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## Importing Equality? The Impact of Globalization on Gender Discrimination

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Sandra E. Black and Elizabeth Brainerd

## Abstract

A key dynamic implication of the Becker model of discrimination (1957) is that increased product market competition will drive out costly discrimination in the long run. This paper tests that hypothesis by examining the impact of globalization on gender discrimination in manufacturing industries. Because concentrated industries face little competitive pressure, an increase in competition from trade should reduce the residual gender wage gap more in these industries than in competitive industries. The authors compare the change in the gender wage gap between 1976 and 1993 in concentrated versus competitive manufacturing industries, using the latter as a control for changes in the gender wage gap that are unrelated to competitive pressures. They find that while trade increases wage inequality by modestly reducing the relative wages of less-skilled workers, at the same time it appears to benefit women by reducing the ability of firms to discriminate.

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# IMPORTING EQUALITY? THE IMPACT OF GLOBALIZATION ON GENDER DISCRIMINATION

SANDRA E. BLACK and ELIZABETH BRAINERD\*

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A key dynamic implication of the Becker model of discrimination (1957) is that increased product market competition will drive out costly discrimination in the long run. This paper tests that hypothesis by examining the impact of globalization on gender discrimination in manufacturing industries. Because concentrated industries face little competitive pressure, an increase in competition from trade should reduce the residual gender wage gap more in these industries than in competitive industries. The authors compare the change in the gender wage gap between 1976 and 1993 in concentrated versus competitive manufacturing industries, using the latter as a control for changes in the gender wage gap that are unrelated to competitive pressures. They find that while trade increases wage inequality by modestly reducing the relative wages of less-skilled workers, at the same time it appears to benefit women by reducing the ability of firms to discriminate.

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**I**n his seminal work on the economics of discrimination, Gary Becker's theory (1957) has the startling implication that increased competition in the product market will reduce discrimination against women and minorities in the long run. This implies a positive relationship between

market power and employment discrimination: because a firm must forego profits in order to indulge in a "taste for discrimination," employers with considerable market power will be better able to practice discrimination than those with little market power. The theory also has the dynamic implication that changes in market power will produce changes in the relative employment and earnings of groups initially subject to discrimination. Of specific interest to us, in that regard, is the prediction that increased product market competition in an industry (or region) over time will reduce earnings and employment disparities between men and women, all else equal.

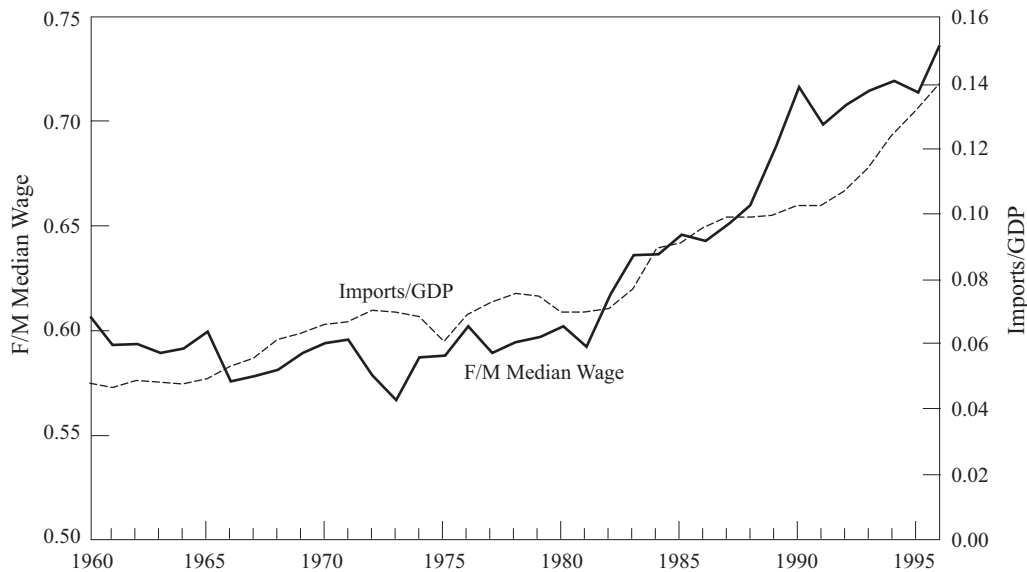
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Copies of the computer programs used to generate the results presented in the paper are available from Sandra Black at [sblack@econ.ucla.edu](mailto:sblack@econ.ucla.edu).

Figure 1. Trends in Female/Male Median Wages (Full-Time Workers) and Imports as a Share of GDP (1992 dollars).



Sources. Gender wage ratio: U.S. Bureau of the Census, *Current Population Reports*. Imports/GDP: U.S. Dept. of Commerce, National Income and Product Accounts.

The recent narrowing of the gender earnings gap in an era of increased competition through international trade and deregulation might seem to offer support for this theory. Since 1960, the time trend for the female:male wage ratio has closely tracked that for imports as a share of GDP, with both series remaining fairly constant between 1960 and 1980, then increasing dramatically through the early 1990s (Figure 1). The gains for women occurred, moreover, at a time when federal anti-discrimination efforts were waning. Despite this suggestive evidence, however, the possibility that women have benefited from increased product market competition resulting from increased trade has received little formal research attention. Blau and Kahn (1997), for example, concluded that female wage gains in the 1980s were largely attributable to women's gains in work experience and occupational status, with improvements in unobserved characteristics

also playing a role.<sup>1</sup> The study also cited reduced labor market discrimination against women as a likely factor, but it did not investigate whether reduced discrimination was in turn related to trade-related changes in competition. That possible link is the subject of the present paper.

Did employers indeed face increased competition in the 1980s? At least in some sectors, it appears that they did: a number of industries (such as banking, trucking, telecommunications, and airlines) faced deregulation in the mid- to late 1970s and early 1980s, and many industries confronted intensified competition in the form of in-

<sup>1</sup>Other important contributions to understanding changes in the gender wage gap include Goldin (1990) and O'Neill and Polachek (1993); Blau (1998) provides a broad overview of changes in the economic status of women from 1970 to 1995.

creased imports from foreign competitors. This paper focuses on the latter form of increased competition, and attempts to answer the question: has increased trade led to a decline in discrimination and, as a result, contributed to the improvement in relative female wages? Putting it another way, did the market step in where the federal government left off, and force at least some employers to reduce discrimination in order to remain viable in an increasingly competitive world?

Using both the Current Population Survey and the 1980 and 1990 Censuses, we test this idea by examining the relationship between changes in trade and changes in the gender wage gap across industries as well as across metropolitan areas. The wage data are broken down by concentrated and competitive industries. Since concentrated industries face little competitive pressure to reduce discrimination, an increase in competition from increased trade should lead to a greater reduction in the gender wage gap in these industries than in competitive industries also hit by trade. We compare the change in the gender wage gap in trade-affected concentrated versus unconcentrated sectors, using the latter as a control for changes in the gender wage gap that are unrelated to competitive pressures.

The positive perspective on trade we implicitly adopt here contradicts the spirit of recent research on the links between trade and the structure of wages, which has largely focused on the contribution of trade to rising wage inequality in the United States, and particularly on the link between trade and the deteriorating fortunes of less skilled workers. While analysts disagree on the size of the impact of trade on wage inequality and relative employment, there is little disagreement over the sign: for less skilled workers, trade hurts.<sup>2</sup> Our study

investigates whether, in contrast to that effect, trade may actually benefit some groups of workers—at least in a relative sense—by reducing the ability of firms to discriminate.<sup>3</sup>

### Conceptual Framework

#### The Becker Model of Employer Discrimination

Becker's 1957 treatise on discrimination began by focusing on employers' personal preferences as a source of discrimination, arguing that some employers had a "taste for discrimination" and would be willing to pay to indulge this taste.<sup>4</sup> As Gary Becker himself put it some 45 years ago:

If an individual has a "taste for discrimination," he must act *as if* he were willing to pay something, either directly or in the form of a reduced income, to be associated with some persons instead of others. When actual discrimination occurs, he must, in fact, either pay or forfeit income for this privilege. This simple way of looking at the matter gets at the essence of prejudice and discrimination. (p. 14)

Employers with a "taste for discrimination" against women will hire fewer than the profit-maximizing number of women, employing more men who are equally skilled yet more highly paid. As a result, non-discriminating employers can drive discriminating employers out of the market because discrimination is costly: employers who discriminate against women sacrifice profits in order to indulge their taste for discrimination. In an increasingly competitive market, the wage gap between men and women with equal skills will narrow and may—under certain conditions—even-

<sup>2</sup>For an overview of the literature on trade and wage inequality, see Freeman (1995) and the references therein.

<sup>3</sup>Note that increased competition can make workers who are discriminated against absolutely worse off but relatively better off if it induces the firm to eliminate both the rents it previously shared with workers and the gender (or racial) wage gap.

<sup>4</sup>Becker also analyzed the effects of discrimination by co-workers and by customers; the focus here is on his model of employer discrimination.

tually disappear, as discriminators are forced by market pressure to change their discriminatory practices or are bought out by non-discriminating firms.<sup>5</sup>

Increased import competition is one mechanism through which this narrowing of the gender wage gap could occur. A model consistent with this prediction is described in Borjas and Ramey (1995). In this model, firms in noncompetitive sectors behave as Cournot oligopolists, choosing quantities of output produced taking the quantities produced by other firms as given. Sectors can be noncompetitive for a number of reasons, including high startup costs and barriers to entry. Rents are shared with workers through bargaining; in the case of interest to us, rents can be shared disproportionately with men, with both women and men willing to work in the sector because wages for both groups are at or above the competitive wage.<sup>6</sup> An exogenous increase in trade reduces rents in the industry and hence reduces wages; if male workers were enjoying more rents than female workers, the gap between the two will shrink with the increased competition. In the competitive sector, since wages were already at the competitive level, the gender wage gap will be less affected by the increase in trade.<sup>7</sup>

It is clear that any form of product market competition—whether through in-

creased imports or increased domestic competition—plays an important role in this model, suggesting a link between market structure and the ability of an employer to practice discrimination: discriminating employers with market power, presumably earning positive economic profits, will be able to survive longer in the market than those operating in a competitive market with zero economic profits. Therefore, the gender wage gap should be smaller in competitive markets than in concentrated markets, all else equal. This prediction appears to provide a relatively simple test of the neoclassical theory of labor market discrimination.

Some of the literature on labor market discrimination has focused on testing this implication of Becker's theory regarding the relationship between market power and discriminatory practices. One of the most compelling studies in this vein examined employment practices in the banking industry and found a negative and statistically significant relationship between market power in local banks and the share of female employment in each bank—thus confirming the predictions of Becker's theory (Ashenfelter and Hannan 1986).<sup>8</sup> More recently, Black and Strahan (2001) studied how the deregulation in the banking industry after the mid-1970s affected banks' ability to share rents with favored workers. They found that banks did share rents disproportionately with men and that deregulation reduced this practice and significantly improved the relative wages of women. Hellerstein, Neumark, and Troske (2002) tested the relationship between profits and female employment across firms with market power and found that firms employing higher proportions of women had higher profits, as the theory predicts. In contrast, they found little support for the hypothesis that discriminatory firms grow more slowly than non-discriminatory

<sup>5</sup>See Becker (1957), Goldberg (1982), and Heckman (1998) for more detailed discussions regarding the conditions required for this relationship to hold. While other empirical tests of Becker's hypothesis (discussed below) have focused on the narrowing of the employment gap implied by the theory, this paper focuses primarily on the narrowing of the wage gap between groups that are discriminated against and those that are not. Becker argued that the wage gap will narrow because firms employing the group that is subject to discrimination (who earn lower wages) will expand relative to firms employing workers not subject to discrimination, and this will increase the wages of the former group relative to those of the latter (Becker 1971:44).

<sup>6</sup>See Black and Strahan (2001) for evidence of this in the banking industry.

<sup>7</sup>See Borjas and Ramey (1995) for a more detailed discussion of the model.

<sup>8</sup>This study also summarizes the early evidence from other studies on the relationship between employment discrimination and product market power.

firms. Their five-year time frame may have been too short to adequately test the latter hypothesis, however.

Unlike most previous researchers, we choose to focus our analysis on one of the key *dynamic* implications of the Becker model—that changes in the competitive environment will lead to changes in the gender wage differential—rather than examine the static correlation between product market competition and the gender wage (or employment) gap at any one point in time. We take this approach because our primary concern is to understand the apparent change in labor market discrimination against women in the 1980s and 1990s.

### Methodology

Testing the simple prediction that increased competition from trade leads to declining discrimination against women and thus a declining gender wage gap is less straightforward than it appears, however. It is evident that the gender wage gap has narrowed since the late 1970s for a variety of reasons, many of which are unrelated to increased competitiveness in product markets. Consider the well-documented increases in women's educational attainment over that period. If, for some reason, women's educational attainment increased by more in trade-affected industries than in non-trade-affected industries, simple empirical tests may indicate that trade contributed to the narrowing of the differential, rather than point to the underlying true cause. Therefore it will be important to control for differing changes in observable characteristics across industries and regions that may confound the results. As a first step toward this goal, we test the links between trade and the residual gender wage gap, that is, the gender wage gap that remains after one controls for differences in education and potential labor market experience between men and women.

It is equally important to control, if possible, for differing changes in women's unobserved characteristics that may have contributed to differing improvements in relative female pay across industries; such

changes are speculated to have contributed to the narrowing of the "unexplained" portion of the gender wage gap in the 1980s (Blau and Kahn 1997). These unobserved characteristics might include, for example, a stronger commitment to the labor force or to one's career, or improved ability or underlying productivity of women relative to men.

To purge our estimates of bias due to these omitted variables, we use a methodology that (conceptually) sorts our observations by industry according to whether the industry (1) was or was not affected by a trade shock in the period under study and (2) was concentrated or was competitive. This estimator will eliminate bias due to omitted variables that (1) have a common value for all trade-affected or non-trade-affected industries, such as shocks to economic conditions in manufacturing industries, and (2) have a common value for all concentrated or competitive industries, such as worker ability or labor force attachment. In other words, the results indicate the impact of trade on the gender wage gap in concentrated industries relative to competitive industries, netting out any factors that have affected the gender wage gap in manufacturing industries, trade-affected industries as a whole, or concentrated industries as a whole.<sup>9</sup> Conceptually we calculate the following differences in the gender wage gap (note that, in practice, we allow the impact of trade to be continuous and not discrete):

$$(1) \quad \left[ \begin{array}{c} \text{trade-affected} \\ \text{concentrated} \end{array} - \begin{array}{c} \text{non-trade-affected} \\ \text{concentrated} \end{array} \right] - \left[ \begin{array}{c} \text{trade-affected} \\ \text{competitive} \end{array} - \begin{array}{c} \text{non-trade-affected} \\ \text{competitive} \end{array} \right]$$

<sup>9</sup>Although trade may have similar effects in the non-manufacturing sector, the empirical analysis focuses on the manufacturing sector because trade data are unavailable for the non-manufacturing sector. In addition, several industries in the non-manufacturing sector were affected by deregulation during the same time period (for example, trucking, airlines, banking, and telecommunications), and it would be difficult to isolate these effects from the effects of trade.

This is equivalent to estimating

$$(2) \quad \Delta_i(\ln[WAGE]_{im} - \ln[WAGE]_{if}) = \alpha + \beta\Delta_i\text{TRADE}_i + \gamma\text{CONCEN}_i + \psi(\Delta_i\text{TRADE}_i * \text{CONCEN}_i),$$

where  $\Delta_i\text{TRADE}_i$  is the change in the import share in industry  $i$  and  $\text{CONCEN}_i$  is an indicator variable equal to one if the industry was concentrated in 1977.<sup>10</sup> The inclusion of the dummy variable for concentrated industries allows for a differential change in the gender wage gap for concentrated industries relative to competitive industries. The marginal effect of trade on concentrated industries relative to competitive industries is represented by the  $\psi$  coefficient; this is the primary parameter of interest.

This approach implicitly makes two assumptions. First, it assumes that discrimination against women did indeed exist, at least at the beginning of the period under study, and that this discrimination was reflected in lower wages for women relative to equally skilled men. While these assumptions are clearly controversial, several recent careful studies provide evidence in their support. Two of these studies compared men and women with very similar human capital investments and labor market skills, and found that a wage gap of 10–15% still exists even when one includes detailed controls for work and skill charac-

teristics (Wood, Corcoran, and Courant 1993; Weinberger 1998). Similarly, an audit study of hiring in Philadelphia restaurants found that high-priced restaurants were substantially more likely to interview and make job offers to men than women with comparable work experience (Neumark 1996). These studies suggest that gender discrimination did persist, at least in the 1980s and early 1990s.<sup>11</sup>

The second assumption implicit in this methodology is that increased imports are equivalent to an increase in competition within an industry and that this increase is exogenous to the residual gender wage gap. Several studies document that increased imports are equivalent to an increase in competition; for example, Katics and Petersen (1994), using industry-level data for the United States, found that increased import competition reduced price-cost margins during the 1976–86 period, and Harrison (1994) showed a strong and statistically significant negative relationship between import penetration and price-cost margins in Cote d'Ivoire. This assumption has also been used in a number of articles, including the work by Borjas and Ramey (1995), which inspired the method we use here. Additionally, recent work by Kletzer (2003) uses import shares as a measure of competition from trade and discusses the assumptions necessary for this procedure to be valid.<sup>12</sup>

<sup>10</sup>This approach is similar in spirit to that of Borjas and Ramey (1995), which examined the relationship between wage inequality and foreign competition by comparing the effect of imports in concentrated versus competitive industries. Like Borjas and Ramey, we use 1977 concentration ratios to determine if an industry is concentrated and we hold this definition constant over the sample period. Our interest is in how the pattern of gender discrimination changed in industries that were initially concentrated in our sample period versus the pattern in industries that were initially competitive. If we allowed the concentration variable to change to reflect the changed status of an industry—and concentration may indeed have changed in some industries over the period, as increased trade generated greater competition—our analysis would fail to capture the full impact of trade on gender discrimination across the sample period in industries that were concentrated at the beginning.

<sup>11</sup>The persistence of wage differentials across industries raises the question as to why women have not simply moved from low- to high-paying industries, thus eliminating gender wage differentials across industries over time. Recent evidence in the banking industry suggests that industries may be sharing rents with workers and disproportionately with male workers. As a result, women—although earning less than their male counterparts—may still be earning a wage above the competitive wage and hence have no incentive to leave despite the discriminatory behavior. See Black and Strahan (2001).

<sup>12</sup>We also considered using industry-level exchange rates or tariff rates as measures of trade; however, we were unable to obtain exchange rates for many of the industries and found changes in tariff rates to be a very weak indicator of differences in trade across industries.

In the trade literature, some evidence supports the idea that the increase in competition from trade is exogenous to the gender wage gap in an industry; for example, Sachs (1988) suggested that the trade experience in the 1980s was in large part due to the effects of monetary and fiscal policy on the exchange rate. Alternatively, one can directly test the validity of the exogeneity assumption by examining the data itself: if the assumption fails to hold, one would expect industries with a higher gender wage gap at the beginning of the period to be more vulnerable to trade, all else equal. However, when we test the relationship between the residual gender wage gap at the beginning of our period (1976) and the change in import share from 1976 to 1993, we find a correlation of only .07, suggesting little correlation between the two. Although these issues are far from settled, based on current research we are reasonably confident that the two assumptions regarding discrimination and the impact of imports on competition hold for the period under study.

### Data

The primary data source for the empirical work is the March Demographic Supplement to the Current Population Survey (CPS) from 1977 through 1994. Although this data set is not ideal for the test outlined above—in particular, it lacks a measure of actual labor market experience—it is preferable to other large data sets due to the relatively long time period over which consistent measures of income and other variables are available, and due to the large sample sizes, which enable analysis across industries and metropolitan areas. The 1977–94 period is chosen because 1977 was the first year in which a relatively large number of metropolitan areas are identified in the CPS, and trade data are available only through 1994.

The sample is defined similarly to that in Borjas and Ramey (1995), which in turn matched many of the data refinements described in Katz and Murphy's (1992) study of the wage structure. The sample includes

individuals aged 18–64 who worked full-time in the civilian sector in the year prior to the survey; a full-time worker is defined as one who worked at least 30 hours in his or her usual work week and worked more than 48 weeks in the previous year. Self-employed individuals and individuals working without pay are excluded from the analysis. The wage data refer to real weekly or hourly earnings in the previous year in 1982 dollars; wages were deflated by the Consumer Price Index. As in the works cited above, workers earning less than \$67 in weekly wages in 1982 dollars are excluded from the analysis, and the wages of workers whose earnings are topcoded are multiplied by 1.45. Industries in which male or female employment comprises less than 10% of total employment are also excluded from the sample. Because trade data are available only for manufacturing industries, the analysis uses only workers employed in that sector.

Two additional sources of information on earnings, work, and demographic characteristics are used to test the sensitivity of the results to the choice of data set: the 1980 and 1990 Censuses, and the Outgoing Rotation Groups of the CPS.<sup>13</sup> The codes for the Metropolitan Statistical Area (MSA) in the Censuses were matched over time in a manner consistent with Jaeger et al. (1998).

The trade data are from the National Bureau of Economic Research (NBER) Trade Database compiled by Robert Feenstra (1996). The impact of trade on an industry is measured using import shares, which are calculated as the ratio of imports—measured as the cost in freight (CIF) value of imports—to domestic shipments; the latter data are from the NBER Manufacturing Productivity database and are described in Bartelsman and Gray (1996).<sup>14</sup>

<sup>13</sup>Census data were obtained from the IPUMS project at the University of Minnesota. For more information, see Ruggles and Sobek (1997) or their webpage at <http://www.ipums.umn.edu>.

<sup>14</sup>Although one could also use (imports + exports) / (domestic shipments) as a measure of the impact of

The industry-level import shares are aggregated at the three-digit level based on the 1980 Census definition. Across MSAs, the impact of trade is measured as the import share for the MSA, calculated as the average of the import shares of the industries in the MSA weighted by the number of workers in that industry in that MSA.

An industry is classified as concentrated if the four-firm concentration ratio was .40 or greater in 1977, based on the Census of Manufactures conducted in that year.<sup>15</sup> This determination was made at the beginning of the sample period in order to exclude the possibility that changes in concentration were due to increased trade. Appendix Table A1 lists the concentrated and non-concentrated industries in the sample based on this definition.<sup>16</sup>

Finally, the dependent variable used for most of the analysis is the change in the residual gender wage gap over the period. To calculate this variable, we first regress the log wage on four categorical education variables, age, age squared, and a non-white dummy variable; this regression is estimated for the pooled sample of men and women

in each year of interest.<sup>17</sup> The residual gender wage gap is then generated as the difference in the average residual wage for men and women, calculated at the industry or MSA level. Although one could also include controls for occupation in the log wage equation, they are excluded here because one form of discrimination against women may have occurred through the types of jobs available to them. By excluding any controls for occupation, the results will measure the effect of increased competition through trade on employers' behavior regarding wages directly as well as indirectly through occupational changes.

Given that this study uses the change in the gender wage gap as the dependent variable, which is in itself a difference in log (residual) wages, it is clear that measurement error in this variable may affect the precision of the estimates. As discussed in Angrist and Krueger (1998) and Bound et al. (1994), the reliability of earnings data declines when earnings are expressed as year-to-year changes rather than as levels. Although this measurement error does not bias the coefficient estimates, it does increase the standard errors of the coefficient estimates and thus reduces the statistical significance of the results. On the other hand, the above studies also indicate that the reliability of earnings estimates increases when one analyzes changes in earnings over longer periods; because this study examines changes over a 17-year period, it is less likely that measurement error will affect the results in a significant way.

## Results

Table 1 reports the results of estimating equation (1) using data from the March CPS across manufacturing industries over the 1976–93 period.<sup>18</sup> In this equation, the

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trade, many recent studies examining the relationship between trade and labor market outcomes have used the import share measure, so the same practice is followed here. Examples of studies that follow this approach are Borjas and Ramey (1995), Horn and Eastman (1997), and Kletzer (1996a, 1996b). Note that import shares are a conservative measure of the impact of trade on an industry: the threat of imports alone may force employers to act more competitively and reduce discrimination. As a result, the import share measure likely underestimates the impact of trade on employer behavior. We tested the sensitivity of our results by using  $(\text{imports} + \text{exports}) / (\text{domestic shipments})$  as a measure of the impact of trade; the results were consistent with those presented here.

<sup>15</sup>We tested the sensitivity of the results to this choice of a cutoff and found the results to be insensitive to concentration ratios ranging from .30 to .50. Following Borjas and Ramey (1995), we considered a CIC manufacturing industry concentrated if the majority of workers in the industry were in concentrated four-digit (SIC) industries.

<sup>16</sup>Note that a few industries were dropped due to missing trade data. The industries included in our sample are listed in Appendix Table A1.

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<sup>17</sup>The four education categories are less than high school, high school, some college, and college or more. These education classifications are reasonably consistent with those suggested in Jaeger (1997).

<sup>18</sup>The observations are weighted by the inverse of the sampling variance of the dependent variable. While nonzero covariances across observations could

change in the industry-level residual gender wage gap is regressed on the change in the import share in the industry over the period, a dummy variable that equals one if the industry was concentrated in the beginning of the period, and the interaction of these two terms. The dependent variable is the change in the residual gender wage gap from 1976 to 1993, so that declines in this variable indicate improving female relative wages over the period.

The positive and statistically significant coefficient on the concentrated industry dummy variable in the first column of Table 1 indicates that the residual gender wage gap increased in concentrated industries relative to competitive industries, or in other words that the gender wage gap declined more in competitive industries than in concentrated industries in the absence of import penetration. The positive coefficient on the "change in import share" variable indicates that, in unconcentrated industries, the gender wage gap grew more in industries that experienced greater increases in imports than in those that experienced little or no competition from increased trade. While this result may appear to contradict the theory discussed above—that is, that if trade is a form of competition, increased trade in an industry should reduce the gender wage gap in that industry relative to industries with no increase in trade—a second effect of trade on relative wages would work in the opposite direction. This effect is the impact of trade on the wages of less-skilled workers relative to more-skilled workers: if trade disproportionately hurts less-skilled workers, as recent research has suggested,<sup>19</sup> and women comprise a disproportionate share of less-

skilled workers, then trade will also affect the relative wages of men and women through this route. If this is the case, one would expect trade to reduce women's wages relative to men's wages, and an increase in the gender wage gap should be observed in trade-affected industries (or, the gender wage gap should narrow more slowly in trade-affected industries). Women may be less skilled than men in the sense that they have less actual labor market experience than men; this has been shown to be an important factor in explaining changes in the gender wage gap (Blau and Kahn 1997).

The key variable of interest for this paper, however, is the interaction between the concentrated industry dummy variable and the change in import share variable. Given that we estimate a positive coefficient on the trade variables, suggesting that increased trade *increases* the gap between male and female residual wages in competitive industries, a negative coefficient on the interaction term would indicate that the impact of trade increased the gender wage gap by less in concentrated industries than in competitive industries that were also affected by trade. The coefficient on this term is indeed negative and statistically significant, indicating that trade-affected, concentrated industries did experience reductions in their residual gender wage gap relative to competitive industries also hit by trade. The estimated coefficients suggest that rising trade increased the gender wage gap in competitive industries (coefficient of .268, with a standard error of .131), but actually reduced the gap in concentrated industries (coefficient of  $-.394$ , with a standard error of .25).<sup>20</sup>

To understand the economic importance of these estimates, we calculate that the

still affect the results, we test for this possibility by estimating the basic regressions in Table 1 using the individual as the level of analysis while correcting the standard errors for clustering by industry. The results are nearly identical to those presented in Table 1 and are omitted here for brevity.

<sup>19</sup>See, for example, Murphy and Welch (1991), Wood (1994), and Borjas and Ramey (1995).

<sup>20</sup>Standardized coefficients are given in brackets underneath the estimates and are presented to enable comparison across different regressions. The standardized coefficient is the estimated coefficient multiplied by (standard deviation of the independent variable / standard deviation of the dependent variable).

Table 1. Industry-Level Regression Results, CPS.  
(Dependent Variable: Change in Residual Gender Wage Gap)

| Description                          | 1976-93            | 1976-93            | 1976-93            | 9-Year                            | 6-Year                            |
|--------------------------------------|--------------------|--------------------|--------------------|-----------------------------------|-----------------------------------|
|                                      | Weekly<br>Earnings | Hourly<br>Earnings | Weekly<br>Earnings | Differences<br>Weekly<br>Earnings | Differences<br>Weekly<br>Earnings |
| Concentrated Industry <sup>a</sup> * | -.66**             | -.65**             |                    | -.64**                            | -.46                              |
| Change in Import Share <sup>b</sup>  | (.28)              | (.28)              |                    | (.29)                             | (.32)                             |
|                                      | [-.249]            | [-.248]            |                    | [-.197]                           | [-.095]                           |
| Price-Cost Margin *                  |                    |                    | -4.55**            |                                   |                                   |
| Change in Import Share               |                    |                    | (2.29)             |                                   |                                   |
| Concentrated Industry                | .19**              | .19**              |                    | .09**                             | .06**                             |
|                                      | (.06)              | (.06)              |                    | (.03)                             | (.03)                             |
| Price-Cost Margin                    |                    |                    | -.12               |                                   |                                   |
|                                      |                    |                    | (.29)              |                                   |                                   |
| Change in Import Share               | .27**              | .27**              | 1.31*              | .22                               | .17                               |
|                                      | (.13)              | (.13)              | (.57)              | (.16)                             | (.17)                             |
| 1988 Dummy                           |                    |                    |                    |                                   | -.001                             |
|                                      |                    |                    |                    |                                   | (.028)                            |
| 1993 Dummy                           |                    |                    |                    | .02                               | .003                              |
|                                      |                    |                    |                    | (.02)                             | (.028)                            |
| N                                    | 63                 | 63                 | 63                 | 123                               | 188                               |
| Adjusted R <sup>2</sup>              | .1253              | .1260              | .1150              | .0287                             | -.0005                            |

Notes: Standard errors in parentheses; standardized coefficient in brackets. The observations are weighted by the inverse of the sampling variance of the dependent variable. Standardized coefficients are the coefficient \*(standard deviation of independent variable/standard deviation of dependent variable).

<sup>a</sup>A concentrated industry is defined as an industry with a four-firm concentration ratio greater than or equal to .40 in the 1977 Census of Manufacturers.

<sup>b</sup>Import share is defined as imports/domestic shipments.

\*Statistically significant at the .10 level; \*\*at the .05 level.

average increase in import share in concentrated industries accounts for a decline in the residual gender wage gap in manufacturing of approximately .034 log points. (The overall decline in the residual gender wage gap in manufacturing was approximately .14 log points during this period.) However, this positive effect is offset by the rising residual gender wage gap in concentrated industries relative to competitive industries and by the rising residual gender wage gap due to increasing imports as a whole.

The second column of Table 1 shows the results of estimating equation (1) using the residual gender gap in hourly earnings as the dependent variable; the coefficient estimates are similar to those in column (1), indicating that the results are insensitive to

the choice of weekly versus hourly wages. Column (3) uses an alternative measure of industry concentration, the price-cost margin,<sup>21</sup> to examine whether the results are sensitive to the measure of market structure chosen. As shown, the key coefficient of interest remains negative and statistically significant. The last two columns of Table 1 increase the number of observations by dividing the time period into two periods (the nine-year differences) and three periods (the six-year differences), respectively, and include time dummies as

<sup>21</sup>The price-cost margin is defined as (value added - labor costs) / (total sales) and was collected from the Census of Manufacturers.

Table 2. Industry-Level Regression Results.  
(Dependent Variable: Change in Residual Gender Wage Gap)

| Independent Variable   | CPS Outgoing Rotation, 1979-93 |                           | Census, 1980-90           |
|--|--------------------------------|---------------------------|---------------------------|
|  | Weekly Earnings                | Hourly Earnings           | Weekly Earnings           |
| Concentrated Industry <sup>a</sup> * Change in Import Share <sup>b</sup> | -.24<br>(.15)<br>[-.305]       | -.25*<br>(.15)<br>[-.317] | -.13*<br>(.07)<br>[-.302] |
| Concentrated Industry  | .07**<br>(.03)                 | .07**<br>(.03)            | .02*<br>(.01)             |
| Change in Import Share   | .04<br>(.09)                   | .04<br>(.09)              | .06*<br>(.03)             |
| N  | 64                             | 64                        | 74                        |
| Adjusted R <sup>2</sup>  | .0344                          | .0415                     | .0321                     |

Notes: Standard errors in parentheses; standardized coefficient in brackets. The observations are weighted by the inverse of the sampling variance of the dependent variable.

<sup>a</sup>A concentrated industry is defined as an industry with a four-firm concentration ratio greater than or equal to .40 in the 1977 Census of Manufacturers.

<sup>b</sup>Import share is defined as imports/domestic shipments.

\*Statistically significant at the .10 level; \*\*at the .05 level.

well. In both cases, the interaction between concentrated industry and change in import share remains negative, and the standardized coefficients suggest that the magnitudes are similar. The coefficient is statistically significant at the 2.9% level for the nine-year differences and at the 15% level for the six-year differences, suggesting that measurement error becomes an increasing problem as the sample is divided into smaller and smaller time periods, as one would expect.

Table 2 tests the sensitivity of these results to the choice of data set. While the March CPS is an appropriate data set in the sense that its sample size is larger than that of any longitudinal survey and it contains consistent measures of the variables of interest over the entire period under study, it is limited in that the cell sizes used for estimating equation (1) (that is, industry by year by gender) may be small. To increase the cell size, equation (1) is also estimated using the CPS Outgoing Rotation Group surveys as well as the 1980 and 1990 Censuses.

The CPS Outgoing Rotation Group surveys are approximately three times larger than the March supplement, a strong ad-

vantage for the empirical work undertaken here. However, the Outgoing Rotation Group begins only in 1979, and it does not include information on the number of weeks worked in the previous year. The latter problem prevents us from conditioning on strong labor force attachment (number of weeks worked), as we did with the March CPS. Despite these differences, however, the results presented in the first two columns of Table 2 using the Outgoing Rotation Groups are quite similar to those of Table 1 that used the March CPS. The coefficient on the interaction of concentrated industry and change in import share is still negative (and still statistically significant, although marginally so); in addition, the standardized coefficient suggests a magnitude consistent with the estimates based on the March CPS. In both of these regressions the change in import share variable is no longer statistically significant.

The last column of Table 2 presents the results using the 1980 and 1990 Censuses 1% sample. The obvious advantage of using Census data is that the sample size is extremely large and therefore the industry cell sizes are much larger than in the case of both CPS data sets. However, because the

data span only ten years, there is less variation in the change in import shares over the period.<sup>22</sup> Nevertheless, the estimated coefficient on the interaction term is still negative and statistically significant and, again, of the order of magnitude suggested by the other data sets.

To this point, the analysis has focused on testing the impact of trade across industries. This is appropriate because we are interested in how trade, as a form of increased competition, differentially affects wages in competitive versus concentrated manufacturing industries.<sup>23</sup> This approach would be less appropriate if one believed that the changes in the gender wage gap in manufacturing industries due to increased trade had spillover effects into non-manufacturing industries. This argument, for example, is similar to the argument given in Borjas and Ramey (1995) for analyzing the impact of trade on skill differentials across metropolitan areas rather than across industries. In that paper, the authors argued that the declining relative wages and employment of less-skilled workers in concentrated industries due to trade had spillover effects on the wages of less-skilled workers in the competitive sector of the economy; as a result, it is appropriate to analyze the impact of trade across local labor markets rather than across industries.

While spillover effects are unlikely to be strong in the case of changes in the gender wage gap, we nevertheless test the sensitivity of the results to this assumption by estimating equation (1) at the MSA level. The results of these tests are presented in Table 3; the tests are conducted using both the March CPS and the 1980 and 1990 Cen-

suses.<sup>24</sup> In this case, the MSA residual gender wage gap is calculated as the employment-weighted average of the residual gender wage gap for each industry in manufacturing in the MSA.<sup>25</sup> The import share is calculated similarly, as the employment-weighted average of the import share in each manufacturing industry in the MSA; the concentration variable is defined as the share of workers employed in a concentrated industry in the MSA.

As indicated in Table 3, the results at the MSA level are essentially the same as the estimates at the industry level. The coefficients appear larger, but this is because the interaction term is now the percentage of employment in the MSA that is in concentrated industries, interacted with the change in the import share at the MSA level, instead of a zero-one dummy variable indicating whether or not an industry is concentrated interacted with the increased trade at the industry level. The first two columns show the results of estimating equation (1) across MSAs using the March CPS over the entire 1976–93 period, using weekly and hourly earnings, respectively. These results are consistent with the industry-level results, and the coefficients on the interaction term are negative and statistically significant. The results are also similar when the 1980 and 1990 Census data are used, but the interaction term is no longer statistically significant. Note that the adjusted *R*-squared is negative in all cases, suggesting that these regressions explain little of the variation in the changes in the residual gender wage gap across metropolitan areas. This is likely due in part to the relatively small variation in import shares and concentrated industries across MSAs com-

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<sup>22</sup>The 1970 Census is not used because there are fewer MSA indicators in that Census than in the later Censuses.

<sup>23</sup>Numerous other studies have used industry-level data to examine the effects of trade; see, for example, Kruse (1988), Revenga (1992), Gaston and Trefler (1994), Kletzer (1996a, 1996b), Horn and Eastman (1997), and Campa and Goldberg (1998).

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<sup>24</sup>The CPS Outgoing Rotation Group data sets are not used for the MSA-level estimation because they lack consistent MSA identifiers over the relevant time period.

<sup>25</sup>We include only manufacturing workers in the MSA estimation. This assumes that manufacturing and non-manufacturing workers are not close substitutes for each another.

Table 3. MSA Level Regression Results.  
(Dependent Variable: Residual Change in the Gender Wage Gap)

| Independent Variable                            | CPS, 1976-93      |                   | Census, 1980-90   |
|---|-------------------|-------------------|-------------------|
|   | Weekly Earnings   | Hourly Earnings   | Weekly Earnings   |
| Percent in Concentrated Industry <sup>a</sup> * | -6.25*            | -6.42*            | -2.97             |
| Change in Import Share <sup>b</sup>             | (3.37)<br>[-1.10] | (3.31)<br>[-1.13] | (2.51)<br>[-.594] |
| Percent in Concentrated Industry                | .80*              | .80*              | .21               |
| Change in Import Share                          | (.47)             | (.46)             | (.19)             |
| Change in Unemployment Rate                     | 2.59*             | 2.69**            | 1.51              |
|   | (1.35)            | (1.34)            | (1.02)            |
| Change in Unemployment Rate                     | .36               | .30               | -.25              |
|   | (.93)             | (.92)             | (.33)             |
| N   | 43                | 43                | 132               |
| Adjusted R <sup>2</sup>                         | -.0027            | -.0056            | -.0037            |

Notes: Standard errors in parentheses; standardized coefficient in brackets. The observations are weighted by the inverse of the sampling variance of the dependent variable.

<sup>a</sup>A concentrated industry is defined as an industry with a four-firm concentration ratio greater than or equal to .40 in the 1977 Census of Manufacturers. "Percent in concentrated industry" is the employment-weighted average of the share of workers employed in a concentrated industry in each MSA.

<sup>b</sup>Import share is defined as the employment-weighted average of the import share in each industry in the MSA.

\*Statistically significant at the .10 level; \*\*at the .05 level.

pared with the variation in these variables across industries (see Appendix Table A2 for means and standard deviations of these and other variables).

### Robustness Checks

One factor that may affect the results and that has thus far been omitted from the discussion is the change in unionization rates over the period. If, as seems likely, concentrated industries tended to be more unionized than competitive industries, and men are more highly unionized on average than women, then the decline in unionization rates over this period would likely have reduced the gender wage gap more in concentrated industries than in competitive industries. Moreover, if import shares rose more in concentrated industries than in competitive industries during this time, the change in the import share in these regressions may simply be acting as a proxy for the change in unionization rates, and the results may simply reflect the impact of the

erosion of union power rather than the impact of trade on the wage structure. To test this possibility, column (1) of Table 4 includes the change in the percentage of workers unionized in each industry in the regression. The results are virtually identical to those without unionization, suggesting that the results do not reflect changes in unionization rates within industries.<sup>26</sup>

Another factor that may affect the results is technological change. The prevailing wisdom suggests that technological change has primarily been skill-biased, which, given that women are disproportionately low-skilled, may increase the gender wage gap;

<sup>26</sup>Note that changes in unionization and trade are likely related to each another; see Horn and Eastman (1997) for an analysis of the impact of increased trade on union density. A variable for the interaction between unionization and concentration in this regression is negative and statistically significant; however, the sign and significance of the primary interaction term remain unchanged.

however, if technological change was biased against manual labor, then women may have been relatively better off as a result.<sup>27</sup> For such a pattern to explain our results, it would have to be the case that trade-affected *competitive* industries faced more skill-biased technological change over this time period than did trade-affected concentrated industries. The technological change would increase demand for skilled workers, driving up the wage premium for both observed and unobserved skills. Because women are disproportionately low-skilled, one would observe a rise in the gender wage gap in trade-affected competitive industries relative to trade-affected concentrated industries.<sup>28</sup>

In order to test this theory, we regressed the percentage of workers who are college-educated (as a proxy for skilled workers) in each industry on the same independent variables as above. If the extent to which observable skills change is affected by whether the industry is concentrated and whether it is trade-affected, this might suggest that unobservable skills are changing in a similar manner and therefore that skill-biased technological change is driving the results. However, when we do estimate the relationship between skill composition and concentrated trade-affected industries relative to trade-affected competitive industries, we find no evidence that demand for skilled workers increased in the latter relative to the former. In other words, the coefficient on the interaction term is statistically insignificant.<sup>29</sup>

<sup>27</sup>See Welch (2000) for further discussion.

<sup>28</sup>Note that because we are controlling for education and age, these changes would have to be based on unobservable skills and not just observable skills, assuming that unobserved skill is correlated with observed skill.

<sup>29</sup>Like education, actual labor market experience is a possible proxy for skill that could explain the results. In order for experience to explain our results, it would have to change differentially in concentrated relative to competitive industries affected by trade. Unfortunately, we are unable to test this possibility, because the data sets used in our study lack information on actual labor market experience.

As a second test of the technological change explanation, we also regressed the percentage of workers who use a computer at work on the same set of independent variables; this measure is intended to more directly capture the pace of technological change across industries in the workplace. The data on computer use are from the October CPS, which asked questions about computer use in the workplace in 1984, 1989, and 1993. The results indicate that although industries experiencing a greater trade shock were slower to implement technological change in the form of computer use, there was no interaction effect between this measure of technological change and changing import shares (Table 4, column 2). This provides supportive evidence that a trade-technology interaction does not explain the results, that is, that concentration is not simply acting as a proxy for technology. Column (3) of Table 4 indicates that, over the period examined in these regressions (1984–93), the main results of interest continue to hold.

Finally, as a third test of the technological change explanation, we estimate our original equation with the difference in the residual gender wage gap as the dependent variable and now include controls for both changing unionization rates and changing computer use in the industry. Note that, because we are using the computer use variable, we estimate our equation on the 1984–93 period. As column (3) of Table 4 showed, our basic results hold for this sub-period. Column (4) presents the results with these extra controls; neither the changing unionization rate nor the changing use of computers over this time explains away our results.

Another factor that may affect the results is the choice of the time period over which the regressions are estimated. Several tests of the sensitivity of the results to this choice have already been conducted, through the use of the CPS Outgoing Rotation Group and Census data sets that restricted the analysis to years other than those tested in the original specification. Specifically, we have shown that the results hold whether

Table 4. Regression Results, CPS: Specification Checks.

| Dependent Variable:   | Unions  |   |   | Technological Change                     |   | Employment   |  | Minority |
|---|---|---|---|--|---|--|--|----------|
|   | Change in Residual Wage Gap, 1976-93 Weekly Wages (1) | Change in % Computer Use at Work, 1984-93 (2) | Change in Residual Gender Wage Gap, 1984-93 (3) | Change in Residual Wage Gap, 1984-93 (4) | Change in Percentage of Employees, 1976-93 Employment (5) | Change in Percentage of Managers Who Are Women, 1976-93 Employment (6) | Change in Residual White/Nonwhite Wage Gap, CPS-ORG, 1979-93 (7) |          |
| Concentrated Industry <sup>a</sup> *<br>Change in Import Share <sup>b</sup> | -.95*<br>(.51)<br>[-.315]                             | -.19<br>(.15)                                 | -.92**<br>(.30)                                 | -1.27**<br>(.66)                         | .17<br>(.12)<br>[.261]                                    | .40**<br>(.14)   | -.35<br>(.26)<br>[-.318]   |          |
| Concentrated Industry   | .22**<br>(.08)  | .04*<br>(.02)                                 | .15**<br>(.04)                                  | .17**<br>(.06)                           | .001<br>(.02)   | -.021<br>(.03)   | .01<br>(.04)   |          |
| Change in Import Share  | .29**<br>(.14)  | -.22**<br>(.09)                               | .26<br>(.18)                                    | .27<br>(.19)                             | -.15<br>(.06)   | -.12<br>(.09)  | .06<br>(.17)   |          |
| Change in Unionization  | .07<br>(.30)  |   |   | -.42<br>(.38)                            |   |  |  |          |
| Change in % Computer Use at Work  |   |   |   | .12<br>(.27)                             |   |  |  |          |
| N   | 58  | 63  | 62  | 60                                       | 66  | 67   | 65   |          |
| Adjusted R <sup>2</sup>   | .1141   | .1850   | .1455   | .1155                                    | .0702   | .1210  | .0098  |          |

Notes: Standard errors in parentheses; standardized coefficient in brackets. The observations are weighted by the inverse of the sampling variance of the dependent variable.

<sup>a</sup>A concentrated industry is defined as an industry with a four-firm concentration ratio greater than or equal to .40 in the 1977 Census of Manufacturers.

<sup>b</sup>Import share is defined as imports/domestic shipments.

\*Statistically significant at the .10 level; \*\*at the .05 level.

the initial period is 1976 (March CPS), 1979 (CPS-ORG), 1980 (Census), or 1984, and whether the end period is 1990 (Census) or 1993 (March CPS and CPS-ORG).<sup>30</sup>

Two additional specification tests are implemented in order to verify that increased competition through trade does indeed reduce the ability of employers to discriminate. These tests are based on further predictions of the Becker employer discrimination model, one regarding the relative employment of women and the other regarding the relative wage of minorities. Regarding the former, Becker's theory predicts that as discrimination is driven away, not only will women's relative wages increase, but their relative employment will increase as well. We have already shown that as competition increases, women's relative wages increase. We now test the second prediction of the theory: that women's relative employment will increase as well. Column (5) of Table 4 reports the results of regressing the change in the percentage of women employed in an industry on the same right-hand-side variables: the concentrated industry dummy, the change in import share over the 1976–93 period, and the interaction of the two terms. Although it is statistically significant at only the 15% level, the positive coefficient on the interaction suggests that as industries face more competition from international trade, concentrated industries increase their relative employment

of women more than competitive industries do.<sup>31</sup>

Another possibility is that women fail to advance out of less-skilled occupations as a result of discrimination. To test this, we examine whether increased trade affected the percentage of managers in manufacturing who were women. We find statistically significant evidence that concentrated industries facing more competition from international trade increased the percentage of managers who were women (column 6). These results are consistent with Becker's prediction and lend further credence to the idea that trade has induced employers to reduce costly discrimination against women.<sup>32</sup>

Since Becker's theory originally attempted to explain the consequences of racial discrimination, it is fitting to test whether the same predictions regarding wage differentials and market competition hold if one examines the racial wage gap rather than the gender wage gap. Although the forces influencing the relative wages of minorities may have differed greatly from those influencing the relative wages of women in this period, one might still expect competitive pressures to affect a firm's ability to discriminate against minorities in the same way that competitive pressures would affect its ability to discriminate against women. Therefore, a final test is to determine whether concentrated industries differ from competitive industries in the extent to which trade affects the minority

<sup>30</sup>Additional sensitivity tests indicate that the results are similar whether 1991 or 1992 is used as the final year; this demonstrates that the results are not influenced by the CPS redesign that affected the 1993 earnings data but not the 1991 or 1992 earnings data. The only year and dataset for which the results fail to hold is the 1994 March CPS. However, given that the results do hold using the 1994 CPS-ORG dataset (the interaction term is statistically significant at the 5% level for both the weekly and hourly earnings specifications), and given the robustness of the results with respect to other endpoints, we conclude that the 1994 March CPS results are anomalous and that overall the model is robust with respect to the choice of time period used in the analysis.

<sup>31</sup>These gains in female relative employment also suggest that the improvement in relative female wages in trade-affected, concentrated industries was not due to women disproportionately dropping out of the labor force due to the impact of trade in these industries.

<sup>32</sup>One concern might be that our results are picking up a relative demand shift that favored female-dominated occupations. However, the fact that we find similar results when we look within broadly defined occupation groups (in this case, managers) supports our interpretation of our results as reflecting a change in discriminatory practices and not an across-occupation demand shift.

residual wage gap (defined as the difference in the average residual wage of white men in an industry minus the average residual wage of nonwhite men in that industry). Because of the limited number of minorities working in the manufacturing industries in the sample, we use the CPS Outgoing Rotation data set to increase the sample size. Table 4, column (7) presents the results of estimating equation (1) using the change in the minority residual wage gap from 1979 to 1993 as the dependent variable. Although not statistically significant, the coefficient on the interaction term is negative and of the same magnitude as earlier estimates for the gender wage gap, which is consistent with the hypothesis that increased competition through trade reduces the employer's ability to discriminate.

### Conclusion

Theory predicts that product market competition will drive out discrimination in the labor market. Because discrimination is costly in the sense that discriminating employers must forego profits in order to indulge their "taste for discrimination," firms with market power can afford to continue discriminatory practices for longer than can firms in competitive markets earning zero economic profits. Thus, the loss of market power in an industry is likely to reduce discrimination and increase the relative wages and employment of women in

that industry. While a number of studies have demonstrated the apparent existence of discrimination, few have focused on this dynamic implication.

In testing this idea across manufacturing industries in the United States, we have assumed that increased international trade in recent years has acted as a form of increased competition in some industries. Our approach compares the impact of trade in concentrated versus competitive industries, and enables us to net out the gains in relative female wages that occurred over the period for other reasons. The results indicate that the residual gender wage gap narrowed more rapidly in concentrated industries that experienced a trade shock than in competitive industries that experienced a trade shock. Moreover, the results are consistent across a variety of specifications and data sets.

Although it is unlikely that increased trade had a substantial impact on the overall gender wage gap in the economy—the manufacturing sector currently comprises only about 15% of the U.S. work force—the empirical work in this paper suggests that the impact of trade on the structure of wages should be viewed in a more positive light than it recently has. Although trade may increase wage inequality by modestly reducing the relative wages of less-skilled workers, at the same time it appears to benefit women by reducing the ability of firms to discriminate.

**Appendix Table A1**  
**Industries Categorized by Whether Concentrated and Whether Affected by Trade**

| <i>Concentrated Industries<sup>a</sup></i>       |   | <i>Non-Concentrated Industries<sup>a</sup></i> |  |
|--|---|--|--|
| <i>CIC Code</i>                                  | <i>Industry<sup>a</sup></i>                     | <i>CIC Code</i>                                | <i>Industry</i>                            |
| <b>Non-Trade-Affected Industries<sup>a</sup></b> |   |  |  |
| 110  | Grain Mill Products                             | 100  | Meat Products                              |
| 130  | Tobacco Manufacturers                           | 101  | Dairy Products                             |
| 140  | Dyeing & Finishing Textiles, Except Wool & Knit | 102  | Canned & Preserved Fruits & Vegetables     |
| 182  | Soaps, Cosmetics                                | 111  | Bakery Products                            |
| 250  | Glass & Glass Products                          | 112  | Sugar & Confectionery Products             |
| 262  | Misc. Nonmetallic Mineral & Stone Products      | 120  | Beverage Industries                        |
| 280  | Other Primary Metal Industries                  | 121  | Misc. Food Prep. & Kindred Products        |
| 291  | Metal Forgings & Stampings                      | 141  | Floor Coverings, Except Hard Surfaces      |
| 292  | Ordnance  | 142  | Yarn, Thread & Fabric Mills                |
| 310  | Engines & Turbines                              | 150  | Misc. Textile Mill Products                |
| 311  | Farm & Machinery Equipment                      | 160  | Pulp, Paper, Paperboard Mills              |
| 352  | Aircraft & Parts                                | 161  | Misc. Paper & Pulp Products                |
| 360  | Ship & Boat Building & Repairing                | 162  | Paperboard Containers & Boxes              |
| 361  | Railroad & Locomotive Equipment                 | 181  | Drugs                                      |
|  |   | 190  | Paints, Varnishes, Related Products        |
|  |   | 191  | Agricultural Chemicals                     |
|  |   | 192  | Industrial & Misc. Chemicals               |
|  |   | 200  | Petroleum Refining                         |
|  |   | 201  | Misc. Petroleum & Coal Products            |
|  |   | 241  | Misc. Wood Products                        |
|  |   | 242  | Furniture & Fixtures                       |
|  |   | 251  | Cement, Concrete, Gypsum, Plaster Products |
|  |   | 271  | Iron & Steel Foundries                     |
|  |   | 282  | Fabricated Structural Metal Products       |
|  |   | 290  | Screw Machine Products                     |
|  |   | 300  | Misc. Fabricated Metal Products            |
|  |   | 341  | Radio, T.V., Communications Equipment      |
|  |   | 370  | Cycles & Misc. Transportation Equipment    |
|  |   | 372  | Optical & Health Services Supplies         |
| <b>Trade-Affected Industries<sup>a</sup></b>     |   |  |  |
| 380  | Photographic Supplies & Equipment               | 132  | Knitting Mills                             |
| 252  | Structural Clay Products                        | 151  | Apparel & Accessories, Except Knit         |
| 261  | Pottery & Related Products                      | 152  | Misc. Fabricated Textile Products          |
| 312  | Construction & Material Handling Machines       | 211  | Other Rubber Products, Plastics            |
| 321  | Office & Accounting Machines                    |  | Footwear, Belting                          |
| 322  | Electronic Computing Equipment                  | 221  | Footwear, Except Leather & Plastic         |
| 340  | Household Appliances                            | 222  | Leather Products, Except Footwear          |
| 342  | Electrical Machinery, Equipment, Supplies       | 281  | Cutlery, Hand Tools, Other Hardware        |
| 351  | Motor Vehicles and Motor Vehicle Equipment      | 320  | Metalworking Machinery                     |
|  |   | 331  | Machinery, Except Electrical               |
|  |   | 371  | Scientific & Controlling Instruments       |
|  |   | 391  | Misc. Manufacturing Industries             |

<sup>a</sup>A trade-affected industry is defined as one in which the import share increased by at least .10 between 1976 and 1993. A concentrated industry is defined as having a four-firm concentration ratio of greater than .40 in 1977.

**Appendix Table A2**  
**Summary Statistics**  
**(Standard Deviations in Parentheses)**

| Variable  | Industry        |                 |                      | MSA             |                 |
|---|-----------------|-----------------|----------------------|-----------------|-----------------|
|   | CPS,<br>1976-93 | Census<br>Data  | Outgoing<br>Rotation | CPS,<br>1976-93 | Census<br>Data  |
| Change in Residual Gender Wage Gap in Manufacturing (Weekly Earnings) | -.138<br>(.157) | -.066<br>(.031) | -.068<br>(.089)      | -.186<br>(.159) | -.075<br>(.060) |
| Change in Residual Gender Wage Gap in Manufacturing (Hourly Earnings) | -.135<br>(.156) |                 | -.068<br>(.089)      | -.185<br>(.159) |                 |
| Percent in Concentrated Industry *                                    | .052<br>(.101)  | .037<br>(.072)  | .051<br>(.113)       | .043<br>(.028)  | .029<br>(.012)  |
| Change in Import Share  | .309<br>(.466)  | .354<br>(.481)  | .301<br>(.462)       | .349<br>(.152)  | .376<br>(.113)  |
| Change in Import Share  | .097<br>(.275)  | .079<br>(.115)  | .086<br>(.270)       | .121<br>(.045)  | .076<br>(.020)  |
| Change in Union Membership  | -.137<br>(.078) | -.032<br>(.053) | -.130<br>(.069)      | -.175<br>(.037) | -.047<br>(.029) |
| Change in Unemployment Rate   |                 |                 |                      | .001<br>(.027)  | -.002<br>(.016) |
| N   | 63              | 74              | 64                   | 43              | 132             |

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