were consistent with rising import in United States and Mexico.

With growing outsourcing from Taiwan to Mainland China, the effects of outsourcing on labor market should be emphasized. A trend of increase in relative demand for skilled workers also took place in Taiwan manufacturing sector and so did the relative wage gap. Using these results to make policy suggestions is the main purpose of this chapter.

2.2.4 Model Assumptions and Derivation of Feenstra and Hanson (1995)

Assume in a world with two countries, North and South. Provided that North is relatively high skilled-abundant and capital-abundant to South, i.e., South is relatively low skilled-abundant, and thus reflect on their prices below.

- A. $r_N < r_S$,⁵
- B. $q_N/w_N < q_S/w_S$,
- C. $L_i'(q_i/w_i) \leq 0$ $H_i'(q_i/w_i) \geq 0$

w_i is the wage of unskilled worker, q_i is for wage of skilled worker, r_i is for the return rate of capital, $L_i(q_i/w_i)$ represents supply of unskilled workers, and $H_i(q_i/w_i)$ is supply of skilled workers, for $i = N, S$. The first unequal function says that capital stock in the North is more than that in the South; the second points out the fact that skilled workers relative to unskilled workers in the North is more than that in South; the third functions only tell us that the demand for skilled and unskilled workers in both countries are consistent with the law of supply.

The production function of intermediate input is shown as equation (2-1).

$$x(z) = A_i [\min\{l(z), h(z)\}]^\theta [K(z)]^{1-\theta} \quad (2-1)$$

Y is the final manufactured good produced from a continuum of intermediate inputs (z), where we normalize $z \in [0,1]$, which are sequentially produced by skilled workers (H_i), unskilled workers (L_i) and capital (K_i). Final goods can be assembled in any country costlessly. Producing a unit of z needs $a_L(z)$ of unskilled worker and $a_H(z)$ of skilled worker, and $L(z), H(z)$ denote the total usage. Accords with reality, $a_H(z)/a_L(z)$ is increasing in z , and each input requires capital $K(z)$ that substitutes for labors in a Cobb-Douglas production function. Suppose capital has the same degree

⁵ Professor Hon pointed out that because the asymmetric size between Taiwan and Mainland China, it is more appropriate for r_i to take per capita form. However, in order no to transform this model, here I am forced to describe r_i in a total form for presenting the originality of this model.

substitution with skilled or unskilled workers in producing intermediate input. $l(z)$ equals to $L(z)/a_L(z)$, which is explained as needed amounts in producing certain degree of intermediate inputs z . The same explanation is for $h(z)$ which equals to $H(z)/a_H(z)$. θ is the percentage of labor using in production process. A_i is the exogenous technological difference between the North and the South.

The production function of final goods Y is equation (2-2):

$$\ln Y = \int_0^1 \alpha(z) \ln x dz, \text{ with } \int_0^1 \alpha(z) dz = 1 \quad (2-2)$$

$\alpha(z)$ is the percentage that degree of intermediate input used for producing Y , integrating $x^{\alpha(z)}$ with z from 0 to 1 and calculating it in a logarithmic form such as we show.

Maximizing equation (2-1) subject to the producer's cost constraint, the minimum cost of producing an input z in country i is stated as equation (2-3). Given wage fixed, the minimum cost of an input is a function of z which is illustrated in Figure 2.1 as $C_N C_N$ and $C_S C_S$.

$$c(w_i, q_i, r_i; z) = B_i [w_i a_L(z) + q_i a_H(z)]^\theta r^{1-\theta}, \text{ where } B_i = \theta^{-\theta} (1-\theta) A_i^{-1} \quad (2-3)$$

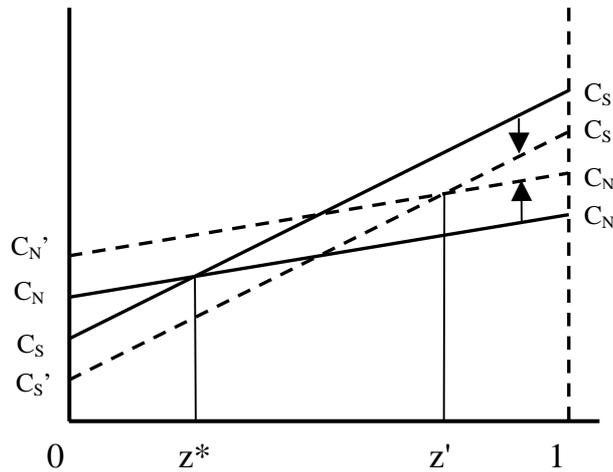


Figure 2.1 Equalization of Production Cost

The minimum cost of producing an input z will equalize in both countries and equation (2-4) is the equilibrium condition computed.

$$c_S(w_S, q_S, r_S; z^*) = c_N(w_i, q_i, r_i; z^*) \quad (2-4)$$

Equation (2-4) points out that activities which $z > z^*$ will take place in the North country and activities $z < z^*$ will take place in the South country. Higher-technological works carry out in North can ensure its competitiveness with the South.

Next question is how to determine z^* ? We have to solve seven unknown variables $L_S^*, H_S^*, K_S^*, z^*, L_N^*, H_N^*, K_N^*$ by eight equations. Take South case for example, differentiate equation (2-3) with relative wage (q_s/w_s) and then integrate with z within the range from 0 to z^* (for Southern workers) or from z^* to 1 (for Northern workers), we can get equation (2-5) and equation (2-6). Then by operating Walras's Law we obtain equation (2-7). For convenience, another simplification is world expenditure that denoted as E , is normalized to 1. Equation (2-8) is obtained in use of the feature of Cobb-Douglas function.

$$L_S(q_s/w_s) = \int_0^{z^*} B_S \theta \left[\frac{r_s}{w_s a_L(z) + q_s a_H(z)} \right]^{1-\theta} a_L(z) x_S dz \quad (2-5)$$

$$H_S(q_s/w_s) = \int_0^{z^*} B_S \theta \left[\frac{r_s}{w_s a_L(z) + q_s a_H(z)} \right]^{1-\theta} a_H(z) x_S dz \quad (2-6)$$

$$r_s K_s = [w_s L_s + q_s H_s] \left(\frac{1-\theta}{\theta} \right) \quad (2-7)$$

$$x(z) = \alpha(z) E / C_s, \quad z \in [0, z^*] \quad (2-8)$$

Repeating the same steps above again, we can also derive three analogous full-employment conditions in the North, and accompanying with the definition of E , we can solve not only z^* but also $L_S^*, H_S^*, K_S^*, L_N^*, H_N^*, K_N^*$. Next step, we prepare to check out the effect of outsourcing.

When a business decide to outsource some part of its production procedures, it faces several kinds of methods what we call outsourcing. It can choose to import some intermediate inputs that have ever been produced domestically, or it can buy some final good produced by foreign firms but sold under its brand name. Other frequently used ways of outsourcing are to

establish a bilateral relationship-specific investment contract (Grossman and Helpman, 2002), or engage in multinational firms (Markusen and Venables, 1995).

Now suppose a Northern enterprise chooses to establish multinational firms in the South and therefore make capital flow from North to South, suchlike the capital flow from Taiwan to Mainland China. What will happen? Through equation (2-3), we find that it will lead to an increase in the minimum cost of producing per input in North, and a decline in the minimum cost of producing per input in South (See Figure 2.1, $C_N C_N$ rises to $C_N' C_N'$, and $C_S C_S$ shifts down to $C_S' C_S'$) which in turn reflected on z that makes z^* shift to z' .

What senses do the outsourcing mean by changing z^* to z' ? Consider the following consequences. First, we replace equation (2-7) into equation (2-5) and equation (2-6) for simplification and get equation (2-9).

$$D_S(q_S/w_S) = \frac{\int_0^{z^*} \left[\frac{a_H(z)\alpha(z)E}{w_S a_L(z) + q_S a_H(z)} \right] dz}{\int_0^{z^*} \left[\frac{a_L(z)\alpha(z)E}{w_S a_L(z) + q_S a_H(z)} \right] dz} \quad (2-9)$$

Equation (2-9) is defined as the relative demand for skilled workers (D_S). Differentiating D_S in logarithmic form with equilibrium z^* , we obtain the comparative static analysis of D_S when equilibrium z^* changes. For the same reason, we can get along with comparative static analysis of D_N when equilibrium z^* changes too. Both are illustrated with equation (2-10) and equation (2-11).

$$\frac{\partial \ln D_S}{\partial z^*} = \frac{L_S(z^*)}{H_S} \left[\frac{a_H(z^*)}{a_L(z^*)} - \frac{H_S}{L_S} \right] > 0 \quad (2-10)$$

$$\frac{\partial \ln D_N}{\partial z^*} = \frac{L_N(z^*)}{H_N} \left[\frac{H_N}{L_N} - \frac{a_H(z^*)}{a_L(z^*)} \right] > 0 \quad (2-11)$$

$L_i(z^*)$ denotes the unskilled workers used in z^* if it is produced only in country i . Equation (2-10) and (2-11) mean that: *an increase in equilibrium z^* will result in a demand of more skilled worker intensive in both countries.* Therefore, there are two probable situations: if we keep full employment assumption, there maybe more workers concentrate on lower-level jobs and higher-level jobs than before within the industry, led to a change in the industrial structure; if we cast off the full employment assumption, a more skilled worker intensive will probably induce to the unemployment of unskilled workers in both countries, while it really follows with industrial upgrading within each country.

Next, when outsourcing occurs, it will enhance technological levels in both North and South, which we call that “technology exporting effect” or “knowledge spillover effect”. It is also vital that outsourcing will also affect relative wage distribution between skilled and unskilled workers through changes in relative demand. In order to understand how the changes in the relative wages after outsourcing, a simple figure narrating could be used to give illustration. Proved by equation (2-10) and equation (2-11), we all know that outsourcing will lead to an increase in equilibrium z^* , and hence raise the relative demand for skilled workers. It is easily shown by Figure 2.2 that the relative demand curve for skilled workers in both countries will shift right and makes equilibrium point from A to C which results in relative wages of skilled workers increase.

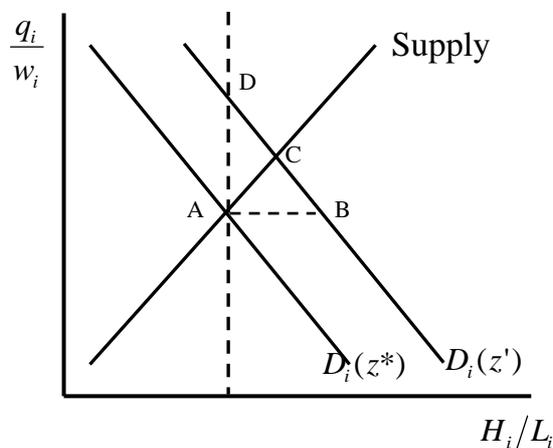


Figure 2.2 Change in Relative Demand for Skilled workers

2.3 Implications, Cases of Taiwan and Findings

2.3.1 Implications

We can obtain some implications for commenting on “no hast, be patient” policy through Feenstra and Hanson (1995). First, outsourcing, no matter what types taken, will incur analogous effects on relative demand and wages that technological progress may cause. See Figure 2.1 and Figure 2.2, if outsourcing activities happen from Taiwan to Mainland China, both countries will tend to more skilled labor intensive than before. Therefore, unemployment of unskilled workers may arise in *both* countries, instead of labor demand shifting toward unskilled workers in Mainland China. The changes in relative demand is accompanied by technological upgrading, which means that such unemployment is probably caused by unskilled workers who fail to move to skilled sectors in a short run. Due to insufficient of knowledge, skills dis-matching, and existence of information costs, unemployment of unskilled workers was recognized as the structural unemployment by Slaughter (1998), Huang (2003) and Bjerring Olsen, Ibsen and Westergaard-Nielsen (2004). That is, such structural unemployment is the expected outcome when trying to make technological/ industrial upgrading, and it is also one of the contemporaneous effects when outsourcing occurs. Nowadays, because many Taiwan businesses enhance their technological level from OEM to ODM and re-outsource low skilled production procedures to Mainland China, technological upgrading takes place as well. Therefore, if government wanted to protect domestic unskilled workers, “no hast, be patient” policy made only little effects.

Second, widening in wage inequality just reflects the shift of demand. For the same reasons, outsourcing is not the only contributor to the increase in wage gap, but also for technology, education, and institutions (Slaughter, 1998). Announcement of “no hast, be patient” policy cannot completely prevent the problem.

Third, a spillover effect implicit in Figure 2.1 can be read out as below. Outsourcing increases in Taiwan will shift some lower-skilled jobs to Mainland China, for examples, assembling, processing, and machine operating. Taiwan businesses invest/outsource to Mainland China brings many effects on increasing employment, workers' quality, and changes in worker structure of their economy. In addition, technological exporting is also a great, invisible benefit to the host country (Caves, 1974). In the flow of foreign investment and outsourcing, Taiwan transfers its know-how and technology to Mainland China, who might replace the role of Taiwan in international market in the final. Thus we can see clearly from this model that strategy of outsourcing should be carefully undertaken. Simply speaking, we have no reasons to limit the unprofitable and disadvantaged industries to move out. What we should do is to develop and expand the higher-skilled sector and to encourage high-technology industries to upgrade the production with the most comparative advantage.

2.3.2 Cases of Taiwan and Findings

Many earlier literatures manipulated different methodologies to check out the causality between international trade and shifting demand, between outsourcing and shifting demand, and between technology progress and shifting demands. Some of them found out empirical evidences by time series and cross-sectional regressions (Berman, Bound, and Griliches, 1994; Feenstra and Hanson, 1995, 1996; Huang, 2003; Sachs and Shatz, 1996), some tried to prove the effects in a theoretical method (Krugman and Lawrence, 1994; Wood, 1995; Slaughter, 1998), and the others showed many figures of current trends of actual facts (Berman, Bound, and Griliches, 1994; Feenstra and Hanson, 1995).

Studies about the effects of FDI researched in Taiwan mostly focus on the relationship between Taiwan and other developed countries. However, few

researches pay attention to the effects of outsourcing on relative employment or widening wage inequality between skilled and unskilled workers at present. In this section, I expect to present how the relation between outsourcing and widening wage inequality is in Taiwan by showing several related figures.

Definitions of Skilled and Unskilled Workers

Before illustrate these figures of trends, I have to make exposition of what I define as skilled and unskilled workers in this thesis. Basically, skilled workers mean non-production workers, who are personnel, installation and service, sales, delivery, professional, technological, administrative workers, etc. Unskilled workers are production workers, who engage in fabricating, processing, assembling, inspecting and other manufacturing (Berman, Bound, and Griliches, 1994). Other classification could be obtained in Wang (1999) that distinguished workers into salaried workers (seen as skilled workers) and wage earners (seen as unskilled workers). Among these, managers, supervisors, clerks, professionals, and technicians & associated professionals are those classified as salaried workers/skilled workers; service workers, sales, and production workers, machine operators, and related workers employed in fabricating, processing, assembling, inspecting are classified as wage earners/unskilled workers. Categories classified in Berman, Bound, and Griliches (1994) and Wang (1999) are somewhat different in the item of service workers & sales. In the subsequent discussion, I take salaried workers as skilled workers and wage earners as unskilled workers for data consistency.

Besides that, Council of Labor Affairs (C.L.A) also tries to classify each employment into white-collar workers or blue-collar workers. White-collar workers include legislators, government administrators, business executives and managers; blue-collar workers include agricultural, animal husbandry, forestry and fishing workers. According to this official classification, however, service workers and sales cannot belong to neither white-collar nor blue-collar

workers. In order to keep data information completely in Table 2.9 and Table 2.10, I add service workers and sales either in white-collar or blue-collar category which is obeyed the definitions of Berman, Bound, and Griliches (1994) and Wang (1999), whereas the distinction is minor in numerical presentation.

Data Sources and Coverage Years

Our work in this section is based on data drawn from *Yearbook of earnings and Productivity Statistics* and *Yearbook of Manpower Survey Statistics* of a period from 1989 to 2002, Census Bureau, D.G.B.A.S. Data in *Yearbook of Wage and Productivity Statistics* gives us the employee-amounts and the employee-wages of salaried workers and wage earners in manufacturing, which I present in Table 2.3 to Table 2.7 subsequently. *Yearbook of Manpower Survey Statistics* offers us to observe the percentage changes in eleven years from 1993 to 2003, which I prepare to show in Table 2.8 and Table 2.9.

Case and Findings

Foreign studies in the topic of outsourcing effects on unemployment and changes in relative wages almost noticed that: When the percentage of outsourcing increases over time, there are major facts usually discovered. Each is *declining share of manufacturing employment in total employment, increasing share of skilled workers' in total manufacturing employment and in total wage bill, while the converse in unskilled workers*. In the next steps, I will review these trends described above to explore whether such phenomena have occurred in Taiwan. The possible explanations and economic implications are also suggested.

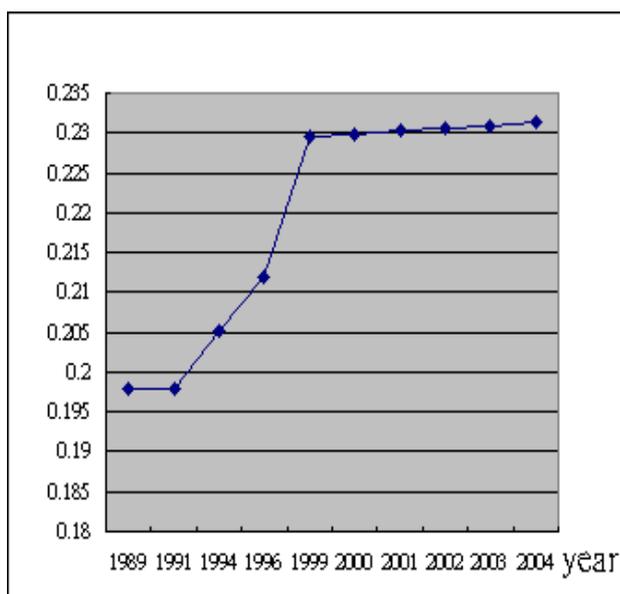
Case and Findings (I) Is outsourcing increasing over time?

Outsourcing is broadly defined. There is still no official data and definition in Taiwan so that we cannot obtain the accurate outsourcing data. I use the estimated data computed in a roundabout way by Huang (2003) and further extend her data from 2000 to 2004 by the average growth rate 0.0016 from her study, see Table 2.2, Figure 2.3 and Figure 2.4.

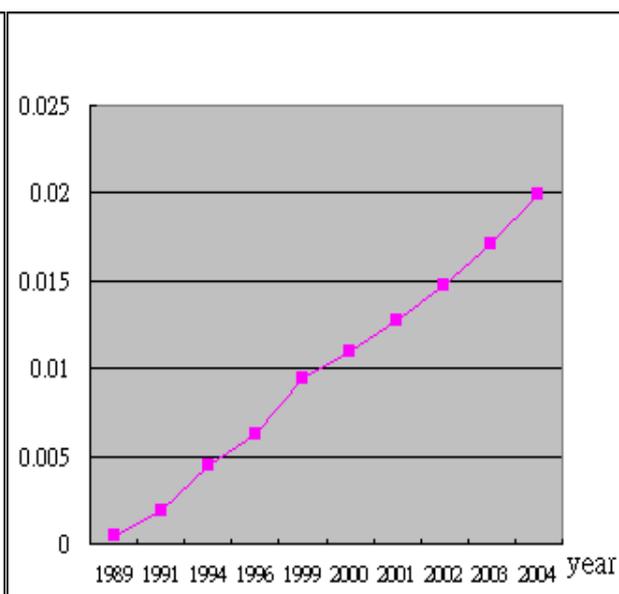
Table 2.2 Percentage of Outsourcing Inputs, 1989-2004.

Year	Outsourcing inputs/total inputs	Outsourcing inputs from China/total inputs
1989	0.1979	0.0005
1991	0.1980	0.0019
1994	0.2051	0.0045
1996	0.2119	0.0063
1999	0.2295	0.0094
2000	0.2299	0.0109
2001	0.2302	0.0127
2002	0.2306	0.0147
2003	0.2310	0.0171
2004	0.2313	0.0199

Data Source: Huang (2003).



Data Source: Table 2.2



Data Source: Table 2.2

Figure 2.3 Percentage of Outsourcing Input Figure 2.4 Percentage of Outsourcing Input from Mainland China

What we can realize from these two figures is that the growth rate of outsourcing inputs from Mainland China is faster than average level of whole outsourcing inputs. It implies the fact that since investment in Mainland China was approved began at 1990s, Mainland China has already become the most important specific-investment partner in recent years. In Figure 2.4, we originally predict the growth rate should be more accelerative after the year 1999 rather than average growth, but one fact “no hast, be patient” policy started at 1997 might lower this acceleration effect. That is to say, if the policy of “no hast, be patient” never occurred, it is reasonable to guess the slope of the curve in Figure 2.4 would be more steeper after 1999 than we have shown.

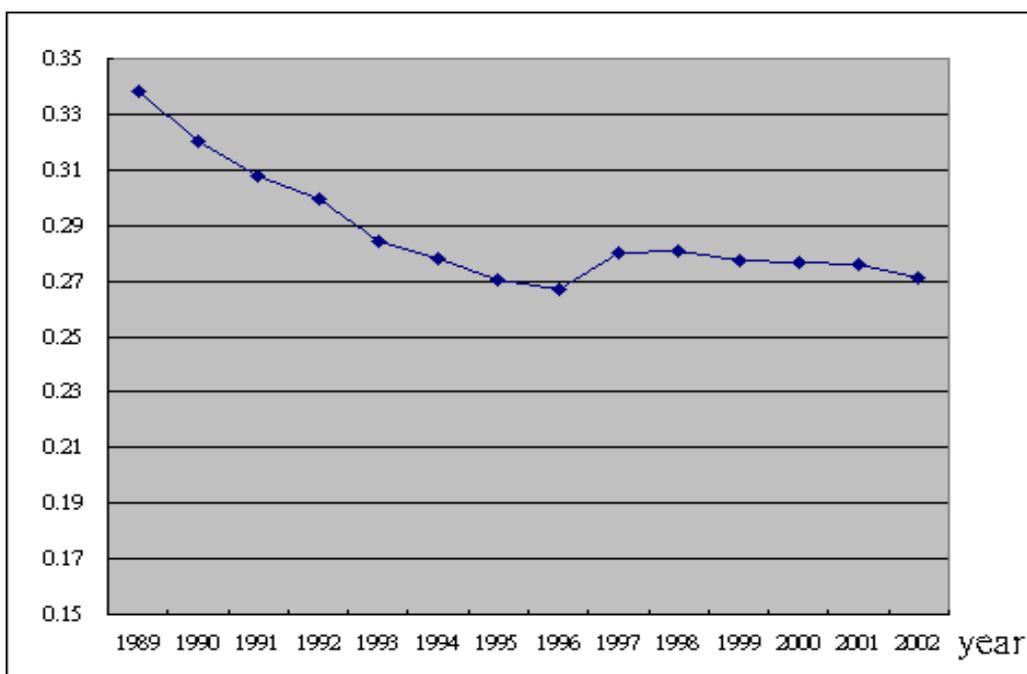
Case and Findings (II) Is the share of manufacturing employment in total employment declining?

Outsourcing means parts of production procedures moving out to other countries, which will lead to relatively developed country shifts away from manufacturing, that is what we called deindustrialization, economic periphery, or industrial hollowing-out. Data of manufacturing employment share in total employment is listed in Table 2.3 and the trend is pictured in Figure 2.5.

Table 2.3 Manufacturing Employment Share in Total Employment

Year	Manufacturing Employment Share in Total Employment (%)	Year	Manufacturing Employment Share in Total Employment (%)
1989	0.3386	1996	0.2671
1990	0.3203	1997	0.2801
1991	0.3079	1998	0.2811
1992	0.2995	1999	0.2774
1993	0.2839	2000	0.2768
1994	0.2780	2001	0.2757
1995	0.2708	2002	0.2711

Data Source: Yearbook of Earnings and Productivity Statistics, Census Bureau, DGBAS.



Data Source: Table 2.3

Figure 2.5 Manufacturing Employment Share in Total Employment

We can see clearly that the share declined sharply during 1989 to 1996 and fluctuated slightly between 0.27 and 0.29 after 1996. So we can say that “no hast, be patient” policy might have the temporary, short run effect, but it still could not stop the declining trend of manufacturing employment share.

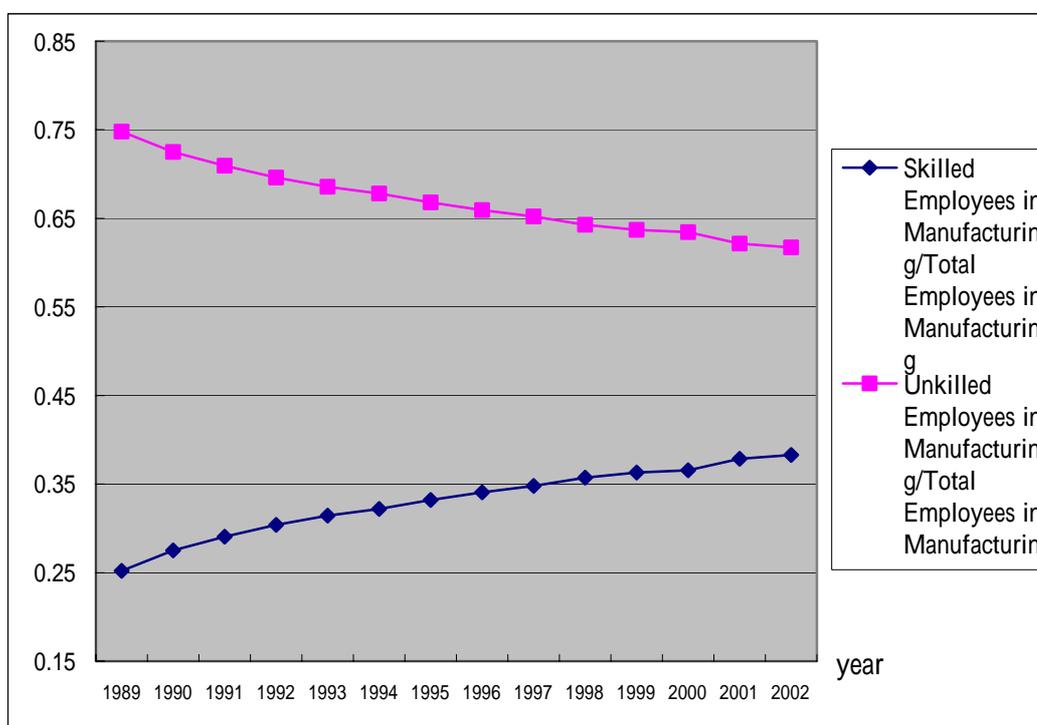
Case and Findings (III) Is the share of skilled workers increasing in total manufacturing employment, while that of unskilled workers decreasing in total employment? Does the wage inequality between skilled and unskilled workers get larger? **Show the evidence on whole manufacturing.**

Only skilled and unskilled **employees** in manufacturing can be obtained from *Yearbook of earnings and Productivity Statistics*, rather than the amounts of skilled and unskilled **employment**. As the result of this limitation, I compute the share of skilled and unskilled employees in manufacturing to total employees in manufacturing at Table 2.4 and figured in Figure 2.6. Wage shares of skilled and unskilled employees’ in manufacturing to total manufacturing employees’ wage bill is provided at Table 2.5 and Figure 2.7.

Table 2.4 Shares of Skilled and Unskilled Employees in Manufacturing to Total Employees in Manufacturing

Year	Skilled Employees in Manufacturing/Total Employees in Manufacturing	Unskilled Employees in Manufacturing/Total Employee in Manufacturing
1989	0.2521	0.7479
1990	0.2751	0.7249
1991	0.2907	0.7093
1992	0.3040	0.6960
1993	0.3142	0.6858
1994	0.3220	0.6780
1995	0.3319	0.6681
1996	0.3406	0.6594
1997	0.3481	0.6519
1998	0.3574	0.6426
1999	0.3632	0.6368
2000	0.3656	0.6344
2001	0.3784	0.6216
2002	0.3830	0.6170

Data Source: Yearbook of earnings and Productivity Statistics, Census Bureau, DGBAS.



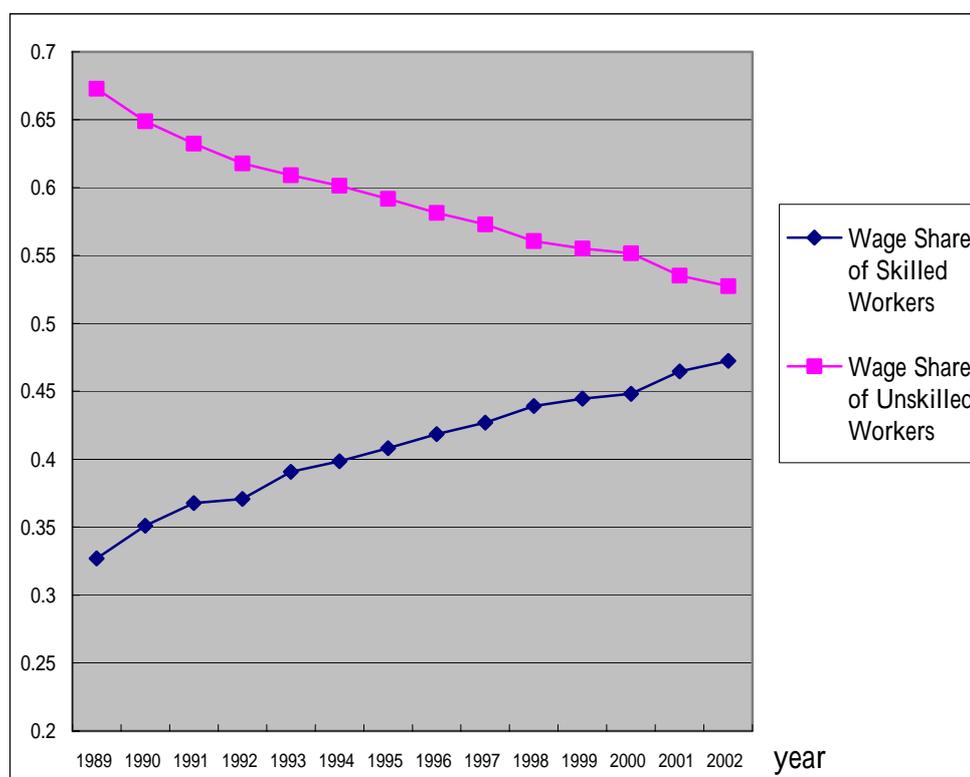
Data Source: Table 2.4

Figure 2.6 Shares of Skilled and Unskilled Employees in Manufacturing to Total Employees in Manufacturing

Table 2.5 Wage Shares of Skilled and Unskilled Employees in Manufacturing to Total Wage Bill in Manufacturing

Year	Wage Share of Skilled Workers	Wage Share of Unskilled Workers
1989	0.3270	0.6730
1990	0.3510	0.6490
1991	0.3677	0.6324
1992	0.3709	0.6178
1993	0.3907	0.6093
1994	0.3986	0.6014
1995	0.4082	0.5918
1996	0.4185	0.5815
1997	0.4272	0.5728
1998	0.4392	0.5608
1999	0.4447	0.5552
2000	0.4482	0.5519
2001	0.4648	0.5352
2002	0.4725	0.5275

Data Source: Yearbook of Earnings and Productivity Statistics, Census Bureau, DGBAS.



Data Source: Table 2.5

Figure 2.7 Wage Shares of Skilled and Unskilled Employees in Manufacturing to Total Wage Bill in Manufacturing

It is not surprising that these trends of skilled employee' employment share and wage share are rising with time, while those of unskilled workers are declining. That is to say, the relative demand for skilled workers increases in the manufacturing labor market. Both findings in Figure 2.6 and Figure 2.7 are consistent with what predicted in Feenstra and Hanson (1995) .

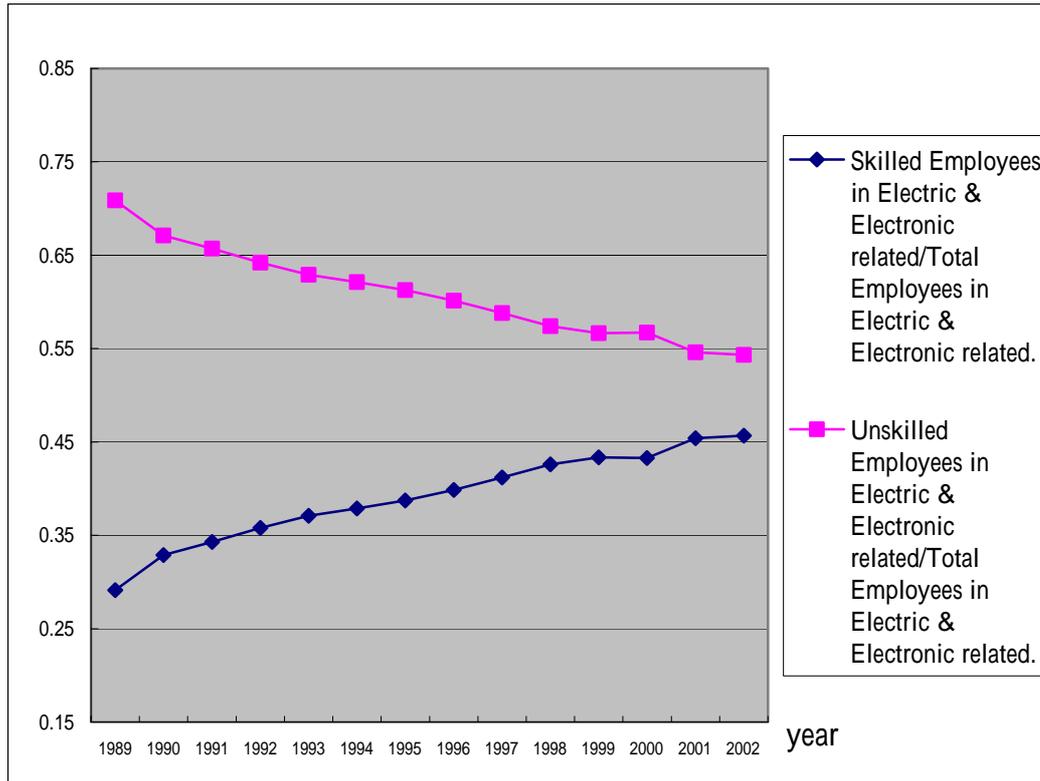
Case and Findings (IV) Check the same questions as (III) but ***show the evidence on electric & electronic related industries.***

We have seen the relative employment and wage trends in the whole manufacturing. It is curious that do those findings also happen in certain specific industry? We take electric & electronic related industries for instance. Table 2.6 and Table 2.7 correspond to employees' employment share and wage share of skilled and unskilled in electric & electronic related industries to total employees and total wage bill in electric & electronic related industries.

Table 2.6 Shares of Skilled and Unskilled Employees in Electric & Electronic related to Total Employees in Electric & Electronic related

Year	Skilled Employees in Electric & Electronic related/Total Employees in Electric & Electronic related.	Unskilled Employees in Electric & Electronic related/Total Employees in Electric & Electronic related.
1989	0.2913	0.7087
1990	0.3289	0.6711
1991	0.3429	0.6571
1992	0.3579	0.6421
1993	0.3709	0.6291
1994	0.3789	0.6211
1995	0.3875	0.6125
1996	0.3985	0.6015
1997	0.4119	0.5881
1998	0.4260	0.5740
1999	0.4334	0.5666
2000	0.4326	0.5674
2001	0.4540	0.5460
2002	0.4566	0.5434

Data Source: Yearbook of Earnings and Productivity Statistics, Census Bureau, DGBAS.



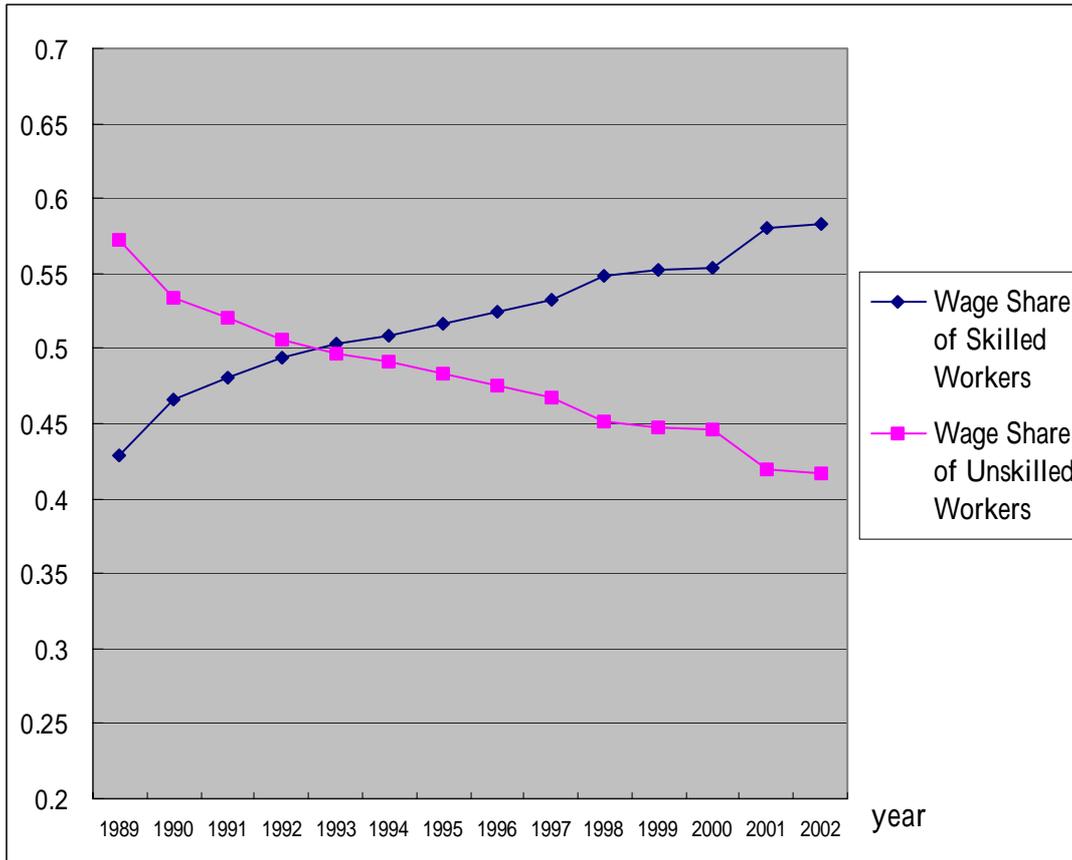
Data Source: Table 2.6

Figure 2.8 Shares of Skilled and Unskilled Employees in Electric & Electronic related to Total Employees in Electric & Electronic related

Table 2.7 Wage Shares of Skilled and Unskilled Employees in Electric & Electronic related to Total Wage Bill in Electric & Electronic related

Year	Wage Share of Skilled Workers	Wage Share of Unskilled Workers
1989	0.4282	0.5718
1990	0.4664	0.5336
1991	0.4801	0.5199
1992	0.4942	0.5058
1993	0.5034	0.4966
1994	0.5086	0.4913
1995	0.5168	0.4832
1996	0.5242	0.4758
1997	0.5328	0.4672
1998	0.5488	0.4512
1999	0.5529	0.4471
2000	0.5539	0.4461
2001	0.5804	0.4196
2002	0.5828	0.4173

Data Source: Yearbook of Earnings and Productivity Statistics, Census Bureau, DGBAS.



Data Source: Table 2.7

Figure 2.9 Wage Shares of Skilled and Unskilled Employees in Electric & Electronic related to Total Wage Bill in Electric & Electronic related

These trends are figured in Figure 2.8 and 2.9. Compare Figure 2.6 with Figure 2.8, Figure 2.7 with Figure 2.9, an interesting situation is observed. Slopes of both type workers' total employment share and wage share in electric & electronic related industries are steeper than those of the whole manufacturing: each is 1.26 times and 1.06 times that of the whole manufacturing.

What is the cause of the differences between Case (III) and Case (IV)? In the outsourcing relationship between Taiwan and Mainland China, Taiwan shall be the role of Northern country in Feenstra and Hanson (1995) model. However, it might be a misunderstanding. An important fact we have to recognize is that Taiwan is also the destination countries of outsourcing in global economy, especially in famous industries electric & electronic related industries. That is to say, Taiwan is also the outsourced country in the global economy, which

was denoted as Southern country in Feenstra and Hanson (1995). Which role of Taiwan in electric & electronics related industries plays more? Finding out the slopes of workers' total employment share and wage share in electric & electronic related industries are 1.26 times and 1.06 times of the whole manufacturing, we can conclude that Taiwan plays more in Southern country in electric & electronic related industries. It also could be clarified through differentiating equation (2-10) and equation (2-11).

We can differentiate both equations with z^* to observe whether Taiwan is the Northern (outsourcing) country or the Southern (outsourced) country in electric & electronic related industries. Assume $\phi_i = (\partial \ln D_i / \partial z^*)$ and case we found in electric & electronic related industries is $(\partial \phi_i / \partial z^*) > 0$,⁶ that is, we can obey this outcome to clarify the role of Taiwan in electric & electronic related industries.

$$\phi_s = \frac{\partial \ln D_s}{\partial z^*} = \frac{L_s(z^*)}{H_s} \left[\frac{a_H(z^*)}{a_L(z^*)} - \frac{H_s}{L_s} \right] > 0 \quad (2-10)$$

$$\Rightarrow \frac{\partial \phi_s}{\partial z^*} = \frac{1}{H_s} \cdot \frac{\partial L_s(z^*)}{\partial z^*} \left[\frac{a_H(z^*)}{a_L(z^*)} - \frac{H_s}{L_s} \right] + \frac{L_s(z^*)}{H_s} \left[\frac{\partial(a_H(z^*)/a_L(z^*))}{\partial z^*} \right] \begin{matrix} > \\ < \end{matrix} 0 \quad (2-12)$$

$$\phi_N = \frac{\partial \ln D_N}{\partial z^*} = \frac{L_N(z^*)}{H_N} \left[\frac{H_N}{L_N} - \frac{a_H(z^*)}{a_L(z^*)} \right] > 0 \quad (2-11)$$

$$\Rightarrow \frac{\partial \phi_N}{\partial z^*} = \frac{1}{H_N} \cdot \frac{\partial L_N(z^*)}{\partial z^*} \left[\frac{H_N}{L_N} - \frac{a_H(z^*)}{a_L(z^*)} \right] - \frac{L_N(z^*)}{H_N} \left[\frac{\partial(a_H(z^*)/a_L(z^*))}{\partial z^*} \right] < 0 \quad (2-13)$$

The sign of Equation (2-12) will be indefinite because of $\partial L_s(z^*) / \partial z^* < 0$ and $\partial(a_H(z^*)/a_L(z^*)) / \partial z^* > 0$. Equation (2-13) will be positive because of $\partial L_N(z^*) / \partial z^* < 0$ and $\partial(a_H(z^*)/a_L(z^*)) / \partial z^* > 0$.

Compared findings in equation (2-12) and equation (2-13) with empirical evidences, we can clarify that because the Southern (outsourced) role weighs

⁶ It means that when the outsourcing level z^* is higher (such as that of electric and electronic related industries is higher than that of whole manufacturing), the effects of outsourcing on relative demand and wage inequality will be stronger.

more than the Northern (outsourcing) role, high unemployment of unskilled workers in electric & electronic related industries cannot be mostly due to outsourcing to Mainland China, but attribute it to outsourced from global economy.

A general implication we get here is when some industry plays outsourced role more, then when the outsourcing level z^* is higher, the effects of outsourcing on relative demand and wage inequality will be stronger probably.

Case and Findings (V) Besides the structural changes between occupation of skilled and unskilled workers during recent years, is there any change within occupation?

It is also found by Berman, Bound and Griliches (1994) and Slaughter (1998) that, not only the relative demand shifts toward skilled workers and thus induced to wage inequality between occupation, but such changes will also happen within-occupation too. We can see how on earth is in manufacturing structure in Taiwan. In Table 2.8 and Table 2.9 we can observe the trend of technological upgrading in the whole. Both Tables show white-collar workers increased and blue-collar workers decreased over time; among these, service workers, shop and market sales workers, production and machine operators and related workers has declined during the decade since 1993.

Table 2.8 Occupational Distributions and Changes Within Manufacturing by Year (According to Berman, Bound and Griliches, 1994)

	1993	1997	2003	(1997-1993)	(2003-1997)
Total Skilled Employees Percent in Manufacturing	0.3142	0.3481	0.3908	0.0339	0.0427
White-Collar Workers	0.2952	0.3191	0.3753	0.0239	0.0562
Business Executive and Managers	0.0685	0.0658	0.0649	-0.0027	-0.0009
Professionals	0.0185	0.0233	0.0386	0.0048	0.0153
Technicians & Associate Professionals	0.1257	0.1366	0.1757	0.0109	0.0391
Clerks	0.0725	0.0852	0.0911	0.0127	0.0059
Service Workers & Shop & Market Sales Workers	0.0101	0.0082	0.0050	-0.0019	-0.0032
Blue-Collar Workers	0.7048	0.6813	0.6243	-0.0235	-0.0570
Production and Machine Operators & Related Workers	0.7048	0.6813	0.6243	-0.0235	-0.0570

Data Source: Yearbook of Manpower Survey Statistics, Census Bureau, D.G.B.A.S.

Table 2.9 Occupational Distributions and Changes Within Manufacturing by Year (According to Wang, 1999)

	1993	1997	2003	(1997-1993)	(2003-1997)
Total Skilled Employees Percent in Manufacturing	0.3142	0.3481	0.3907	0.0339	0.0427
White-Collar Workers	0.2851	0.3109	0.3703	0.0258	0.0594
Business Executive and Managers	0.0685	0.0658	0.0649	-0.0027	-0.0009
Professionals	0.0185	0.0233	0.0386	0.0048	0.0153
Technicians & Associate Professionals	0.1257	0.1366	0.1757	0.0109	0.0391
Clerks	0.0725	0.0852	0.0911	0.0127	0.0059
Blue-Collar Workers	0.7149	0.6895	0.6293	-0.0254	-0.0602
Production and Machine Operators & Related Workers	0.7048	0.6813	0.6243	-0.0235	-0.0570
Service Workers & Shop & Market Sales Workers	0.0101	0.0082	0.0050	-0.0019	-0.0032

Data Source: Yearbook of Manpower Survey Statistics, Census Bureau, D.G.B.A.S

2.4 Concluding Remarks

2.4.1 Summary

In 1980s, the businesses' operation costs had increased a lot due to NT dollar appreciated relative to US dollar. For this reason, many businesses started to transfer their investments offshore and one of the main destinations is Mainland China. In order to prevent a large quantity of unemployment and trade crisis from investing in Mainland China, president Lee claimed a policy of "no hast, be patient" and rule into a legislated regulation in 1996.

Many studies about relative demand shifting toward skilled workers (and thus cause unskilled workers unemployed) concluded that technological progress should be accountable for the major, rather than outsourcing or international trade. Actually, outsourcing has an equivalent effect like "non-neutral technological progress", so we cannot exclude any one from possible candidates. Through Feenstra and Hanson (1995), we know outsourcing will cause relative demand shifting away from unskilled workers and towards skilled workers. Widening wage inequality between these two different types of labor forces emerges.

The timing of these changes in Taiwan labor markets has coincided with growth of outsourcing to Mainland China, that is to say, when outsourcing to Mainland China grew rapidly at the beginnings of 1990s, some facts can be observed.

Examine by empirical evidence, we know that the predicted results of economics literatures are quite accurate, and thus can offer some good ideas for policies making.

First, the employment of domestic manufacturing sharply declined 7%

from 34% to 27% during the period of 1989 to 1996, although it stopped falling at 1996 (which might be the effects of “no hast, be patient” policy by guess) , its scale was only 0.27% to 0.29% or so, however.

Second, changes in the shares of skilled and unskilled employees in manufacturing to total employees in manufacturing fitted the result predicted by Feenstra and Hanson (1995): employment shares of skilled workers’ in manufacturing increased while shares of unskilled decreased. Such changes in relative demand reflected on their relative wages too.

Third, outsourcing percentage of electric & electronic related industries is the most among all manufacturing at present, so I repeat to observe the changes in relative demand and relative wage but focus on electric & electronic related industries. The finding is that: share of skilled workers’ total employment increased while that of unskilled decreased in electric & electronic related industries. The same trends also happened to changes in their wage shares. There is one more surprising and interesting thing that, slopes of both types of workers’ total employment share and wage share in electric & electronic related industries are steeper than those of the whole manufacturing. Through the static analyses in equation (2-12) and equation (2-13), we clarify that Taiwan is still the outsourced destination in electric and electronic related industries. A general implication we get is when some industry plays outsourced role more, then when the outsourcing level z^* is higher, the effects of outsourcing on relative demand and wage inequality will be stronger probably.

2.4.2 Policy Implications

First, outsourcing is the result of equalizing production cost, thus if government regulated limitation on outsourcing/ FDI to Mainland China before reaching the equilibrium, production inefficient would therefore emerge both in Taiwan and China. At the same time, we have understood that “no hast, be patient” policy only had the temporary effects on stopping the declining share of manufacturing employment share. So we have no reasons to limit the traditional industries moving out for lowering production cost and increasing profit. Furthermore, why not try to develop domestic technological skill level to maintain competitiveness, instead of prohibiting businesses from outsourcing?

Second, even if outsourcing will widen the wage gap between skilled and unskilled workers, it dose not suggest a case for increased outsourcing limitation (Sachs and Shatz, 1996; Slaughter, 1998). Foreign experience also teaches us that we should respond to the unemployment and wage inequality by widening the premium on education, including schooling job training, which is the better way to solve these problems.

Third, Ms. HO, the new Minister of M.O.E.A, declared the new industrial policy that government would encourage FDI in order to strive for the advantage of businesses. However, the characteristics of different industries are divergent so there should be different industrial policies applicable to different features of each industry. To announce a rough and uniform policy will probably do more harms than goods. For example, some industries in Taiwan play more in the outsourced role and the reset play more in the outsourcing role. On the other words, our economic and industrial policies should be long term and double- or even multi-directional. We shall take higher-technological industries with respect to outsourced industries and design a policy to development and stay them in Taiwan. Conversely, traditional industries can be taken in the respect of outsourcing industry for factor price equalization.