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Working Paper No. 373

Does Trade Promote Gender Wage Equity? Evidence from East Asia

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I. INTRODUCTION

During the last several decades, industry and export mixes in Taiwan and South Korea have shifted toward higher-skill, technology-intensive products, while lower-skill, labor-intensive industries have been moving abroad. At the same time, women's relative educational attainment and skill levels improved considerably. Yet some trends have differed across these two economies. Taiwan became increasingly open to trade, with a steady rise in the total trade to output ratio from a low of 48% in the early 1980s to a high of almost 90% by the late 1990s. Against this backdrop, Taiwan's average female-male wage ratio in manufacturing dropped fairly steadily from 66% in 1981 to 60% in 1993. Only in the mid-1990s did the wage ratio begin a strong climb upward, reaching 67% by 1999. In contrast, Korea's slow and steady improvement in women's relative wages--from 47% in 1980 to 58% by 1998--was accompanied by a slight decline in trade openness.¹ Industrial structure and

policy also differ between the two economies, with Taiwan having a higher proportion of small firms and relatively less emphasis on selective government intervention. These divergent features in two of the most successful practitioners of the export-led growth model make Taiwan and Korea well-suited to examine the impact of international trade competition on the gender wage gap.

Increased participation in the global economy is expected to generate growing pressures on firms to engage in cost-cutting practices that may affect female employees differently than male employees, particularly if sex discrimination plays a role in firms' hiring and pay decisions. The dynamic implications of Becker's (1959) theory of discrimination lead us to expect that if discrimination is costly, then increased competition from international trade will reduce the incentive for employers to discriminate against women. This effect should be more pronounced in concentrated sectors of the economy, where employers can use excess profits to cover the costs of discrimination. Alternatively, wage discrimination may increase with growing trade in a context of employment segregation that limits women's ability to achieve wage gains. For example, trade competition can entail technological restructuring that contributes to women's absorption into lower paying jobs and a relative loss of power in wage bargaining situations.

Following the approaches in Borjas and Ramey (1995) and Black and Brainerd (2000), the empirical strategy controls for differences in market structure across industries in order to isolate the effect of competition from international trade. The methodology is applied separately to Taiwan and Korea, and the results are compared. To control for the effects of changes in worker productivity characteristics, estimations are performed using average residual wage gaps as well as average unadjusted wage gaps by industry. The residual wage gap--the portion of the wage gap that cannot be explained by observed productivity differences between men and women--is commonly attributed to wage discrimination against women.

This study contributes to scholarship on globalization by yielding new evidence on the impact of competition from international trade on the gender wage gap in two of the world's most trade-oriented economies. By integrating micro data on labor markets with macro data on industrial structure and trade, the study moves beyond the unsatisfactory treatment of discrimination in the labor literature as an unexplained residual. At the same time it can include controls for worker productivity characteristics that are lacking in studies that pursue an industry-level analysis of gender wage differentials. Previous research on the effect of increasing competition on wage discrimination is still inconclusive and limited in geographical coverage, leaving the impact of globalization on the gender gap an empirical puzzle.

The econometric analysis does not support the dynamic implications of Becker's theory. Results indicate that competition from international trade has a positive relationship with residual wage gaps between men and women in both Taiwan and Korea. While this result is associated more strongly with import growth in Taiwan and with export growth in Korea, we conclude that in both cases the situation of persistent gender wage inequality can be best remedied with passage and enforcement of anti-discrimination legislation.

II. COMPETITION AND THE GENDER WAGE GAP: EXISTING RESEARCH

The Neoclassical Approach

According to neoclassical theory based on Gary Becker's *The Economics of Discrimination* (1959), long-run competition is not compatible with persistent discrimination. The existence of an equally productive but underpaid group of workers will attract profit maximizing firms that don't have discriminatory tastes against this group. Hence the expansion of demand for the group that is discriminated against will gradually eliminate the wage differential. Discrimination will persist only in the least competitive sectors. There employers and managers, who choose to indulge their taste for discrimination by avoiding to hire the lower paid workers and employing higher cost labor instead, can continue to engage in costly discrimination as long as they are making excess profits. Under increasing competition in these industries--through, for example, deregulation of the industry, entry of new firms, or competition from cheaper imports--the use of the underpaid labor is expected to grow and gradually the increase in demand will bid up the wages of this group of workers, reducing the wage gap.²

Consistent with this theoretical notion of discrimination, empirical studies operationalize discrimination as the wage differential that remains after accounting for all measured productivity differences between two groups.

This differential is labeled as the "unexplained residual" wage difference.³ A fairly small number of empirical studies have examined the hypothesis that increased competition leads to less gender discrimination and an improvement in women's relative wages. Among studies of competition in domestic product markets, Black and Strahan (2001) find that by reducing rents that previously accrued to men, banking-sector deregulation has led to improvements in women's relative wages beyond what can be explained by improvements in women's skill characteristics. Also for the United States, Hellerstein, Neumark and Troske (1997) find evidence of wage discrimination against female employees among plants with higher levels of product market power, whereas this finding is not evident in plants with lower levels of market power. However, because discriminatory plants with market power do not grow more slowly than non-discriminatory plants, the dynamic implies that market forces over time have little impact on reducing discrimination.

In the labor market, less domestic regulation can contribute to the weakening of anti-discrimination laws and their enforcement, thus generating the result that greater competition enlarges the gender wage gap. For example, Meng (1996) reports that the unexplained portion of the gender wage gap is considerably larger for the rural industrial sector in China than for the urban state sector. The author concludes that wage discrimination by gender is more problematic in the rural industrial sector because the relative lack of government involvement has strengthened traditional attitudes toward the unequal roles of men and women in the labor market. But other researchers argue that more competitive labor markets should work to women's advantage by penalizing firms that discriminate against women, whereas less competitive labor markets increase the potential for firms to engage in gender discrimination. For example, Winter-Ebmer (1995) finds that in Austria, monopsony power among firms contributes to larger gender wage gaps.⁴

Among studies of competition from international trade, Black and Brainerd (2000) find that in United States manufacturing industries that are both concentrated and increasingly exposed to competing imports, the residual gender wage gap narrows to a greater extent than in non-concentrated, trade impacted industries. The authors interpret this result as evidence supporting Becker's hypothesis that discrimination cannot persist in an increasingly competitive environment. The authors also find that increased trade openness in general, controlling for domestic and international competitiveness, increases the U.S. gender wage gap. Curiously, the authors attribute this latter result to the adverse effect of trade on the wages of unskilled workers (presumed to be predominantly female), even though regressions with residual wages already control for worker skill characteristics. A drawback of the study is its application to data from the United States, a relatively closed economy. Artecona and Cunningham (2001) apply Black and Brainerd's methodology to examine the impact of trade liberalization in Mexico and obtain similar but weaker results. Similar to Black and Brainerd, the authors also find that trade liberalization alone widened the residual gender wage gap and attribute this result to the increasing premium for men's greater experience. In a cross-country analysis using data for 3 middle-income and 13 high-income countries, Behrman and King (1999) find some evidence that increased competitive pressure due to trade openness is associated with higher gender wage ratios. Although this result controls for the impact of competition in domestic markets, as measured by the number of firms relative to production by sector, it is not robust across sample specifications.

By contrast, Zveglic, Rodgers, and Rodgers (1997) and Rodgers (1998) strike a cautionary note against optimism about trade openness. These studies determine how changes over time in measured skill characteristics and their market returns contribute to the evolution of the wage gap in Taiwan and Korea. They conclude that women experienced growing losses in unmeasured gender-related factors over time--losses that worked against women's relative improvements in education and experience. These unexplained losses more than offset women's measured productivity gains in Taiwan during the 1980s and early 1990s, while they partially offset women's productivity gains in Korea in the same period. While these studies do not explicitly relate trade competition to trends in residual gender wage gaps, they do suggest a possible rise in wage discrimination during a period of outward-oriented growth.

In sum, the empirical studies that examine the impact of increased exposure to competitive forces on the gender wage gap, often controlling for contemporaneous changes in detailed worker characteristics, have yielded results that are largely inconclusive. In addition to this group of studies, there are a smaller number of studies that have adopted the non-neoclassical perspective on the labor market and have sought to examine the relationship between trade and the gender wage gap in the context of East Asian countries.

The Non-Neoclassical Approach

In the non-neoclassical approach, wages are determined by not only labor quality, but also industry characteristics, which are the product of competition among firms within an industry and across industries.⁵ Competition is the tendency for uniform profit rates to emerge across industries under conditions of capital mobility. In contrast to the neoclassical concept, competition is not antithetical to, but encompasses, monopoly and tendencies toward industrial concentration, since concentration may facilitate mobility of capital and equalization of the profit rate. Moreover, competition involves not only rivalry and conflict among different firms within and across industries but also competition among groups of workers.

According to this approach, discrimination is not an aberration that arises when competitive conditions fail to hold. On the contrary, it is a product of competition among firms and groups of workers, each behaving in economically rational ways. In this approach, the existence of a hierarchy of jobs and the specter of joblessness are the preconditions for discrimination. In response to these employment conditions, established groups in the labor market become primary agents of discrimination. These privileged groups act collectively to secure favorable employment conditions in a self-interested manner and engage in exclusionary behavior. The groups' respective bargaining power, shaped by their recent social class history, will determine how successful each group will be in securing favorable employment conditions. In this approach, the agency of the established group of workers, by virtue of its greater collective power, will shape the pattern of employment segregation and the position where each group is able to locate itself in the job hierarchy.

In this tradition, feminist economists have long argued that organized action by male workers has shaped the gender-segregated structure of jobs in industrial economies and the associated lower pay for women workers (Hartmann 1976; Milkman 1990). In the context of contemporary East Asia, given the weakness of organized labor for much of this period, male workers may not have been as instrumental in shaping the gender-segregated patterns of employment. A number of studies present evidence to show that, instead, employment segregation by gender in Korea and Taiwan is produced by employer and state hiring, training, employment, and labor control policies in a context of patriarchal gender norms (Seguino 1997; Cheng and Hsiung 1994; Nam 1994). Women are excluded from higher paying, skilled occupations because they are denied access to training, or steered away by gender specific job advertisements. Their employment experience and potential for wage increases are cut short by the employer practice of the "marriage bar." Furthermore, women's wage growth is dampened by the state's promotion of home-based work and relaxation of immigration rules to expand the supply of labor. In turn, the restriction of women's employment opportunities via these policies limits women's bargaining power vis-a-vis employers, and therefore their ability to secure wage gains. The state's emphasis on suppressing collective bargaining in export industries, where women workers are concentrated, has translated into relatively more suppression of women's bargaining efforts. The state may have implemented some of these policies with the objective of supporting continued export competitiveness, rather than perpetuating gender inequalities; nonetheless, their effect is likely to have perpetuated gender wage inequalities. Feminist economists also argue that Taiwan and Korean firms may have sought to preserve labor peace by favoring men over women in their employment policies. Furthermore, wage discrimination against women workers in export industries may have been used as a vehicle by Korea's chaebol, which own firms in a variety of industries, to maintain profitable operations in their capital-intensive firms.⁶

The last two decades in Taiwan and Korea represent a confluence of a number of developments that complicate the analysis of how competition from international trade affects the gender wage gap. Trade competition, outward foreign direct investment, and technological upgrading in several industries are all linked in the effort to maintain or extend competitiveness at the firm and industry levels. Empirical studies using the non-neoclassical framework have examined the impact of trade and foreign direct investment on changes in the gender wage gap. In the Taiwan context, Berik (2000) uses industry-level panel data to provide an explicit test of the effect of export orientation in Taiwan on (unadjusted) gender wage ratios. She finds that, after controlling for employment segregation by gender and other industry characteristics, greater export orientation is associated with smaller wage differentials between men and women. However, this result is due to the fact that export orientation has a larger adverse impact on men's wages than women's wages, suggesting the importance of examining absolute wage levels as well as relative wages.

Seguino (2000) finds support for her thesis that divergent trends in the (unadjusted) gender wage ratio in Taiwan and Korea over the 1981-1992 period are related to the differences in the nature of foreign direct investment flows in the two countries. Accordingly, greater capital mobility in Taiwan's labor-intensive, female-intensive sectors leaves women workers more vulnerable to losses of bargaining power in wage negotiations. In Korea, however, the government exercised greater control over capital outflows in labor-intensive, export-oriented sectors. Relative to Taiwan, Korean capital was more likely to flow out of capital-intensive, male-dominated sectors. Subsidized credit to export-oriented firms for productivity-enhancing investments also helped to facilitate women's relative wage increases in Korea. In an environment where capital is more mobile, the reality or threat of moving to lower wage sites limits the ability of workers to secure higher wages. An environment of lesser capital mobility, on the other hand, encourages firms to maintain competitiveness by other strategies, such as technological upgrading and improvements in product quality.

Unexamined so far are the effects of technological upgrading that are likely to be differentiated by gender. In a period of technological restructuring, men may seek to preserve the new, stable, and higher paying jobs for themselves in the face of competition from lower-waged women workers (Darity 1989). Women, in turn, may experience greater job losses as unskilled jobs disappear, with three possible outcomes: first, women may not find new employment because new jobs require more skills and women may not qualify without training, but from which they are excluded; second, women may get absorbed into reclassified (lower paying) jobs; and third, women may be absorbed into new jobs that are not held by men. Each of these scenarios indicates perpetuation of and perhaps increase in wage discrimination against women workers. While adherents of the non-neoclassical approach do not predict an increase in wage discrimination in technologically dynamic sectors, one could plausibly provide such an account: industries that are undergoing technological upgrading are likely to shed labor associated with the old technology, and hire new, more skilled labor. Such a process is likely to intensify job competition among groups of workers. This process may widen the gender wage gap as the emerging employment structure makes it even less likely that women will find employment in higher paying positions, and their longer job queues for such positions will keep their wages in check.

In sum, non-neoclassical studies have either found or predicted adverse effects of greater international openness on the gender wage gap. These studies have explained employment and pay discrimination by sex in the context of employer incentives, the power of established groups of employees, state objectives to maintain export competitiveness, bargaining power, and gender norms. In such a context, major structural shifts due to capital mobility, trade, and technological restructuring have affected not only changes in labor demand across sectors, but also persistent pay inequities between men and women within sectors. Two recent studies have attempted to disentangle changes in employment and pay in explaining overall changes in Taiwan and Korea's gender wage gaps. Seguino (2000) argues that the redistribution of employment across industries appears to matter less than gender pay discrepancies within industries. A similar conclusion is reached in an analysis by occupation groups rather than industries: pay discrepancies within detailed occupation groups rather than shifts in employment structures across occupations explain much of Taiwan's wage inequality during the 1980s and 1990s (Zveglic and Rodgers 2002). These results imply that women in Taiwan and Korea are not receiving equal pay for work of equal value within industry and occupation groups, results that could be explained by the presence of wage discrimination in the Taiwan and Korean labor markets. The following descriptive and regression analyses provide more detail on sectoral patterns in employment and pay differentials and how these differentials are related to competition from international trade.

III. DESCRIPTIVE ANALYSIS

Wage Structures

Korea is notorious for having one of the lowest gender wage ratios in East Asia. Figure 1 provides wage ratio estimates for selected Pacific Rim economies. In 1990 only Malaysia had a lower wage ratio, and by the late 1990s both Korea and Japan ranked at the bottom with ratios of 58%. Taiwan's gender wage ratio during the 1990s compared favorably with other East Asian economies but stood below that of the industrialized countries, including Australia, New Zealand, and the United States. According to the Figure, during the 1990s the wage ratio generally rose across countries.

Turning next to more detailed trends in the Taiwan and Korean gender wage ratios, Figure 2 shows that without adjusting for any gender differences in skills, the female-male wage ratio in manufacturing fell considerably for

much of the period, from 66% in 1981 to 60% in 1993, before rising again to 67% by 1999. In contrast, women's relative wages in non-manufacturing industries remained fairly stable at roughly 71% until the mid-1990s, when they started to climb by about a percentage point a year. Once gender differences in education and experience are taken into account, women's relative earnings fall sharply until the mid-1990s, particularly in manufacturing, with a recovery in both sectors during the late 1990s.⁷ Patterns in Korean gender wage ratios are reported in the second panel. Like Taiwan, Korean women's relative wages are lower in manufacturing industries than in non-manufacturing industries, but unlike Taiwan, Korea's female to male wage ratio rose fairly steadily throughout the period in both parts of the economy. Once gender skill differentials are taken into account, residual wage ratios are again lower in manufacturing than elsewhere in the economy, with some upward trend in the early to mid-1980s and not much movement thereafter. Notably, unadjusted wage ratios are quite low in Korea relative to Taiwan while residual wage ratios are considerably higher in Korea. This result occurs because observed worker characteristics explain a larger portion of the gender wage differential in Korea than they do in Taiwan, so once worker characteristics are taken into account, the Korean wage differential narrows more for Korea than for Taiwan.⁸

To illustrate how competitive forces from international trade might be related to women's relative wages, Figure 3 plots the manufacturing-sector residual wage ratios against aggregate manufacturing trade ratios in both Taiwan and Korea.⁹ In Taiwan, the period of falling residual wage ratios coincides with a fairly steady increase in trade ratios, while the recovery in women's relative residual wages toward the end of the period coincides with a flattening in both trade ratios. These patterns, which appear to be slightly stronger for the import series, suggest that increasing openness over time is negatively related to patterns in women's relative earnings. In Korea, the slow but steady increase in the residual wage ratio contrasts noticeably with a decline in the aggregate export ratio for most of the period, while there is no clear relationship with imports.¹⁰

Competitive forces from domestic market structures may also have played a role in determining women's relative wages in the manufacturing sector. Figure 4 reports both wage ratios and wage levels by industry concentration for Taiwan and Korea. For Taiwan, Panel A shows that both the unadjusted and residual wage ratios are higher in concentrated industries than in non-concentrated industries. Further analysis (Panel B) shows that wage levels for both men and women are higher in concentrated industries than non-concentrated industries--though men in non-concentrated industries earn substantially more than women in concentrated industries.¹¹ The most likely explanation is the ability of firms in concentrated industries to pay higher wages to all workers, reflecting the technological dynamism of concentrated industries such as electronics, chemical products, and chemical materials (Chen and Chen 1995; Amsden and Chu 2002). Chen and Chen (1995) infer technological capability from sectoral patterns in foreign direct investment. Sectors in which outward foreign direct investment to high wage economies exceed that directed to low wage economies, are sectors where firms are engaged in efforts to expand markets by differentiating products from home production. These industries are also likely to have firms engaged in internal restructuring in Taiwan, introducing new product lines to replace the transplanted ones, and reemploying skilled employees in newly created departments. Industries that have limited capacity to upgrade products or pay higher wages, on the other hand, include several of the non-concentrated industries in this study. These industries experience absolute declines in output as firms replicate home production in low-wage economies in Southeast Asia.

Trends over time are similar in Taiwan's concentrated and non-concentrated industries. Both experienced a steep decline in wage ratios in the 1980s, followed by relatively flat wage ratios in the early 1990s, and a slight rise in the late 1990s. This commonality across industries suggests that wage trends are shaped by forces other than changes in industrial policy or industrial structure, which were both relatively stable during the period. In the latter half of 1990s, the residual wage ratio in non-concentrated industries began to converge to the residual wage ratio in concentrated industries. Panel B shows that this convergence reflects the fact that men in non-concentrated industries experienced virtually no wage growth after 1995, while wages of women in non-concentrated industries continued to rise. In contrast, the Korean residual wage ratio in non-concentrated industries has been relatively flat while the ratio in concentrated industries has been rising (Panel C). Panel D shows that, similar to Taiwan, men and women in Korea's concentrated industries earn more than their counterparts in non-concentrated industries.¹²

Employment Distributions

Changes in labor demand may provide further insight into the changes in the gender wage gaps. According to Becker's theory, trade expansion is likely to reduce discrimination by increasing not only women's relative wages, but also the relative demand for women workers. To shed some light on quantity effects during the period of analysis, Tables 2 (Taiwan) and 3 (Korea) present more detailed information on employment shares by gender, wage ratios, and trade shares across sectors for the 1980-99 period. Within manufacturing Taiwan and Korea share some similar trends, in that both female and male employees recorded dramatic shifts out of low-skilled jobs-- especially textiles and garments--into higher-skilled jobs--especially electrical and electronic equipment. In Taiwan in 1981, over half of women's employment in manufacturing (62%) was in textiles and apparel, electronics, and plastics. In 1999 women's employment continued to be concentrated in the three major employers of women-- now, electronics, textiles and apparel, and metals (basic and fabricated), which accounted for 61% of women's employment. Men's employment was more evenly distributed across sectors than women's, but became more concentrated in a few sectors over time. The top three employers of men accounted for 38% of male employment in 1981 and 50% in 1999. Employment patterns in Korea are similar. The largest employers of women were textiles, apparel, and electronics in both 1980 and 1998. In contrast to Taiwan, the concentration of women in these three industries declined over time, whereas the top three employers of men accounted for a larger share of male employment in 1998 (42%) than in 1980 (30%). In both economies, the industries where women's employment is concentrated are also among the most female intensive sectors.

Table 2 does not indicate support for Becker's theory. Increasing trade competition in Taiwan is not associated with an increase in both the wage ratio and the relative demand for women, particularly in concentrated industries where this effect may be expected. Among concentrated industries, only the chemical products and transport equipment industries experienced rising import (or export) ratios that accompanied a rise in residual wage ratios and an increase in women's share of industry employment. In non-concentrated industries, the relative demand for women rose along with higher trade shares in all but two industries, but this change was accompanied by a decline in wage ratios, suggesting absorption of women into lower paying positions. The non-concentrated sectors have been especially subject to relocation in Southeast Asia and mainland China and are now the source of rising import competition in Taiwan. Except in the plastics industry, these sectors experienced growth in their export shares along with rising import shares, which suggests that they continue to be competitive in export markets. Declining residual wage ratios in all of the non-concentrated industries, not only in industries undergoing capital flight, may indicate the threat of capital mobility on women's relative wages.¹³

Changes in employment, pay, and trade for Korea differ considerably. Table 3 shows that in Korea's concentrated industries, increases in either import or export shares tend to accompany rising wage ratios. However, in most cases these gains are associated with a decline in the female share of industry employment. The relative demand for women also fell in most nonconcentrated industries, and several of these declines were associated with declining export orientation and rising import competition.¹⁴

Focusing on the largest employers, Tables 2 and 3 further show that in both countries import competition in textiles and apparel is associated with greater decline in job opportunities for women than for men. At the same time, this industry has become more export-oriented in Taiwan, while in Korea only textiles experienced an increase in its export share, in both cases most likely on the basis of higher quality products.¹⁵ Consistent with the decline in relative demand for female workers, the residual wage ratio in Taiwan's textile and apparel industries declined over time, and fell in textiles but was relatively constant in Korea's apparel industry. The lower wage ratio may reflect not only that the jobs held by women are rapidly disappearing but also that women are being absorbed into new lower-paying positions in textiles and apparel as the industry undergoes restructuring. The electrical and electronic goods industries in both Taiwan and Korea also saw a decline in the percent of the workforce that is female. In Taiwan, this change was associated with a decline in trade ratios and in the wage ratio, which suggests that women are being absorbed into lower paid jobs and are unable to secure wage gains relative to men as this concentrated sector undergoes technological restructuring. In Korea, however, the decline in women's representation among electronics workers was accompanied by a higher wage ratio and by greater trade shares.¹⁶ These patterns among the largest employers signal the contrasting experiences of female workers in Taiwan and Korea since 1980 as labor markets responded to the forces of trade and technological change.

IV. METHODOLOGY

The regression analysis determines the extent to which the gender wage gap responds to increased competition from international trade. The basic strategy underlying the empirical approach is to separate the effects of greater openness in international trade from other contemporaneous shocks that are unrelated to international competitiveness. The effect of greater openness in international trade is isolated by controlling for differences in market structure across industries.

Increased openness in international trade is hypothesized to place pressure on firms to reduce discrimination against women. Firms in relatively more concentrated industries are considered to face less domestic pressure to engage in competitive behaviors such as reducing costly discrimination against women, compared to firms in relatively less concentrated industries. Any reduction in the gender wage gap in relatively concentrated industries should then be attributed to the competitive forces from international trade. Intuitively, the wage effects from trade openness are identified by comparing the wage impact of trade openness in more concentrated industries to less concentrated industries.

The estimation model, as employed in Black and Brainerd (2000), tests the idea that changes in competitiveness over time affect changes in wage gaps over time. Let W_{ist} be the average log wage of workers with sex s in industry i and year t , and let $\Delta_s W_{ist}$ denote the difference between men and women in average log wages in industry i and year t . Further, let Δ_t denote the difference in any variable between two years within any industry. The estimation equation is:

$$\Delta_t \Delta_s W_{ist} = \alpha_0 + \alpha_1 C_i + \alpha_2 (\Delta_t M_{it}) + \alpha_3 (C_i \times \Delta_t M_{it}) + error$$

where the dependent variable is the change over time in the average gender log wage gap by industry. The notation C_i is the industry-specific measure of domestic concentration, $\Delta_t M_{it}$ is the change over time in the industry-specific import ratio (and alternatively the export ratio), and $C_i \times \Delta_t M_{it}$ represents the interaction between industry concentration and the change in the trade share. The coefficient α_1 represents the effect from domestic concentration, and α_2 represents the effect from increased exposure to international trade. The final coefficient α_3 represents the wage gap effect in a sector that is more open and concentrated; it is the estimate of changes in international competitiveness on changes in the wage gap over time. Each variable is disaggregated by detailed industry codes. Regressions are weighted using probability weights based on average-period employment levels by industry. All data used to estimate the model are described in the Data Appendix.

The dependent variable is constructed from time series information on average wages by sex, industry, and year. The above equation is estimated using both average unadjusted wage gaps by industry and average residual wage gaps by industry. The residual wage gap--the portion of the wage gap which cannot be explained by observed productivity differences between men and women--is commonly attributed to wage discrimination against women. To calculate these figures, a human capital earnings function is estimated for male employees in each year. Here, the dependent variable is log monthly earnings. Because the independent variables include log monthly hours worked, the analysis effectively estimates an hourly-wage equation.¹⁷ The remaining observable characteristics include a standard set of human capital indicators, such as education, experience, regional locations, and worker status.¹⁸ Occupation dummy variables are excluded since occupational attainment may involve some degree of labor market discrimination. The coefficients from the male regression are used to calculate predicted log wages for male and female workers.¹⁹ Residual wages are the difference between actual log wages and predicted log wages, and the residual gender wage gap is the difference between male and female residual wages.

The industry-specific measure of domestic concentration is constructed from Pareto function estimates of concentration across revenue categories and industries. Following Curry and George (1983), the number of firms of size x or larger in a given industry can be written as a Pareto distribution of the following form:

$$P(x) = (x_0 / x)^\alpha \quad \text{for } x \text{ greater than a minimum size } x_0$$

where α denotes a constant. Taking the logarithm of both sides yields the following estimation equation:

$$\log P(x) = \alpha_0 \log x_0 - \alpha \log x$$

Intuitively, on a log-log scale, the distribution of firms along increasing size categories is described as a downward sloping line with slope α .²⁰ The steeper the slope coefficient, the less concentrated--or more competitive--the industry. This method can be applied to data that is readily available for many developing countries, including both Taiwan and Korea, whereas other popular indices of concentration have more stringent data requirements. The Pareto function estimates are used to specify domestic concentration as a continuous variable and, alternatively, as a dummy variable. For the latter, industries are ranked in descending order of competitiveness, and industries above a critical breakpoint are assigned a value of zero for non-concentrated, while industries below a critical breakpoint are assigned a value of one for concentrated.

To check for robustness in our determination of concentration across industries, the Pareto function is estimated using alternative proxies for size categories and alternative years of data. In particular, revenue size categories are measured by operating receipts for Taiwan and shipments for Korea. Alternatively, asset size categories are measured by assets for Taiwan and paid-in-capital for Korea. For each series the function is estimated with data from a beginning year and an end year. Table 1 presents results for both countries' industry-specific domestic competitiveness using the Pareto function approach applied to revenue size categories using data from a beginning year. Rank correlation coefficients indicate that the rankings do not change much over time and are robust to alternative measures of industry concentration.²¹

Finally, the import ratio variable is constructed from time series information on the ratio of imports to domestic production (and alternatively, the ratio of exports to domestic production). Trade shares may be a less precise indicator of trade openness compared to measures based on tariffs, non-tariff barriers, and export subsidies, particularly for economies such as Taiwan and South Korea whose governments used an extensive array of trade policies to protect their export and import-substitute sectors. However, even though the tradeables sectors in these countries benefited from government protection, the protection was linked with carefully-structured incentives for competition, thus making trade shares a reasonable indicator of international competitiveness.²² In the regression analysis, trade ratios are specified as natural logs, so the coefficients on the trade ratio variables are interpreted as elasticities.

V. REGRESSION RESULTS

Estimation results are found in Table 4 (Taiwan) and Table 5 (Korea). The results are reported as changes in the male-female wage gap measured in log points. The male-female gap may be converted to a female to male ratio by exponentiating its negative. Both tables report results from estimations where domestic concentration is specified as a time-invariant dummy variable (columns 1 and 3) and as a time-invariant continuous variable (columns 2 and 4). Both tables report results for the full period of analysis (columns 1 and 2), and to avoid possible distortions from the East Asian financial crisis, for the period ending in 1996 (columns 3 and 4).

A strong result emerges for Taiwan: an increase in international competitiveness over time in concentrated industries is associated with a widening in the gender wage gap. This result is robust to alternative end years in estimation, alternative weighting methods, and most alternative specifications of industry concentration. However, the result holds only when trade openness is measured using the ratio of imports to output by sector. Table 4 shows that after controlling for worker productivity characteristics, an increase in international competitiveness from imports in concentrated industries ($C \times \Delta_t M_t$) between 1981 and 1999 is associated with a statistically significant increase in the residual wage gap. The result could imply that wage discrimination against women rises in the face of increased competition from imports. While an increase in competitiveness from exports in concentrated industries ($C \times \Delta_t X_t$) also appears to be associated with an increase in the residual wage gap, the result is not significant. For unadjusted wage gaps in Panel A, the main result holds, but the coefficient estimate on $C \times \Delta_t M_t$ for the 1981-99 period loses its precision once concentration is

measured using a continuous variable.

When 1996 is used as the endpoint, increased competitiveness from imports in concentrated industries is similarly associated with wider wage gaps across specifications for both the residual and unadjusted wage gaps. This result suggests that the main conclusion is not sensitive to any spillover effects from the financial crisis. In additional tests for robustness (not reported), the positive coefficient on the interaction between concentration and the import ratio for both the unadjusted and residual wage gap regressions maintains its precision when concentration is measured using the assets-based Pareto estimates, regardless of the end year of the estimation period. A similar robustness across alternative measures of concentration is in evidence when 1997 is used as the end year. When concentration is measured in terms of the number of enterprises/output, the estimates for $C \times \Delta_t M_t$ are more sensitive to the end year chosen and only become significant in most specifications that use 1996 and 1997 as the end year.

The conclusion that trade competition in concentrated sectors is positively associated with the gender wage gap still holds for Korea, but the results are not as strong, and competition from exports appears to matter more than competition from imports. The first panel of Table 5 shows that increased competitiveness from exports is associated with a widening in the unadjusted wage gap in concentrated industries when domestic concentration is specified as a continuous variable but not as a dummy variable. This conclusion also holds for the residual wage gap for the 1980-98 period only. In the shorter period that controls for the effects of the East Asian crisis, it appears that competitiveness from imports, rather than exports, is positively associated with widening residual wage gaps. Similar conclusions are reached in robustness tests when concentration is measured using the number of establishments/output by sector.

VI. CONCLUSION

This study has examined the impact of international competitiveness on industry-level gender wage gaps in Taiwan and Korea's manufacturing sectors between 1980 and 1999. During much of this period the gender wage gap in Taiwan widened, only to begin a recovery in the mid-1990s. By contrast, Korea's gender wage gap narrowed slowly and steadily through most of the period. While both countries are highly open to trade, trends in trade ratios also diverged over this period, with Taiwan becoming relatively more exposed to international competitive pressures than Korea. Taiwan experienced a near continuous rise in both export and import shares of its manufactured output, while Korea experienced a decline in its export share for much of the period along with a flat trend in its import share. Taiwan's greater trade openness has been driven by not only increasing imports of labor-intensive goods from Southeast Asia--which has become the center of Taiwan's investments--but also by efforts to technologically upgrade the export sector. Both countries had a relatively stable industrial structure and policy during the period, Taiwan being the more competitive and market-oriented of the two. The descriptive analysis, therefore, has shown that in Taiwan rising trade openness and a continued highly competitive industrial structure are associated with rising gender wage inequality. By contrast, Korea's declining total trade openness, coupled with its less competitive industrial structure, is associated with a gradual narrowing of the manufacturing-sector gender wage gap.

The study specifically aimed to test the dynamic implications of Becker's theory that greater competition erodes wage discrimination against women. The empirical analysis centered on the effects of trade on the gender residual wage gap in relatively concentrated industries. Residual wage gaps, which account for gender differences in observed productivity characteristics, are often attributed to wage discrimination against women. In concentrated industries, employers face less pressure from domestic competition to cut costs, so any reduction in the residual wage gap could then be attributed to the competitive forces from international trade rather than to domestic pressures. Consistent with the descriptive analysis, industry-level wage-gap regressions do not support Becker's theory. Quite the contrary, results indicate that increasing competitiveness from trade is positively associated with the residual wage gap in concentrated industries in both countries. The more robust regression results emerge for Taiwan. They show that from 1981 to 1999, rising import shares are associated with rising wage discrimination against women workers in concentrated industries, which include the largest employer and major exporter sectors, such as the textiles/apparel and the electronics/electrical industries. For Korea, a slight decline in export orientation is weakly associated with a reduction in wage discrimination against female workers in concentrated industries between 1980 and 1998.

The results for Taiwan may be explained in light of the restructuring in Taiwan's labor-intensive, export-oriented industries, which experienced layoffs following the expansion of foreign direct investment in the same industries from Taiwan toward mainland China and Southeast Asia. Concentrated industries that are more successful in technological upgrading and capturing new export markets are also the ones that disproportionately employ higher-paid, male workers. Moreover, rising import competition in previously export-oriented sectors appears to be associated with more layoffs for women than men and greater downward pressure on women's wages in an environment that affords little protection for workers. Through both channels, female workers appear to disproportionately bear the costs of greater exposure to international trade. In the Korean case, improvements in women's relative pay occurred not in the presence of greater competition from international trade, as implied by Becker's theory, but in the face of slightly weaker international trade pressures. The result is consistent with arguments in Seguino (2000) that the relative lack of capital mobility out of export-oriented sectors compared to Taiwan and the government's policies to support upgrading efforts among high-volume firms in these sectors could have inadvertently benefited women. The comparative analysis of two highly successful export economies thus shows that increasing international openness does not ensure an improvement in women's relative economic status.

The major policy initiative to ensure that gains from globalization are shared more equally between men and women would be to pass and enforce anti-discrimination legislation. This initiative would not only open up access to jobs for women in a wider range of occupations and industries than the ones they are concentrated in but also ensure equal pay for equal work. The political economic context, however, indicates the enormous difficulty of passing, let alone enforcing, such legislation. Taiwan has had an equal pay for equal work clause on the books since enacting the 1984 Labor Standards Law, but evidence in Chiu (1993) shows that firms were less likely to comply with the equal pay clause than they were with other measures in the Labor Law. Taiwan still has no equal opportunity in employment legislation on the books. Chen's (2001) discussion of the "Gender Equal Employment" Bill (GEEB), first introduced in the parliament in 1989, shows the resistance to the bill that came from business groups and economic ministries of the government entrusted with ensuring continued export competitiveness. The bill is a comprehensive law aimed to protect women's equal rights in the labor market. It prohibits employment discrimination in various forms and introduces provisions such as parental leave to reduce the conflict between employment and family responsibilities. Chen states that representatives of business groups threatened to move firms out of Taiwan or not hire women, should the bill be passed, and in the recessionary environment of the early 1990s these threats were effective in preventing the passage of this bill into law. The threats suggest that wage discrimination against women workers continues to be an important means for continued export competitiveness, in spite of the manufacturing industry's shift from the low-wage route to maintaining export competitiveness to a route where competition is more on the basis of export product quality.

In the Korean case, the government has had equal opportunity in employment legislation on the books since 1987. Additional labor reforms in 1987 relaxed the government's control on unions and liberalized collective bargaining procedures. These changes resulted in greater pressure on firms to comply with existing labor standards they had previously ignored, including an equal pay for equal work clause. The slight decline in export orientation and support from the government's industrial policy in concentrated industries may have facilitated better enforcement of this anti-discrimination legislation during the period of analysis, helping to explain the decline in wage discrimination in export-oriented, concentrated industries.

DATA APPENDIX

Taiwan's standard industry classification has undergone six revisions since its inception in 1967. The first year of data used in this study is based on the second revision. Revisions 3 (1983), 4 (1987), and 6 (1996) contain changes primarily at the three-digit level, which are readily reconcilable with earlier versions for the two-digit classifications. Only the fifth revision, published in 1991, contains major changes at the one- and two-digit levels, but this change only affects the labor data from 1993 onwards. Korea's standard industry classification has undergone seven revisions since its establishment in 1963. The first year of data used in this study is based on the fourth revision. Revisions 5 (1984) and 7 (1998) contain changes primarily at the four-digit and five-digit levels, which are readily reconcilable with earlier versions for three-digit classifications (Kang, 2001). Only the sixth revision, published in 1991, contains major changes at all levels of aggregation, but this change only affects the labor data from 1993 onward. Both the Taiwan and Korea industry classification systems are based on

international standards. We categorize manufacturing industries by two-digit codes for Taiwan and three-digit codes for Korea since the labor data record industry of employment at that level. As shown in Appendix Table 1, some additional aggregation was necessary to provide consistency over time and to avoid small cell sizes in the calculation of average wages by gender and industry.²³

Appendix Table 2 summarizes the key variables and their sources. The labor data for Taiwan are from the Manpower Utilization Survey for the period 1981-1999. This household-level survey contains detailed information on earnings, employment, and worker characteristics. The Korean labor data come from the Occupational Wage Survey (OWS), but due to constraints on data availability, the sample is limited to the years 1980, 1983, 1986, 1989, 1992, 1994, 1996, and 1998. This establishment-level survey similarly contains comprehensive labor-market information for individual workers. Surveyed establishments are selected using a stratified random sampling method from establishments with at least 10 workers. In addition to small firms, the OWS also excludes the self-employed, family workers, temporary workers, and public-sector workers. Wages for both countries are deflated using the consumer price index.

The US-dollar value of exports and imports by 4-digit International Standard Industrial Category (ISIC) are from the International Economic Data Bank (IEDB) for the period 1980-1999 for both Taiwan and Korea. IEDB converts UN trade data from Standard International Trade Categories to ISIC using concordance tables based on the structure of trade and production in the two economies. The trade ratios are relative to a measure of gross production by industry. For Taiwan, the data are gross receipts by 2-digit level Taiwan industry codes (revision 6) in new Taiwan dollars. The production data are converted to US dollars using the annual average exchange rate. The trade data are regrouped according to 2-digit Taiwan industry codes (revision 6) using a linking scheme based on concordance tables published by the United Nations and the government of Taiwan. For Korea, the production data are gross output in US dollars by 3-digit ISIC codes from the UNIDO Industrial Statistics Database.

For Taiwan, the data for estimating domestic competitiveness come from the Industrial and Commercial Census. This census, conducted once every five years, contains data by disaggregated industry on the number of enterprises in various operating-receipts categories of increasing size. The census also has data on the number of enterprises by asset size categories and by industry. We use both series in alternative estimates of the Pareto function for a base year (1981) and an end year (1996). For Korea, the data for estimating domestic competitiveness come from the Korean Industrial Census. This census, conducted once every five years, contains data by disaggregated industry on the number of establishments in various shipment-value categories of increasing size. The census also has data by industry on the number of establishments by asset size categories, as indicated by paid-in-capital. Both series are used in alternative estimates of the Pareto function for a base year (1983) and an end year (1998).

Appendix Table 1: Consistent Manufacturing Aggregates by Standard Industrial Classification Codes, Taiwan and Korea

| <i>Taiwan Manufacturing Industry Aggregates</i> | | <i>Rev. 2-4 (1981-92)</i> | <i>Rev. 5-6 (1993-99)</i> |
|---|---|-------------------------------|-------------------------------|
| 1. | Food, Beverage, and Tobacco Manufactures | 20, 21 | 11, 12 |
| 2. | Textile Industries; Manufacture of Wearing Apparel and Accessories | 22, 23 | 13, 14 |
| 3. | Manufacture of Leather, Fur, and Related Products | 24 | 15 |
| 4. | Manufacture of Wood Products, Bamboo Products, and Furniture | 25 | 16, 17 |
| 5. | Manufacture of Paper and Paper Products; Printing | 26 | 18, 19 |
| 6. | Manufacture of Chemical Materials; Manufacture of Petroleum and Coal Products | 27, 29 | 21, 23 |
| 7. | Manufacture of Chemical Products | 28 | 22 |
| 8. | Manufacture of Rubber Products | 30 | 24 |
| 9. | Manufacture of Plastic Products | 31 | 25 |
| 10. | Manufacture of Non-metallic Mineral Products | 32 | 26 |
| 11. | Basic Metal Industries; Manufacture of Fabricated Metal Products | 33, 34 | 27, 28 |
| 12. | Manufacture and Repair of Machinery and Equipment | 35 | 29 |
| 13. | Manufacture and Repair of Electrical and Electronic Machinery and Equipment | 36 | 31 |
| 14. | Manufacture and Repair of Transport Equipment | 37 | 32 |
| 15. | Manufacture of Precision Instruments | 38 | 33 |
| 16. | Manufacture of Miscellaneous Industrial Products | 39 | 39 |

| <i>Korean Manufacturing Industry Aggregates</i> | | <i>Rev. 4-5 (1980-92)</i> | <i>Rev. 6-7 (1993-98)</i> |
|---|---|-------------------------------|-------------------------------|
| 1. | Food Manufactures | 311 | 151-154 |
| 2. | Beverage and Tobacco Manufactures | 313, 314 | 155, 160 |
| 3. | Textile Industries. | 321 | 171-173 |
| 4. | Manufacture of Wearing Apparel | 322 | 181 |
| 5. | Manufacture of Leather, Fur, Related Products, and Footwear (except Rubber or Plastic Footwear) | 323, 324 | 182, 191, 192 |
| 6. | Manufacture of Wood Products and Cork Products | 331 | 201, 202 |
| 7. | Manufacture of Furniture and Fixtures | 332 | 361 |
| 8. | Manufacture of Paper and Paper Products | 341 | 210 |
| 9. | Printing and Publishing | 342 | 221, 222 |
| 10. | Manufacture of Chemical Materials | 351 | 241 |
| 11. | Manufacture of Chemical Products | 352 | 242, 243 |
| 12. | Manufacture of Petroleum and Coal Products | 353, 354 | 231-233 |
| 13. | Manufacture of Rubber Products | 355 | 251 |
| 14. | Manufacture of Plastic Products | 356 | 252 |
| 15. | Manufacture of Pottery, China, and Glass Products | 361, 362 | 261 |
| 16. | Manufacture of Other Non-metallic Mineral Products | 369 | 269 |
| 17. | Iron and Steel Basic Industries; Non-Ferrous Metal Basic Industries | 371, 372 | 271-273 |
| 18. | Manufacture of Fabricated Metal Products | 381 | 281, 289 |
| 19. | Manufacture of Machinery and Equipment | 382 | 291-293 |

| | | | |
|---|--|-----|-------------------------------|
| 20. | Manufacture of Electrical and Electronic Machinery and Equipment | 383 | 300, 311-315, 319, 321-323 |
| 21. | Manufacture of Transport Equipment | 384 | 341-343, 351-353, 359 |
| 22. | Manufacture of Precision Instruments | 385 | 331-333 |
| 23. | Manufacture of Miscellaneous Industrial Products | 390 | 369, 371, 372 |
| Sources: DGBAS (1987, 1991) and NSO (2001). | | | |

| Appendix Table 2: Key Variable Definitions and Data Sources | | | |
|--|--|---|--|
| <i>Variable</i> | <i>Description</i> | <i>Date Source: Taiwan</i> | <i>Date Source: Korea</i> |
| Real Wage: | | | |
| Nominal Wage | Average wages and average residual wages by sex and industry | Manpower Utilization Survey, DGBAS 1981-1999 | Occupational Wage Survey, Ministry of Labor 1980, 83, 86, 89, 92, 94, 96, 98 |
| Wage Deflator | Consumer price index | Monthly Bulletin of Statistics, DGBAS (various) 1981-1999 | NSO Online Statistical Database, NSO 1980-1998 |
| Trade Shares: | | | |
| Imports | CIF value by industry | International Economic Data Bank, ANU (2001) 1981-1999 | International Economic Data Bank, ANU (2001) 1980-1998 |
| Exports | FOB value by industry | International Economic Data Bank, ANU (2001) 1981-1999 | International Economic Data Bank, ANU (2001) 1980-1998 |
| Domestic Production | Gross receipts (Taiwan), gross output (Korea) by industry | National Income Accounts, DGBAS 1981-1999 | Industrial Statistics Database, UNIDO (2000) 1980-1998 |
| Exchange Rate | Average exchange rate | Financial Statistics (IMF), Central Bank of China (various) 1981-1999 | Not applicable |
| Industry Concentration: | Pareto function estimates by industry | Industrial and Commercial Census, DGBAS 1981, 1996 | Korean Industrial Census, NSO 1983, 1998 |

Table 1: Pareto Function Estimates of Domestic Competitiveness For Taiwan and Korea (Industry ranking in descending order of competitiveness)

| <i>Taiwan</i> | | <i>1981</i> | <i>Korea</i> | | <i>1983</i> |
|---------------|---|-------------|--------------|--|-------------|
| 1. | Basic Metal Industries; Fabricated Metal Products | -0.77 | 1. | Furniture and Fixtures | -0.75 |
| 2. | Wood Products, Bamboo Products, and Furniture | -0.76 | 2. | Miscellaneous Industrial Products | -0.73 |
| 3. | Machinery and Equipment | -0.76 | 3. | Wood Products and Cork Products | -0.73 |
| 4. | Paper and Paper Products; Printing | -0.71 | 4. | Printing and Publishing | -0.71 |
| 5. | Miscellaneous Industrial Products | -0.71 | 5. | Wearing Apparel | -0.66 |
| 6. | Plastic Products | -0.67 | 6. | Fabricated Metal Products | -0.65 |
| 7. | Food, Beverage, and Tobacco Manufactures | -0.62 | 7. | Plastic Products | -0.61 |
| 8. | Textile Industries; Wearing Apparel & Accessories | -0.61 | 8. | Machinery and Equipment | -0.58 |
| 9. | Non-metallic Mineral Products | -0.61 | 9. | Other Non-metallic Mineral Products | -0.57 |
| 10. | Chemical Products | -0.58 | 10. | Precision Instruments | -0.57 |
| 11. | Leather, Fur, and Related Products | -0.56 | 11. | Leather, Fur, Related Products, and Footwear | -0.54 |
| 12. | Transport Equipment | -0.53 | 12. | Textile Industries | -0.54 |
| 13. | Rubber Products | -0.52 | 13. | Pottery, China, and Glass Products | -0.53 |
| 14. | Electrical, Electronic Machinery & Equipment | -0.51 | 14. | Food Manufactures | -0.47 |
| 15. | Precision Instruments | -0.51 | 15. | Beverage and Tobacco Manufactures | -0.45 |
| 16. | Chemical Materials, Petroleum, and Coal Products | -0.26 | 16. | Paper and Paper Products | -0.44 |
| | | | 17. | Transport Equipment | -0.40 |
| | | | 18. | Electrical, Electronic Machinery & Equipment | -0.37 |
| | | | 19. | Rubber Products | -0.35 |
| | | | 20. | Chemical Products | -0.24 |
| | | | 21. | Iron and Steel, Non-Ferrous Metal Industries | -0.23 |
| | | | 22. | Chemical Materials | -0.22 |
| | | | 23. | Petroleum and Coal Products | -0.04 |

Note: Figures report the coefficient estimates of Pareto functions using data on number of enterprises by size categories of operating receipts (Taiwan) or shipments (Korea).

**Table 2: Employment, Residual Wage, and Trade Ratios by Industry Concentration, Taiwan: 1981-1999
(In Percentage Points)**

| | <i>Female Employment Share</i> | | <i>Male Employment Share</i> | | <i>Percent Female</i> | | Δ <i>Residual Wage Ratio</i> | Δ <i>Import Ratio</i> | Δ <i>Export Ratio</i> |
|------------------------------------|--------------------------------|------------------|------------------------------|------------------|-----------------------|-------------|-------------------------------------|------------------------------|------------------------------|
| | <i>Base</i> | <i>Change</i> | <i>Base</i> | <i>Change</i> | <i>1981</i> | <i>1999</i> | | | |
| | <i>1981</i> | <i>1999-1981</i> | <i>1981</i> | <i>1999-1981</i> | <i>1981</i> | <i>1999</i> | <i>1999-1981</i> | <i>1999-1981</i> | <i>1999-1981</i> |
| <i>Non-Concentrated Industries</i> | | | | | | | | | |
| Basic Metal; Fabricated Metal | 3.3 | 4.9 | 17.8 | 3.7 | 12.6 | 21.1 | -5.9 | -6.7 | 9.5 |
| Wood Products | 4.1 | -1.4 | 8.2 | -4.2 | 28.1 | 32.1 | -3.7 | 24.2 | 3.1 |
| Machinery and Equipment | 1.4 | 1.5 | 8.3 | 0.7 | 11.6 | 18.4 | -3.3 | 39.8 | 243.4 |
| Paper; Printing | 2.3 | 1.4 | 5.0 | 0.2 | 26.7 | 33.3 | -3.1 | 12.8 | 3.5 |
| Misc. Industrial Products | 6.7 | -2.6 | 3.9 | -1.5 | 57.5 | 54.5 | -1.0 | 8.6 | 6.1 |
| Plastic Products | 8.6 | -2.9 | 6.6 | -1.1 | 50.2 | 41.9 | -13.9 | 6.6 | -14.2 |
| <i>Concentrated Industries</i> | | | | | | | | | |
| Food, Beverage, and Tobacco | 5.1 | 0.2 | 7.2 | -1.3 | 35.7 | 38.7 | -2.5 | 12.4 | -6.4 |
| Textile and Apparel | 36.1 | -17.5 | 9.7 | -3.2 | 74.4 | 66.6 | -11.5 | 8.2 | 25.1 |
| Non-metallic Mineral Products | 4.5 | -1.7 | 5.9 | -1.5 | 37.3 | 30.5 | -8.5 | 10.3 | -4.8 |
| Chemical Products | 1.4 | 0.8 | 2.4 | -0.2 | 31.5 | 41.5 | 3.9 | 7.7 | 8.3 |
| Leather, Fur, Related Products | 4.4 | -2.7 | 2.5 | -1.5 | 57.8 | 53.5 | -14.5 | 13.5 | -67.4 |
| Transport Equipment | 1.7 | 1.6 | 6.0 | 0.3 | 17.9 | 26.5 | 2.6 | 15.0 | 9.5 |
| Rubber Products | 0.9 | 1.7 | 1.2 | 0.4 | 36.8 | 52.6 | 2.4 | -2.1 | -8.1 |
| Electrical, Electronic | 17.3 | 16.5 | 10.0 | 9.0 | 57.5 | 55.5 | -2.8 | -0.5 | -8.6 |
| Precision Instruments | 1.4 | -0.4 | 1.6 | -0.7 | 41.0 | 44.1 | -6.4 | 282.9 | 62.0 |

| | | | | | | | | | |
|-------------------------------------|-----|-----|-----|-----|------|------|------|------|------|
| Chemical Materials, Petroleum | 0.8 | 0.8 | 3.6 | 0.8 | 14.8 | 20.3 | -6.6 | 11.5 | 18.6 |
|-------------------------------------|-----|-----|-----|-----|------|------|------|------|------|

**Table 3: Employment, Residual Wage, and Trade Ratios by Industry Concentration, Korea: 1980-1998
(In Percentage Points)**

| | <i>Female Employment Share</i> | | <i>Male Employment Share</i> | | <i>Percent Female</i> | | <i>Δ Residual Wage Ratio</i> | <i>Δ Import Ratio</i> | <i>Δ Export Ratio</i> |
|------------------------------------|--------------------------------|------------------|------------------------------|------------------|-----------------------|-------------|------------------------------|-----------------------|-----------------------|
| | <i>Base</i> | <i>Change</i> | <i>Base</i> | <i>Change</i> | | | | | |
| | <i>1980</i> | <i>1998-1980</i> | <i>1980</i> | <i>1998-1980</i> | <i>1980</i> | <i>1998</i> | <i>1998-1980</i> | <i>1998-1980</i> | <i>1998-1980</i> |
| <i>Non-Concentrated Industries</i> | | | | | | | | | |
| Furniture and Fixtures | 0.3 | 1.0 | 0.9 | 0.1 | 25.0 | 31.0 | 3.6 | -2.3 | 2.7 |
| Misc. Industrial Products | 4.6 | -1.7 | 2.4 | -0.5 | 63.4 | 35.3 | 6.3 | -0.6 | 9.0 |
| Wood Products and Cork | 1.4 | -0.2 | 2.8 | -1.2 | 30.3 | 19.6 | 1.0 | 31.2 | -34.2 |
| Printing and Publishing | 1.0 | 1.3 | 2.4 | 0.7 | 27.7 | 21.1 | -7.0 | -1.6 | -4.8 |
| Wearing Apparel | 18.4 | -8.3 | 4.2 | -2.2 | 80.0 | 64.4 | 0.5 | 8.2 | -40.4 |
| Fabricated Metal Products | 2.2 | 0.5 | 8.0 | -3.6 | 19.8 | 17.9 | 13.4 | -12.9 | -14.6 |
| Plastic Products | 0.8 | 0.8 | 1.5 | 1.3 | 33.3 | 17.2 | 0.6 | 2.4 | -18.4 |
| Machinery and Equipment | 0.6 | 3.9 | 6.6 | 4.4 | 7.8 | 12.8 | 10.9 | -83.8 | 21.8 |
| Other Non-metallic Mineral | 0.9 | 1.4 | 4.4 | -1.8 | 16.0 | 23.8 | -8.8 | -0.1 | -10.9 |
| Precision Instruments | 1.4 | 0.4 | 1.3 | -0.1 | 48.8 | 33.5 | 3.6 | 31.1 | 18.5 |
| Leather, Fur, Related Products | 2.8 | 0.3 | 2.8 | -1.2 | 47.5 | 41.5 | -14.7 | -16.5 | 14.4 |
| Textile Industries | 30.5 | -15.7 | 11.3 | -5.1 | 71.0 | 45.9 | -5.4 | 7.6 | 41.8 |
| Pottery, China, and Glass | 1.5 | -1.2 | 2.2 | -1.2 | 37.4 | 8.9 | 21.0 | 11.1 | 2.0 |
| <i>Concentrated Industries</i> | | | | | | | | | |
| Food Manufactures | 5.1 | 4.8 | 5.6 | -0.6 | 45.0 | 40.9 | 9.2 | -2.0 | -1.8 |

| | | | | | | | | | |
|--------------------------|------|------|------|------|------|------|-------|-------|-------|
| Beverage and Tobacco | 0.5 | 0.5 | 1.5 | 0.9 | 22.3 | 12.5 | 21.8 | 3.1 | 0.6 |
| Paper and Paper Products | 1.1 | 0.0 | 2.5 | 0.5 | 29.0 | 11.5 | 8.1 | -6.6 | 14.6 |
| Transport Equipment | 0.7 | 3.4 | 7.8 | 5.9 | 7.1 | 9.5 | 11.2 | -31.7 | -0.1 |
| Electrical, Electronic | 16.1 | 11.0 | 10.8 | 6.9 | 57.4 | 35.2 | 13.0 | 17.3 | 36.2 |
| Rubber Products | 6.3 | -5.5 | 4.4 | -2.8 | 56.6 | 15.3 | 5.1 | 0.2 | 107.6 |
| Chemical Products | 3.0 | 1.7 | 4.3 | 0.5 | 38.5 | 25.5 | 10.8 | 3.3 | 6.0 |
| Iron and Steel | 0.4 | 0.6 | 7.5 | -2.7 | 4.3 | 6.9 | 4.4 | 0.7 | 4.7 |
| Chemical Materials | 0.4 | 0.3 | 2.4 | 1.1 | 12.3 | 6.3 | -2.5 | -8.6 | 25.7 |
| Petroleum and Coal | 0.2 | 0.8 | 2.4 | 0.8 | 5.8 | 9.5 | -21.1 | 10.7 | 28.7 |

Table 4: Determinants of Change in the Gender Wage Gap, Taiwan
(in log points x 100; standard errors in parentheses)

| | (1) | (2) | (3) | (4) |
|-------------------------------------|-----------|-----------|-----------|-----------|
| Panel A: Unadjusted Wage Gap | | | | |
| <i>C</i> | -15.23*** | -54.13*** | -18.35*** | -69.28*** |
| | (2.94) | (8.88) | (5.36) | (18.58) |
| $\Delta_t M_t$ | -4.73 | 28.12 | -3.76* | 61.72*** |
| | (3.43) | (22.05) | (2.07) | (18.68) |
| <i>C</i> x $\Delta_t M_t$ | 10.66* | 43.37 | 17.83*** | 85.72*** |
| | (5.08) | (32.76) | (4.71) | (25.85) |
| <i>constant</i> | 7.35*** | -34.89*** | 12.02*** | -42.34*** |
| | (1.89) | (5.68) | (2.88) | (13.00) |
| <i>C</i> | -9.51** | -44.66** | -4.18 | -19.23 |
| | (3.61) | (16.53) | (4.62) | (20.97) |
| $\Delta_t X_t$ | -1.79 | 2.20 | 4.26 | -16.55 |
| | (1.61) | (10.37) | (5.24) | (16.49) |
| <i>C</i> x $\Delta_t X_t$ | -1.04 | 6.46 | -4.22 | -29.17 |
| | (5.36) | (15.11) | (11.33) | (24.87) |
| <i>constant</i> | 5.25 | -28.40** | 7.80** | -6.91 |
| | (2.98) | (9.71) | (2.74) | (13.66) |
| Panel B: Residual Wage Gap | | | | |
| <i>C</i> | -6.86** | -20.28** | -11.03 | -39.93 |
| | (3.00) | (8.08) | (6.96) | (24.27) |
| $\Delta_t M_t$ | -1.17 | 37.28** | -1.46 | 72.00*** |
| | (1.86) | (13.10) | (4.16) | (17.71) |
| <i>C</i> x $\Delta_t M_t$ | 11.07** | 49.85** | 17.74*** | 96.21*** |
| | (3.72) | (17.86) | (5.57) | (25.20) |
| <i>constant</i> | 8.39*** | -8.31 | 12.62** | -19.87 |
| | (1.72) | (5.91) | (5.47) | (16.10) |
| <i>C</i> | -2.01 | -20.44 | -0.66 | 4.99 |
| | (3.71) | (15.11) | (6.51) | (31.11) |
| $\Delta_t X_t$ | -5.73 | 14.73 | -4.29 | -8.23 |
| | (3.73) | (9.38) | (10.29) | (22.27) |
| <i>C</i> x $\Delta_t X_t$ | 8.64 | 25.90 | 9.11 | -14.81 |
| | (6.04) | (15.01) | (14.47) | (35.87) |

| | | | | |
|-----------------|---------|--------|---------|---------|
| <i>constant</i> | 9.25*** | -4.85 | 12.93** | 15.22 |
| | (2.53) | (9.26) | (5.58) | (18.55) |

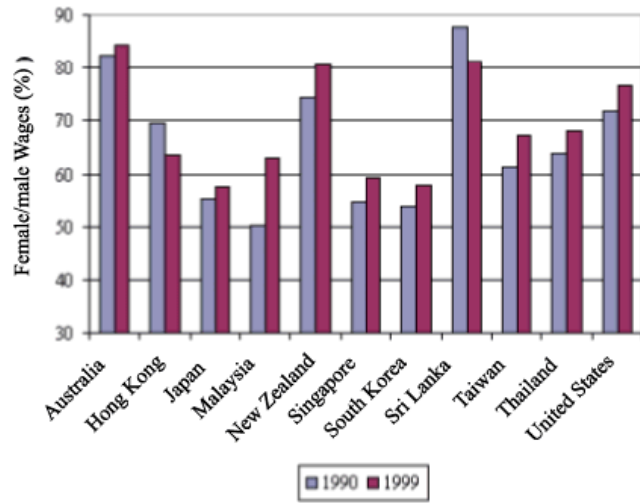
Note: Columns differ as follows: (1) C = dummy variable, estimation period is 1981-1999; (2) C = continuous variable, estimation period is 1981-1999; (3) C = dummy variable, estimation period is 1981-1996; and (4) C = continuous variable, estimation period is 1981-1996. The notation *** indicates statistically significant at the .01 level; ** at the .05 level; * at the .10 level. Each regression has 16 observations and is weighted using probability weights based on average-period employment levels by industry. The R² statistics range from 33% to 52% for regressions with import ratios, and 1% to 32% for regressions with export ratios.

**Table 5: Determinants of Change in the Gender Wage Gap, Korea
(in log points x 100 standard errors in parentheses)**

| | (1) | (2) | (3) | (4) |
|-------------------------------------|-----------|----------|-----------|---------|
| Panel A: Unadjusted Wage Gap | | | | |
| <i>C</i> | -10.83* | 3.65 | -4.60 | 5.48 |
| | (5.82) | (27.06) | (5.81) | (19.53) |
| $\Delta_t M_t$ | -1.09 | -5.14 | -0.72 | 29.75 |
| | (1.94) | (15.91) | (1.10) | (18.40) |
| <i>C</i> x $\Delta_t M_t$ | -4.81 | -6.66 | 8.68 | 46.71 |
| | (4.81) | (26.62) | (10.82) | (28.73) |
| <i>constant</i> | -10.76*** | -14.04 | -13.95*** | -13.93 |
| | (3.24) | (15.11) | (2.75) | (10.60) |
| <i>C</i> | -16.21** | -35.26 | -8.06 | -4.70 |
| | (7.67) | (30.76) | (4.74) | (32.21) |
| $\Delta_t X_t$ | 5.33** | 20.80** | 4.92*** | 17.26* |
| | (2.17) | (8.60) | (1.32) | (9.66) |
| <i>C</i> x $\Delta_t X_t$ | 7.17 | 29.47* | 7.68 | 23.65* |
| | (9.61) | (14.32) | (9.21) | (13.56) |
| <i>constant</i> | -11.66*** | -36.96* | -12.01*** | -19.40 |
| | (2.42) | (17.81) | (1.45) | (16.72) |
| Panel B: Residual Wage Gap | | | | |
| <i>C</i> | -10.66* | -10.99 | -6.44 | -11.13 |
| | (5.38) | (18.38) | (4.77) | (14.71) |
| $\Delta_t M_t$ | 1.86 | 5.82 | 0.61 | 25.92** |
| | (2.80) | (9.60) | (2.41) | (9.86) |
| <i>C</i> x $\Delta_t M_t$ | -1.36 | 6.36 | 8.20 | 38.88** |
| | (3.80) | (15.94) | (5.87) | (16.28) |
| <i>constant</i> | -1.40 | -11.71 | -2.43 | -11.28* |
| | (4.57) | (9.28) | (4.16) | (6.30) |
| <i>C</i> | -15.96*** | -37.39 | -9.84** | -21.63 |
| | (4.93) | (22.41) | (4.49) | (22.00) |
| $\Delta_t X_t$ | 1.21 | 14.06*** | 3.60 | 11.25** |
| | (5.25) | (3.60) | (3.48) | (4.20) |
| <i>C</i> x $\Delta_t X_t$ | 7.05 | 21.46* | 3.57 | 13.27 |
| | (6.34) | (10.45) | (4.78) | (8.07) |
| <i>constant</i> | -0.78 | -26.87** | -0.33 | -16.06 |
| | (3.88) | (11.45) | (3.58) | (10.16) |

Note: Columns differ as follows: (1) *C* = dummy variable, estimation period is 1980-1998; (2) *C* = continuous variable, estimation period is 1980-1998; (3) *C* = dummy variable, estimation period is 1980-1996; and (4) *C* = continuous variable, estimation period is 1980-1996. The notation *** indicates statistically significant at the .01 level; ** at the .05 level; * at the .10 level. Each regression has 23 observations and is weighted using probability weights based on average-period employment levels by industry. The R² statistics range from 1% to 27% for regressions with import ratios, and 18% to 34% for regressions with export ratios.

Figure 1: Manufacturing-Sector Female/Male Wage Ratios: Cross-Country Evidence



Note: Wage data are for 1990 and 1999, or for the closest available years.
Sources: International Labour Office (2000); authors' calculations for South Korea and Taiwan.

Figure 2: Gender Wage Ratios by Manufacturing Industry Status, Taiwan and Korea

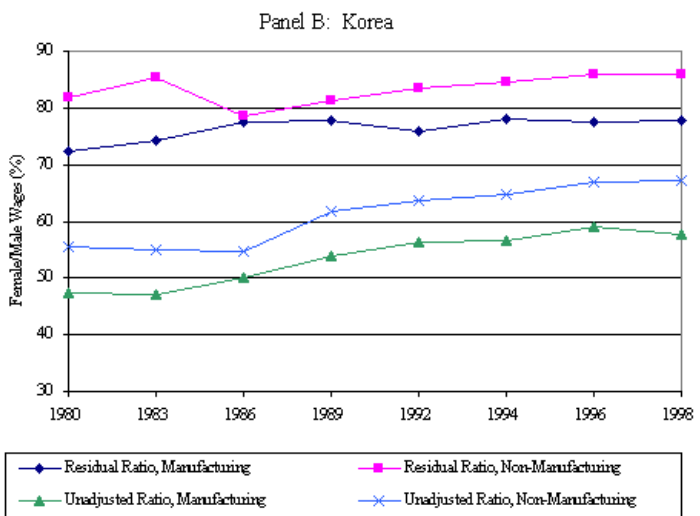
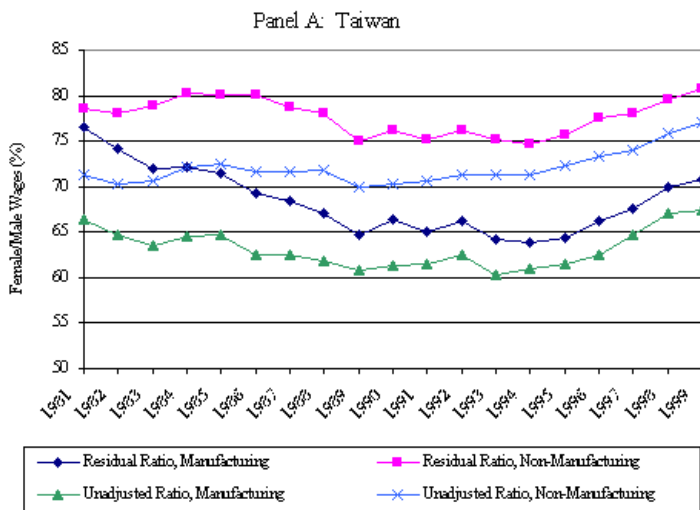


Figure 3: Gender Wage Ratios and Manufacturing Trade Ratios, Taiwan and Korea

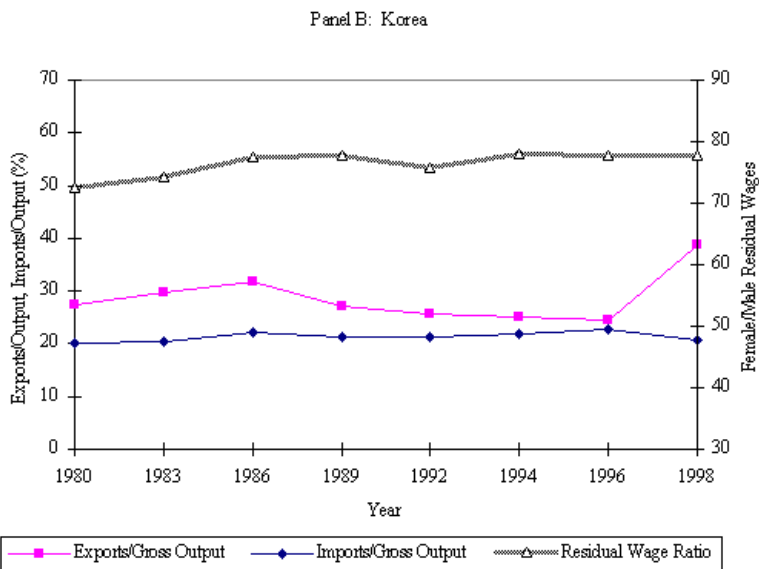
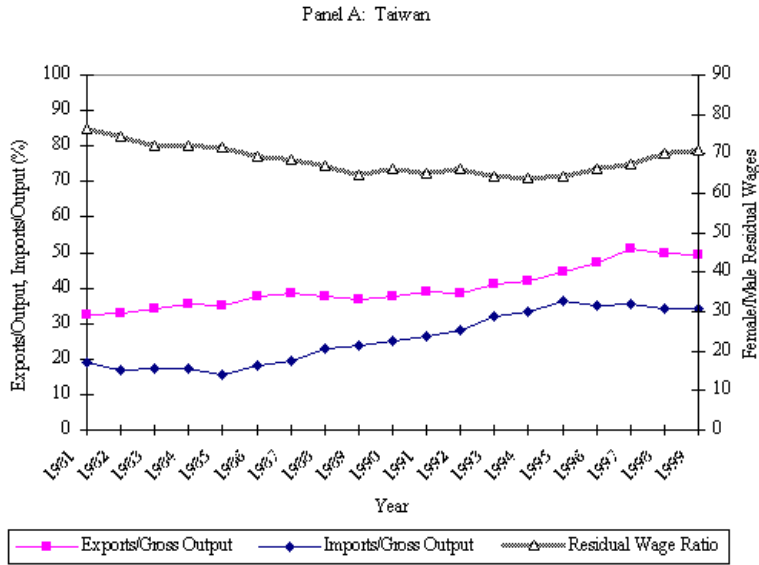
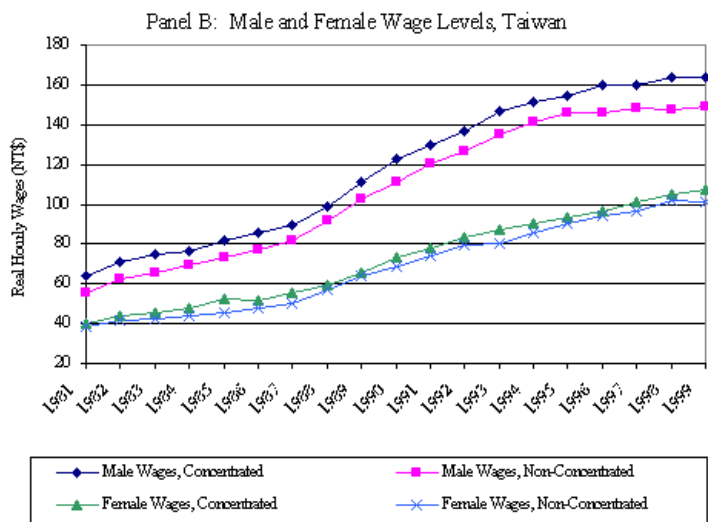
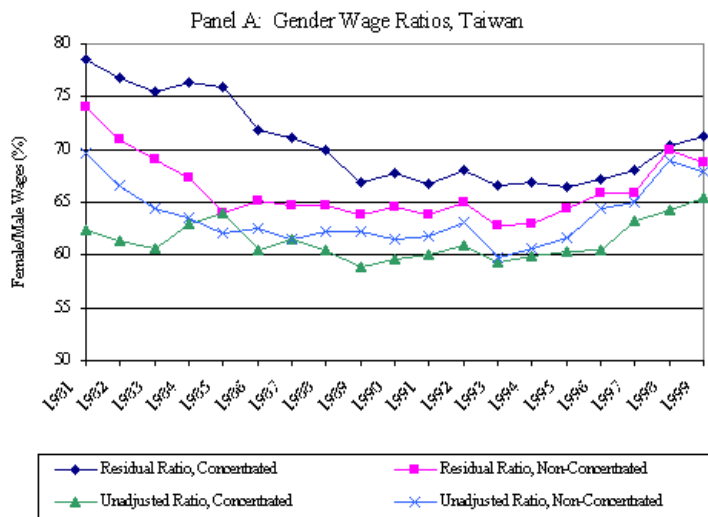
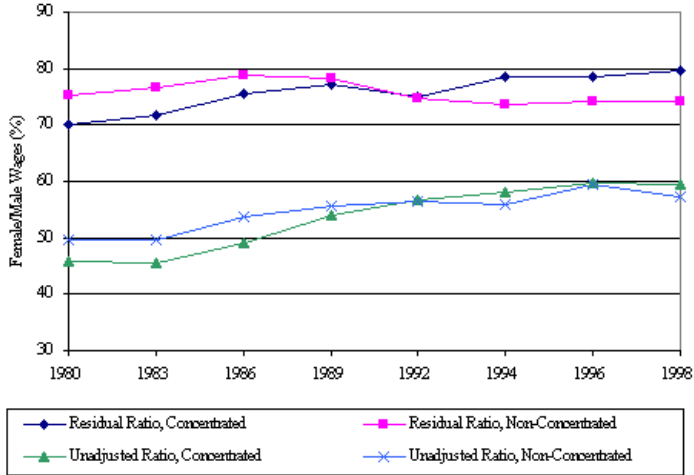


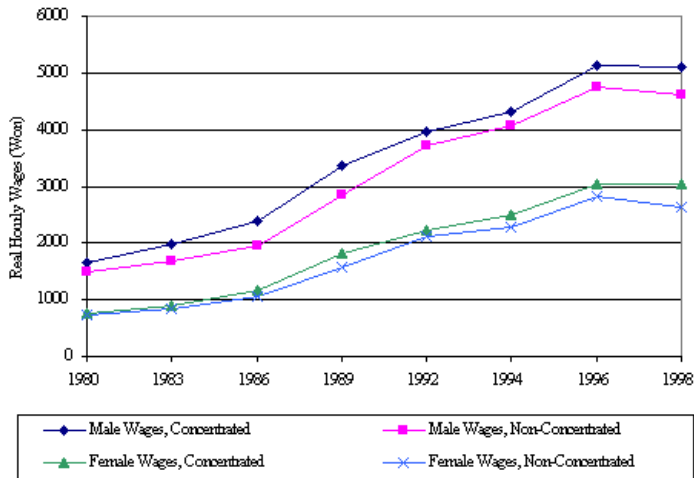
Figure 4: Gender Wage Ratios by Industry Concentration, Taiwan and Korea



Panel C: Gender Wage Ratios, Korea



Panel D: Male and Female Wage Levels, Korea



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ENDNOTES

1. Korea's total trade ratio fell continuously from a high of 56% in 1985 to a low of 45% in 1993, thereafter rising again, owing to the collapse of output, to 51% in 1997 and 60% in 1998.
2. Becker's original notion of competitiveness is based on characteristics of domestic industrial structure. More recent empirical studies on discrimination include international trade as a potential source of increased competitiveness. Behrman and King (1999) report that the idea that international trade increases competition or imposes market discipline is a longstanding one in the trade literature, and one that has recently found empirical support in Levinsohn (1993).
3. A common technique, based on Oaxaca (1973), uses cross-sectional data on workers and decomposes the wage gap in individual years into a portion explained by measured skill differences between men and women, and a residual portion commonly attributed to wage discrimination.
4. The totality of findings for China is quite mixed. For example, contrary to his previous work, Meng (2000) reports that men earn significantly more than women in domestic market-oriented, state sector employment whereas no gender differential exists in foreign-owned firms. The World Bank (2001) further discusses the mixed evidence on increased labor market competition and the gender wage gap.
5. The summary of theoretical frameworks is based on Darity (1989), Williams and Kenison (1996), Mason and Williams (1997), and Mason (1999).
6. See Seguino (1997), Cheng and Hsiung (1994), and Nam (1994) for further discussion of these arguments.
7. For each country, the residual wage ratio in manufacturing and non-manufacturing industries is calculated using a wage regression based on the full set of non-farm employees.
8. For Taiwan, observed productivity characteristics explain about 40% to 60% of the gender wage differential during the 1980s and early 1990s (Zveglich, Rodgers, and Rodgers 1997), while for Korea, observed characteristics explain about 70% to 80% of the gender wage differential during the same period (Rodgers 1998).
9. The aggregate manufactured export share is constructed as total manufactured exports divided by total manufactured output, and similarly for imports.

10. The sharp rise in the aggregate export ratio between 1996 and 1998 reflects the dramatic drop in output due to the Asian crisis.
11. This inverse relationship between industry competitiveness and wage levels holds at the inter-industry level in a given year as well, especially in the early 1980s, and is robust to the measure of industry concentration used.
12. Similar to Taiwan, in a given year, the more concentrated the industry the higher the wages of both men and women, and this relationship is also robust to the measure of industry concentration used.
13. Further analysis shows that trends based on sectoral average changes over the entire period are consistent with the changes reported in Table 2.
14. Trends in Korea's non-concentrated industries are sensitive to the choice of 1998 as the end year. Changes over time in sectoral averages show that the trend in non-concentrated industries is one of increasing trade shares that are associated with a decline in wage ratios and in the female share of industry employment.
15. Chen and Chen (1995) indicate that in Taiwan, outward foreign direct investment in textiles and apparel is largely motivated by attempts to maintain firm competitiveness by relocation to lower wage sites. The relocation of apparel production to China and Southeast Asia stimulated expansion of exports of selected products in textiles to these countries, fostering cross-border linkage effects based on prior vertical integration of these industries in Taiwan. However, this linkage has not prevented the decline of Taiwan's textile industry given the loss of European and U.S. export markets and the simultaneous undermining of cross border linkages by some textile firms that invested abroad along with apparel factories. This intra-industry restructuring is consistent with a gendered restructuring of employment opportunities in Taiwan, whereby men's employment expands in the growing, higher-paying sub-sectors of textiles, while women's job opportunities decline or are reclassified as the lower tier jobs in textiles and apparel.
16. Closer inspection of Korean time series data for electronics indicates the outlier nature of the 1998 trade shares and the need to isolate the effects of the Asian crisis. Over the 1980-1996 period, the rising wage ratio was associated with a decline in both export and import shares, but trade shares sharply rose after 1996 owing to the collapse of industry output following the crisis.
17. This approach is followed because the Taiwan survey reports monthly earnings and weekly hours worked.
18. In particular, the regressions for both Taiwan and Korea include a dummy variable for part-time worker (less than forty hours per week for Taiwan or 160 hours per month for Korea), dummy variables for education level attained, years of potential experience (age, minus education, minus six) and its square, years of establishment-specific tenure and its square, and dummy variables for regional locations. In addition, regressions for Taiwan include dummy variables for major area of study and a dummy variable for urban status.
19. This approach, also followed in Blau and Kahn (1996), implicitly assumes that male coefficients more accurately reflect competitive returns to observable characteristics than female coefficients. An alternative approach combines coefficient estimates for both men and women following Oaxaca (1973). These two approaches yield the same measures for the total, predicted, and residual earnings gaps.
20. The data source presents size categories as ranges. In the estimations, size levels are chosen to be the mid-point for each range. Because the final range has no upper bound, the size level is top coded as 1.2 times the lower bound.
21. In further robustness checks, results are compared with rankings based on available data for number of enterprise (or establishment) units divided by output per industry, the K-firm concentration ratio, the Herfindahl index, and the profit rate by industry.
22. See Amsden (2001) and Stiglitz and Yusuf (2001) for discussions of the competitive environment within the export and import-competing sectors. Also, data constraints for measures related to trade policy in both Taiwan and Korea limit our options for measuring international competitiveness.
23. The minimum cell size for a gender-industry group in the sample period was 13. Larger cell sizes would entail a tradeoff with degrees of freedom in the model estimations.