The Effects of Rising Female Labor Supply on Male Wages

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This article examines whether increases in female labor supply contributed to rising wage inequality and declining real wages of less skilled males during the 1980s. While male wage declines are concentrated in the 1980s, female labor supply growth slowed in the 1980s relative to the 1970s. Women also increased the relative supply of skill in the economy in the 1980s. Using state-level data we estimate cross-substitution effects between men and women. Once we account for demand changes we find little evidence that women substitute for men or that they contributed to the rapid inequality growth in the 1980s.

I. Introduction

Two of the most important phenomena in the U.S. labor market during the past several decades have been rising labor force participation of married women and dramatic increases in earnings inequality. A substantial literature now documents the sharp declines in real wages of less skilled men during the 1980s—both in an absolute sense and

We thank Kevin Murphy and Dan Hamermesh and other National Bureau of Economic Research participants at the Summer Institute Labor Studies Meeting July 1995 for helpful comments. We would also like to thank David Jaeger, Kevin Murphy, Elaine Reardon, Michael Palumbo, and Ken Troske for sharing various data sets and programs.

[*Journal of Labor Economics,* 1999, vol. 17, no. 1]

0734-306X/99/1701-0005$02.50

relative to more skilled workers.[1] While most of this literature emphasizes relative demand shifts rather than supply shifts, a question still remains as to what extent the growing number of women in the labor force has contributed to these changes. In this article, we seek to answer two distinct yet related questions. First, have women reduced real wages of men by substituting for their labor? Second, have women contributed to rising inequality between skilled and less skilled male workers? Previous works that have examined the substitution possibilities between women and other groups have found women to be strong substitutes for youth (Grant and Hamermesh 1981) and adult black males (Borjas 1986). Recently, Topel (1994) has also reported that increasing numbers of highly skilled female workers could possibly account for the entire decline in relative wages of less skilled males since the early 1970s.

Our approach is to build a body of evidence using different variations in the data. Using the decennial census, we first examine aggregate changes in female labor supply and male wages over the period 1940 to 1990. We also disaggregate the data by skill level and examine how women's contributions to labor of different skill types have varied across the decades. Our main finding is that the aggregate evidence is inconsistent with a simple story where supply shifts among women have played a major role in recent changes in the male wage structure. First, comparing across the decades we find that female labor supply growth actually slowed down in the 1980s relative to the 1970s. In the absence of other factors, this implies that we should have observed the largest wage declines and the largest increases in wage inequality during the 1970s. Since the dramatic changes in the wage structure occurred in the 1980s and not in the 1970s, this suggests that other factors, such as demand shifts away from less skilled male workers, were important during the 1980s.

The evidence when we disaggregate by skill also points in the direction of demand shifts. We find that over the 1980s women actually made greater contributions to labor in the higher-skill categories than in the lower-skill categories. This is a distinct break from past trends in which women have typically added more to the lower-skill categories. To the extent that women and men are substitutes within skill levels, this suggests that the entry of more skilled women into the labor force may have tempered, rather than contributed to, male wage inequality growth during the 1980s. These findings based on aggregate changes confirm the earlier

[1] The most often cited works include Bound and Johnson (1989); Katz and Murphy (1992); Levy and Murnane (1992); Murphy and Welch (1992); and Juhn, Murphy, and Pierce (1993). See also Freeman and Katz (1994).

findings in the wage inequality literature that emphasize the importance of relative demand shifts in favor of skilled workers over less skilled workers.[2]

Using state- and standard metropolitan statistical area (SMSA)-level data we also directly estimate cross-price elasticities between men and women. We find that the results here depend crucially on how we control for demand changes. Similar to Topel (1994), in specifications where we restrict the coefficients on labor quantities and our measured demand shifts to be equal we find weak evidence that college-educated women may be substitutes for high school dropout men and also that college-educated women may be better substitutes for high school dropout men than high school graduate men, thereby widening inequality in the bottom half of the male wage distribution. When we enter demand shifts as separate regressors in our estimation, thereby allowing them to play a larger role, we find that the substitution between educated women and less educated men disappears. Instead, we find evidence that college-educated women are substitutes for college-educated men and that, consistent with the aggregate evidence, their rapid entry into the labor market may have actually tempered the growth in male wage inequality in the 1980s.

This article is organized as follows. Section II lays out a simple framework that forms the basis for our empirical work. Section III describes the data. Section IV examines aggregate changes in male wages and female employment and concludes by comparing female labor supply growth across different skill types. Section V presents our main findings from the cross-state analysis. Section VI concludes.

II. A Labor Demand Framework

Following LaLonde and Topel (1989), Katz and Murphy (1992), and Topel (1994), we lay out a simple aggregate demand framework to facilitate the discussion of the main hypotheses to be examined in this article. We begin by specifying an economy consisting of I sectors (defined by industry-occupation cells) and J factors. Assuming a constant returns to scale production technology, we can write the cost function of sector i as

$$C^i(\hat{w}^i, y_i) = A^i(\hat{w}^i)y_i, \quad \hat{w}^i = (W_1/\tau_1^i, \ldots, W_J/\tau_J^i), \; i = 1 \sim I. \quad (1)$$

The variable $\hat{w}^i$ is a J-dimensional wage vector normalized by sector-specific and factor nonneutral shocks (τ_j^is). Sector i's output is y_i, and

[2] For example, Bound and Johnson (1989); Katz and Murphy (1992); Murphy and Welch (1992); and Berman, Bound, and Griliches (1994).

A^i is the unit cost function of sector i that is homogeneous of degree 1 with respect to $\hat{w}^i$.

Using Shepherd's Lemma, sector i's compensated factor demand for skill group j can be written as

$$X_j^i\left(=\frac{\partial C^i}{\partial W_j}\right) = A_j^i(\hat{w}^i)\,\frac{y_i}{\tau_j^i}\,, \quad j = 1 \sim J, \tag{2}$$

where A_j^i is the partial derivative of $A^i(\cdot)$ with respect to the jth element of $\hat{w}^i$. By taking logs and totally differentiating equation (2), we can write

$$\dot{X}_j^i = \sum_{k=1}^{J} \varepsilon_{jk}^i(\dot{W}_k - \dot{\tau}_k^i) + \dot{y}_i - \dot{\tau}_j^i, \tag{3}$$

where ε_{jk}^i is the compensated demand elasticity of factor j with respect to the price of factor k in sector i. The second term, $\dot{y}_i$, represents factor-neutral product market shocks that increase factor demands proportionately within each sector. With profit maximization, we can write $\dot{y}_i$ as a cost share weighted average of input changes as in the following:

$$\dot{y}_i = \sum_{j=1}^{J} \omega_{ij}\dot{X}_j^i, \quad \text{where } \omega_{ij} = \frac{W_j X_j^i}{\sum_{j=1}^{J} W_j X_j^i}\,. \tag{4}$$

Aggregating over all sectors yields

$$\dot{X}_j\left(\equiv \sum_{i=1}^{I} S_{ji}\dot{X}_j^i\right) = \sum_{k=1}^{J}\left(\sum_{i=1}^{I} S_{ji}\varepsilon_{jk}^i\right)\dot{W}_k + \sum_{i=1}^{I} S_{ji}\left(\sum_{j=1}^{J} \omega_{ij}\dot{X}_j^i\right) + \eta_j, \tag{5}$$

where S_{ji} is sector i's share of factor j employment and η_j is the weighted average of sector specific demand shocks for factor j. The first term in equation (5) corresponds to the change in demand for factor j due to relative wage changes, the second term represents the component due to product demand shocks, and the final term corresponds to the component due to factor-specific demand shocks, which may or may not vary across sectors.

By stacking these equations, using the equilibrium condition that factor demands equal factor supplies and inverting, we can write

$$\begin{aligned}\dot{W} &= E^{-1}\cdot(\dot{X} - \dot{D}) + E^{-1}\eta \\ &= E^{-1}(\dot{X} - \dot{D}) + \xi.\end{aligned} \tag{6}$$

The vector $\dot{W}$ is a $J \times 1$ vector of wage changes, $\dot{X}$ is a $J \times 1$ vector of factor employment changes, $\dot{D}$ is a $J \times 1$ vector of factor-neutral product demand shifts, and ξ is a $J \times 1$ vector of factor nonneutral demand shocks. The matrix E^{-1} is a J-dimensional square matrix of elasticities of factor price.[3]

We also derive an equation for elasticities of complementarity by measuring wages and net supplies of skill groups relative to male high school graduates:

$$\dot{W}^R = \Phi(\dot{X} - \dot{D})^R + \Psi. \tag{7}$$

Superscript R indicates that wages and supplies are measured relative to male high school graduate wages and supplies. The matrix Φ is now the $J - 1$ dimensional square matrix of partial elasticities of complementarity that measure the percentage effects on W_j/W_k of a change in input ratio X_j/X_k, again holding other input quantities and marginal cost constant.

For women to have negatively affected male wages and significantly contributed to inequality growth in the 1980s, women and men must be substitutes in production (the appropriate factor price elasticities are negative and large in magnitude), and the net supply of women, $\dot{X} - \dot{D}$, must have increased substantially during the 1980s.[4] In Section IV we begin by reporting observed aggregate changes in wages, $\dot{W}$, and factor quantities, $\dot{X}$. We find that these changes are inconsistent with the hypothesis that women have substituted for men even if we were to assume that female labor supply increased exogenously and that demand shifts were unimportant. There is in fact a great deal of evidence that demand shifted in favor of women in the 1980s. Katz and Murphy (1992) report (and we also report similar results in table

[3] Each element of the matrix, e_{jk}, measures the percentage response of factor price W_j with respect to change in the factor quantity X_k, holding other factor quantities and marginal cost constant. We ignore capital in our discussion of factor demands. This may bias our estimates (Berndt 1980; Grant and Hamermesh 1981), but we maintain the separability assumption owing to lack of data on capital stock at state and industry level.

[4] More precisely, we mean that men and women are q-substitutes, that is, the wages of men falls as the net supply of women in the economy increases, holding marginal cost of production constant. For the distinction between p-substitutes and q-substitutes, see Sato and Koizumi (1973) and Hamermesh (1986). Note also, that we are holding marginal cost constant, which means that we are interested in women's effect on male wages, abstracting from absolute wage changes that are associated with changes in scale or marginal cost.

Table 1
Change in Real Log Weekly Wage (Multiplied by 100)

	Years				
	1939–49	1949–59	1959–69	1969–79	1979–89
All	13.1	24.7	20.6	1.1	−5.8
Men	13.2	25.6	21.1	1.1	−8.5
Women	12.9	22.2	19.3	.9	1.5
Men, years of schooling:					
<8	20.9	22.0	19.5	6.1	−11.0
8–11	16.6	23.3	17.6	1.8	−12.5
12	12.0	24.9	19.7	3.0	−14.1
13–15	13.2	26.1	20.8	−.9	−7.3
16+	7.1	30.7	27.6	−2.6	2.5
Women, years of schooling:					
<8	20.0	24.5	23.6	5.8	−5.0
8–11	17.5	20.0	17.4	4.2	−5.3
12	15.8	19.7	16.4	1.7	−2.2
13–15	12.8	20.2	19.1	1.5	4.5
16+	1.4	30.6	25.2	−5.8	13.1

NOTE.—The numbers are calculated from the 1940–90 Public Use Microdata Sampler files. The sample includes men and women with 1–40 years of potential labor market experience who were in the nonagricultural sector, who worked full-time and at least 40 weks, who were not self-employed, and who earned at least 1/2 the legal minimum weekly wage. Wages are deflated using the PCE deflator from the national product and income accounts.

1) that female wages increased relative to male wages during the 1980s even as the relative supply of women increased, suggesting demand must have shifted in favor of women. This simultaneous rise in the price and quantity of female labor remains even after one takes into account changes in the skill composition of the female labor force such as the rise in their actual labor market experience (Blau and Kahn 1994). Since we suspect that a great deal of the rise in female employment may in fact be an endogenous response to shifts in demand, we are most likely overstating women's contribution to declining male wages and rising inequality in this section. Endogenous female labor supply will further underscore our point that women were not the major culprits.

In Section V we estimate the matrix of factor price elasticities, E^{-1}, and the matrix of elasticities of complementarity, Φ, directly using state and SMSA-level data. We should stress at this point that equations (6) and (7) represent the relationship between observed (equilibrium) wage and quantity variables. The supply shifts and the elasticities of supply with respect to wages do not appear in the equations because they are implicit in the net supply terms, $\dot{X} - \dot{D}$, the observed (equilibrium) quantities net of demand shifts.[5] In reality, we do not observe the demand

[5] More specifically, using our notation, factor demands are $\dot{X}_D = E\dot{W} + \dot{D}$. Specify the factor supply equation as $\dot{X}_S = Z\dot{W} + \dot{S}$. The vectors $\dot{D}$ and $\dot{S}$ represent

shifts, $\dot{D}$. One strategy for estimating equations (6) and (7) in this case is via instrumental variables. However, we are not confident that we can locate the appropriate instruments that are correlated with shifts in female labor supply but not with changes in male wages. In this article we take a different approach and use the observed equilibrium wage and quantity variables along with an empirical proxy for the demand shift term, $\dot{D}$. We find that our estimates of cross-price elasticities from the state-level data depend crucially on how we control for these demand changes. In Section V, we explore the importance of unmeasured demand shifts by entering our demand shift measures as separate regressors in our estimation. If our measured demand shifts are understated but proportional to the true demand shifts, this method will yield consistent estimates.

III. The Data

Our calculations are based on the 1/100 sample of the 1940–90 U.S. Census of Population micro data. Our wage measures are based on a select sample of individuals with strong labor force attachment. Specifically, we choose male and female wage and salary workers in the nonagricultural sector who had 1–40 years of potential labor market experience, who worked full-time, who worked at least 40 weeks and earned at least $\frac{1}{2}$ the legal federal minimum weekly wage. Our wage measure is the weekly wage calculated as annual earnings divided by weeks worked. Annual earnings were deflated using the personal consumption expenditure (PCE) deflator from the national product and income accounts.

We use two alternative measures of labor quantities. One measure, which we call our unweighted measure, is constructed by counting the number of men and women with 1–40 years of experience who were working during the survey week. A second measure, which we call our weighted measure, is based on a sample of individuals who worked at least 1 week the previous year, and we construct labor quantities by summing over total annual hours worked.[6] Following Katz and Murphy

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demand and supply shifts, respectively, and E and Z are matrices of factor demand and supply elasticities. Endogenous labor supply is represented by nonzero elements in Z. The change in equilibrium factor prices are then $\dot{W} = (E - Z)^{-1}(\dot{D} - \dot{S})$. Denoting the change in equilibrium factor quantities as $\dot{X}$, we obtain $\dot{S} = \dot{X} - Z\dot{W}$ from the supply equation. Replacing $\dot{S}$ in the equilibrium factor price equation with this expression and rearranging terms yields $\dot{W} = E^{-1}(\dot{X} - \dot{D})$. This is illustrated in fig. A1 in the appendix, which shows that once we observe factor price changes, $\dot{W}$, factor quantity changes, $\dot{X}$, and provided that we know the magnitude of the demand shifts, $\dot{D}$, we can exactly identify the relevant elasticities of factor price, E^{-1}.

[6] Usual hours worked last year, which would be more appropriate for calculating total annual hours, is unavailable until the 1980 census. We use hours worked during the survey week to maintain consistency.

(1992), for each year we divided the data into 80 groups defined by sex, education, and experience categories.[7] For each demographic group we calculate average employment share over the entire period, 1940–90. We use these average shares as fixed weights to calculate average wages at more aggregate levels and also to calculate a fixed-weight wage index for each year. For much of our analysis we examine relative wages for different demographic and skill groups by dividing the group's average wage by the fixed-weight wage index for that year. We also multiply the group's labor share by the group's relative wage averaged over all years to convert labor quantities into efficiency units. While we report cross-state regression results based on annual hours weighted efficiency units of labor, we have not found our results to be sensitive to the choice of the labor quantity measure.

IV. Male Wages and Female Employment Growth, 1940–90

In this section we examine the long run changes in male wages and female employment over the period 1940–90. Table 1 presents log changes in average weekly wage by gender and education group. Overall, real wages grew rapidly during the 1950s and the 1960s, were constant during the 1970s, and fell considerably during the 1980s. Male and female wages moved closely together up to 1980 and diverged sharply, with males losing considerably more than women.

The second panel of table 1, showing wage changes for men, tells the most dramatic story. Table 1 shows that real wages of high school dropout and high school graduate men fell approximately 12.5% and 14.1% during the 1980s, or about 6–8% more than average. While less educated women also lost during the 1980s (note that high school graduate women lost 2.2% in real wages during the 1980s), the wage declines for women have not been nearly as dramatic.

Table 2 examines the long run trends in female employment growth. Panel A presents changes in employment to population ratios for women with 1–40 years of potential experience. Female employment growth was particularly rapid during the 1970s, with the employment to population ratio rising by 11 percentage points from .474 to .585. In the 1980s, however, the pace of female employment growth actually slowed down somewhat to 9.4 percentage points. In percentage terms, female employment to population ratios increased at a rate of approximately 20% per decade until the 1980s, when it grew approximately 15%. Panels B and C illustrate which women have entered the labor force most intensively. During the 1980s in particular, increases in female employment rates

[7] We use five education categories, <8, 8–11, 12, 13–15, and 16+ years of schooling, and eight 5-year experience categories.

Table 2
Female Employment Population Ratios

A. All Women

	1940	1950	1960	1970	1980	1990
	.263	.324	.392	.474	.585	.679

B. Education

Years of Schooling	1940	1950	1960	1970	1980	1990
<8	.205	.265	.327	.362	.377	.397
8–11	.232	.291	.364	.418	.446	.470
12	.346	.365	.408	.495	.595	.667
13–15	.340	.381	.434	.512	.654	.743
16+	.455	.477	.546	.601	.723	.804

C. Husband's Wage Quintile

	1940	1960	1970	1980	1990
1–20	.149	.326	.437	.511	.598
21–40	.153	.320	.440	.555	.678
41–60	.144	.293	.409	.550	.688
61–80	.138	.262	.376	.522	.666
81–100	.122	.194	.306	.471	.610

NOTE.—The numbers are calculated from the 1940–90 Public Use Microdata Samples files. The sample includes women with 1–40 years of potential labor market experience who were not in school or military service. Employment rates reported in panels A and B are fractions of women who were working during the survey week. The employment rates reported in panel C are based on a sample of married women and numbers are reported by husband's wage quintile. Employment rates are calculated by dividing number of weeks worked last year by 52.

have occurred almost exclusively among high school and college graduate women.

Panel C isolates married women and disaggregates by the husband's relative earning power. One question that needs to be addressed is whether the large increase in married women's labor supply is in response to the decline in husband's wages. To the extent that husbands and wives make joint decisions regarding family labor supply, a decline in husband's earnings can be expected to increase the labor supply of the wife via the income effect. This type of substitution of husband's and wife's labor supply at the household level might bias our results toward finding substitution between men and women at the market level. In panel C, we briefly explore the extent to which these supply-side effects might bias our results. Consistent with findings reported in Juhn and Murphy (1997), panel C suggests that the decline in husband's wages and earnings was not a major explanation for the increase in married women's employment rates. Contrary to expectations, it is the wives of men in the top wage categories (men who have done well in the 1980s) who exhibit particularly strong entry patterns, with employment rates growing approximately 14 percentage points over the 1980s.[8]

Table 3 shows how rising employment rates translated into increases in the female share of the labor force. Panel A of table 3 reports the ratio of female workers to total number of workers while panel B reports the ratio of female hours worked to total hours worked. Changes in the female share of the labor force exhibit the same basic time pattern as the changes in employment rates, in that female labor supply growth accelerates somewhat in the 1970s and slows down in the 1980s. There are some important differences between the weighted and unweighted numbers, however. Based on the unweighted numbers, female share of the labor force increases 9.1 percentage points from .288 in 1940 to .379 in 1970. When we weight by annual hours the increase in female share is much smaller, rising less than 5 percentage points from .258 to .305. This suggests that a sizable fraction of newly entering cohorts of women over this period may have been part-time and part-year workers who worked significantly less than their male counterparts. In contrast, the growth in female labor supply since 1970 is somewhat larger when workers are weighted by their annual hours, suggesting that part-time work may have become less important over time for women.[9]

Panels C and D report female shares of the labor force by education category. These panels show the rapid changes in the educational composition of the female work force. For example, women with less than a high school degree accounted for approximately 10% of total hours worked in 1969. By 1989, these women accounted for 4.3% of total hours worked. College graduate women, in contrast, accounted for 3.3% of the nation's labor supply in 1969. By 1989, their share had more than tripled to 10.1%. This rapid increase in the labor supply share of college graduate women

[8] In Juhn and Murphy (1997), we estimate the effect of husband's earnings on the wife's employment probability using household-level data from the March Current Population Survey (CPS). We find that a $1,000 increase in husband's earnings reduces the wife's employment probability by .4 to .7 percentage points. Husbands in the bottom quintile of the wage distribution lost approximately $1,800 in earnings from 1979 to 1989. This suggests that a trivial amount, approximately .7 to 1.3 percentage points, of the 8.6 percentage points increase in the employment of wives in these households may be due to the decline in husband's earnings. In addition, we point out that these women were not the ones with the fastest growing employment rates. We also estimated female labor supply elasticities with respect to own wages of about .15 in these data. Even if we were to apply a much larger labor supply elasticity of 1.0, since measured female wages did not rise enormously over the period, this would still account for a small portion of the total rise in female employment.

[9] Using March CPS data, Levenson (1995) shows that the fraction of women employed part-time was constant over the 1970s and declined over the 1980s.

Table 3
Female Share of the Labor Force

A. All Women—Unweighted

	1940	1950	1960	1970	1980	1990
	.288	.308	.335	.379	.428	.461

B. All Women—Hours Weighted

	1939	1959	1969	1979	1989
	.258	.266	.305	.364	.408

C. Women by Education—Unweighted

Years of Schooling	1940	1950	1960	1970	1980	1990
<8	.053	.047	.035	.020	.013	.004
8–11	.114	.104	.110	.094	.062	.052
12	.079	.102	.123	.170	.192	.145
13–15	.024	.031	.038	.052	.087	.152
16+	.019	.024	.030	.043	.075	.109

D. Women by Education—Hours Weighted

Years of Schooling	1939	1959	1969	1979	1989
<8	.046	.026	.016	.010	.003
8–11	.101	.085	.073	.049	.040
12	.075	.102	.140	.165	.127
13–15	.020	.030	.042	.075	.137
16+	.015	.023	.033	.064	.101

NOTE.—The numbers are calculated from the 1940–90 Public Use Microdata Samples files. Panels A and C report the number of women working during the survey week divided by the total number of workers during the survey week. Panels B and D report annual hours worked by women as a share of total annual hours worked. Annual hours for 1949 are not reported owing to the unreliability of the weeks-worked data.

reflects both the rapid rise in the fraction of the population going to college and rising participation rates among college-educated women.

We conclude from examining the long-run changes in male wages and female labor supply that, while wage declines among less skilled men were concentrated in the 1980s, the pace of female labor supply growth was somewhat slower than in the previous decades. If the aggregate change in female labor supply was not exceptional in the 1980s, what was different about the 1980s? We argue below that the most notable change regarding female labor supply during the 1980s was its changing composition rather than its growing number. We now turn to a more systematic examination of how the skill composition of working women has changed over time.

Similar to Borjas, Freeman, and Katz (1992) and, more recently, Jaeger (1995), who examine immigrants' contribution to relative wage changes, we ask in this section how working women have altered the relative supply of skill in the economy. In a more general framework, women may substitute for men of different skill type (e.g., high-skilled women may substitute for low-skilled men). However, in this section we have in mind a simpler framework where women substitute for men *within* skill levels. Building on this assumption, then, we may ask whether women have increased or decreased the relative supply of skilled workers in the economy, thereby reducing or increasing wage inequality between skilled and less skilled workers. In order to answer this question, we examine the ratio of all workers including women to male workers in each skill category. The percentage change in this ratio over time tells us how women's contributions to the labor supply of different skill types have changed over time. Finally, we can compare across skill categories to examine whether women have increased or decreased the relative supply of skilled workers. We use three alternative definitions of skill: relative wages, education, and three-digit occupation. In our first method, we first determine wage percentile cutoffs by pooling the men in our wage sample over all years. We then allocate men and women to different wage percentile categories based on their observed wages. One concern with this method is that it may be confounding changes in wage discrimination against women with real changes in skill level. We therefore also predict the number of men and women in different wage categories based on the distribution of observable characteristics such as education and occupation.

We predict the ratio of all workers to male workers of percentile category p at time t using the following equation:

$$\frac{\hat{N}_{pt}}{\hat{N}^{m}_{pt}} = \frac{\sum_{j} \alpha_{pj} N_{jt}}{\sum_{j} \alpha_{pj} N^{m}_{jt}}, \tag{8}$$

where $\alpha_{pj} = N^{m}_{pj}/N^{m}_{j}$ (the conditional wage distribution of men with characteristic j). In other words, we predict changes in labor quantities of different skill types using changes in the distribution of the characteristic j. To calculate the average conditional wage distribution, α_{pj}, we used the pooled wage sample of men over all the years 1940–90. To calculate changes in the distribution of j across years, we used the entire sample of men and women who worked during the survey week.

Figure 1 shows the ratio of total to male labor supply by skill type when we allocate men and women to skill categories based on their wages. There are two points we wish to make regarding figure 1. First, in every period, women alter the skill distribution of the economy by adding significantly more labor to the bottom skill categories than the

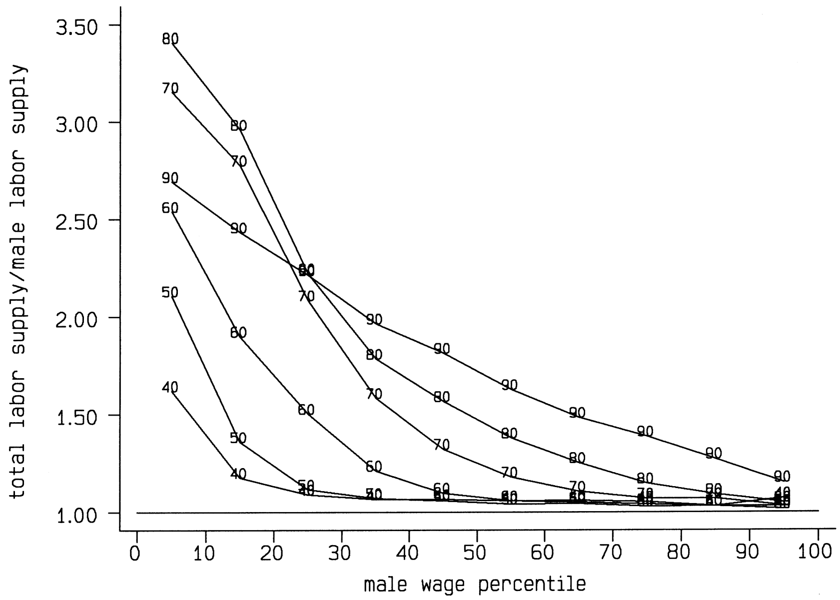

FIG. 1.—Female contribution to labor, based on wages, 1940–90

top skill categories. If women and men had the same skill distribution and also participated in the labor force in equal numbers, then we would observe a horizontal line at 2. This says that women simply double the effective supply of workers in each part of the skill distribution. Compared to this benchmark, figure 1 shows that in 1980 women more than tripled the effective labor supply of workers in the bottom wage category and made virtually no difference to the effective supply of workers in the top wage category. This is a statement about the levels (i.e., how women alter the skill distribution at a point in time). However, we are mainly interested in the changes or, more specifically, how women's contributions by skill level have changed over time. When we focus on the differences between the lines in figure 1, we find that women added more to the bottom skill categories in every period until 1980. Over the 1980s, however, women's contributions to the very bottom skill categories actually declined while their contributions to the middle and top skill categories increased.

Figure 2 shows our results based on education while figures 3–5 present our results based on three-digit occupations.[10] The flatter lines in figure

[10] We present changes over 1940–70, 1970–80 and 1980–90 in three separate figures reflecting our ability to match occupations across the different census years. We are unable to match occupations at the three-digit level across the 1970

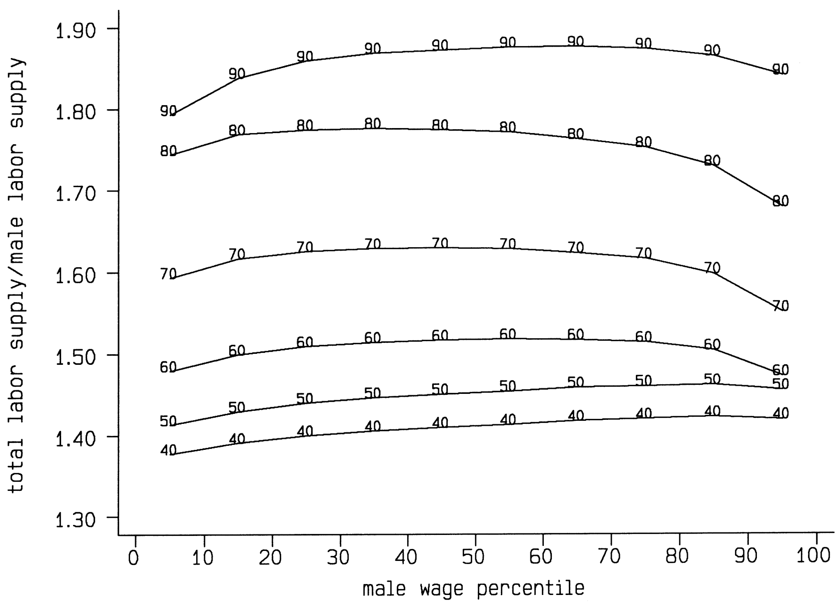

FIG. 2.—Female contribution to labor, based on education, 1940–90

2 indicate that the distribution of female workers is much closer to that of male workers when we compare across education categories than when we compare across wage categories. In terms of changes, figure 2 shows that women have had an almost neutral effect on changes in the skill composition of the work force until the 1980s. Once again, the 1980s appear to be distinct in that women added significantly more labor to the top skill categories than the bottom skill categories. In percentage terms, we estimate the incremental contribution of women to the labor supply of the top quintile group to be approximately 8% over the 1980s. Their contribution to the bottom quintile appears to be about 3%. Based on these numbers, women increased the relative supply of the most highly skilled workers in the economy to that of the least skilled workers by 5 extra percentage points. Our findings regarding changes over the 1980s are qualitatively similar but more dramatic in number when we use occupation as a measure of skill. Figure 5 shows that the growth of female labor supply by skill type has been distinctly nonneutral in the 1980s. Based on occupational changes, we estimate that women's contribution to the increase in the relative supply of skilled workers in the economy

and the 1980 censuses and therefore present results based on 1969–71 and 1979–81 March CPS surveys in fig. 4.

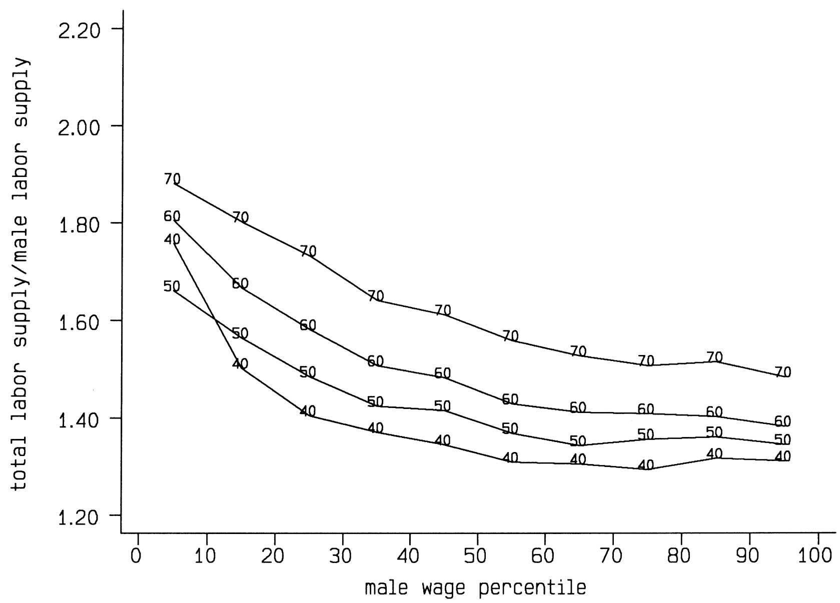

FIG. 3.—Female contribution to labor, based on occupation, 1940–70

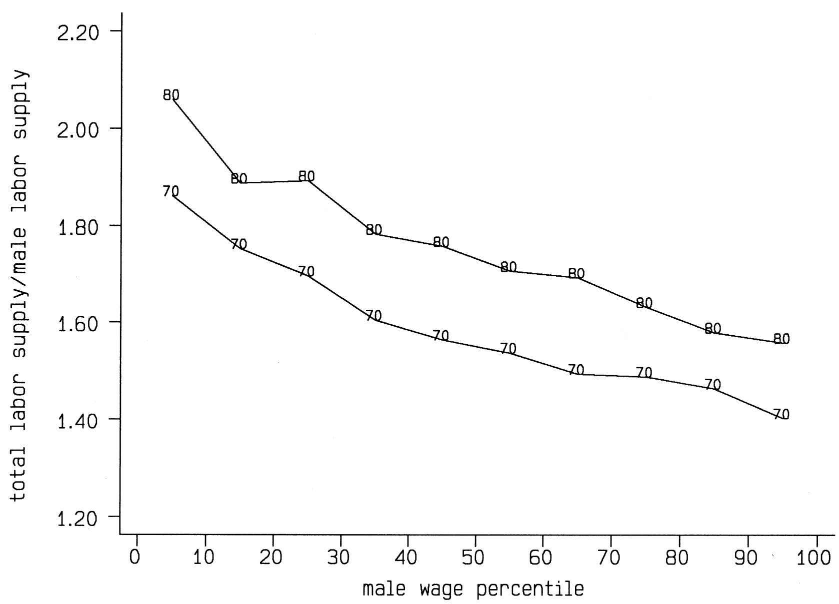

FIG. 4.—Female contribution to labor, based on occupation, 1970–80

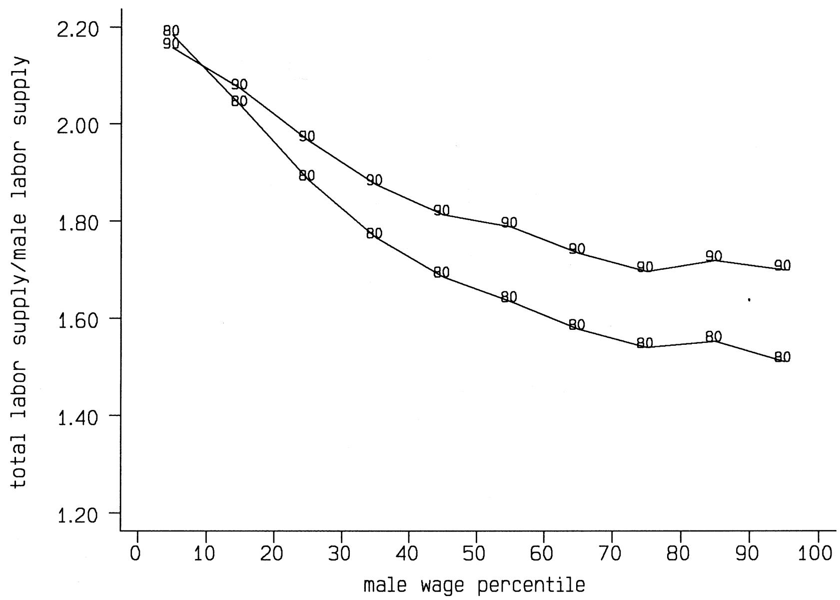

FIG. 5.—Female contribution to labor, based on occupation, 1980–90

(again measured as the ratio of workers in the top quintile to workers in the bottom quintile) was in the order of 11 percentage points. Our results based on all three measures of skill clearly indicate that women increased the relative supply of skill in the economy in the 1980s.[11] This is a break from past trend where women have typically added more labor to the bottom than the top skill categories. A plausible interpretation of this difference is that the pattern of female labor supply growth in the 1980s largely reflects the differential response of skilled and less skilled women to relative demand shifts favoring more skilled workers in general. However, to the extent that we regard changes in female labor supply as exogenous changes and to the extent that we maintain the assumption that women substitute for men within skill levels, our findings here suggest that women may have actually reduced, rather than increased, the wage gap between skilled and less skilled male workers in the 1980s.

[11] We suspect that we have somewhat understated the skill upgrading of female workers relative to male workers in the 1980s by ignoring increases in actual labor market experience and the increasing market orientation of women's education in recent years. For example, O'Neill and Polachek (1993) and Blau and Kahn (1994) report that rising relative experience levels among women account for a significant portion of the wage convergence between men and women in the 1980s.

V. Estimates of Factor Price Elasticities Using State and SMSA Data

In this section we use cross-state and cross-SMSA variation in female employment changes (net of demand changes) and male wage changes to estimate elasticities of factor price between male and female workers. We also estimate elasticities of complementarity, defining high school graduate males as the base group. After laying out our framework and describing the data we present our results in tables 4 and 5.

We apply equations (6) and (7) to state-level data to estimate the elasticities of factor price and elasticities of complementarity. For our cross-state analysis, we focus on the latter period, 1970–90. To reduce the number of parameters to be estimated we use six labor aggregates defined by gender and education (those with <12 years of schooling, those with 12–15 years of schooling, and those with 16+ years of schooling). We are interested in estimating factor price elasticities holding marginal cost constant. We hold marginal cost (or more precisely, average cost) constant in our estimation by normalizing our dependent variable, weekly wages of men in different education categories, by the state-level fixed-weight wage index at time *t.* Factor supplies are measured as shares of total annual hours worked (in efficiency units) in state *s* at time *t.*[12]

Our demand shift measures are state-level counterparts to the between-sector demand shift measures employed by Katz and Murphy (1992) and are comparable to those used by Bartik (1991), Blanchard and Katz (1992), and Bound and Holzer (1993). We estimate relative demand shifts owing to product demand, $\dot{D}_{js}$, for each of our six labor inputs by the following formula,

$$\dot{D}_{jst} = \sum_{i=1}^{I} \left[\frac{\hat{N}_{ist}/\hat{N}_{st}}{N_{it}/N_t} - \frac{N_{ist-1}/N_{st-1}}{N_{it-1}/N_{t-1}} \right] \frac{N_{ij}}{N_j} ,$$

where N_{ij}/N_j is sector *i*'s share of group *j*'s employment in efficiency units and the term inside the brackets is the change in employment share of sector *i* in state *s* (normalized by the aggregate change).[13] Intuitively, we predict a positive demand shift for the skill group *j* in state *s* if it is

[12] Factor supplies are measured in efficiency units, which again means that each labor input *j* is weighted by its wage averaged over all years. Since this average wage does not vary by year, our regression results do not suffer from simultaneity bias.

[13] The variables in the equations now have *s* subscript to represent state-level values.

Table 4
Estimated Elasticities of Factor Price

	(1)	(2)	(3)	(4)
Wages of men with <12 years of schooling:				
Labor quantities:				
Men:				
<12	−.14* (.05)	−.16* (.04)	−.12* (.04)	−.17* (.04)
12–15	.32* (.09)	.19* (.07)	.21* (.10)	.19* (.07)
16+	.03 (.08)	−.01 (.05)	−.02 (.08)	−.02 (.05)
Women:				
<12	−.07 (.04)	−.02 (.04)	−.05 (.04)	−.02 (.04)
12–15	−.09 (.09)	−.05 (.07)	−.06 (.10)	−.03 (.08)
16+	−.06+ (.03)	.05 (.04)	.04 (.05)	.04 (.04)
Year dummy = 89	−.12* (.02)	−.06* (.02)	.00 (.13)	−.05* (.02)
State unemployment rate	−.01* (.00)	...	−.00 (.00)	...
Wages of men with 12–15 years of schooling:				
Labor quantities:				
Men:				
<12	.01 (.02)	−.01 (.02)	.02 (.02)	−.01 (.02)
12–15	−.07 (.04)	−.00 (.03)	−.07* (.04)	−.00 (.03)
16+	.04 (.03)	.05+ (.03)	.02 (.03)	.05* (.03)
Women:				
<12	−.02 (.02)	.00 (.02)	.02 (.02)	.01 (.02)
12–15	.02 (.04)	−.04 (.03)	−.01 (.04)	−.05 (.04)
16+	.01 (.02)	.01 (.02)	.05* (.02)	.01 (.02)
Year dummy = 89	−.07* (.01)	−.06* (.01)	−.06 (.05)	−.06* (.01)
State unemployment rate	−.00 (.00)	...	−.00 (.00)	...
Wages of men with 16+ years of schooling:				
Labor quantities:				
Men:				
<12	.02 (.04)	.03 (.03)	.04 (.04)	.06+ (.03)
12–15	−.07 (.08)	−.04 (.05)	.04 (.08)	−.06 (.06)
16+	−.16* (.07)	−.00 (.04)	−.11 (.07)	−.00 (.05)
Women:				
<12	.02 (.04)	−.01 (.03)	.00 (.03)	−.02 (.03)
12–15	.16+ (.08)	.08 (.06)	.11 (.08)	.08 (.06)
16+	.03 (.03)	−.06* (.03)	−.08* (.04)	−.07* (.03)
Year dummy = 89	.09* (.02)	.07* (.01)	−.22* (.10)	.06* (.02)
State unemployment rate	.00 (.00)	...	−.00 (.00)	...
Demand shifts as separate regressors	No	No	Yes	Yes
Units of observation	State	SMSA	State	SMSA
No. of observations	96	102	96	102

NOTE.—Regressors in cols. 1 and 2 are log changes in specified labor quantities net of demand changes. In cols. 3 and 4 labor quantities and demand shifts are entered as separate regressors. Homogeneity restriction is imposed in all columns.
+ Significant at the 10% level.
* Significant at the 5% level.

predominantly located in sectors that are growing faster than the national average. One concern is that regional differences in sectoral employment changes may reflect exogenous supply changes (such as the influx of low-skilled immigrants into the West region). We therefore obtain predicted

Table 5
Estimated Partial Elasticities of Complementarity

	(1)	(2)	(3)	(4)
Wages of men with <12 years of schooling:				
Labor quantities:				
Men:				
<12	−.13* (.04)	−.15* (.05)	−.12* (.04)	−.16* (.06)
16+	.03 (.04)	.02 (.03)	.02 (.04)	.03 (.03)
Women:				
<12	−.07 (.04)	−.03 (.06)	−.05 (.04)	−.03 (.06)
12–15	−.09 (.08)	−.04 (.09)	−.07 (.08)	−.04 (.10)
16+	−.06* (.03)	.00 (.05)	.02 (.04)	−.00 (.05)
Year dummy = 89	−.12* (.02)	.00 (.02)	−.02 (.03)	.00 (.02)
State unemployment rate	−.01* (.00)	...	−.00 (.00)	...
Wages of men with 16+ years of schooling:				
Labor quantities:				
Men:				
<12	.03 (.04)	.02 (.03)	.02 (.04)	.03 (.03)
16+	−.16* (.07)	−.05 (.06)	−.08 (.07)	−.06 (.06)
Women:				
<12	.02 (.04)	.00 (.04)	.01 (.04)	.00 (.04)
12–15	.16+ (.09)	.18* (.07)	.12 (.09)	.17* (.08)
16+	.03 (.03)	−.08+ (.04)	−.09* (.04)	−.08* (.04)
Year dummy = 89	.09* (.02)	.14* (.02)	−.01 (.03)	.14* (.06)
State unemployment rate	−.00 (.00)	...	−.00 (.03)	...
Demand shifts as separate regressors	No	No	Yes	Yes
Units of observation	State	SMSA	State	SMSA
No. of observations	96	102	96	102

NOTE.—Regressors in cols. 1 and 2 are log changes in labor quantities relative to high school graduates and net of relative demand changes. In cols. 3 and 4 log changes in relative labor quantities and relative demand changes are entered as separate regressors. Symmetry restriction is imposed in all columns.
+ Significant at the 10% level.
* Significant at the 5% level.

sectoral employment shares in state s at time t by using initial sectoral employment in the state and aggregate changes according to the following formula:

$$\frac{\hat{N}_{ist}}{\hat{N}_{st}} = \frac{N_{ist-1}(N_{it}/N_{it-1})}{\sum_{i=1}^{I} N_{ist-1}(N_{it}/N_{it-1})} .$$

Since we lack direct measures of factor specific demand shocks, η_s, its effects remain in our error term. All variables in the regressions are specified as (decade) log changes thereby controlling for state-specific fixed effects. We run weighted least squares where each observation is weighted by the number of wage observations in the state averaged over all years. We use 48 states, excluding Washington, D.C.; Hawaii; and Alaska. We explore an alternative cross-sectional variation using SMSA-level data and also report the results in tables 4 and 5.[14] We estimate factor price elasticities and elasticities of complementarity by pooling the 1970–80 and the 1980–90 changes. We have also estimated the elasticities using only the 1970–80 changes since a larger part of observed employment changes in the 1980s may reflect demand shifts rather than supply shifts. The parameters estimated from the 1970–80 changes are qualitatively similar to those from the pooled regression but are less precisely estimated. We therefore report below the results from the pooled regression.

Table 4 reports factor price elasticities of male wages with respect to each of the six labor quantities. In columns 1 and 2 our regressors are net supply measures, changes in the specified labor quantities net of our measured demand shifts. While our demand measures account for between-sector demand shifts, we have not accounted for factor specific demand changes that may have occurred within sectors. To the extent that we imperfectly capture demand shifts away from low-skilled male workers toward high-skilled female workers, in our estimation this will bias our results toward finding "substitution" between these two groups.[15] We explore the importance of these biases in columns 3 and 4 of table 4 by allowing our demand shift measures to play a larger role. In columns 3 and 4, we include factor quantity changes and our demand shift measures as separate regressors. If our demand shift measures understate true demand shifts by constant proportions, this method will yield consistent estimates under standard assumptions.

Turning first to our estimates based on state-level data reported in columns 1 and 3, we find negative and mostly significant own effects for all three skill groups, which builds our confidence in these results. One puzzling finding is that high school graduate men are strong complements in production for high school dropout men. When we

[14] We limit the number of SMSAs to the 51 largest SMSAs that we are able to match across all census years. We thank David Jaeger for providing us with the code to match SMSAs across the 1980 and the 1990 censuses.

[15] If, however, men and women are substitutes within a skill class, their demand changes will be correlated. Not controlling for these demand changes will bias our estimates toward zero or toward *not* finding substitution between men and women. Based on our between-sector demand measures, we find that aggregate demand changes for men and women are correlated for high school dropouts and college graduates but not for high school graduates. Entering our demand shift measures as separate regressors will also address this potential problem.

regress wage changes on net supply measures (col. 1) we find weak evidence that women may be substitutes for high school dropout men. For example, the coefficient on college graduate women is marginally significant (at the 10% significance level) in the high school dropout equation when net supply measures are used as regressors. The hypothesis that the effects of all three types of women are jointly zero in the high school dropout male equation can be rejected at the 10% level, although not at the 5% level. When we include our demand measures as separate regressors (col. 3), the negative effect of college-educated women on wages of high school dropout men disappears. Also, we can no longer reject the hypothesis that the effects of all three types of women are jointly zero at standard levels of significance. Instead, the coefficient on college-educated women in the college-educated male wage equation turns negative and significant, which suggests that college-educated women may be substitutes for college-educated men. Notice that own effects remain negative and significant even in these latter specifications.

In the SMSA-level regressions reported in columns 2 and 4, the own effects are negative and significant for high school dropout men but insignificant for high school and college graduate men. Our failure to find significant own effects in the high school graduate and the college graduate equations may reflect our inability to match SMSAs cleanly across all census years because of changing definitions of county groups. Also, labor mobility between adjacent SMSA and non-SMSA areas may weaken the link between price and quantity changes observed between SMSAs. Because of these considerations, we are less confident in our results based on SMSA data. However, it is worth noting that in the high school dropout equation where we do estimate strong own effects, we do not find substitution effects between women and high school dropout men.

We also estimate (partial) elasticities of complementarity using male high school graduates as the base group and we report these results in table 5. Our dependent variables are relative wage changes (measured relative to high school graduate male wages). In columns 1 and 2 our regressors are log changes in relative labor quantities (all measured relative to high school graduate males) net of relative demand changes. In columns 3 and 4 we again enter our demand shift measures as separate regressors. When we use net supply measures as regressors (col. 1) we find that college graduate women have a significant negative effect (−.06) on the wage ratio between high school dropout and high school graduate men implying that increasing numbers of college educated women will increase wage inequality between the bottom two male skill groups. Again, the hypothesis that the effects of all three types of women are jointly zero in the high school dropout male equation can be rejected at the 10% level. When demand shifts are entered as separate regressors (col. 3), the negative effect of college-educated women on the wages of less educated men and the joint significance of all women disappears. College-educated women negatively affect the relative wages of college graduate men, suggesting that the increase in supply of more educated women in the labor force may have actually dampened the growth in the college–high school wage premium.

To summarize, our cross-state results offer some weak evidence that college graduate women may be substitutes for high school dropout men and have contributed to increasing wage inequality between high school dropout and high school graduate men. However, these results appear to be largely driven by unmeasured demand shifts that favored skilled women and worked against less skilled men. When we allow our demand shift measures to play a larger role and enter them as separate regressors in our estimation, the apparent "substitution" between these two groups disappears. Instead, we find the more plausible result that college educated women may have actually reduced the wages of college graduate men and dampened the increase in the college wage premium in the recent decades.

VI. Conclusion

In this article we have examined to what extent rapid increases in female labor supply contributed to rising wage inequality and to declining real wages of less skilled males during the 1980s. Based on aggregate changes, we find that (1) female labor supply growth slowed in the 1980s relative to the 1970s, and (2) women increased the relative supply of skill in the economy in the 1980s. These findings are inconsistent with a simple story in which supply shifts among women have played a major role. Instead, they further support the view that relative demand shifts, rather than supply shifts, have been the underlying cause of declining opportunities for less skilled males and rapid inequality growth in the 1980s.

Recently, Topel (1994) has suggested that cross-substitution effects may exist between men and women of different skill levels. More specifically, the entry of skilled women in the 1980s may have worked to the disadvantage of less skilled men. In a more general framework, we estimate these cross-substitution effects using state and SMSA-level data. We find that our results depend crucially on how we control for demand changes. Once we allow our measured demand shifts to play a larger role, we find little evidence that women are substitutes for men or that the entry of educated women into the labor force contributed to male wage inequality growth in the 1980s.

Appendix

Estimated Elasticities

Table A1
Estimated Elasticities of Factor Price, 1970–80 Changes Only

	(1)	(2)	(3)	(4)
Wages of men with <12 years of schooling:				
Labor quantities:				
Men:				
<12	−.24* (.09)	−.13* (.04)	−.25* (.09)	−.13* (.04)
12–15	.40* (.11)	.21* (.06)	.39* (.11)	.21* (.06)
16+	.01 (.10)	−.01 (.04)	.01 (.09)	−.01 (.04)
Women:				
<12	.03 (.07)	−.04 (.03)	.02 (.07)	−.04 (.03)
12–15	−.12 (.12)	−.04 (.06)	−.10 (.12)	−.04 (.06)
16+	−.07+ (.04)	−.00 (.03)	−.07* (.03)	−.00 (.03)
State unemployment rate	.00 (.00)	. . .	.00 (.00)	. . .
Wages of men with 12–15 years of schooling:				
Labor quantities:				
Men:				
<12	.02 (.05)	−.03 (.02)	.04 (.05)	−.03 (.02)
12–15	−.09 (.06)	−.03 (.03)	−.10 (.06)	−.03 (.03)
16+	.01 (.05)	.01 (.02)	.04 (.05)	.01 (.02)
Women:				
<12	.01 (.04)	.02 (.02)	−.01 (.04)	.02 (.02)
12–15	.03 (.06)	.04 (.03)	.02 (.07)	.04 (.03)
16+	.02 (.02)	−.00 (.01)	.01 (.02)	−.00 (.01)
State unemployment rate	−.00 (.00)	. . .	−.00 (.00)	. . .
Wages of men with 16+ years of schooling:				
Labor quantities:				
Men:				
<12	.05 (.09)	.10* (.04)	.06 (.09)	.10* (.04)
12–15	−.09 (.11)	−.11* (.05)	−.07 (.11)	−.10+ (.05)
16+	−.07 (.10)	−.01 (.04)	−.07 (.09)	−.01 (.04)
Women				
<12	.01 (.07)	−.00 (.03)	−.00 (.07)	−.02 (.03)
12–15	.05 (.12)	.03 (.05)	.03 (.12)	.03 (.05)
16+	.05 (.04)	−.00 (.02)	.05 (.03)	−.00 (.02)
State unemployment rate	−.01 (.01)	. . .	.01 (.01)	. . .
Demand shifts included	No	No	Yes	Yes
Units of observation	State	SMSA	State	SMSA
No. of observations	48	51	48	51

NOTE.—Homogeneity restriction is imposed on all equations.
+ Significant at the 10% level.
* Significant at the 5% level.

Table A2
Estimated Partial Elasticities of Complementarity, 1970–80 Changes Only

	(1)	(2)	(3)	(4)
Wages of men with <12 years of schooling:				
Labor quantities:				
Men:				
<12	−.28* (.12)	−.10* (.05)	−.32* (.10)	−.09* (.05)
16+	.00 (.08)	.07+ (.04)	−.03 (.07)	.05 (.04)
Women:				
<12	−.02 (.09)	−.06 (.04)	.09 (.07)	−.06 (.04)
12–15	−.14 (.15)	−.09 (.07)	−.06 (.13)	−.07 (.07)
16+	−.09* (.04)	−.02 (.03)	−.03 (.05)	−.02 (.03)
State unemployment rate	−.00 (.01)	. . .	.01 (.01)	. . .
Wages of men with 16+ years of schooling:				
Labor quantities:				
Men:				
<12	.00 (.08)	.07+ (.04)	−.03 (.07)	.05 (.04)
16+	−.11* (.12)	−.02 (.05)	.06 (.11)	−.00 (.05)
Women:				
<12	.02 (.07)	.01 (.05)	−.03 (.06)	.02 (.04)
12–15	.01 (.16)	−.02 (.07)	−.03 (.13)	−.03 (.07)
16+	.04 (.04)	.00 (.03)	−.15* (.05)	.02 (.03)
State unemployment rate	−.01 (.01)	. . .	−.01 (.01)	. . .
Demand shifts as separate regressors	No	No	Yes	Yes
Units of observation	State	SMSA	State	SMSA
No. of observations	48	51	48	51

NOTE.—Symmetry restriction is imposed on all equations. Columns 1–2: regressors are log changes in relative net supplies. Columns 3–4: regressors are log changes in relative supplies and relative demand changes.

+ Significant at the 10% level.

* Significant at the 5% level.

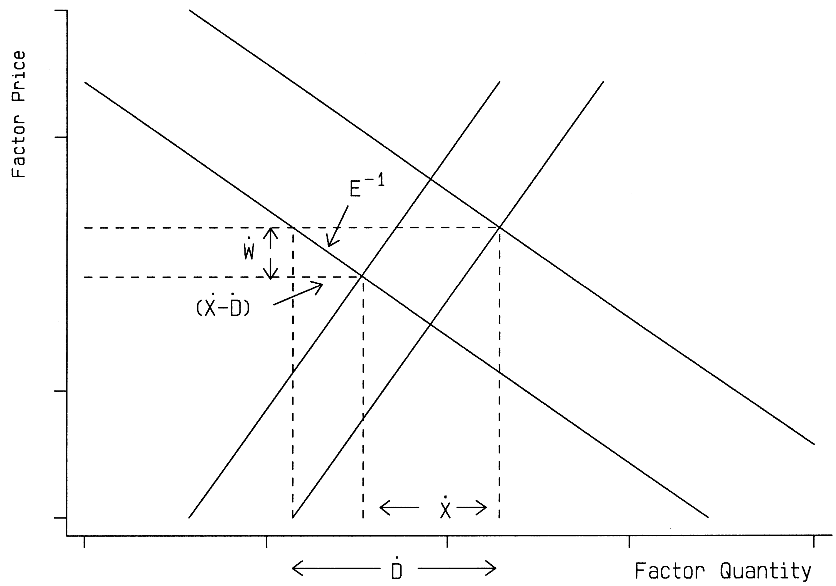

FIG. A1.—Identifying elasticities of factor price in the presence of demand and supply shifts.

References

Bartik, Timothy J. *Who Benefits from State and Local Economic Development Policies?* Kalamazoo, MI: W. E. Upjohn Institute, 1991.

Berman, Eli; Bound, John; and Griliches, Zvi. "Changes in the Demand for Skilled Labor within U.S. Manufacturing: Evidence from the Annual Survey of Manufactures." *Quarterly Journal of Economics* 109 (May 1994): 367–98.

Berndt, Ernst. "Modelling the Simultaneous Demand for Factors of Production." In *The Economics of the Labor Market,* edited by Z. Hornstein et al. London: Her Majesty's Stationery Office, 1980.

Blanchard, Olivier J., and Katz, Lawrence F. "Regional Evolutions." *Brookings Papers on Economic Activity* 1 (1992): 1–75.

Blau, Francine D., and Kahn, Lawrence M. "The Impact of Wage Structure on Trends in U.S. Gender Wage Differentials: 1975–1987." Working paper. Cambridge, MA: National Bureau of Economic Research, 1994.

Borjas, George J. "The Demographic Determinants of Demand for Black Labor." In *The Black Youth Employment Crisis,* edited by R. B. Freeman and H. J. Holzer. Chicago: University of Chicago Press, 1986.

Borjas, George J.; Freeman, Richard B.; and Katz, Lawrence F. "On the Labor Market Effects of Immigration and Trade." In *Immigration and the Work Force,* edited by George J. Borjas and Richard B. Freeman. Chicago: University of Chicago Press, 1992.

Bound, John, and Holzer, Harry J. "Industrial Shifts, Skill Levels, and the Labor Market for White and Black Males." *Review of Economics and Statistics* 75 (August 1993): 387–96.

Bound, John, and Johnson, George. "Changes in the Structure of Wages during the 1980s: An Evaluation of Alternative Explanations," Working paper. Cambridge, MA: National Bureau of Economic Research, 1989.

Freeman, Richard B., and Katz, Lawrence F. "Rising Wage Inequality: The United States vs. Other Advanced Countries." In *Working under Different Rules,* edited by Richard Freeman. New York: Russell Sage, 1994.

Grant, James H. and Hamermesh, Daniel S. "Labor Market Competition among Youth, White Women and Others." *Review of Economics and Statistics* 63 (August 1981): 354–60.

Hamermesh, Daniel S. "The Demand for Labor in the Long Run." In *Handbook of Labor Economics,* vol. 1, edited by Orley C. Ashenfelter and Richard Layard, pp. 429–71. Amsterdam: Elsevier Science Publishers, 1986.

Jaeger, David A. "Skill Differences and the Effects of Immigrants of the Wages of Natives" Working paper. Ann Arbor: University of Michigan, 1995.

Juhn, Chinhui, and Murphy, Kevin M. "Wage Inequality and Family Labor Supply." *Journal of Labor Economics* 15 (January 1997): 72–97.

Juhn, Chinhui; Murphy, Kevin M.; and Pierce, Brooks. "Wage Inequality and the Rise in Returns to Skill." *Journal of Political Economy* 101 (June 1993): 410–42.

Katz, Lawrence, and Murphy, Kevin M. "Changes in the Wage Structure, 1963–1987: Supply and Demand Factors." *Quarterly Journal of Economics* 107 (February 1992): 35–87.

LaLonde, Robert J., and Topel, Robert H. "Labor Market Adjustments to Increased Immigration." In *Immigration, Trade and Labor Market,* edited by John M. Abowd and Richard B. Freeman. Chicago: University of Chicago Press, 1991.

Levenson, Alec R. "Where Have All the Part-Timers Gone? Recent Trends and New Evidence on Dual-Jobs." Working paper. Santa Monica, CA: Milken Institute, 1995.

Levy, Frank, and Murnane, Richard J. "U.S. Earnings Levels and Earnings Inequality: A Review of Recent Trends and Proposed Explanations." *Journal of Economic Literature* 30 (September 1992): 1333–81.

Murphy, Kevin M., and Welch, Finis. "The Structure of Wages." *Quarterly Journal of Economics* 107 (February 1992): 285–326.

O'Neill, June, and Polachek, Solomon. "Why the Gender Gap in Wages Narrowed in the 1980s." *Journal of Labor Economics* 11 (January 1993): 205–28.

Sato, R., and Koizumi, T. "On the Elasticities of Substitution and Complementarity." *Oxford Economic Papers* 25 (March 1973): 44–56.

Topel, Robert H. "Regional Labor Markets and the Determinants of Wage Inequality." *American Economic Review* 84 (May 1994): 17–22.