Globalization and the Gender Wage Gap

Remco H. Oostendorp

There are several theoretical reasons why globalization will have a narrowing as well as a widening effect on the gender wage gap, but little is known about the actual impact, except for some country studies. This study contributes to the literature in three respects. First, it is a large cross-country study of the impact of globalization on the gender wage gap. Second, it employs the rarely used ILO October Inquiry database, which is the most far-ranging survey of wages around the world. Third, it focuses on the within-occupation gender wage gap, an alternative to the commonly used raw and residual wage gaps as a measure of the gender wage gap. This study finds that the occupational gender wage gap tends to decrease with increasing economic development, at least in richer countries, and to decrease with trade and foreign direct investment (FDI) in richer countries, but finds little evidence that trade and FDI also reduce the occupational gender wage gap in poorer countries. JEL Codes: F16, F21, J16, J31, J44, O15

Many studies have analyzed whether globalization has important distributional impacts, across poor and rich countries, across urban and rural regions, and across low- and high-skill workers. Much less attention has been paid to whether globalization affects male and female workers differently. Recent empirical studies from 61 countries indicate that the gender wage gap is still large, amounting to 23 percent in developed countries and 27 percent in developing economies (World Bank 2001, pp. 55–57). Only about one-fifth of this gender gap in earnings can be explained by observed differences in worker and job characteristics, and therefore it is an important question whether globalization will reduce or increase this still significant gap.

The literature suggests several reasons why globalization would have a narrowing effect on the gender wage gap. First, according to neoclassical theory,

Remco Oostendorp is an associate professor at VU University Amsterdam, a research fellow at the Tinbergen Institute, a fellow of the Amsterdam Institute for International Development, and a research associate of the Centre for the Study of African Economies, Oxford University; his email address is roostendorp@feweb.vu.nl. The author thanks participants at seminars at the World Bank in Washington, D.C., the World Bank country office in Jakarta, the Institute of Southeast Asian Studies in Singapore, and the University of Utrecht for useful comments. He is particularly grateful to Aart Kraay, Andy Mason, Nayantara Mukerji, Susan Razzaz, and Yana Rodgers for constructive comments and to the journal editor and five anonymous referees for helpful suggestions. A supplemental appendix to this article is available at http://wber.oxfordjournals.org/.

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globalization will lead to increasing competitive pressures, making it more costly for individuals and firms to discriminate (Becker 1971). Second, expanding trade will boost job opportunities, increasing the number of women being absorbed in export-oriented industries (Cagatay and Berik 1990; Wood 1991; Joekes 1995; Anker 1998; Standing 1999; Ozler 2000). If the greater demand for female labor increases women's relative wages, the gender wage gap will decline.[1] Third, insofar as trade spurs economic growth with increased investments in infrastructure and improved availability and quality of public services, gender disparities in human capital would tend to fall, and with them the gender wage gap (World Bank 2001).

However, globalization may also worsen the gender wage gap. First, standard trade theory predicts that trade will adversely affect the compensation paid to the relatively scarce factors of production in the economy. If female workers in developed economies have lower average skills than male workers do, then the wages of female workers will fall more than those of male workers as trade with developing economies increases. This skill effect would increase the gender wage gap. The opposite is true for developing economies—their gender wage gap should decrease with increases in trade. Second, globalization through increasing competition may weaken the bargaining power of workers, especially of female workers if they are disproportionately employed in sectors increasingly competing on the basis of "cheap" labor (Seguino 2005). Third, there are complicated linkages between the traded sectors and other sectors in the market economy, as well as between the market economy and the unpaid household economy, where women are the main workers (Fontana and Wood 2000). For instance, if trade leads to more occupational segregation or less leisure time for female workers, women may be less motivated to pursue a life-long career, thereby increasing the gender wage gap.

Only a few country studies have looked at the impact of trade and foreign direct investment (FDI) on the gender wage gap, and most suggest that more trade and FDI reduce the gap (Fontana and Wood 2000; García-Cuéllar 2000; Artecona and Cunningham 2002; Berik, van der Meulen Rodgers, and Zveglich 2004; Black and Brainerd 2004).[2] The country studies look at the impact of trade and FDI on the overall gender wage gap (raw wage gap) or the unexplained gender wage gap (residual wage gap). This study contributes to this literature in three respects. First, it is a large cross-country study of the impact of globalization on the gender wage gap.[3] Second, it employs the rarely used ILO October Inquiry database, the most far-ranging global survey of

1. However, if the increased employment for women is mostly low wage and low skill, the total gender wage gap could increase (Hunt 2002; Blau and Kahn 2003; Olivetti and Petrongolo 2006).

2. Insofar as globalization affects market structure, some country studies suggesting that deregulation, market power, and transition affect the gender wage gap are also relevant (Brainerd 2000; Black and Strahan 2001; Hellerstein, Neumark, and Troske 2002).

3. The move from country- or industry-specific analysis to cross-country analysis is useful because the impact may vary across country characteristics, such as level of economic development, and because the impact may extend beyond an individual industry, due to externalities and spillovers.

wages with information on the gender wage gap in 161 narrowly defined occupations in more than 80 countries for 1983–99 (International Labour Organization various years). And third, it focuses on the within-occupation gender wage gap (occupational gender wage gap), which is analytically and empirically related to the commonly used raw and residual wage gaps.

Section I introduces the ILO October Inquiry database and discusses the occupational gender wage gap as an alternative indicator of gender wage inequity. The occupational gender wage gap is analytically and empirically related to the commonly used raw wage gap and the residual wage gap. Section II discusses the extent to which theories about the impact of globalization on the gender wage gap are also relevant for the occupational gender wage gap and includes a descriptive analysis of the occupational gender wage gap around the world, particularly its relationship with economic development, trade, and FDI. Section III uses a regression framework to examine whether globalization reduces the occupational wage gap.

I. The Ilo October Inquiry and the Occupational Gender Wage Gap as an Indicator of Gender Wage Inequity

The data for this study were derived from the ILO October Inquiry, which collects information on pay (wages, earnings, and hours of work) across detailed occupations at the four-digit International Standard Classification of Occupations (ISCO88) level. The scope of the ILO October Inquiry has been increasing since its inception in 1924, both in country coverage and in number of occupations included. In gender breakdown, the 1983–99 data are the most extensive, providing information on pay for men and women across 161 occupations and 83 countries. However, the number of occupations varies across years for each country, and most countries do not report for each year. The supplemental appendix provides a detailed description of the database (available at http://wber.oxfordjournals.org/).

With the ILO October Inquiry data, it is possible to look up the occupational gender wage gap—the female–male wage difference within an occupation for a given country and year. The ILO October Inquiry does not contain information on employment within occupations, and the data cannot be used to measure the average gender wage gap across workers or to estimate the impact of globalization on female and male employment.[4]

Before analyzing the occupational gender wage gap, the occupational wage gap must be shown to be a useful indicator of gender wage inequity, alongside

4. It has been suggested that sectoral employment weights from other data sources could be used to derive an aggregate gender wage gap. However, for many countries, there are not enough observations with female–male wage data across (even broad) sectors to get a good measure of the overall gender wage gap.

the commonly used indicators of the raw wage gap and the residual wage gap (Blinder 1973; Oaxaca 1973).

First, the occupational gender wage gap can be interpreted as an independent measure of the relative female wage position that abstracts from occupational segregation. Note that the raw wage gap and the occupational wage gap are related through the following identity:

$$(1) \qquad (\overline{\ln W^m} - \overline{\ln W^f}) = \sum_{j=1}^{J} P_j^f (\overline{\ln W_j^m} - \overline{\ln W_j^f}) + \sum_{j=1}^{J} (P_j^m - P_j^f)\, \overline{\ln W_j^m},$$

where $\overline{\ln W^m}, \overline{\ln W^f}$ are the average log wages of men and women; P_j^m and P_j^f denote the occupational distribution of men and women, with $j = 1, \ldots, J$ occupations and $\sum_{j=1}^{J} P_j^m = \sum_{j=1}^{J} P_j^f = 1$; and $\overline{\ln W_j^m}, \overline{\ln W_j^f}$ are the average log wages of men and women within occupation j. Equation (1) indicates that the raw wage gap is equal to the average occupational wage gap (first term on the right side) and an interoccupational component, which represents the part of the raw wage gap that is due to differences in the distribution of men and women across occupations (second term on the right side). Clearly, unless men and women are similarly distributed across occupations (no occupational segregation) or the gender differences in the occupational distribution, $(P_j^m - P_j^f)$, and the wage distribution, $\overline{\ln W_j^m}$, are uncorrelated, the raw and occupational wage gap will differ.

In practice, however, there is a strong correlation between both gender gaps. From the Luxembourg Employment Study and the Living Standards Measurement Study, the raw and occupational wage gaps were constructed for 19 countries (10 developed countries from the Luxembourg Employment Study and 9 developing economies from the Living Standards Measurement Study). The analysis was limited to the most recent survey (Luxembourg Employment Study) or the largest (the Living Standards Measurement Study) that was nationally representative, free of charge, and included occupational information at the two-digit (or higher) level (ISCO88). Gaps were calculated for hourly wages for working people between the ages of 15 and 65. Occupations for which there were fewer than 25 observations for either men or women were excluded.

The overall correlation between the raw wage gap and the occupational wage gap is high, at 0.79. The correlation between the average gender wage gap and the unweighted occupational gender wage gap, $(\frac{1}{J}\sum_{j=1}^{J} (\overline{\ln W_j^m} - \overline{\ln W_j^f}))$, is even higher, at 0.86. This is important, because the ILO October Inquiry lacks information on employment, and the analysis is based on unweighted data.

Second, the occupational wage gap can be viewed as a proxy for gender wage discrimination. The raw wage gap typically measures the gender wage differential for all employed workers or for broad occupational categories. Because of gender differences in human capital, this measure will tend to overstate the actual gender wage gap if these differences were controlled for. Thus many studies have looked at the so-called residual wage gap, which is the female–male wage differential that remains if gender differences in human capital are removed (typically through regression analysis).

In cases where female and male workers in narrowly defined occupations have similar skills, the occupational wage gap provides a direct measure of the residual gender wage gap. The critical issue is then whether the gender gap in skills within occupations is relatively narrow. Although it is straightforward to calculate the gender gap in skills within occupations, there is not one measure of skills but several, such as education, age, work experience, and tenure, and the relative importance of these different gaps is not clear a priori. The Oaxaca–Blinder decomposition of gender wage gaps can be used to calculate first how much of the raw wage gap can be explained by observed skills. Next, one can calculate how much of the raw wage gap can be explained by skills if one also controls for occupation in the Mincerian wage regression by including occupational dummy variables. The results of the Oaxaca–Blinder decomposition for the sample of countries from the Luxembourg Employment Study and the Living Standards Measurement Study are reported in table 1.

In line with the literature, human capital differences can explain only a small part of the total raw wage gap. A sizable residual gender wage gap remains. Important, however, is that when the Mincerian regression also controls for occupational heterogeneity, the explanatory power of human capital differences is significantly reduced (from 0.053 to 0.036 for developed countries and from 0.064 to 0.032 for developing economies). This implies that for given occupations, human capital differences explain little of the gender wage gap.

Even if human capital differences do still explain (a small) part of the raw wage gap, this does not imply that the occupational wage gap is an inferior proxy for gender wage discrimination compared with the residual gender wage gap. First, the occupational information in the Luxembourg Employment Study and the Living Standards Measurement Study is available mainly at the two-digit level, while the ILO October Inquiry data are at the four-digit level, where within-occupation human capital differences should play an even smaller role. Second, the residual gender wage gap controls only for observable human capital differentials, while the occupational wage gap also corrects for unobservable human capital differences to some extent. Third, the occupational wage gap does not rely on a regression model to eliminate the impact of human capital differences.

For these reasons, the occupational wage gap could be a superior proxy for gender wage discrimination compared with the residual gender wage gap.

TABLE 1. Oaxaca–Blinder Decomposition without and with Occupation Dummy Variables

		Explained by skills				Explained by skills	
		Occupation dummy variables				Occupation dummy variables	
Developed country	Raw wage gap	No	Yes	Developing economy	Raw wage gap	No	Yes
Belgium	0.16	0.02	0.02	Albania	−0.01	−0.04	−0.01
Canada	0.21	0.02	0.02	Bosnia and Herzegovina	0.12	0.00	0.00
France	0.19	0.01	0.01	Brazil	−0.09	−0.21	−0.17
Germany	0.34	0.07	0.03	Bulgaria	0.11	−0.03	−0.02
Ireland	0.31	0.09	0.07	Kosovo	0.17	−0.03	−0.02
Luxembourg	0.37	0.13	0.05	Nicaragua	−0.45	−0.17	−0.04
Netherlands	0.25	0.09	0.07	Panama	0.36	0.02	0.03
Spain	0.23	−0.01	0.01	Peru	−0.02	−0.06	0.00
Switzerland	0.33	0.08	0.07	Vietnam	0.13	−0.02	0.00
United States	0.16	−0.01	−0.01				
Average[a]	0.255	0.053	0.036		0.162	0.064	0.032

Note: The following skill measures were included in the Mincerian regressions: dummy variables for levels of education completed, age (squared), potential work experience (if information available, defined as age minus age when obtained highest level of education or training), and tenure (squared). The male wage structure is used to estimate the Mincerian returns to skills.

[a]Average of absolute values.

Source: Author's analysis based on the Luxembourg Employment Survey and the Living Standards Measurement Study.

Thus, both the occupational and residual wage gaps can be viewed as useful proxies for gender wage discrimination.

That being the case, it becomes interesting to look at the empirical properties of both measures. The first desirable property is that they move in the same direction with respect to the raw wage gap. The second desirable property is that both proxies are highly correlated. Both properties hold for the sample of 19 countries (figure 1).[5] The horizontal axis shows the difference between the raw and residual wage gaps. The vertical axis shows the difference between the raw and occupational wage gaps. It is clear for almost all countries that the residual and occupational wage gaps move in the same direction—they lie in either the first or third quadrant.[6] And there is a strong correlation between the residual and occupational wage gaps (the correlation coefficient is 0.83).

II. A Descriptive Analysis of the Occupational Gender Wage Gap Around the World

Does the occupational gender wage gap become larger or smaller with economic development? Figure 2 shows the occupational gender wage gap for 63 countries by the level of economic development measured as the logarithm of GDP per capita (in constant 1995 US dollars).[7]

The overall average occupational gender wage gap is 0.11 across all countries in the data set.[8] There is a nonlinear and inverted U-shaped cross-section relation between the occupational gender wage gap and the level of economic development.[9] This suggests that the expected negative relation

5. The figure reports the unweighted occupational gender wage gap—the results for the weighted occupational gender wage gap are virtually the same.

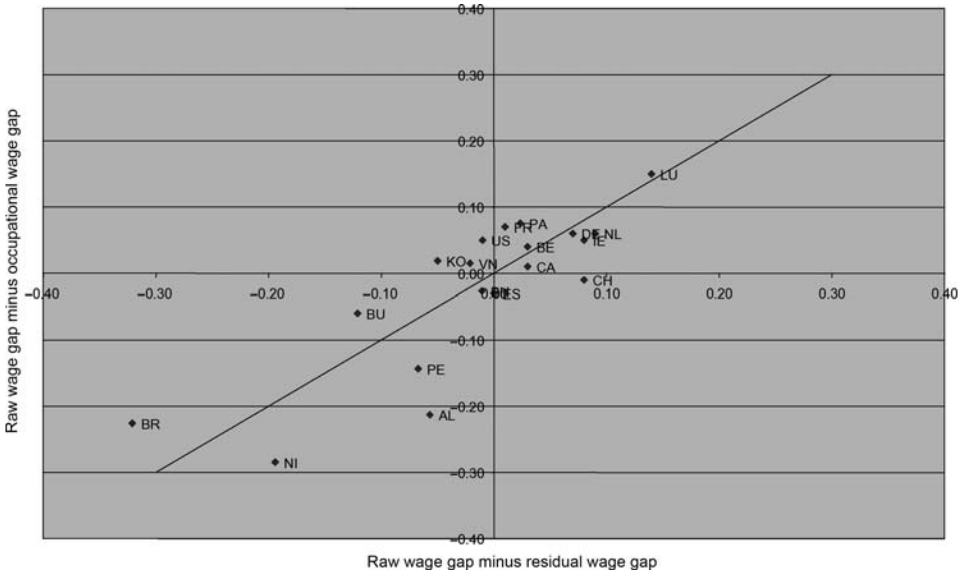
6. It is also interesting to note that for countries in the first quadrant, women tend to be less educated than men, and for countries in the third quadrant, women tend to be more educated than men.

7. The occupational gender wage gap is measured as one minus the average ratio of the reported female and male wage for a given country across occupations and years (at least two occupational gaps). See table S.6 in the supplemental appendix for more information on the underlying data.

8. The reported occupational gender wage gap is below zero for some countries, such as Bangladesh, Democratic Republic of Congo, and Togo, suggesting that women's occupational wages are higher than men's in these countries. This is possible, for instance, if female workers have more education than male workers in these countries, even within narrowly defined occupations (see section I on the importance of human capital differentials for understanding occupational gender wage gaps). More important, however, the reported gender wage gaps are measured with error, and especially in the poorest countries, there is a wide variation in reported occupational gender wage gaps. The countries with negative occupational wage gaps are not excluded, however, as this would create a sample selection (truncation) bias in the estimates.

9. The cross-section relationship was estimated with an OLS regression, with dummy variables for the outlier countries of Cyprus, Japan, and Republic of Korea [estimated coefficients, with standard errors in parentheses, for linear and quadratic GDP per capita variables: 0.09 (0.08) and −0.0047 (0.005); p-value of F-test on joint significance 0.08]. The dummy variables were included because the cross-section estimates were strongly affected if these high wage gap countries were excluded (see footnote 21).

FIGURE 1. Residual and Occupational Wage Gaps



Note: Country key: AL: Albania; BH: Bosnia and Herzegovina; BE: Belgium; BR: Brazil; BU: Bulgaria; CA: Canada; CH: Switzerland; DE: Germany; ES: Spain; FR: France; IE: Ireland; KO: Kosovo; LU: Luxembourg; NI: Nicaragua; NL: The Netherlands; PA: Panama; PE: Peru; US: United States; VN: Vietnam.

Source: Author's analysis based on data from the Luxembourg Employment Survey and the Living Standards Measurement Study.

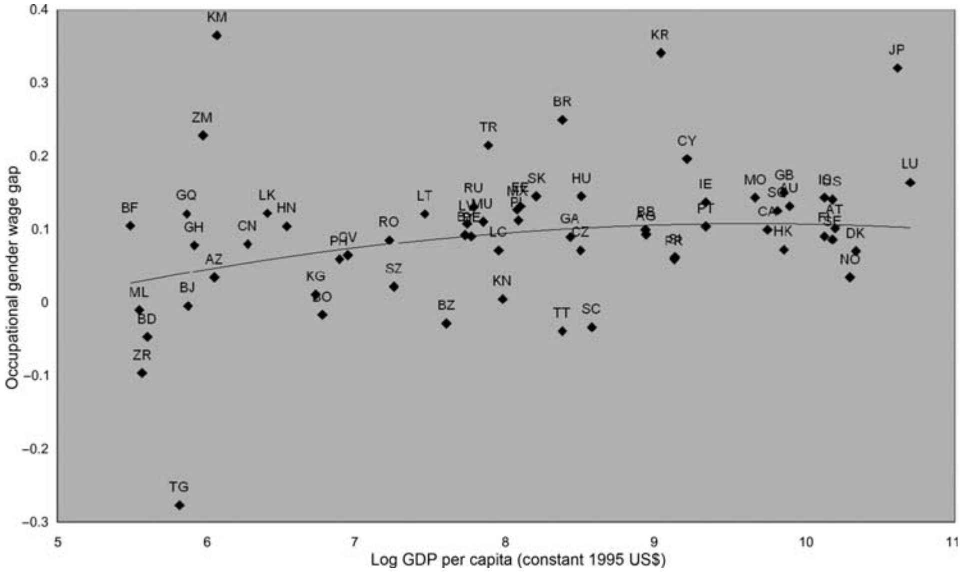
between the occupational gender wage gap and the level of economic development holds only for richer countries but not for poorer countries.[10] Boserup (1970) noted three decades ago that development has to reach a certain threshold before gender gaps close with further economic growth, and Dollar and Gatti (1999) found more recently a convex relation between per capita incomes and the proportion of women in parliament and gender equality in secondary school attainment, with minor or nonexistent correlation as countries move from very low income to lower middle income.

Countries report different occupations, and this may affect the estimated relation between the occupational gender wage gap and the level of development in figure 2. However, if the occupational gender wage gap is adjusted for cross-country differences in occupations reported, there is still a nonlinear relationship.[11]

10. The reported (between-country) regression will be biased if countries report varying sets of occupations and there are correlated unobserved occupation fixed effects [α_o in equation (2)]. This can explain the too high turning point in figure 2 (at log GDP per capita equal to 9.6) compared with the turning point in a regression including occupational fixed effects (at log GDP per capita equal to 9.1; see table 3, column 1).

11. Specifically, a regression was run of the occupational gender wage gap on occupation dummy variables and country by year dummy variables. The adjustment was done by subtracting the part of the occupational gender wage gap that could be explained by the occupation dummy variables.

FIGURE 2. Occupational Gender Wage Gap versus Log GDP per Capita, by Country



Notes: For each country, the year is included for which most occupational gender wage gaps were reported (minimum two occupational wage gaps). Country key: AG: Antigua and Barbuda; AT: Austria; AU: Australia; AZ: Azerbaijan; BB: Barbados; BD: Bangladesh; BF: Burkina Faso; BJ: Benin; BO: Bolivia; BR: Brazil; BY: Belarus; BZ: Belize; CA: Canada; CN: China; CV: Cape Verde; CY: Cyprus; CZ: Czech Republic; DK: Denmark; EE: Estonia; FI: Finland; GA: Gabon; GB: United Kingdom; GH: Ghana; GQ: Guinea Equatorial; HK: Hong Kong, China; HN: Honduras; HU: Hungary; IE: Ireland; IS: Iceland; JP: Japan; KG: Kyrgyzstan; KM: Comoros; KN: St Kitts and Nevis; KR: Republic of Korea; LC: St Lucia; LK: Sri Lanka; LT: Lithuania; LU: Luxembourg; LV: Latvia; ML: Mali; MO: Macau; MU: Mauritius; MX: Mexico; NO: Norway; PE: Peru; PH: Philippines; PL: Poland; PR: Puerto Rico; PT: Portugal; RO: Romania; RU: Russian Federation; SC: Seychelles; SE: Sweden; SG: Singapore; SI: Slovenia; SK: Slovakia; SZ: Swaziland; TG: Togo; TR: Turkey; TT: Trinidad and Tobago; US: United States; ZM: Zambia; ZR: Democratic Republic of Congo.

Source: Author's analysis based on data from ILO October Inquiry and World Bank World Development Indicators Database.

Also, if the analysis is limited to the country-year pairs reporting at least 5 of the 20 most reported occupations, an inverted U-shape relation is found between the level of economic development and the gender gap.

This descriptive analysis suggests that if there is any relation between the occupational gender wage gap and the level of development, it may have an inverted U-shape. However, the analysis above does not take into account other country differences that may affect the occupational gender wage gap and that are correlated with the level of development, such as trade and FDI. Nor does it allow for possible endogeneity bias. The regression analysis in section III will control explicitly for these possible biases.

One can control for time-invariant country characteristics, however, by looking at within-country changes in the occupational gender wage gap. The sample was separated into two groups: the top third of countries that have seen the fastest growth in GDP per capita between the 1980s and 1990s, and the bottom third slowest growing countries. The average change in the occupational gender wage gap for the slow GDP growth group is +0.04 (median change +0.02) between the 1980s and 1990s (table 2). The corresponding change for the fast growth group is −0.02 (median change −0.01). Thus, the fast growth group experienced a narrowing of the occupational gender wage gap, while the slow growth group experienced a widening. Also, six of eight countries in the slow growth group experienced an increase in the occupational gender wage gap, while six of eight countries in the fast growth group experienced a decrease.

The introduction mentioned several theories about the impact of globalization on the gender gap. These theories often have implications for the gender wage gap across occupations or skill levels but not for the gender wage gap within occupations or skill levels. For instance, standard trade theory predicts that the compensation paid to the relatively scarce factors of production will fall, implying that both male and female wages will fall in occupations intensive in scarce factors. Similarly, any trade-induced fall in gender disparities in human capital will probably lead to more employed women in the higher skill

TABLE 2. Change in and Number of Countries with Increase and Decrease in Occupational Gender Wage Gap between the 1980s and 1990s, by Growth in GDP per Capita, Trade, and FDI

	Change		Number of countries with	
Growth measure and country group	Mean	Median	Decrease	Increase
GDP per capita				
Bottom third	0.04	0.02	2	6
Top third	−0.02	−0.01	6	2
Trade				
Bottom third	0.04	0.02	3	5
Top third	−0.05	−0.02	5	2
FDI				
Bottom third	−0.01	−0.02	6	2
Top third	0.02	0.01	0	7

Note: Country groups: GDP per capita growth, bottom third: Australia, Denmark, Finland, Gabon, Honduras, Iceland, Peru, and Sweden; top third: Cyprus, Hong Kong (China), Republic of Korea, St Lucia, Sri Lanka, Mauritius, Portugal, and Singapore. Trade growth, bottom third: Cyprus, Gabon, Iceland, Japan, Republic of Korea, Peru, Sweden, and Singapore; top third: Bolivia, Finland, Hong Kong, Honduras, Sri Lanka, Mauritius, and United States. FDI growth, bottom third: Australia, Bolivia, Cyprus, Gabon, Iceland, Seychelles, Singapore, and United States; top third: Austria, Denmark, Finland, Japan, Norway, Peru, and Sweden.

Source: Author's analysis based on data from ILO October Inquiry and World Bank World Development Indicators Database.

occupations, but not necessarily to a lower gender wage gap within occupations.

However, globalization is expected to narrow the gender wage gap within occupations. First, trade will lead to more competition and therefore less discrimination. Second, increases in trade will drive up the relative demand for female labor because women are disproportionately represented in export-oriented sectors, at least in developing economies. Thus, prima facie, a negative relation between globalization and the occupational gender wage gap is expected.

Globalization can be measured along different dimensions and is measured here by trade as a percentage of GDP (in current prices) and by FDI net inflows as a percentage of GDP. The cross-country relation between these measures of globalization and the occupational gender wage gap is negative (figures not shown). Similar results are found if trade is measured as a percentage of GDP in constant local currency units, the measure used by Dollar and Kraay (2004). Hence, cross-country analysis suggests that trade and FDI inflows lower the occupational gender wage gap.

However, instead of looking at the cross-sectional pattern, one can also compare countries with low and high trade growth. Countries in the bottom third of countries for increase in trade (as a percentage of GDP in current prices) between the 1980s and 1990s are in the low trade group, and countries in the top third are in the high trade growth group. The average change in the occupational gender wage gap is +0.04 (median +0.02) for the low trade growth group and −0.05 (median −0.02) for the high trade growth group (table 2). Five of seven countries among the high trade growth group have seen a decrease in the occupational gender wage gap, as against three of eight among the low trade growth group. This supports the cross-section finding that trade lowers the occupational gender wage gap.

However, the opposite pattern is found for FDI net inflows as a percentage of GDP. The mean and median occupational gender wage gap rose for the group of countries with the largest increase in FDI net inflows, but fell for the group of countries with the smallest increases in FDI net inflows (table 2). The regression analysis discussed in the following section, however, suggests that the positive cross-section relation between FDI and the occupational gender wage gap is primarily a result of reverse causality.

III. Does Globalization Reduce the Occupational Gender Wage Gap? A Regression Analysis

It is clear that the descriptive analysis above may suffer from occupational heterogeneity (specification bias), feedback effects from the gender gap on trade and FDI (simultaneity bias), and the omission of factors that may have caused the changes in the occupational gender wage gap (omitted variable bias).

The following more in-depth regression analysis of the impact of globalization on the gender gap takes these potential biases into account.

The impact of globalization on the gender gap may vary across occupations. First, globalization may be expected to have the greatest impact on occupations with the largest gap (and potential for reduction). Second, occupations differ in worker and sector characteristics and may therefore be affected differently.

An important distinction is between high- and low-skill occupations in combination with the distinction between poorer and richer countries.[12] If the gender gap is reduced primarily through sector expansion (with increasing relative demand for female labor), trade would be expected to have a negative (narrowing) impact on the low-skill gender gap in poorer countries and the high-skill gender gap in richer countries. Conversely, if the gender gap is reduced primarily through sector contraction (with increasing competition from imports), then a large impact would be expected on the high-skill gender gap in the poorer countries and the low-skill occupations in the richer countries. Thus, trade may have different impacts on the gender gap depending on the income (or average skill) level of the country and the skill type of the occupation.[13] Therefore, the following regression model is estimated for low and lower middle income countries and high and higher middle income countries:[14,15]

$$occ_{cot} = \beta_1^j D_o^{LS} GDP_{ct} + \beta_2^j D_o^{HS} GDP_{ct} + \beta_3^j D_o^{LS} GLOB_{ct} + \beta_4^j D_o^{HS} GLOB_{ct} + \beta_5^j COMM_{ct} + \alpha_o^j + \alpha_t^j + \varepsilon_{cot}^j, \quad (2)$$

where c is country, o is occupation, t is year, $j \in$ {low/lower middle income countries, high/higher middle income countries}, occ is the occupational gender wage gap, D_o^{LS} and D_o^{HS} are dummy variables for low- and high-skill occupations, GDP is GDP per capita in constant 1995 US dollars, $GLOB$ is a measure of globalization, $COMM$ is a dummy variable for communist countries, α_o and α_t are occupation and year fixed effects, and ε is an error

12. The author is grateful to Aart Kraay for pointing this out.

13. It could be argued that the effect of globalization might be observed more strongly in occupations in traded than in nontraded sectors (at least in the short-run). The results for virtually all regression models showed no difference in impact, suggesting that the results should be interpreted as long run, in the sense that occupational labor markets between traded and nontraded sectors are integrated.

14. Following the suggestion of an anonymous referee, an interaction term was also included for country-income level and skill type, as statistically different coefficients were found for the GDP per capita variable across these skill types.

15. A Chow test confirms that the coefficients vary significantly across these two groups of countries. The high and higher middle income countries tend to be high education (skill) countries and the low and lower middle income countries to be low education countries. Although the sample is relatively small for the low and lower middle income countries, an equal split of the sample would make the relatively poor countries highly heterogeneous in human capital (measured as the number of years of education for the population ages 25 years and older).

term. The inclusion of year dummy variables in the regression subsumes any time pattern revealing the cross-sectional relation between globalization and the occupational gender wage gap. Occupation dummy variables are included to control for possible occupation-specific differences in occupational gender wage gaps.[16] Because communist countries have shown a particular commitment to gender equality in the labor market with, for instance, relatively high minimum wages and generous maternity leave and day care benefits (Brainerd 2000), a dummy variable for communist countries is included to capture these institutional features.[17] Aggregate trade (in current and constant prices) and FDI net inflows (in current prices) as a percentage of GDP are used as measures for globalization. Because independent information is lacking on the skill or education levels in each occupation, high-skill occupations are defined as falling within the top half of the occupational wage distribution within a country and low-skill as falling within the bottom half.[18] The regressions have different numbers of observations because of differences in data availability of the trade and FDI variables.

Moulton (1990) shows that there may be a serious downward bias in estimated standard errors if attempts are made to measure the effect of aggregate variables on micro units while assuming independent disturbances. In the analysis above, the dependent variable varies over three dimensions (country, occupation, year), while *GDP* and *GLOB* vary over only two dimensions (country, year). Moulton suggests that if disturbances are correlated within country-year groupings, then even small levels of correlation can cause the standard errors from ordinary least squares (OLS) to be seriously biased downward. Shore-Sheppard (1996) shows that this problem may also arise in an instrumental variables (IV) analysis if the instruments are measured at a higher level of aggregation than the dependent and explanatory variables. This is indeed the case in the IV analysis below, where instruments are used that vary over only one dimension (country). Therefore, the error term in equation (2) is assumed to have the following random components:

$$\varepsilon^{j}_{cot} = c^{j}_{c} + c^{j}_{ct} + c^{j}_{co} + u^{j}_{cot} \tag{3}$$

where c^j_c captures the correlation within country groupings, c^j_{ct} the correlation within country-year groupings, c^j_{co} the correlation within country-occupation groupings, and u^j_{cot} is an idiosyncratic error term. The first component (c^j_c) is included because the instrument varies only across countries (following Shore-Sheppard), while the second component (c^j_{ct}) is included because the

16. The Hausman test for random occupation effects was strongly significant (rejected) for the high and higher middle income countries (p-value < 0.00001) and insignificant for the low and lower middle income countries. This result may be due to the small sample size, and therefore occupation fixed effects are preferred in all regressions.

17. Omission of the communist dummy variable does not affect the results.

18. See supplemental appendix for more details on this measure of skill.

explanatory variables *GDP* and *GLOB* vary only across country-year groupings (following Moulton). The term c_{co}^{j} is also included because correlation within country-occupation groupings is also expected (if the gender wage gap is high for an occupation in a given country and year, it is likely to be high in another year as well). The standard errors were calculated with a three-step procedure.[19] First, the regressions were estimated with OLS or IV. Second, the residuals were used to estimate the variance–covariance matrix of ε_{cot}^{j} ($\bar{\Omega}$). Third, the standard errors of the OLS and IV regressions were calculated according to the formulas (Moulton 1990; Shore-Sheppard 1996):[20]

$$\text{OLS:} \quad (X'X)^{-1}X'\hat{\Omega}X(X'X)^{-1} \tag{4}$$

$$\begin{aligned} \text{IV: } & [(X'Z)(Z'Z)^{-1}(Z'X)]^{-1}(X'Z)(Z'Z)^{-1}Z'\hat{\Omega}Z(Z'Z)^{-1}(Z'X) \\ & [(X'Z)(Z'Z)^{-1}(Z'X)]^{-1}, \end{aligned} \tag{5}$$

where X and Z are matrices of explanatory and instrumental variables, respectively.

Table 3 (panel A, columns 3, 4, 7, and 8) reports the OLS estimates of equation (2).[21] The relation between the occupational gender wage gap and the GDP per capita variable for the whole sample, including a quadratic term, is reported in column 1. Although the quadratic term is just insignificant at 10 percent, there appears to be a nonlinear relationship, as was evidenced in figure 2.[22] However, occupations have been reported by varying sets of countries, creating a possible selection bias.[23] Therefore, the regression in column 1 was also re-estimated for a subset of occupations reported for a consistent set of countries. Because none of the occupations has been reported by all countries simultaneously, a subsample of 10 countries that reported most

19. Generalized method of moments (GMM) estimates based on an optimal weighting matrix [reflecting the variance–covariance structure of the error term in equation (2)] would in principle be more efficient, but the estimates turned out to be very similar. The commonly used OLS and IV estimates were therefore applied, but corrected for the nonhomoskedastic nature of the error term.

20. The standard errors of the first-stage IV regressions were similarly corrected.

21. Azerbaijan; Hong Kong, China; Luxembourg; and Singapore were omitted in all regressions, because they are untypical in either trading volume or FDI net inflows. Dummy variables for Cyprus, Japan, and the Republic of Korea were included because the cross-section estimates were strongly affected if these high wage gap countries were excluded. With these dummy variables, the results are robust to the exclusion of any country in the sample.

22. The turning point is log GDP per capita of 9.1, with 18 economies on the declining part of the relationship: Austria, Australia, Canada, Cyprus, Denmark, Finland, Ireland, Iceland, Japan, Republic of Korea, Macau (China), Norway, Puerto Rico, Portugal, Sweden, Slovenia, United Kingdom, and United States.

23. The author appreciates the thorough discussion of this issue with one of the referees. He notes, however, that possible sample selection bias is arguably reduced by the inclusion of occupational dummy variables in the regression (identifying the impact of GDP per capita on country-differences in the gender wage gap for a *given* occupation rather than for the average reported occupation).

TABLE 3. Ordinary Least Square and Instrumental Variables Regression Estimates of the Effect of per Capita Income, Trade, Foreign Direct Investment Net Inflows on the Occupational Gender Wage Gap, by Occupational Skill Level and Country Income

	1	2	3	4	5	6	7	8	9	10
	All		Low/lower middle income countries				High/higher middle income countries			
Variable	OLS	OLS	OLS	OLS	IV	IV	OLS	OLS	IV	IV
Panel A. Ordinary and two-stage least squares										
Log GDP per capita ($*10^{-2}$)	**7.29**	11.9								
	(0.09)	(0.20)								
* Low skill			0.60***	0.64***	−0.59*	0.18	**−2.42*****	−0.71***	**−3.18*****	**−12.9*****
			(0.66)	(0.60)	(0.69)	(0.95)	(0.00)	(0.31)	(0.01)	(0.05)
* High skill			**2.22*****	1.72***	0.96*	0.19	**−2.06*****	−0.39***	**−2.39*****	**−12.5*****
			(0.10)	(0.16)	(0.50)	(0.92)	(0.00)	(0.58)	(0.01)	(0.07)
(Log GDP per capita)^2 ($*10^{-2}$)	−0.40	−0.67								
	(0.12)	(0.21)								
Trade (percent GDP, current prices) ($*10^{-3}$)										
* Low skill			0.01		0.15		**−0.76*****		**−1.50*****	
			(0.97)		(0.75)		(0.00)		(0.00)	
* High skill			−0.23		0.29		**−0.72*****		**−2.11*****	
			(0.42)		(0.51)		(0.00)		(0.00)	
FDI net inflows (percent GDP) ($*10^{-2}$)										
* Low skill				**−0.58**		−1.11		**−0.44**		**−14.3*****
				(0.09)		(0.77)		(0.11)		(0.09)
* High skill				0.11		3.09		−0.14		**−14.5*****
				(0.74)		(0.39)		(0.60)		(0.01)
Year dummy variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Occupation dummy variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Dummy variables for Cyprus, Japan, Republic of Korea	Yes	Yes[a]	na	na	na	na	Yes	Yes	Yes	Yes
Dummy variable for communist country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.40	0.53	0.24	0.24			0.56	0.56		
Number of observations	9,600	1,103	2,184	2,182	1,704	1,702	7,398	7,161	7,004	6,877

(Continued)

TABLE 3. Continued

Panel B. First stage for regressions	(5) Trade* Low skill	(5) Trade* High skill	(6) FDI* Low skill	(6) FDI* High skill	(9) Trade* Low skill	(9) Trade* High skill	(10) FDI* Low skill	(10) FDI* High skill
Log GDP per capita								
* Low skill	**6.16*****	0.35***	**0.55*****	−0.02***	**−3.96*****	**−7.76*****	**−0.34*****	**−0.54*****
	(0.00)	(0.78)	(0.01)	(0.93)	(0.00)	(0.00)	(0.01)	(0.00)
* High skill	1.61***	**4.96*****	0.11***	**0.39*****	**−7.40*****	**−4.35*****	**−0.44*****	**−0.46*****
	(0.18)	(0.00)	(0.59)	(0.03)	(0.00)	(0.00)	(0.00)	(0.00)
Geographic trade								
* Low skill	**1.59*****	**0.11*****	0.01***	**0.02****	**1.47*****	0.02***	**0.01*****	−0.001***
	(0.00)	(0.03)	(0.40)	(0.01)	(0.00)	(0.75)	(0.01)	(0.85)
* High skill	**0.11*****	**1.68*****	**0.02*****	**0.01****	−0.001***	**1.46*****	−0.002***	**0.02*****
	(0.04)	(0.00)	(0.01)	(0.08)	(0.99)	(0.00)	(0.65)	(0.00)
Tariff rate (*10^{-2})	−2.04	−2.98	0.61	−0.53	−10.6	−2.05	−0.46	−0.59
	(0.64)	(0.52)	(0.40)	(0.40)	(0.19)	(0.79)	(0.55)	(0.31)
Year dummy variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Occupation dummy variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Dummy variables for Cyprus, Japan, Republic of Korea	Na	na	na	na	Yes	Yes	Yes	Yes
Dummy variable for communist country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F on excluded instruments	8.21	9.99	3.50	2.91	31.2	33.2	20.8	35.9
Hansen's J-statistic (p-value)	0.22		0.35		0.20		0.58	
Adjusted R^2	0.92	0.92	0.65	0.69	0.92	0.92	0.49	0.49
Number of observations	1,704		1,702		7,004		6,877	

na is not applicable.

Note: Numbers in parentheses are p values. Numbers in bold are coefficients that are individually significant at a 10 percent level or less. Standard errors are corrected (see text).

*Coefficients for the variables for which both interaction terms (for low- and high-skill occupations) are jointly significant at 10 percent,**5 percent, or ***1 percent.

[a]Dummy variable for Republic of Korea only.

Source: Author's analysis based on data sources discussed in the text.

wage gaps across the occupations was selected, and the occupations reported by each them were identified (21 occupations).[24] The subsample includes countries across the entire GDP per capita spectrum and many low- as well as high-skill occupations.[25] Estimates for this subsample are reported in column 2. The coefficients are less precisely estimated—because of the much smaller sample—but comparable to those in column 1 (not statistically different taking into account the sampling error) and imply a similar turning point.[26] Thus the observed nonlinear relationship in column 1 appears not to be driven by selection bias.

The nonlinearity is also evident in the OLS estimates of equation (2), with a significant positive impact of GDP per capita on the gender wage gap in poorer countries and a negative impact in richer countries. A nonlinear relation suggests a gender-equivalent of the Kuznets curve. However, IV analysis (discussed below) suggests that the positive relation between GDP per capita and the gender wage gap observed for poorer countries is not be robust, leaving a negative relation for the richer countries.

A negative impact of trade on the gender wage gap is found for low- and high-skill occupations in the richer countries.[27] This result confirms the finding in table 2. For the poorer countries, there are no significant results for the impact of trade. However, there is a negative impact of FDI net inflows on the gender wage gap for low-skill occupations in poorer and richer countries.

In general, caution should be exercised in inferring causality from a cross-section regression, given the possibility of simultaneity bias. The gender wage gap may affect trade and FDI net inflows in turn (reverse causality), for instance, because a high gender wage gap may reflect low female wages and potential cost-savings if exports are "female-led" (Rodrik 2000; Seguino 2000; Kucera 2002; Busse and Spielmann 2006). Also, a high gender wage gap may reflect discrimination and inefficiency in an imperfectly competitive environment, affecting the incentives for trade and foreign investment.

It is therefore important to consider instruments for the trade and FDI variables. In principle, trade policy variables such as tariffs and nontariff barriers are good instruments except that trade outcomes and trade policy variables are extremely weakly correlated (Dollar and Kraay 2004). Alternatives are the Frankel and Romer (1999) measures of the geographic component of countries' trade. Here, both tariff rates and the Frankel–Romer instruments are used and

24. Other subsamples were also tried, but they generated similar results.

25. The following countries (log GDP per capita in parentheses) are included in the subsample: China (6.3), Romania (7.2), Latvia (7.7), Estonia (8.1), Poland (8.1), Republic of Korea (9.0), Portugal (9.3), Austria (9.9), Finland (10.1), and Sweden (10.2). The selected occupations include laborers, garment cutters, building painters, sales people, mathematics teachers, chemical engineers, and general physicians, among others.

26. The implied turning point is at log GDP per capita of 8.9.

27. The table reports the results for trade in current prices. The results for trade in local currency units are virtually the same.

interacted with the skill level of the occupation as instruments for the trade and FDI measures.[28] The resulting IV estimates are reported in table 3, panel A, columns 5, 6, 9, and 10, and the corresponding first-stage regression results are reported in panel B. The Hansen *J*-statistic does not reject the joint null hypothesis that the instruments are valid (uncorrelated with the error term) and that the excluded instruments are correctly excluded from the estimated equation at the 5 percent significance level.[29] The *F*-statistics on the excluded instruments suggest that there is no problem with weak instruments (creating a bias toward the OLS estimates) apart, possibly, from the regression with FDI net inflows for poorer countries (regression 6).

Now the positive relation between GDP per capita and the gender wage gap in poorer countries is no longer robust. It becomes insignificant, with its sign depending on the specification. For the richer countries, there is still a negative relation between GDP per capita and the gender wage gap—economic development tends to reduce the gender wage gap.[30] This finding is consistent with Boserup's idea (1970) and Dollar and Gatti's finding (1999) that development has to reach a certain threshold before gender gaps close with further economic growth.

A significantly negative impact of trade on the gender wage gap is still found for low- and high-skill occupations in the richer countries.[31] For the FDI variable, there is now a significantly negative impact for both low- and high-skill occupations in the richer countries. Also, there is still a negative impact for low-skill occupations in poorer countries, but the coefficient is no longer significant.

The estimated coefficients for the trade and FDI variables are generally larger when instrumented. This result may reflect the attenuation bias because of measurement error as well as simultaneity bias. In the richer countries, a 100 percentage point increase in trade (as a percent of GDP) is estimated to lower the gender gap by approximately 15–21 percentage points. The impact of FDI on the gender gap is also significant—a 1 percentage point increase in FDI (as a percent of GDP) would lower the gender gap in richer countries by 14 percentage points.[32] Given that the average occupational gender gap is 8 percentage points, trade and FDI can potentially reduce the occupational gender wage gap substantially.

28. Tariff rates are unweighted averages for all goods in ad valorem rates, applied rates, or most favored nation rates, depending on which data are available for a longer period.

29. The optimal GMM estimator is used for computing the Hansen *J*-statistic (Cameron and Trivedi 2005, p. 181).

30. Although the coefficients for the GDP variables differ considerably across columns 9 and 10, the 95 percent confidence intervals are overlapping.

31. The results for trade in local currency units are virtually the same.

32. Average trade is 93 percent of GDP, while average FDI net inflows are 2.4 percent of GDP for the sample of countries.

These estimates may still suffer from omitted variable bias if the occupational gender wage gap is affected by factors other than economic development, trade, and FDI net inflows. Therefore, it was also investigated whether wage-setting institutions, intracountry trade, or occupational segregation and inequality could explain the observed relation between globalization and the gender wage gap. They did not—the observed relations did not change.[33] Also, after including a measure of female net supply, following the methodology of Blau and Kahn (2003), the coefficients for the GDP per capita, trade, and FDI variables are barely affected.

IV. Conclusion

This article undertakes one of the first truly global studies of the effect of globalization on the gender wage gap. The study is based on the most far-ranging cross-country survey of wages available, the ILO October Inquiry, permitting the gender wage gap to be measured within narrowly defined occupations. The occupational wage gap is an interesting indicator of gender inequality, as an independent measure of the relative female wage position that abstracts from occupational segregation, and also as an independent proxy for gender wage discrimination next to the residual wage gap.

The results of the study show that the occupational gender wage gap appears to decrease with increasing economic development, at least for richer countries. Also, the occupational gender wage gap tends to decrease with trade and FDI in richer countries, but no clear effect is found for poorer countries.

The findings for richer countries conform to the theoretical expectation that trade has a narrowing impact on the gender wage gap within occupations, through either a reduction in discrimination or an increase in the relative demand for female labor. If either of these explanations dominated, the impact would be expected to differ across skill level (see section III). However, there is no noticeable difference in impact across the skill level of occupation, suggesting that neither of these two mechanisms dominates.

Therefore, the evidence that trade and FDI reduce the occupational gender wage gap applies primarily to richer countries. For poorer countries, there is little evidence of this effect, in line with Boserup's (1970) conjecture that development has to reach a certain threshold before gender gaps close with further economic growth. At the same time, the possibility remains that it could be simply attenuation bias due to measurement error—poorer countries rely relatively more on nonsurvey-based data sources compared with richer countries (see supplemental appendix)—or the relatively small sample size for the poorer countries. Also, the gap is already relatively low in the lower middle income countries and particularly the low-income countries (supplemental appendix, table S.6), and therefore there is less scope for a reduction in the first place.

33. Results are reported in Oostendorp (2004).

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