The Skill Wage Differential of Korea after the 1980s:
The Effects of Supply, Demand and International Trade, 1981-99*

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* This brief manuscript is based on two papers written in Korean (my M.A. dissertation that was submitted to the School of Economics, Seoul National University in August, 2001 and a manuscript that is now under review for publication in Korean Journal of Economics). I make it clear that this summarized and translated version is not complete, and thus any citation or quotation without the author’s permission is NOT advised.

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Abstract

Korea’s skill wage differential decreased substantially from the 1980s to the early 1990s, but from then it began to increase or at least remained stable. Prior to the mid-1990s when the wage differential was decreasing, many people thought that changes in the wage differential could be adequately explained by considering the supply factor only. However, the fact that the skill differential and higher education has expanded simultaneously in recent years is undermining the basis of such an argument. Meanwhile, the fundamental causes of such change have yet to be clearly answered. Therefore, this paper analyzes the changes of Korea’s skill wage differential for the 1981-1999 period by using a labor market supply-demand model to identify some acceptable explanations.

Several important findings of this paper are as follows:

First, for the 1987-1994 period, the dramatic decrease of Korea’s skill wage differential is not properly explained only by a supply-demand story. Instead, there seem to be important changes in wage setting institutions associated with the rise of labor unions.

Second, after the early 1990s, there were significant demand shifts favoring more-skilled workers over less-skilled workers. Specifically, the shifts were more overwhelming in sectors that consist of firms with 10 or more workers.

Third, therefore, there has been a rise in the skill wage differential after the early 1990s in spite of steady increase in the supply of college graduates, and this reversion is relatively well-explained by a supply-demand story.

Fourth, the share of trade-induced demand change in total demand change increased sharply after 1994 for the whole economy. Therefore, changes in international trade seem to have played an important role in altering Korea’s relative labor demand, and thus its skill wage differential.

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1. Introduction

This paper analyzes the changes of Korea’s skill wage differential after the 1980s by using a labor market supply-demand model. Korea’s skill wage differential decreased substantially from the 1980s to the early 1990s, but from then it began to increase or at least remained stable. Prior to the mid-1990s when the wage differential was decreasing, many people thought that changes in the wage differential could be adequately explained by considering the supply factor only [Kim and Topel, 1995]. However, the fact that the skill differential and higher education has expanded simultaneously in recent years is undermining the basis of such an argument. Meanwhile, the fundamental causes of such change have yet to be clearly answered [Jung and Choi, 1999; Park, 2000]. Therefore, this paper attempts to identify some acceptable explanations for the changes in Korea’s wage differential.

According to numerous studies on the cases of developed countries, recent increases in the skill wage differential can be explained largely by three main causes. The first is changes in the relative labor supply by education or “skill” [Levy and Murnane, 1992; Katz, Loveman and Blanchflower, 1995; Autor, Katz and Krueger, 1998]. The second is shifts in the relative demand for labor favoring more-educated, and thus “more-skilled” workers over less-educated and “less-skilled” workers. And furthermore, technological changes and/or changes in the trade deficit are considered as likely candidates for the primary cause of these shifts. While technological changes associated with the computer revolution are postulated to make the relative labor demand more “skill-biased” [Krueger, 1993; Doms, Dunne and Troske, 1997; Autor, Katz and Krueger, 1998], it is argued that shifts in product demand associated with large trade deficits have led to a sharp decline in manufacturing employment and a shift in employment toward sectors that are more skill intensive [Murphy and Welch, 1991; Wood, 1994]. The third explanation is one that focuses on changes in wage-setting institutions such as decline in unions [Blau and Kahn, 1996; Card, 1998], changes in social norm [Rotemberg, 1996], and the erosion of the real and/or nominal value of the minimum wage [DiNardo, Fortin and Lemieux, 1996; Lee, 1998].

This paper first examines whether recent changes in the skill wage differential in Korea can be explained by considering the supply and demand side of the Korean labor market. Then, relative labor demand shifts associated with changes in international trade are looked at in more detail. There are three reasons for focusing on “demand” and “trade.” First, while the portion of more-educated workers in the total employment has
continued to increase since the 1970s, the movement of the education-based wage differential has seen little fluctuation. Specifically, after the early 1990s it has increasing slightly or at least remained stable in contrast to a dramatic decrease before then. This does not appear to be consistent with the simple supply-side explanation. Second, Korea is a typical small open economy that has pursued a foreign-dependent development strategy over the last 30 years. Therefore, changes in international trade may have more significance for Korea than for the U.S. or European countries. Third, for the present, no credible and complete data to measure technological or institutional changes – which also used to be mentioned as main causes of wage differential changes – could be found in Korea for the long-term period.

This paper is organized as follows. Section 2 describes the samples from the Wage Structure Surveys (WSSs), the successor to the Occupational Wage Surveys after 1992, and Economically Active Population Surveys (EAPSs) that are used throughout the paper. Section 3 uses these samples to describe the basic patterns of changes in real and relative wages in Korea over the 1981 to 1999 period. Section 4 applies the simple supply-demand framework that Katz and Murphy (1992) and Bound and Johnson (1992) have used, and examines whether a supply-demand story can adequately explain the observed patterns of changes in relative wages, and, if not, what considerations are needed. Section 5 expands the basic model to incorporate the effects of international trade changes, and then, estimates their magnitudes. Section 6 summarizes my findings and offers some conclusions.

2. Data

The data used in this paper come from two sources. The first is a series of 19 consecutive Wage Structure Surveys (WSSs) for the years 1981 to 1999. These data were collected from 5,500 firms with 10 or more full-time workers, and provide information on wage and hours worked in the survey months for about 5.5 million full-time workers, or approximately 40 percent of all Korean employees. These features of WSSs cause a serious problem in using them as employment data in that there is a serious sampling bias due to the systematic exclusion of part-time and temporary workers who occupy about half of total employees, as well as workers in small firms. To address this problem, the Economically Active Population Surveys (EAPSs), which were collected from about 30,000 households and provide information on hours worked in the preceding calendar week for all individuals 15-years old or over, was also used as employment data.
Two samples were created from these two sources, following Katz and Murphy (1992) and Bound and Johnson (1992): (1) a wage sample used to measure monthly wages of full-time workers by individual characteristic groups (created from WSSs) and (2) an hourly sample used to measure the amount of labor supplied by each of these groups (created from EAPSs). Each sample is then split into 4,352 characteristic groups based on 2 genders, 4 values for completed years of schooling (less than 9, 9-12, 13-15, and 16+ years), 8 levels of potential labor market experience\(^1\) (1-5, 6-10, 11-15, 16-20, 21-25, 26-30, 31-35, and 36+ years), 17 industries\(^2\), and 4 occupational categories.\(^3\) While the wage sample provides information on the average monthly wage of full-time workers (who work at firms with 10 or more full-time employees) within a characteristic group, the hourly sample provides information on the average hours worked in that month. Combining these two samples, the average hourly wage rate and the estimate of total labor supply of individuals with given characteristics for each year is then calculated.\(^4\) However, complete EAPSs hourly data covering the entire period from 1981-1999 could not be obtained. Thus, in addition to this “EAPSs hourly sample” that covers the 15-year period from 1985 to 1999, a separate hourly sample from WSSs that covers the entire period, “WSS hourly sample” is created. Both sets are used independently, and the consequences are then compared.

In this way, two hourly wage rate samples (one for the period 1981-1999, the other for 1985-1999) and two total labor supply samples were obtained. These samples can be summarized by the \((4,352 \times 19)\) or \((4,352 \times 15)\) matrix. Furthermore, using these matrices and a fixed-weight aggregation scheme, two samples of relative wage and two samples of labor supply in terms of efficiency units were constructed. Fixed weights are assigned by the 4,352 element vector of average employment shares over the 1981 (or 1985) to 1999 period which are denoted by \(N\). This vector is used in order to construct wage indices for each year as \(N^tW\), where \(W\) is an hourly wage rate sample. Deflating wages in each year by the value of this index for the year generates a time series of relative wages by groups (where each group’s wage is indexed

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\(^1\) Potential labor market experience is calculated as min(age-years of schooling-7, age-18), where age is the age as of the survey date.

\(^2\) Industrial categories: mining, electricity/gas/water supply, construction, wholesale/retail trade, hotels/restaurants, transport/communication, finance/insurance/real estate/rent and leasing/business activities, individual/social service (excluding public administration and defense), food/tobacco, textiles/apparel/leather, lumber/furniture, paper/printing, chemicals/petroleum/rubber, clay/stone/glass, primary metals, fabricated metals/machinery/electrical equipment/automobile/other transport equipment, miscellaneous manufacturing. Agriculture is excluded.

\(^3\) Occupational categories: professional/technical/managers, clerical workers, sales/service workers, production workers.

\(^4\) The acceptability of using two separate samples from different sources has been justified by Katz and Murphy (1992). They explained its acceptability and necessity through “the different criteria each sample must meet.” (Katz and Murphy (1992), p.39).
to the wages for a fixed bundle of workers). The average of these relative wages through time provides an estimate of the average relative wage of a given group and hence provides a natural basis for aggregating quantities of labor supplied across groups in terms of efficiency units. Accordingly, more aggregate supplies are computed from the individual cell supplies by weighting hours worked in each cell contained in the aggregate by the average relative wage of that cell and summing. It should be made clear again that this manipulating depends on the works of Katz and Murphy (1992) and Bound and Johnson (1992).

3. Change in the Skill Wage Differential after the 1980s in Korea

Table 1 describes changes in the real relative hourly wage rates of several aggregated characteristic groups for the 1981-1999 period. The first two rows of the table indicate that over the entire period the relative wage rate of male workers increased by -4.6% (for WSSs) or -3.7% (for EAPSs). That is, for the entire period, the wage differential by gender decreased. After the year 1994, however, the relative wage rate of male workers increased only by –0.8% (for WSSs) or –0.5% (for EAPSs).

The next rows of the table show even more dramatic occurrences. While the education-based wage differential decreased for the entire period, its movement is not monotonic. Before 1994, the wage differential decreased substantially. For example, differences in wage growth rates between male high school dropouts and graduates (9-12 years of schooling) and male college graduates (16+ years of schooling) were about -23.5%p or -26.1%p for the 1987-1994 period. After 1994, however, this wage differential seems to have increased slightly, or at least remained stable. And, as a result, the differences were 1.4%p or 1.8%p for the 1994-1997 period. In the case of female workers, while there is not such a reversion, the decrease of the wage differential obviously is decelerated after 1994.

These facts indicate that there must be some important changes in wage structure in the Korean labor market these days. Furthermore, if we interpret an education-based wage differential as a skill-based one, these changes in education-based wage differential indicate the recent rise of the skill wage differential in Korea. In the following sections, I analyze the main causes of such changes using a labor market supply-demand model.

5 These descriptions are fundamentally in accordance with those of some previous works, e.g., Jung and Choi (1999); Park (2000).
4. Effects of Labor Supply and Demand Shifts

1) Labor Supply Shifts

Table 2 shows changes in relative factor supplies per year (in terms of efficiency units) over the 1981-1999 period and several sub-periods for the same aggregates used in Table 1. The table illustrates that there has been substantial long-run growth in the relative supply of more-educated, and thus “more-skilled,” workers irrespective of gender. For the entire period, the share of high school dropouts and graduates (9-12 years of schooling) in total labor supply increased by 1.2% (for WSSs) or 0.2% (EAPs) per year, and that of college graduates (16+ years of schooling) increased by 4.6% or 4.7% per year.

Interestingly, this supply growth pattern is observed similarly for all sub-periods and for all characteristic groups. For example, this pattern appears also for the 1994-1997 period when the skill wage differential increased. That is, the share of male high school dropouts and graduates in total labor supply increased by −0.7% (for WSSs) or −
2.1% (for EAPSSs) per year during the 1994-1997 period, and that of college graduates increased by 4.9% or 1.0% per year during the same period. Furthermore, the increase in the relative labor supply of college graduates is more extreme after 1994 than in the earlier period, irrespective of gender. While the supply of college graduates increased by 3.9% per year during the 1987-1994 period, it increased by 5.8% per year during the 1994-1997 period for WSSs (for EAPSSs, these numbers are 0.5% and 1.1%, respectively). That is, supply increase of skilled workers is being accelerated while their relative price is also increasing.

Therefore, these patterns of supply shifts strongly indicate the possibility that the recent rise of the skill wage differential in Korea is caused mainly by changes in labor demand, wage setting institutions, technology, and so on, not by labor supply.6

Table 2
Relative Supply Changes per Year, 1981-1999a

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<tbody>
<tr>
<td>Male</td>
<td>0.5 0.9 0.1 -3.7 0.3</td>
<td>-0.8 -0.2 -0.5 -0.3 -0.3</td>
<td>2.4 0.6 1.3 0.8 1.0</td>
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<tr>
<td>Female</td>
<td>-1.4 -3.2 -0.4 15.0 -1.0</td>
<td>5.0 0.5 1.1 -4.3 4.7</td>
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<td>Years of schooling</td>
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<tr>
<td>All Less than 9</td>
<td>-6.7 -7.0 -10.3 -7.3 -7.9</td>
<td>-6.7 -1.4 -3.2 -1.7 -6.8</td>
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<tr>
<td>9-12</td>
<td>4.1 0.9 -1.3 -0.1 1.2</td>
<td>3.2 -0.7 -1.7 -0.4 0.2</td>
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<td>13-16</td>
<td>8.7 7.5 7.3 5.5 7.8</td>
<td>4.3 4.7 11.0 16.9 5.5</td>
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<tr>
<td>16+</td>
<td>4.3 3.9 5.8 0.8 4.6</td>
<td>5.0 0.5 1.1 -4.3 4.7</td>
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<tr>
<td>Male Less than 9</td>
<td>-5.5 -5.9 -10.2 -8.7 -7.1</td>
<td>-8.0 -1.8 -4.2 -2.4 -8.0</td>
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<tr>
<td>9-12</td>
<td>3.3 1.6 -0.7 -4.4 1.0</td>
<td>2.3 -0.9 -2.1 0.1 0.0</td>
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<td>13-16</td>
<td>8.5 7.0 5.7 0.5 6.9</td>
<td>3.0 4.1 9.6 17.3 4.5</td>
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<td>16+</td>
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<td>4.2 0.4 1.0 -4.6 4.0</td>
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<tr>
<td>Female Less than 9</td>
<td>-9.3 -10.2 -10.6 -2.8 -9.9</td>
<td>-3.4 -0.5 -1.2 -0.7 -4.3</td>
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<tr>
<td>9-12</td>
<td>6.5 -1.3 -3.1 14.6 1.7</td>
<td>5.7 -0.3 -0.8 -1.7 0.9</td>
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<tr>
<td>13-16</td>
<td>9.9 9.4 12.7 18.5 10.9</td>
<td>8.1 5.9 13.7 16.1 8.0</td>
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<tr>
<td>16+</td>
<td>9.3 0.9 14.4 25.1 8.0</td>
<td>11.1 0.6 1.4 -2.9 8.6</td>
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</table>

a. The numbers in the table represent log changes (multiplied by 100) per year in each group’s share of total supply measured in efficiency units (annual hours times the average relative wage of the group for the period).

2) Labor Demand Shifts

To measure demand shifts, the samples are divided into 17 industries and 4 occupational categories. Then, the index d(ln Di) defined in equation (1) below is used

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6 The disagreement between WSSs and EAPSSs in relative supply changes by gender is caused by the characteristic of WSSs that over-represents sectors which consist of firms with 10 or more workers.
as a demand shift measure, following Katz and Murphy (1992). In equation (1), $N_i$ is the base-year employment of group $i$ in efficiency units, and $N_j$ is total labor input in sector $j$ measured in efficiency units, thus $\phi_{ij}$ is group $i$’s share of total employment in efficiency units in sector $j$ in the base year. The average of the entire sample period is chosen as the value of base year.

$$d(\ln D_i) \approx \sum_j \phi_{ij} d(\ln \phi_j) \quad \text{where} \quad \phi_j = \frac{N_j}{\sum_j N_j}, \quad \phi_{ij} = \frac{N_{ij}}{N_i} \quad (1)$$

Table III presents relative demand shift estimates measured by this index. From this, three facts can be pointed out:

First, the pace of overall demand growth for college graduates appears to have been relatively steady over the entire period for both samples. Relative demand for male college graduates shifts 4.4% or 3.6% (for WSSs and EAPSs, respectively) per year for the entire period while demand for male high school graduates shifts –0.6% or –1.1% per year. Also, the situation for females does not differ largely.

Second, the increase of relative demand for college graduates over high school graduates (including high school dropouts) accelerated after 1994 for both samples. For example, differences in demand shift rates between the two groups expanded from 4.6%p (1987-1994) to 6.3%p (1994-1997) for male workers in WSSs and from 5.6%p to 7.3%p in EAPSs. Meanwhile, there are some differences in the degree to which relative demand shifts accelerated for female workers between the two samples. For WSSs, the difference in demand shift rates between female college graduates and female high school graduates increased sharply from 1.8%p to 8.5%p while it increased only from 4.5%p to 5.8%p for EAPSs. This discrepancy can be explained partly by pointing out the sampling bias of WSSs. That is, for manufacturing sectors or sectors that consist of firms with 10 or more full-time workers, there are substantial labor demand shifts favoring more-educated or “more-skilled” workers, and these shifts accelerated very sharply after 1994. For the whole economy, however, there are also substantial expansions of service sectors favoring less-educated or “less-skilled” workers, and thus demand shifts accelerated more mildly.

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7 Of course, I agree with Bound and Johnson (1992) who pointed out that this index “confounds product demand shifts with relative supply changes,” and provided an alternative index. Therefore, in my original papers, I have used both indices and produced two results. Finally, I have realized that both were telling the same story. Therefore, in this paper, one of them is omitted on account of space consideration.

8 In fact, there are “high-skill intensive” service sectors as well as “low-skill intensive” service sectors. From investigating changes of employment share by industry, I could identify the following facts: First, after 1994, there actually have been substantial expansions of service sectors for both samples. Second, the share of “low-skill intensive” service sectors is even larger for EAPSs than for WSSs (i.e., the share of “wholesale/retail trade, hotels/restaurants, individual/social service” is about 36% of total employment for EAPSs while it is only 19% for
Third, for the 1987-1994 period, when skill wage differential has been dramatically decreasing, there are substantial demand shifts favoring “more-skilled” workers in Table 3 as well as supply shifts in Table 2. Specifically, given the fact that magnitudes of supply and demand shifts indicate that the two forces offset each other roughly, there seems to be other forces influencing the movement of skill wage differential (e.g., institutional changes, non-neutral technological changes, etc.).

Table 3
Relative Demand Shift Measured per Year, 1981-1999a

<table>
<thead>
<tr>
<th></th>
<th>WSSs</th>
<th>EAPs</th>
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<tbody>
<tr>
<td></td>
<td>81-87 87-94 94-97 98-99</td>
<td>81-99</td>
</tr>
<tr>
<td>Male Less than 9</td>
<td>-0.5 -2.7 -4.7 -5.6 -2.8</td>
<td>-2.3 -2.2 -3.3 3.5 -3.3</td>
</tr>
<tr>
<td>Female Less than 9</td>
<td>-2.7 -6.5 -10.0 3.5 -5.5</td>
<td>0.9 -2.2 -1.6 6.5 -1.7</td>
</tr>
<tr>
<td>9-12</td>
<td>0.9 0.2 -2.6 -5.1 -0.6</td>
<td>0.9 -0.5 -2.1 1.0 -1.1</td>
</tr>
<tr>
<td>13-16</td>
<td>3.3 4.7 1.0 -1.7 3.0</td>
<td>1.6 2.9 2.5 -2.8 1.7</td>
</tr>
<tr>
<td>16+</td>
<td>5.0 4.8 3.7 0.1 4.4</td>
<td>1.8 5.1 5.2 -5.0 3.6</td>
</tr>
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</table>

a. The numbers in the table are of the form (log (1+ d(ln D )))/years, where i indexes 2x4=8 gender-education-experience groups and j indexes 17x4=68 industry-occupational categories.

3) Evaluation of the Supply-Demand Story

In the literature concerned with skill wage differential, there are some key questions to be addressed: the degree to which the time series of the relative price by skill has been driven by fluctuations in the shifts of supply and demand, the existence and magnitude of the third factor, and the timing of each factor.

CES production function provides a basis for one of the simplest approaches to investigate these questions. Consider the simplest CES production function with two factors, s and u (skilled workers and unskilled workers), so that relative wages in year t, \(w_s(t)/w_u(t)\), and relative supplies in year t, \(s_s(t)/s_u(t)\), satisfy the relationship

\[
\log(w_s(t)/w_u(t)) = \frac{1}{\sigma} \{D(t) - \log(s_s(t)/s_u(t))\}
\]

where \(\sigma\) is the elasticity of substitution between two types of workers and D(t) is the time series of relative demand shifts measured in log quantity units. Given that there are

WSSs). Third, the demand expansions in these sectors are accelerated more dramatically after 1994 for EAPs than for WSSs. I assume these disagreements to be caused by the characteristic of WSSs that are collected from firms that hire 10 or more full-time workers.
other inputs in the production function, this is a conditional factor demand framework which requires that demand shifts be defined to include the effects of changes in the prices of supplies of these other inputs [Katz and Murphy, 1992; Bound and Johnson, 1992; Katz and Autor, 1999]. The series of relative supply and price have already been extracted directly from my samples, and the series of relative demand shifts have been measured indirectly. In this subsection, using only the data obtained directly, the above questions are addressed. If these results and those of the previous subsections are largely compatible, a step forward can be taken more easily and convincingly.

The model in equation (2) in which \( D(t) \) is substituted by a linear time trend may fit the data reasonably well. OLS estimation of this equation for the 1981-1999 period using the WSSs sample yields equation (3) with \( R^2 \) of 0.929.

\[
\log\left(\frac{w_s}{w_u}\right) = -0.9335 \log\left(\frac{s_s}{s_u}\right) - 0.0014 \text{Trend} + 0.0702
\]

\((s.e. 0.312) \quad (s.e. 0.007)\) (3)

The estimate of \( \sigma \) in (3) implies an elasticity of substitution between skilled (college graduates) and unskilled workers (high school graduates and dropouts) of about 1.1. The actual time series of relative price and the fitted values from this regression are shown together in Figure 1.

Figure 1
Relative Wages: Actual and Predicted, 1981-1999 (for WSSs)

9 This relation is based on the following assumptions: 1) all markets are cleared, 2) there is no non-neutral technological change, and 3) labor supply is determined independently.
Equation (2) and Figure 1 provide very meaningful information:

First, this model can explain the movement in the relative wages to some degree.

Second, there are two exceptional periods, however. One is the second half of the 1980s, and the other is the period after 1994. For the second half of the 1980s, actual relative price series decreased sharply while the predicted values increased slightly. In contrast, for the period after 1994, actual series increased slightly while the predicted values are decreased sharply.

Third, for the second half of the 1980s, there are two alternative explanations. That is, there might actually be substantial demand shifts favoring unskilled workers (instead of linear time trend), and/or there might be the third force (e.g., institutional changes).

Fourth, for the period after 1994, there also are two alternative explanations. That is, there might be actually substantial demand shifts favoring skilled workers (instead of linear time trend), and/or there might be the third force (e.g., institutional changes and/or skill-biased technological changes).  

From comparing these with the results of the previous subsections, I reach some provisional conclusions:

First, for the entire period, changes in labor supply side seem to be an important factor to explain changes in the skill wage differential of Korea.

Second, during the second half of the 1980s, however, there might be substantial institutional changes having driven the decrease of the skill wage differential. This is not only because changes in supply and demand cannot explain the dramatic decrease of the wage differential (obviously, there were no demand shifts favoring unskilled workers), but also because the concept of “low-skill biased” technological change seems somewhat confusing. Furthermore, this is a very acceptable story for the Korean case where from 1987 to the early 1990s there was a dramatic rising of a radical labor movement.

Third, after the early 1990s, demand shifts favoring skilled workers is playing a role in determining the skill wage differential, at least for sectors that consist of firms with 10 or more workers, though it is not clear whether the role is a leading one or not and what caused it. In the next section, I will touch on this issue.

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10 For the first exceptional period, the reason for excluding the possibility of “low-skill-biased” technological changes is simply because it seems somewhat unacceptable given the usual pattern of technological change. However, it is also possible theoretically.
5. Effects of International Trade and a Decomposition of Relative Wage Changes

Table 4 shows changes in Korea’s international trade after the 1980s. Several points are worth emphasizing:

First, Korea’s Total Trade Ratio (TTR), defined as a ratio of export plus import to GDP, is even larger than those of OECD member countries.11 This means that the degree to which Korea’s domestic market depends on international trade is also high.

Second, Korea’s TTR bottomed out in 1994, and has since been rising sharply due to a simultaneous rise in the Import Ratio and Export Ratio to GDP. Given the stable growth of Korea’s GDP from 1994 to 1997, this means that Korea’s dependence on external economies became greater after the middle 1990s.

Third, in the case of exports, while the shares of textile, apparel, leather manufacturing and primary metals manufacturing – which are regarded usually as unskilled-labor intensive industries - have been decreasing sharply, the shares of machinery and equipment manufacturing and chemicals manufacturing – namely, relatively skilled-labor intensive industries - have been increasing dramatically for the entire period.

Table 4
Changes in International Trade of Korea after the 1980s (%)

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Trade (=Exports + Imports)</td>
<td>68.3</td>
<td>65.8</td>
<td>56.1</td>
<td>49.2</td>
<td>56.6</td>
<td>64.8</td>
</tr>
<tr>
<td>Exports</td>
<td>30.6</td>
<td>32.5</td>
<td>28.3</td>
<td>23.8</td>
<td>28.9</td>
<td>35.4</td>
</tr>
<tr>
<td>Imports</td>
<td>37.7</td>
<td>33.4</td>
<td>27.8</td>
<td>25.4</td>
<td>30.7</td>
<td>29.5</td>
</tr>
<tr>
<td>Export Share by Industry</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food, tobacco</td>
<td>0.6</td>
<td>0.4</td>
<td>0.2</td>
<td>0.1</td>
<td>0.2</td>
<td>0.1</td>
</tr>
<tr>
<td>Textiles, apparel, leather</td>
<td>38.2</td>
<td>30.8</td>
<td>31.2</td>
<td>21.6</td>
<td>16.8</td>
<td>14.1</td>
</tr>
<tr>
<td>Lumber</td>
<td>2.3</td>
<td>0.3</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Paper, printing</td>
<td>0.8</td>
<td>0.5</td>
<td>0.7</td>
<td>0.9</td>
<td>1.2</td>
<td>1.3</td>
</tr>
<tr>
<td>Chemicals, petroleum, rubber</td>
<td>5.9</td>
<td>5.1</td>
<td>5.0</td>
<td>8.6</td>
<td>10.3</td>
<td>9.5</td>
</tr>
<tr>
<td>Clay, stone, glass</td>
<td>3.1</td>
<td>1.2</td>
<td>1.4</td>
<td>0.7</td>
<td>0.5</td>
<td>0.6</td>
</tr>
<tr>
<td>Primary metals</td>
<td>15.7</td>
<td>12.3</td>
<td>10.3</td>
<td>8.8</td>
<td>8.6</td>
<td>8.2</td>
</tr>
<tr>
<td>Fabricated metals, machinery, electrical equipment, transport equipment</td>
<td>25.0</td>
<td>40.9</td>
<td>40.4</td>
<td>52.3</td>
<td>56.7</td>
<td>59.6</td>
</tr>
<tr>
<td>Miscellaneous manufacturing</td>
<td>8.3</td>
<td>8.6</td>
<td>10.8</td>
<td>6.7</td>
<td>5.7</td>
<td>6.3</td>
</tr>
<tr>
<td>Import Share by Origin</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OECD</td>
<td>-</td>
<td>-</td>
<td>79.6</td>
<td>75.6</td>
<td>71.6</td>
<td>68.8</td>
</tr>
<tr>
<td>Non-OECD</td>
<td>-</td>
<td>-</td>
<td>20.4</td>
<td>24.4</td>
<td>28.4</td>
<td>31.2</td>
</tr>
</tbody>
</table>

a. Imports from OPEC are excluded.
b. Including automobiles.
Source: Bank of Korea, National Accounts, for each year; Korea International Trade Association, Korea Trade Information Service (www.kotis.net).

11 TTRs of OECD member countries in 1995 – U.S. (24.0%), Germany (46.0%), France (43.0%), Japan (17.0%) - are generally less than Korea’s, except for the U.K. (57.0%) (World Bank (1997)).
Fourth, in the case of imports, the share of imports from non-OECD countries has been increasing steadily. If these countries can be thought of roughly as less developed and more unskilled labor-abundant than Korea, this indicates that the pressure of imports to substitute Korean unskilled labor has been increasing also.

Putting these facts together, the following hypothesis is reached: Increased import competition and transition to a skill-exporting economy have played an important role in shifting relative demand against less-skilled workers, and thus has raised the skill wage differential recently. Only empirical verification can give an answer.

To verify this hypothesis empirically, I depend on the factor content approach, which has been used frequently by many economists. This approach has some advantages in that it is simpler in the theoretical aspect and easier to obtain and manipulate credible data than its competitor, although some economists doubt its properness. To estimate the effects of trade on the labor market, trade flows are transformed into equivalent bodies on the basis of the utilization of labor inputs in the domestic manufacturing industries that constitute the bulk of the traded goods sector. I do this by estimating the trade-induced labor demand directly, ignoring indirect input-output effects. Thus, the trade-induced labor demand is the labor input required to produce traded output, which might not be required if trade did not occur. Furthermore, in measuring the effect of trade on relative demand for each group, two distinctive and complementary specifications are applied to both of my samples only for tradable sectors.

\[
S_i = -(1/N_i) \sum_j \left[ e_{ij} N_j \left( I_j / Y_j \right) \right] + \sum_j N_j \left( I_j / Y_j \right) \tag{4}
\]

\[
T_i = -(1/N_i) \sum_j \left\{ \left[ e_{ij} N_j \left( X_j / Y_j \right) \right] - \left[ p_{ij} N_j \left( M_j / Y_j \right) \right] \right\} + \sum_j N_j \left( I_j / Y_j \right) \tag{5}
\]

Equation (4) shows the first strategy, and equation (5) shows the second. In both equations, \( I_j \) is net import in industry \( j \), \( Y_j \) is domestic output of industry \( j \), \( N_j \) is the share of total employment in the whole Korean economy employed in industry \( j \), \( e_{ij} \) is the average proportion of employment in industry \( j \) made up of workers in group \( i \), and \( N_i \) is the average share of total employment of group \( i \). In equation (5), \( X \) measures exports, \( M \) measures imports, and \( p_{ij} \) is group \( i \)’s average share of production worker

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12 Katz and Murphy (1992); Wood (1994); Sachs and Shatz (1994); Borjas, Freeman and Katz (1992) and so on.

13 An alternative method, product price approach, needs detailed and credible price data. However, I could not obtain them for Korean case.


15 In fact, it is not important whether trade flows are to be regarded as of supply side or as of demand side. Both approaches are ultimately based on the same logic. See Katz and Autor (1999).
employment in industry j. Each quantity of employment is measured in efficiency units, and each average number is calculated over the entire period (1981-1999 or 1985-1999).

There is no difference between the two equations except for the first term on the right-hand sides. In equation (4), I assume that trade-induced changes in an industry’s output alter the employment of production and non-production workers in that industry in the same manner as would domestically induced changes in output. However, it is plausible that exports and imports may affect quite different portions of an industry and may have differential impacts on the employment of production and non-production. In fact, many activities of non-production workers (e.g., marketing, sales, accounting) may be relatively complementary with production workers overseas [Katz and Murphy, 1992]. To take this issue into account, the first term in equation (5) is modified so that exports are allocated to all workers in the same manner as domestic production for domestic consumption, but imports are allocated to production workers only. Katz and Murphy (1992) called the first strategy “equal allocation,” and the second strategy “production worker allocation.” It is acceptable to consider the actual effect of trade to appear between the two measurements.

Trade data obtained from Korea Trade Information Service covering 2-digit SKTC (the Korean version of SITC) manufacturing industries for each year from 1981-1999 are used. Output data are obtained from Korea National Statistical Office. Both trade data and output data are aggregated into 9 manufacturing industries as in Section 1.

Table 5 shows the results from combining the effects of trade measured by equation (4) and (5) with relative wage changes measured in Section 3, and supply and demand changes measured in Section 4. This combining is based on equation (2) and (3). Namely, taking into account that the elasticity of substitution between skilled and unskilled workers has been estimated to be about 1.1 in equation (3), the results from Table 1 (relative wage change), Table 2 (supply change), Table 3 (demand change), and equation (4) and (5) (effect of trade) are inputted into equation (2). Thus, Table 5 provides a decomposition of changes in Korea’s skill wage differential into two major factors (labor supply and demand), one sub-factor (international trade) measured by two strategies, and the residual. For simplicity, I present only for two important sub-periods (1987-1994 and 1994-1997), and for the relative wage of college graduates over high school graduates and dropouts. And the elasticity of substitution is assumed at 1.0, which is very close to the value estimated in equation (3), 1.1.
First, for the 1987-1994 period, the dramatic decrease of the skill wage differential is not properly explained only by a supply-demand story. While supply shifts occurred to some degree, demand shifts offset most of them. Therefore, the residuals – calculated by extracting supply and demand effects from actual wage changes – have very large magnitudes for both genders and for both samples. This means there should be other forces. As stated in Section 4, emphasizing wage equalization from the rise of labor unions is a very acceptable explanation for the Korean case. In particular, this factor seems to have played a more important role for male workers than for female workers.

Second, in contrast, the changes of skill wage differential during the 1994-1997 period are explained largely well by a supply-demand story. The residuals significantly diminish compared with those for the 1987-1994 period.

Third, the share of trade-induced demand change in total demand change for the whole economy increased sharply from 15.7% for 1987-1994 to 53.0% for 1994-1997.

From Table 5, several important results are obtained:

First, for the 1987-1994 period, the dramatic decrease of the skill wage differential is not properly explained only by a supply-demand story. While supply shifts occurred to some degree, demand shifts offset most of them. Therefore, the residuals – calculated by extracting supply and demand effects from actual wage changes – have very large magnitudes for both genders and for both samples. This means there should be other forces. As stated in Section 4, emphasizing wage equalization from the rise of labor unions is a very acceptable explanation for the Korean case. In particular, this factor seems to have played a more important role for male workers than for female workers.

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Third, the share of trade-induced demand change in total demand change for the whole economy increased sharply from 15.7% for 1987-1994 to 53.0% for 1994-1997.
when the arithmetic average of EA and PA is considered as the actual trade effect.\textsuperscript{16} From this, it is inferred that a large part of demand shifts after 1994 might be explained by trade changes.

Interestingly, changes in trade-induced demand exceed changes in relative wage for the 1994-1997 period. If we take this story at face value, the conclusion would be that changes in international trade have “entirely” caused the recent rise in the skill wage differential. This inference, however, seems to be somewhat misleading because I did not formally include two important potential contributors into the model in this paper – i.e., non-neutral technological changes and institutional changes.\textsuperscript{17} Such being the case, it is more plausible to say that changes in international trade have played some role in “significantly” altering the skill differential, instead of saying “entirely,” for the present. A remaining task is to compare contributions of international trade, non-neutral technological changes, and institutional changes more comprehensively and acceptably.

6. Conclusions

Korea’s skill wage differential decreased substantially from the 1980s to the early 1990s, but from then it began to increase or at least remained stable. By the mid-1990s, when the wage differential was decreasing, many people thought that changes in the wage differential could be adequately explained by considering the supply factor only. However, the fact that the skill differential and higher education has expanded simultaneously in recent years is undermining the basis of such an argument. Meanwhile, the fundamental causes of such change have yet to be clearly answered. Therefore, this paper attempts to analyze the changes of Korea’s skill wage differential for the 1981-1999 period by using a labor market supply-demand model in order to identify some acceptable explanations.

This paper found several important results as follows:
First, for the 1987-1994 period, the dramatic decrease of Korea’s skill wage differential is not properly explained only by a supply-demand story. Instead, there seem to be important changes in wage setting institutions associated with the rise of labor unions.

\textsuperscript{16} These numbers are calculated by dividing the arithmetic average of [EA] and [PA] with [Demand] changes for [All] workers. On the other hand, for WSSs, the share of trade-induced demand decreased instead of increased. This is natural because WSSs include only full-time workers and thus inevitably exclude substantial less-skilled workers. When increase of trade volumes and shifts of net import toward less-skilled labor intensive sectors occur simultaneously, WSSs must underestimate the trade-induced demand shifts because of their underestimation of employment share of less-skilled workers in those sectors.

\textsuperscript{17} This is basically concerned with the obtainability of these data.
Second, after the early 1990s, there were significant demand shifts favoring more-skilled workers over less-skilled workers. Specifically, the shifts were more overwhelming in sectors that consist of firms with 10 or more workers.

Third, therefore, there has been a rise in the skill wage differential after the early 1990s in spite of steady increase in the supply of college graduates, and this reversion is relatively well-explained by a supply-demand story.

Fourth, the share of trade-induced demand change in total demand change increased sharply after 1994 for the whole economy. Therefore, changes in international trade seem to have played an important role in altering Korea’s relative labor demand, and thus its skill wage differential.
References


