# People People: Social Capital and the Labor-Market Outcomes of Underrepresented Groups*

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**Abstract**

Despite indications that people skills are important for understanding individual labor-market outcomes and have become more important over the last decades, there is little analysis by economists. This paper shows that people skills are important determinants of labor-market outcomes, including occupations and wages. We show that technological and organizational changes have increased the importance of people skills in the workplace. We particularly focus on how the increased importance of people skills has affected the labor-market outcomes of underrepresented groups. We show that the acceleration in the rate of increase in the importance of people skills between the late 1970s and early 1990s can help explain why women's wages increased more rapidly, while the wages of blacks grew more slowly over these years relative to earlier years.

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## I. Introduction

It has been widely documented that in the United States gender wage gap shrank rapidly from the late 1970s to the early 1990s after holding steady for years, while the black-white wage gap closed more slowly during this period after shrinking for years. A variety of explanations have been provided for these trend breaks but there are no unified explanations and some of the explanations for one phenomenon deepen the puzzle for the other.[1] This paper shows that an acceleration in the rate at which interpersonal or "people" tasks are becoming more important provides a unified explanation for these trend breaks. While psychologists have pointed to gender differences in interpersonal styles and a long-standing literature discusses impediments to cross-racial interactions in the labor market, to the best of our knowledge, we are the first to link the increased importance of people tasks to trends in the labor markets of underrepresented groups.

The importance of people skills has long been recognized in the popular literature[2] and is increasingly being recognized in psychology (see Gardner [1983], Sternberg [1984], and Goleman [1996]) and has begun entering economics through work on social capital (Coleman [1990], Becker and Murphy [2000], and Glaeser, Laibson, and Sacerdote [2002]), non-cognitive traits (Heckman and Rubinstein [2001] and Heckman, Stixrud and Urzua [2005]) and behavioral approaches (Bowles, Gintis, and Osborne [2001]). Moreover, the shift in employment from manufacturing to services and the diffusion of computer technology and innovative workplace organizations are likely to have increased the demand for "people people". Despite this interest, people skills have received little attention in the economics literature.

We provide a simple, early model of the role of people skills in the labor market. In our model, individuals vary in their stock of people skills and jobs differ in the importance of people tasks. People with more people skills have higher marginal products in jobs with more people tasks and are assigned to them. We conjecture that people derive utility from people tasks, so that jobs where people tasks are more important may pay lower wages. Using individual-level longitudinal data form the United States and Britain, we show that people who were more

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[1] For instance Blau and Kahn [1997] show that the increase in skill prices proposed by Juhn, Murphy, and Pierce [1991] as an explanation for the slowing progress of blacks works against the closing of the gender gap.

[2] The massive market for material on *How to Win Friends and Influence People*, as Dale Carnegie's [Carnegie 1936] classic book is titled, indicates that people tasks are widely believed to be important. Carnegie's work has sold over 15 million copies and, almost 70 years after it was first published, is ranked 209th of all books on Amazon.com (on November 30, 2005).

sociable when they were young are more likely to be in jobs where people tasks are more important and that the returns to their people skills are greater in these jobs. Also for the United States and Britain we find that jobs where people tasks are more important pay lower wages, all else constant.

After this general analysis of people skills, we apply our model to understand the labor-market outcomes of underrepresented groups. Psychologists have argued that women place more weight on the effects of their actions on others [Gilligan 2001] and women report being better in performing people tasks. It is also likely that racial, ethnic, linguistic, and cultural differences interfere with the performance of people tasks, either because members of such minority groups are less able to interact with members of the majority group or because of prejudice on the part of customers and co-workers (see Becker [1971] and Holzer and Ihlanfeldt [1998]). Supporting these hypotheses, in both cross-sectional and panel data, we find that the relative employment of women is higher in occupations in which people tasks are more important in Britain, Germany and the United States. The reverse is true for racial, ethnic, cultural, and linguistic minorities in the United States.

Using structural breaks, we show that the importance of people tasks increased particularly rapidly between the late 1970s and the early 1990s. Data for Britain, Germany and the United States show that this trend is linked to the increased use of computers and innovative work practices. In both levels and changes, people tasks are more important in occupations with greater computer use, in which team work is more important, and in firms which have recently gone through organizational changes. Combined, with our estimates of the effect of people tasks on the employment of underrepresented groups, we show that the rapid increase in the importance of people tasks over this time period helps explain the increase in women's wages relative to men and the stagnation in wages of black workers relative to white workers.[3]

Our empirical work falls into the emerging literature on "soft skills". The returns to beauty found by Hamermesh and Biddle [1994] and Möbius and Rosenblat [2005], Machiavellianism (Turner and Martinez [1977]), personality (Osborne [1999]), self-esteem

[3] The coding of Hispanics changes over time, and Borjas [1982] has argued that Hispanics are a heterogeneous group. The wages of Hispanic workers decline markedly starting in the late 1970s, while their employment increases. Given these changes, estimates of demand shifts toward Hispanics are highly sensitive to assumptions about elasticities. See also Borjas [1995] for an analysis of the labor-market developments of immigrants in the 1980s.

(Goldsmith, Veum and Darity [1997]) and to height among youths by Persico, Postlewaite, and Silverman [2004] support our result of positive labor-market returns to people characteristics, but beauty is only one aspect of interpersonal styles. In addition, Machin et al. [2001] find positive but rather small labor-market returns to sociability variables in Britain, but do not consider the assignment of people with different attitudes to different jobs. For men in the U.S., Kuhn and Weinberger [2005] find positive returns to being a leader in high school, especially in managerial jobs. We look at a broader set of implications than this paper to explain labor-market success. Glaeser et al. [2000] and Glaeser, Laibson and Sacerdote [2002] present suggestive evidence that workers with better people skills tend to be employed in jobs in which social interactions occur more frequently. Finally, Glaeser, Sacerdote and Scheinkman [1996] develop an index of social interactions and find that social interactions are important in explaining individual choices in committing different types of crime and schooling choice.

This paper proceeds as follows. Section II outlines trends in the wages, employment, and demand for women and blacks and reviews different explanations from the literature to explain these trends. Section III presents our model of how people skills influence labor-market outcomes. Section IV presents the data sources we use. Section V presents general evidence for our model. Section VI studies the effects of people tasks on the demand for women and blacks and shows that trends in the importance of people skills can help explain trends in the gender and racial wage gaps. Section VII concludes.

## II. Trends in the Labor-Market Outcomes for Women and Blacks

This section discusses trends in the labor-market outcomes of women and blacks in the United States (see Altonji and Blank [1999] for a review). Figures I and II show the evolution of the male-female and the black-white wage gaps and the proportion of the workforce that is female and black in the United States from 1963 to 2002, using data from the March Current Population Surveys (CPS) (see Appendix A2 for details). It has been well documented that women's wages show little growth until the late 1970s, at which point they begin rising rapidly until the mid-1990s. At the same time, women's share of employment increased steadily from 1964 to 2003, with a slight deceleration in the 1990s.[4] Besides increased labor supply and levels

[4] Mulligan and Rubinstein [2004] offer an alternative view on the evolution of the gender wage gap. They argue that within-gender wage inequality has changed the composition of the group of women in the labor market and show that, accounting for a growing selection bias over time, the closing of the gender wage gap could be overestimated.

of education there are a number of developments, which can be connected to this development.[5] Goldin [2004a] shows that changes in the labor-market outcomes for women were rooted in the growth of a wide variety of white-collar jobs, combined with the greater ability of women to hold certain professional jobs. This latter fact is consistent with findings of an increased share of women at the top of the job hierarchy (Bertrand and Hallock [2001] and Goldin [2004b]). The use of the birth-control pill by young women has delayed marriage and motherhood, which opened opportunities for women to progress in the labor market and earn higher wages than before (Goldin and Katz [2002] and Bailey [2006]). In addition, the computerization of the labor market has taken away some of the (physical) disadvantages women had in a non-computerized labor market (Weinberg [2000]). Finally, Black and Brainerd [2004] argue that globalization has increased competition through trade, which has contributed to the relative improvement in female wages in concentrated relative to competitive industries.

From the mid-1990s on however, women's wages are again flat, a development so far unexplained. A recent contribution by Blau and Kahn [2004], using the Michigan PSID, attributes the slowing in the convergence of the gender wage gap to changes in labor-force selectivity, unobserved female characteristics and discrimination, but also to less favorable supply and demand shifts. A number of studies have explained the remaining gender wage gap from gender differences in occupations. For example, Bayard et al. [2003] find that a sizable fraction of the gender wage gap can be attributed to segregation of women into lower-paying occupations, industries, establishments, and occupations within establishments. Blau and Kahn [1997] find for the 1980s in an analysis of shifts in the composition of supply and demand that

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Their estimates can, however, not be reconciled with the developments of the importance of people tasks in the labor market and, at the same time, the movements in the racial wage gap.

[5] Mincer and Polachek [1974] analyze the division of labor in the family using the 1967 National Longitudinal Survey of Work Experience (NLS). They find that differences in labor-market experience, due to interruptions in job careers and the associated loss of skills, can account in large part for the gender wage gap in the 1960s and early 1970s. An early study on female labor supply decisions is Heckman [1974] who estimates the effect of child-care programs on women's labor supply. He finds significant increases in female labor supply and career continuity (see also Meyer and Sullivan [2004]). More recently, Greenwood and Guner [2004] argue that technological progress in the household sector since the late 1940s has reduced the need for labor at home, which increased female labor supply and labor-market opportunities. Juhn and Murphy [1997] investigate whether married women have increased their labor supply in the recent decades to compensate for slowed earnings growth of their husbands and do find no significant increases. Their estimates suggest that the wage effect dominates the cross husband-wife effect for changes in male and female labor supply. A wealth of studies on female labor supply increases identified the increased level of education of women as a major source. In addition, the more labor-market relevant college majors taken by women and their increased enrollment in professional schools are likely to play a major role as well

demand changes favored lower educated women over men but do not consider the stagnation in the gender wage gap afterwards. Blau and Kahn [1997] and Black and Juhn [2000] investigate the labor-market outcomes for high-educated women in the 1980s and 1990s and find that despite the increase in supply, college-educated women entered high-wage professional occupations in response to the recent increase in skill demand. Goldin [2002] also finds a diminishing effect of the importance of gender in employment across occupations, but these studies are not able to explain the break in the gender wage gap since the mid-1990s.[6] Two recent papers (Xenogiani [2002] and Fortin [2004]) seek to relate women's labor-market outcomes to people skills, although neither considers racial differences in outcomes.

By contrast, Figure I shows that the racial wage gap closes by 20 percentage points between 1964 and the late 1970s, which is often attributed to the Civil Rights Act of 1964,[7] but is essentially flat from then until 2003. The employment of blacks fluctuated moderately over the period, increasing somewhat during the 1980s and by more in later years as shown in Figure II.[8] Juhn, Murphy and Pierce [1991], Bound and Freeman [1992], and Smith [1993] all analyze the stagnation in wages in great detail.[9] Using information from the CPS, Bound and Freeman [1992] look at the relative labor-market position of young black men. Their findings suggest that

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(Goldin [1990], Blau and Ferber [1992], and Brown and Corcoran [1997]).

[6] A number of recent studies have linked changes in the gender wage gap to changes in male wage inequality (e.g., Juhn and Kim [1999], Fortin and Lemieux [2000], and Welch [2000]).

[7] For example, Freeman [1973], Smith and Welch [1977; 1984], Brown [1984], Card and Krueger [1993], and Collins [2001] address the timing of the improvements in black workers' relative earnings. Using a variety of research strategies and data sources, they all find evidence consistent with a break in labor-market variables, such as relative employment and wages, in favor of blacks. The improvement in relative school quality in segregated states in the first half of the 20th century is also seen as a source of falling racial wage gaps since the 1960s. For example, Donohue, Heckman and Todd [2002] address the racial wage gap in the period 1910-1960 and find considerable convergence in wages for cohorts born since the late 1930s, which they attribute to increases in schooling quality in the Southern States. Card and Krueger's [1992] findings are consistent with improvements in the relative quality of black schools in the first half of the 20th century. Their estimates suggest that improved quality of schooling is able to explain about 20 percent of the narrowing of the racial wage gap in the period 1960-1980.

[8] There are a number of papers that have studied selection bias in estimating black-white wage gaps. Using U.S. Census data Chandra [2000] reports that labor-market participation among prime-aged black men was considerably lower than the labor-market participation of white men in the period 1940-1990. Neal [2004] measures the black-white wage gap among women using a variety of U.S. data sources and finds that different reasons for non-participation between black women (often single mothers) and white women (often receiving support from a high-earning spouse) have led to a downward bias in the measured black-white wage gap. A recent paper by Chandra [2003] is concerned with the efficacy of the Civil Rights Act and the development of the racial wage gap in the period thereafter (see also Heckman, Lyons and Todd [2000]). His estimates suggest that selection bias plays a considerable role in understanding racial wage gaps (Donohue and Heckman [1991] provide a review of the effects of the Civil Rights Act on racial differences in the U.S. labor market).

[9] See e.g., Smith and Welch [1989], Jaynes [1990] and Heckman and Donohue [1991] for overviews of the labor-

increases in the racial wage gap seem to originate from different sources than the overall trend towards increasing wage inequality since the early 1980s. In particular, they attribute the worsening of black labor-market prospects to a variety of sources, which are different for different educational and geographical groups. Among the most prominent sources are the decreased emphasis on affirmative action during the Reagan administration, the decline of inner cities, the shift from manufacturing to services, the decline in union density, and the fall in real minimum wages, which hit young black workers hardest. Cutler and Glaeser [1997] add to this that the increased segregation of blacks worsens their economic and schooling performance, particularly if they live in central cities.[10] Juhn, Murphy and Pierce [1991], and Smith [1993] attribute the slowdown in the closing of the racial wage gap to slowing education gains, the sharp rise in returns to education in favor of white prime-aged workers, and falling wages at the bottom end of the labor market which hurt low-educated black men severely.[11]

As indicated, these simple patterns of wages and employment of underrepresented groups are known in the literature and a variety of explanations have been provided for them, but we are not aware of a unified explanation. Unlike most research, which has focused on changes in wages, we focus on the change in labor demand for women and blacks. To estimate trends in the demand for women and blacks, we assume a constant elasticity of substitution (CES) aggregate production function and impute the demand series in employment terms as

$$D = \ln\left(\frac{w_G}{w_{\sim G}}\right) + \varepsilon \ln\left(\frac{e_G}{e_{\sim G}}\right), \tag{1}$$

where $w_G$ ($e_G$) and $w_{\sim G}$ ($e_{\sim G}$) denote the wages (employment) of people in group *G* or other groups ~*G*. We apply elasticities of substitution of 1, 1.75, and 2.5.[12] The imputed demand series

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market position of blacks in the United States.

[10] Cutler, Glaeser and Vigdor [1999] find that over the 20th century segregation between blacks and whites has varied over time. They find evidence that the mechanism sustaining segregation has changed from excluding blacks from neighborhoods (mid-century) to decentralized racism, where whites pay more than blacks to live in predominantly white areas (1990s).

[11] See also Juhn [1992]. Neal and Johnson [1996] suggest that racial discrepancies in basic skills due to differences in education and family background are also important factors in explaining the slowdown in the convergence of the racial wage gap. Card and Lemieux [1994] find mixed results for the return to skill. Among females the racial wage gap widened in the early 1980s. For men wage gap declined between 1979 and 1985, which is inconsistent with the rise in the return for skills.

[12] We motivate our use of these values for the elasticities of substitution as follows. Weinberg [2000] estimates an elasticity of substitution between men and women of 2.4. We have estimated the elasticity of the demand for blacks

for women is shown in Figure III: It is relatively flat until the late 1970s, rises rapidly until 1992 and then flattens out again. Figure IV for blacks shows a substantial increase until the late 1970s and a more gradual increase thereafter. There is some indication of acceleration in the demand for black workers in the 1990s. In both cases, the size of the imputed demand shift increases with the elasticity assumed in the years when wages for women and blacks were increasing because higher elasticities place more weight on wage changes.

Panel A of Table I provides estimates of structural breaks in the series based on Bai [1997]. We reject the hypothesis of less than two breaks in the demand series for women at all elasticities. Bootstrapped confidence intervals indicate that the demand shift toward women accelerated between 1975 and 1977 (depending on the assumed elasticity) and decelerated in 1992. Taking into account the 95 percent confidence intervals for these break years, the breaks are estimated to be between 1973 and 1978, and 1991 and 1993. The confidence interval for the first break becomes smaller when the assumed elasticity is higher.

The demand shift toward blacks decelerated after 1977 or 1978. For elasticities up to 1.75 we find a second break in 1997, with the confidence interval for the year of the break ranging from 1993 to the end of the period.[13] When the elasticity equals 2.5 the demand series becomes unstable. We find a second break year in 1983, but when testing for more breaks, other significant breaks can be found too.

Figure V provides some evidence on the increase in the importance of people tasks in the labor market from 1971 to 2002. The estimates are averages of tasks in three-digit occupations from the 1977 Dictionary of Occupational Titles (DOT), which are weighted by the fraction of the workforce in each occupation (Appendix A1 provides details about the definition of people tasks). Thus, these figures give the trend in the importance of people tasks arising from shifts between three-digit occupations. Insofar as much of the shift in the importance of people skills occurs within occupation categories, this figure understates the full increase in the importance of people tasks. It is possible to compare within and between-occupation changes using data from Germany. In those data, we estimate that 95 percent of the increase in the importance of people

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using panel data on the nine Census divisions from 1963 to 2002, by regressing the log employment of blacks relative to non-blacks on the log wage of blacks relative to whites and division and time fixed effects. This regression yields an estimate for the elasticity of substitution of 1.027 with a standard error of .093.

[13] To guarantee a consistent estimation, break years in the first and last 5 years of the time series are excluded.

skills arises within occupations. Cross-region regressions of within-occupation changes in people tasks on between occupation changes yield a point estimate of 2.579 (standard error 1.234). Taking these estimates as indications of the relationship between within and between occupation changes, the total increase in the importance of people tasks is likely to be at least 3.6 times between-change and potentially much larger. While caution is required in inferring the exact timing or magnitude of the increased importance of people skills, these patterns suggest that the importance of people tasks affects the labor markets of women and blacks, links we test directly below.

To provide some indication of types of jobs in which people tasks are important, Table A3 lists the 25 largest three-digit occupations in the United States and Table A4 lists the 10 largest two-digit occupations in Germany sorted by the importance of people tasks. Despite the differences between the countries and the differences in the classifications, in both countries people tasks are particularly important for nurses, teachers, sales workers, and secretaries. People tasks are relatively unimportant for machine operators and truck drivers. Table A5 lists the 10 occupations with the largest increases and decreases in the importance of people skills in the Germany between 1979 and 1991. Most, but not all, of the occupations with increases are the ones in which people skills were originally important. The ones with declines are those in which people tasks were not important. Thus, there is some accentuation in the variations in the importance of people skills.

Looking for breaks in the three series simultaneously (following Bai, Lumsdaine and Stock [1998]) we find breaks in 1977 and 1992.[14] Panel B of Table I provides estimates of the breaks in the series based on these break years.[15] The estimates indicate that if women's relative wages had remained constant over the period, firms would have increased their relative employment of women by between .9 percent and 2.8 percent more per year between 1977 and 1992 than in the years before 1977 and by 2.4 percent to 4.3 percent more per year than in the years after 1992. The deceleration in the shift in demand toward blacks would lead their relative employment to increase by 1.0 to 3.5 percent less per year after 1977 if their wages had remained constant over the entire period. After 1992 the demand increases by between 1.0 and 1.2 percent

[14] These estimates are based on elasticities of substitution of 1.75.
[15] Estimates based on break years one or two years before or after 1977 and 1993 provide similar findings, which shows the robustness of the results.

per year. Consistent with these findings, the indicator of people skills accelerates in 1977 and decelerates in 1992. We further investigate this link using micro data after providing a simple model of people skills in the labor market.

## III. A Simple Theory

This section presents a simple model to illustrate the labor market effects of people skills and provides some context for our empirical work. Workers' utility depends on their consumption, *c*, which equals their wage, and the importance of people tasks on their job, *x*, according to

$$u(c,x) = \ln(c) + \theta x .$$

We allow the importance of people tasks on a person's job to affect his utility under the assumption that people may derive utility from jobs where people tasks are more important.[16] Workers also are endowed with a level of people skills, *a*, which has a cumulative density of $F_a(a)$ and a probability density $f_a(a)$.

Firms each hire one worker and are characterized by the importance of people tasks. The cumulative density and probability density of people tasks across firms are given by $F_x(x)$ and $f_x(x)$ respectively. Firms' revenue (or net revenue excluding the cost of the worker) is given by $R(x,a)$. We assume that workers with more people skills raise revenue (or lower costs other than their wage by, for instance, negotiating better deals or being more pleasant to interact with) and that this effect is greater on jobs where people tasks are more important, so that $R_{xa}(x,a) > 0$. Firms' profits are given by

$$\pi(x,a) = R(x,a) - w(x,a),$$

where wages are allowed to depend on the importance of people tasks at the firm and the worker's people skills.

In equilibrium the workers with the most people skills will be employed at the firms

[16] While we ignore the possibility for simplicity that in a more general formulation the marginal utility of people tasks might be higher for people with more people skills.

where people tasks are most important. We test this implication by seeing if people with more people skills take jobs where people tasks are more important. The equilibrium assignment of firms to workers is $x^*(a) = (F_x)^{-1}(F_a(a))$ and the assignment of workers to firms is $a^*(x) \equiv (x^*)^{-1}(x) = (F_a)^{-1}(F_x(x))$).

In equilibrium, a worker with people skills *a* must be indifferent to changes in *x* in the neighborhood of $x^*(a)$, implying that

$$\frac{\partial U}{\partial x} = 0 \Rightarrow \frac{w_a(x^*(a), a)}{w(x^*(a), a)} = -\theta \leq 0 .$$

Thus, for a worker with a given level of people skills, jobs where people skills are more important will pay lower wages (at least weakly) because they are more desirable (at least weakly).

Similarly a firm where the importance of people tasks is *x* must be indifferent to changes in *a* in the neighborhood of $a^*(x)$, implying that

$$\frac{\partial \pi(x, a^*(x))}{\partial a} = 0 \Rightarrow w_a(x, a^*(x)) = R_a(x, a^*(x)) > 0 .$$

For any given firm, wages are higher for workers with more people skills because they generate more (net) revenue.

We explore our model's wage implications by regressing an individual's log wages on the importance of people tasks at his job and the interaction between people tasks and the person's level of people skills. Assuming some imperfections in the assignment process, increases in the importance of people skills should be associated with lower wages, while the interaction should be positive because people skills are more valuable in jobs where people tasks are more important.

The preceding results give the effect of changes in either people skills or people tasks on wages holding the other constant. The relationship between people skills and wages in the equilibrium assignment is

$$\frac{dw}{da}\left(x^*(a),a\right) = w_a\left(x^*(a),a\right) + w_x\left(x^*(a),a\right)\frac{dx}{da}$$
$$= w_a\left(x^*(a),a\right) + w_x\left(x^*(a),a\right)\frac{f_a(a)}{f_x\left(x^*(a)\right)}.$$

On the one hand people with more people skills earn more because they generate higher (net) revenue, as given by the first term. On the other hand, people with more people skills take jobs where people tasks are more important and these jobs pay less all else equal, which is reflected in the second term.

As indicated by the second equality, looking any place in the distribution of jobs and workers that are assigned in equilibrium, an increase in the density of jobs with a particular level of people tasks relative to people with the appropriate level of people skills leads jobs to span more workers and generates a more positive relationship between wages and people skills. We estimate how the increased importance of people tasks has affected the wages of underrepresented groups.

Technological change is likely to affect the importance of people tasks. On the one hand, new technologies may lead people to work on their own. On the other hand, they may place more emphasis on the aspects of jobs, such as people tasks, that cannot be automated effectively. New technologies may also shift production to more complicated processes that involve more group work. We estimate the effect of new technologies and work practices on the importance of people tasks.

## IV. Empirical Implementation

### *IV.A. Data Sources*

Our analysis requires measures of the importance of tasks performed in occupations and how these tasks change over time. As our main U.S. source we draw on information from the Fourth [1977] Edition and the Revised Fourth [1991] Edition of the U.S. Department of Labor's *Dictionary of Occupational Titles* (DOT).[17] Examiners from the U.S. Department of Labor used a

[17] The DOT has been updated four times since its first edition in 1939 [1949, 1965, 1977, and 1991]. However, the structure has not changed significantly during these revisions. The most recent revision has let to the Occupational Information Network (O*NET) a more up-to-date source of information, but impossible to append to earlier editions.

unified framework to assess 12,000 occupations along 44 objective and more subjective dimensions.[18]

We append DOT occupation characteristics to the Current Population Survey (CPS) March files to get a picture of the trends over a longer period, in this case 1971-2002, as shown in Figure V. Our main source of information is drawn form the Fourth [1977] Edition of the DOT because it contains more detailed information on job tasks than the Revised Fourth [1991] edition.

We also append the DOT to estimates of the demographic composition of occupations estimated from the 1980 and 1990 U.S. Censuses to investigate the effect of people skills on the employment shares of underrepresented groups. Details about the construction of the variables and the merging of databases can be found in the Data Appendix, particularly Sections A1 and A2.

To complement these analyses we draw on a number of other databases. First, for our U.S. analysis we use the National Longitudinal Survey of Youth of 1979 (NLSY79), which contains information on youth sociability. We investigate whether people who are more sociable when young are employed in occupations where people tasks are more important as adults using the DOT task measures.

We use the First [1997] and Second [2001] British Skills Survey (BSS) of the ESRC Centre on Skills, Knowledge and Organisational Performance (SKOPE) at Oxford to obtain information about job tasks in Britain. The BSS assesses the importance of 36 job activities and key skills, including people tasks, at two points in time for all jobs.[19] The BSS characterizes job requirements on a five-point scale, giving a more nuanced picture than the binary information in the DOT.[20]

We draw information from the 1970 British Cohort Study (BCS) to address personality

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[18] See the *Handbook for Analyzing Jobs* [U.S. Department of Labor 1972]. Other researchers have been using the DOT to analyze changing job requirements [Rumberger 1981], to address and compare different ways of skill measurement [Spenner 1990] or for the distinction between routine and non-routine job tasks in association with computerization [Autor, Levy and Murnane 2003].

[19] Ashton et al. [1998] provide a detailed overview of the design and present basic analyses of the BSS. Felstead, Gallie and Green [2002] provide an overview of the second BSS.

[20] A potential limitation of the BSS variables could be that since respondents have to rate their own occupation, the implicit scales they use could differ from person to person. There is evidence that self-assessment provides satisfactory results, however. Spenner [1990] presents evidence that there is a high correlation between self-reported job requirements and measures obtained from controlled experiments and expert evaluation, such as the DOT.

traits and social behavior. The BCS follows people born in the week of April 5, 1970. We apply information about sociability and personality at age 16 and relate this information to labor-market outcomes at age 30 in 2000. To compare current job tasks with sociability at younger ages we append information on the tasks performed in three-digit occupations estimated in the BSS to the BCS. Table A2 in the Data Appendix shows the definitions of the sociability variables in the BCS and the NLSY.

Finally, we use German data collected by the *Bundesinstitut für Berufsbildung* (BIBB) in Berlin and *Institut für Arbeitsmarkt- und Berufsforschung der Bundesanstalt für Arbe*it (IAB) in Nürnberg. This BIBB/IAB database is representative for the German population and contains worker surveys in 1979, 1985, 1991 and 1998, with information about a worker's job tasks. For consistency we only use West-German workers.[21] An advantage of the BIBB/IAB is that it contains four waves of data on job tasks over a relatively long period of time.

***IV.B. People Tasks***

To identify variables that best measure people tasks, we aggregated DOT job task information to a relevant subset using the definitions of job tasks provided in the 1977 questionnaire. To estimate the importance of people tasks we selected three variables from the DOT temperaments that measure adaptability requirements of workers in specific job-worker situations. These are (i) adaptability to situations involving the interpretation of feelings, ideas or facts in terms of personal viewpoint, (ii) adaptability to influencing people in their opinions, attitudes or judgments about ideas or things, and (iii) adaptability to dealing with people beyond giving and receiving instructions. The DOT provides a binary indicator of the presence or absence of a given temperament. We also include two variables from DOT interest factors to signify interests, tastes and preferences for certain kinds of activities that are entailed in job performance. These are (i) a preference for activities involving business contact with people, and (ii) a preference for working for the presumed good of people. The interests take on 3 values, –1, 0, or 1. We use the sum of these variables normalized by their standard deviations.[22]

For the BSS we measure the importance of people tasks by aggregating variables measuring the importance of dealing with people; working with a team of people; instructing,

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[21] See Spitz [2004] for a detailed description of these data.

[22] Autor, Levy and Murnane [2003] apply percentile measures of the DOT scores rather than "raw" DOT scores. Results are similar when we do so.

training or teaching people; making speeches or presentations; persuading or influencing others; selling a product; counseling, advising or caring for customers or clients; and listening carefully to colleagues. We selected three variables that are comparable to the DOT's general educational development (GED): reading, writing, and math. We also constructed job tasks on the occupational importance of planning job activities, knowledge about the organization and products, problem solving, noticing problems and (procedural) faults, and physical skills and work.

The BIBB/IAB contains binary indicators of job tasks. We measure people tasks as the weighted sum of teaching or training; negotiating, lobbying, coordinating and organizing; serving others; helping others; selling, buying, advising customers and advertising; and entertaining or presenting. To obtain a consistent series over time, we aggregated this information at the two-digit occupational level. Table A1 in the Data Appendix offers the definitions of people tasks in our three data sources.

## V. Empirical Results

### *V.A. Youth Sociability and Adult Occupations*

We begin by relating people's sociability as youths to the tasks in their adult occupations. Evidence that more sociable youths go into occupations where people skills are more important will validate our measures of people tasks and show that variations in people skills affect labor-market outcomes. How sociability as a youth is related to the importance of other tasks will depend on whether people skills complement other skills and whether people with good people skills are also endowed with more of other skills. If they do, people with stronger people skills tend to be in jobs where other tasks are more important.

We present two sets of estimates, the first are from the National Longitudinal Survey of Youth of 1979 (NLSY79). The 1984 wave of the NLSY79 contains data on the number of social clubs respondents participated in during high school. The 1985 survey contains data on contemporaneous sociability (when the respondents were 20-28 years old) and sociability at age six. Exploiting the panel aspect of the data, we regress the 1977 DOT scores for the respondents' occupations in all years on their responses to these questions (see Appendix A3 for details). Our models include random effects for respondents and dummy variables for calendar years.

Table II reports the estimates. The first rows show a large positive effect of the three measures of the respondents' sociability on the importance of people tasks in their occupations.

The later rows report the effect of the sociability variables on the importance of other skills. These models show that those who were more sociable when young are in occupations where cognitive tasks are more important. The figures in brackets give the portion of a standard deviation in the task variables that can be explained by a one standard deviation change in sociability. The relationship between sociability and cognitive tasks is much smaller than the relationship between sociability and people tasks, suggesting that sociability is particularly important in occupations where people tasks are important.

We perform a similar analysis using the BCS and BSS. Table III reports the regression results for the United Kingdom. The age 16 round of the BCS conducted in 1986 includes a variety of behavioral measures of sociability, including the frequency with which the respondents spent time with friends during the school year and during holidays; the frequency with which time is spent with friends during leisure time (as opposed to non-social leisure activity), and number of friends. The survey also asks the extent to which respondents describe themselves as outgoing. To obtain measures of the importance of tasks, we assigned to each three-digit occupation the mean of the importance of the tasks for that three-digit occupation calculated from the 2001 BSS (see Appendix A4 for details).

The first row of Table III shows that all of the indicators of social behavior are positively related to the importance of people tasks. The remaining rows report the relationship between the youth sociability measures and the importance of other tasks. With the exception of planning activities, which has an interactive component, there are no systematic relationships.

The finding that youth sociability is strongly related to the importance of people tasks in peoples' subsequent occupations provides validation for our measures of the importance of people tasks. It also shows that the importance of people tasks and the ability to perform those tasks are important determinants of occupation choice.

***V.B. Youth Sociability and Adult Wages***

The wage effects of people skills will vary across jobs. To address wage effects we relate wages in adulthood to the importance of people tasks in occupations and an interaction between the importance of people tasks and youth sociability using the NLSY79. Our model is

$$y_{it} = PTASKS_{it}^{O}\gamma + SOCIABILITY_i * PTASKS_{it}^{O}\beta + TASKS_{it}^{O}\theta + X_{it}\phi + \omega_t + \nu_i + \eta_{it}^{O} + \varepsilon_{it}.$$

Here, $y_{it}$ denotes the individual *i*'s log wage at time *t*; $PTASKS_{it}^{O}$ denotes the importance of

people tasks in *i*'s occupation at time *t* (from the 1977 DOT); and $SOCIABILITY_i$ denotes *i*'s sociability when young. The first parameter of interest is $\gamma$, which gives the direct effect of people tasks on wages. It is expected to be negative if jobs in which people skills are important are more desirable jobs. Also of interest is $\beta$, the effect of the importance of people tasks on the sociability premium. We expect $\beta > 0$, so that sociability is more beneficial in jobs where people tasks are important. In addition, the model includes measures of the importance of other tasks in *i*'s occupation at *t* ($TASKS_{it}^{O}$); time varying individual characteristics (a quadratic in experience and education, given by $X_{it}$); and time dummy variables ($\omega_t$). Individual fixed effects ($v_i$) are included to account for fixed differences in wages correlated with measures of people skills. Given that the data contain many observations for the same occupation, we include occupation random effects ($\eta_{it}^{O}$) as well as a classical error, $\varepsilon_{it}$.

Table IV reports the results. The estimates in first row show that occupations in which people tasks are more important pay lower wages. A one standard deviation increase in the importance of people tasks is associated with five percent lower wages. The second row shows that youth sociability is particularly beneficial in jobs where people skills are important. With individual fixed effects, the direct effect of sociability is unidentified. In models without individual fixed effects, a one standard deviation increase in sociability at age six, for instance, raises adult wages by one percent. Given the estimates in Table IV, a one standard deviation increase in the importance of people tasks comes close to doubling this effect.

Results for the United Kingdom, using 1970 BCS merged with the 2001 BSS, are reported in the bottom panel of Table IV. Because we only have cross-sectional data on labor-market outcomes in the BCS, the individual fixed effects, $v_i$, must be dropped from the model, and the time effects, $\omega_t$, are incorporated in the intercept. The estimate for social behavior during school term and holidays are insignificant, but the other three sets of estimates reported in columns (3-5) suggest that a one standard deviation increase in the importance of people tasks is associated with four to nine percent lower wages. The estimates in the second row show that sociability at age 16 pays more in jobs demanding people skills.

***V.C. Technological Change and the Importance of People Tasks***

Computers have changed the content of many jobs [e.g., Autor, Levy and Murnane 2003,

Borghans and ter Weel 2004, and Spitz 2006] and firms have adjusted their organizational structures to make the most of computer technology, emphasizing teams and quality circles as well as skill [Caroli and Van Reenen 2001, Bresnahan, Brynjolfsson and Hitt 2002, and Ichniowski and Shaw 2003]. These changes require workers to communicate and work with others more effectively. In addition, computer technology substitutes for routine cognitive tasks, further increasing the importance of people skills, which are hard to computerize.

We estimate the effect of technological change and innovative work practices by relating the importance of people skills in occupations to the share of workers in that occupation using computers and to the share of workers working in teams and who are a part of quality circles. Data on computer use is available for Britain, Germany, and the United States. Data on teamwork and quality circles are only available for Britain (see Appendix A6 for details).

The top panel of Table V shows results for Britain, where the importance of people skills, computer use, and the extent of teamwork and quality circles are all estimated at the three-digit occupation level from the BSS. Columns (1)-(8) report cross-sectional estimates. These estimates (and those below) include controls for the gender and educational composition of the industries. Columns (9)-(12) use the two cross-sections to estimate changes, to account for differences in occupations, which may be correlated with technological and organizational change and with the importance of people tasks. When technological and organizational changes are included separately, all are found to have a significant positive relationship with the importance of people skills. Given the positive correlation between the three variables, estimates that include all three together yield lower coefficients, but the computer use and teamwork variables remain large and statistically significant. Panel estimates are moderately lower than cross-sectional estimates, but technological and organizational changes remain significant determinants of the importance of people tasks.

The middle panel reports results for Germany. We relate the importance of people tasks to computer use in two-digit occupations (variables for organizational change are not available). Columns (1) and (5) report cross-sectional estimates for the first and last years of the BIBB/IAB, 1979 and 1998. Column (9) pools data for all years and includes occupation and year fixed effects. We find a positive relationship between computer use and the importance of people skills. The panel estimates are noticeably smaller than the cross sectional estimates, but remain positive and significant.

The bottom panel of Table V reports estimates for the United States. Computer use is estimated from the 1984 and 1993 Supplements to the October CPS. The importance of people tasks in occupations is from the 1977 and 1991 DOT. Cross-sectional estimates of the relationship between 1984 computer use and the importance of people skills in the 1977 DOT in an occupation (reported in Column (1)) and between computer use in 1993 and 1991 DOT scores (reported in Column (5)) are large and statistically significant. Changes in DOT scores within occupations most likely understate true changes [National Academy of Sciences 1981], so it is unclear whether the weaker difference estimates reported in Column (9) indicate that the cross-sectional estimates are biased upward or if the differences model suffers from attenuation bias. Overall, our estimates suggest that technological and organizational changes are associated with an increased emphasis on people skills.

## VI. People Skills and Underrepresented Groups

This section studies the effect of people tasks in an occupation on the employment by gender, race, ethnicity, immigrant status, and English ability in that occupation. We study the effect of people tasks on the employment share of women in Britain, Germany, and the United States. We focus on the United States when looking at race, ethnicity, immigrant status, and language.

### *VI.A. Gender*

Women are underrepresented in many occupations, as reviewed in Section II. Women report being more effective in people tasks than men (Borghans, ter Weel, and Weinberg [2005]) and they report being members of more clubs in high school,[23] which is consistent with Gilligan's [2001] work on gender differences. Experimental studies also find that women are more likely to cooperate than men in playing prisoner's dilemmas (Frank, Gilovich and Regan [1993] and Ortmann and Tichy [1999]; Andreoni and Vesterlund [2001] find that women are more generous when it is costly). We therefore expect women to be more likely to enter jobs where people tasks are more important.

We regress women's relative employment in an occupation, defined as the log of women's employment relative to men's employment, on job tasks and covariates for the experience and education distribution of the occupation. Estimates based on this measure of

[23] Estimates from the NLSY79 show that after controlling for observed characteristics, women report being in .40

relative employment are directly comparable to estimates of the change in labor demand.

Table VI reports results for Britain. Data on women's relative employment and the importance of tasks are constructed from the 1997 and 2001 BSS. The first two columns report the means and standard deviations of the task variables. Cross-section estimates for 1997 (column 3) and 2001 (column 4) show that occupations where people skills are more important have higher relative employment of women. Women report that people tasks are more important on their jobs than men, so exogenous changes in women's employment will bias our estimates of the effect of people skills up. To account for this effect, we instrument for the change in the importance of all of the task variables by the change in the task variables among men. In addition to the point estimates, the table reports in brackets the effect of the increased importance of the various tasks between 1997 and 2001 on women's relative employment. To control for unobserved differences in women's employment that may correlate with the task variables, the last column reports results for the change in women's relative employment on the change in the task variables between 1997 and 2001. While many of the task variables become insignificant in this change regression, the importance of people tasks remains positive and statistically significant. The increased importance of people tasks over the four years from 1997 to 2001 is estimated to have raised women's relative employment by 10.3 percent. The bottom panel of the table shows that the demand for women increased by between 9.2 percent and 13.1 percent depending on the elasticity of substitution, so people skills are an important factor in the increase in demand for women.

Table VII reports analogous results for Germany. Data on women's relative employment and the importance of tasks are constructed from the 1979, 1985, 1992, and 1998 BIBB/IAB. Panel A reports the means and standard deviations of all tasks. Panel B reports regression estimates. In both random effects and fixed effects models, increases in the importance of people tasks are found to increase women's relative employment, with the choice of estimation method having little impact on the coefficient. The last set of results instrument for the change in the importance of all of the task variables by the change in the task variables among men. Given that we instrument for changes, the estimates are not statistically significant, but they are virtually identical to those estimated without the instrument. The increase in the importance of people

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more clubs than men (standard error of .03).

tasks over this period in Germany would have raised the demand for women by 28 percent, roughly half of the estimated increase in demand over this time period shown in the bottom panel of the table.

Table VIII reports results for the United States. Data on women's relative employment are constructed from the 1980 and 1990 Census Public Use Micro Samples. Data on the importance of tasks are drawn from the 1977 and 1991 DOT. Cross-sectional estimates for women's relative employment in 1980 on the importance of tasks as measured in the 1977 DOT indicate that occupations where people tasks are most important have higher relative employment of women.[24] The predicted effect of a one standard deviation change in the importance of people tasks is .506, one quarter of a standard deviation in women's relative employment across occupations. The DOT was revised in 1991, but as indicated, many of the variables used in our analysis were not updated. The next columns report regressions of changes in women's relative employment from 1980 to 1990 on changes in the DOT scores. While caution is required in interpreting these results, given the limitations of the 1991 DOT, it is noteworthy that the importance of people tasks is found to increase women's relative employment.

To provide a sense of the magnitudes of the effects, we estimate how acceleration in the importance of people tasks after 1977 and the deceleration after 1992 accelerated and then decelerated the demand shift toward women. These estimates equal the estimated effect of people tasks on women multiplied by the acceleration in 1977 and deceleration in 1992 in the importance of people tasks. Unfortunately, we only have reliable estimates of trends in the importance of people tasks arising from shifts between occupations. Analysis of the German data indicates that the total shift is likely to be between 3.6 and 20 times the between-occupation shift. As shown in the bottom panel of the table, when between occupation changes are assumed to account for 28 percent (=1/3.6) of the total change, the acceleration in the importance of people tasks implies an annual acceleration of between .5 and .9 percent in the demand for women after 1977 and a roughly similar annual deceleration after 1995. These estimates are large relative to the estimated annual acceleration in demand for women after 1977 of .9, 1.8, or 2.8 percent (based on elasticities of 1, 1.75, and 2.5, respectively) and annual deceleration after 1992 of 2.4,

[24] Estimates in both levels and differences for that instrument for the task variables using the task variables constructed for white men here and for the other groups described below are similar, but slightly lower than those estimated without instrumenting for the tasks.

3.4, or 4.3 percent.

***VI.B. Race and Ethnicity***

Racial and ethnic minorities may be less effective in people tasks with members of a majority culture or members of the majority culture may prefer not to interact with minorities. We test these hypotheses by estimating how the relative employment of racial and ethnic minorities in an occupation is affected by the importance of people tasks in that occupation. As with women, our measure of relative employment is the natural logarithm of the employment of a group relative to the employment of all other groups. We use data from the United States because racial and ethnic differences are more salient in the United States and because the Census Public Use Micro Samples are considerably larger than the other data sets, which is particularly important when constructing the employment of small groups in three-digit occupations.

Columns (3) and (4) of Table VIII report estimates for the relative employment of blacks. The importance of people tasks is a major determinant of the share of an occupation that is black. Estimates based on changes between 1980 and 1990 exceed estimates for the 1980 cross section, although the difference is not statistically significant. A one standard deviation increase in the importance of people skills lowers the percentage black workers by 21 percent, compared to a standard deviation in black relative employment of 79 percent.

The bottom panel of the table reports the deceleration in the demand for blacks after 1977 and the acceleration after 1992 based on the acceleration and deceleration in the increase in the importance of people tasks. Assuming that 28 percent of the increase in people tasks arises from shifts between occupations implies an annual deceleration in the demand for blacks of between .3 and .5 percent after 1977 and a slightly smaller acceleration after 1992. Again, these are a substantial portion of the estimated annual deceleration in demand for blacks of 1, 2.2, or 3.5 percent after 1977 and acceleration of between 1 and 1.2 percent after 1992 (based on elasticities of 1, 1.75, and 2.5 respectively).

The top panel of Table IX repeats the estimates for blacks and reports analogous estimates for the other race category (American Indians, Asians, Pacific Islander's, etc.) in column (2) and for Hispanics in (3). Occupations that place more weight on people tasks have lower employment shares for members of other racial groups, although there is no difference for Hispanics.

Wilson [1997] argues that employers and customers have particularly negative reactions

to black men. We have tested this hypothesis by regressing the relative employment of black men on the task measures. As reported in the bottom panel of Table IX, occupations where people tasks are more important have markedly lower employment of black men relative to other groups. A one standard deviation increase in the importance of people tasks lowers the relative employment of black men by 47 percent. Estimates for Hispanic men and other race men are comparable to those for black men. Thus, we find large negative effects of people tasks on the employment of men from underrepresented groups, although this effect is not limited to black men.

***VI.C. Immigrant Status and Language***

People with poor language skills will be at a comparative disadvantage in occupations that emphasize people tasks, especially if poor language skills are associated with less familiarity with a majority culture. The U.S. Census asks whether respondents "sometimes or always speak a language other than English at home" (Bureau of the Census [1993], B-24). The estimates presented in Column (1) of Table X show that the importance of people tasks raises the relative employment of people who do not speak a language other than English at home even after controlling for the importance of language, which has the expected sign. A one standard deviation increase in the importance of people tasks raises the relative employment of people who do not speak a language other than English at home by 11.4 percent, one quarter of a standard deviation.

People who report speaking a language other than English at home were asked about their ability to speak English. Column (2) reports the results of an analysis that takes as a dependent variable the natural logarithm of the employment of people who speak a language other than English at home whose English speaking ability is very good (the highest category) relative to those whose English is not as good. The estimates show that a one standard deviation increase in the importance of people tasks raises the relative employment of people whose English is very good by 17.4 percent, a quarter of a standard deviation.[25]

Column (3) reports estimates from an analysis that takes the relative employment of foreign-born workers (those born outside of the United States or its territories) in an occupation

[25] This result is related to the results from the Census in Lazear [1999]. He has shown that the likelihood that an immigrant speaks English is inversely related to the proportion of the local population that speaks their native language. In addition, he argues that these people suffer welfare losses.

as the dependent variable. A one standard deviation increase in the importance of people tasks lowers the relative employment of immigrants by 8.4 percent, 15 percent of a standard deviation.

Taken together, these estimates suggest that increases in the importance of people tasks in an occupation affect the employment of underrepresented groups in that occupation. As people tasks become more important the relative employment of women and people with good English skills increases, but that of racial and ethnic minorities and immigrants declines. The effects of people tasks on these variables are generally much larger and statistically stronger than the effects of other tasks and skills, which are often only of minor importance.

## VII. Conclusion

Despite informal arguments that people skills are important for understanding individual outcomes and are becoming more important, economists have done little to analyze their economic consequences. This paper provides a first step in this direction, developing a unified model to understand the labor-market consequences of people skills and demonstrating the relationship between people skills and labor-market outcomes.

We test our model's implications using a range of data sources from the United States, Britain, and Germany and find that sociability at young ages is positively correlated with the importance of people tasks in a worker's adult occupation. We also find that computerization and modern forms of work organization complement the importance of people tasks. With respect to labor-market outcomes of underrepresented groups our results suggest that occupations in which people tasks are more important employ more women relative to men, but fewer racial, ethnic, and linguistic minorities and fewer immigrants.

Finally, our results shed new light on changes in the labor-market outcomes of underrepresented groups in the United States over the last four decades. We have shown that the large increase in the importance of people tasks at work from the late 1970s to the early 1990s helps to explain the rapid decline in the gender wage gap over this period. Similarly, the slowing convergence of the gender wage gap since the mid-1990s, seems to be consistent with a slowdown in the growth rate of the importance of people tasks. Our estimates are also consistent with the opposite trends in the black-white wage gap.

## Data Appendix

### *A.1. Constructing Job Task Measures Over Time*

Our main source of information on job tasks in the United States is the Fourth [1977] version of the Dictionary of Occupational Titles (DOT). We merge information on job tasks from the DOT into the March CPS and 1980 and 1990 Censuses. Since the occupation classification in the DOT is much more detailed than the U.S. Census classification employed in the CPS, we aggregated scores in the April 1971 CPS data set to the classification used in the CPS. To do this we use the CPS April 1971 data – constructed by the Committee on Occupational Classification and Analysis of the National Academy of Science [1981] – in which all occupations are classified according to the Census 1970 and the DOT classification.

The occupation classification in the CPS is changed every ten years based on new classifications used in the U.S. Census. To bridge these changes we used a common classification for the 1960s and 1970s as developed by Autor, Levy and Murnane [2003] based on information from Priebe, Heinkel and Greene [1972]. Differences between the occupational classifications used in the 1970s and the 1980s in the CPS are too large to develop a sensible crosswalk. For that reason we matched our data with the so-called Treiman file. This file contains 122,141 observations from the 1980 Census that are dual coded with both the occupational classification for the CPS in the 1970s and the 1980s and aggregated the occupational scores separately for the 1980 classification. Based on a joint classification for the CPS in the 1980s and the 1990s developed by Autor, Katz and Krueger [1998] we put the CPS classification for both decades into one framework. Subsequently, we append the DOT information to the CPS.

To investigate changes in the scores for the occupations between the Fourth version from 1977 and the 1991 Fourth Revised Edition, we matched occupation characteristics from the Revised Edition from the data set of the U.S. Department of Labor, U.S. Employment Service, and the North Carolina Occupational Analysis Field Center [1994], using the conversion tables of code and title changes from the Fourth to Revised Fourth Edition Dictionary of Occupational Titles. Table A1 lists the specific variables used to measure the importance of people tasks in the DOT and in the other datasets described below.

### *A.2. Current Population Surveys*

We use all observations for workers, aged 18-64, to measure the importance of people tasks in the labor force, and took a sub-sample of full-time, full-year workers to calculate wages by gender, skill and occupation similar to the procedure followed by Katz and Murphy [1992]. To measure supply we weighted all observations by hours worked times weeks worked. For the years in the CPS for which the number of weeks worked are not known, we assumed that part year workers worked 50 percent of the year. People who worked full-time were assumed to work 40 hours per week. Wage results are based on full-time, full-year workers only. Top-coded wages have been multiplied by 1.4. We estimated wage equations for each year in the sample separately, including dummy variables for sex, race (black, other), a quartic in potential experience, dummy variables for individual levels schooling, and state dummy variables. The relative wage series for women and blacks reported are the estimated parameters for these groups in each year.

### *A.3. NLSY and Census*

We use data from the National Longitudinal Survey of Youth of 1979 (NLSY79) to estimate the effect of people skills on marriage, fertility, and labor-market outcomes. The 1984 wave of the NLSY79 contains data on the number of social clubs respondents participated in during high school. The 1985 survey contains data on sociability at age 6 and as an adult, when the respondents were 20-28 years old. Table A2 lists the specific variables we used to measure

sociability in the NLSY79 and in the other datasets discussed below. We estimate the relationship between these sociability variables and the tasks in adult occupations by assigning respondents the 1977 DOT scores associated with the three-digit occupation they hold. We also estimate the relationship between sociability and wages using the hourly rates of pay, which were converted to 1982-1990 dollars. Respondents with hourly rates of pay beneath $1 per hour or above $100 per hour were deleted from the sample. We exploit the panel aspects of the NLYS79 by using data for all years for which wages are reported. The NLSY79 is attractive because it contains a wealth of information about individuals, including parents' education, the respondents' score on the Armed Forces Qualifying Test, and characteristics of the household in which the respondent was raised.

We use the five percent Public Use Micro Samples of the 1980 and 1990 Census to estimate the share of workers in each three-digit occupation who are black; other race (American Indians, Asians, Pacific Islander's, etc.); from a Hispanic background; who speak a language other than English at home; whose English is very good (the highest category) conditional on speaking a language other than English at home; and who were born outside of the United States and its territories. The sample was restricted to people who held a job at the time of the survey between 18 and 65, who were not enrolled in school. All observations with imputed values for any variable used in the analysis were deleted. Individuals were weighted using the person weight. These measures of the demographic composition of each occupation were then merged to measures of task importance from the 1977 DOT.

### *A.4. BSS and BCS*

The First [1997] and Second [2001] British Skills Surveys (BSS) are two cross-sections of a representative sample of the British population. The ESRC Centre on Skills, Knowledge and Organisational Performance (SKOPE) initiated the first edition of the BSS in 1997 aimed at "investigating the skills used at work in Britain … [and] to collect data from individual job-holders on a rich array of variables characterizing British jobs. The intention is that the survey generates a more valid and detailed picture of skills than is normally available from examining individuals' qualifications or their occupations" [Ashton et al. 1998, 5]. The most innovative feature of the data is that it is derived from a combination of job analysis principles and procedures with the conventional techniques of a representative survey. The second BSS is an update of the first and its structure was little altered. A sample of 2,467 jobholders was interviewed face-to-face for the 1997 survey. The 2001 survey includes 4,470 workers. The interviewers assess the importance of 36 job activities and key skills, including problem solving, noticing mistakes, mathematical ability, reading and writing, physical skills, the ability to plan activities, knowledge about products and the workplace and people tasks. We construct nine job task categories out of these detailed job tasks (see e.g., Table A1 in Section A.7).

The 1970 Birth Cohort Study (BCS) is similar to the earlier National Child Development Study (NCDS) and began as the British Birth Survey, which includes over 17,000 babies born in Britain in the week 5-11 April 1970.[26] Four major follow up surveys in 1975, 1980, 1986, and 1996 monitor the health, education, social and economic circumstances of the surviving cohort members. We focus on the sociability questions asked in 1986 when the cohort members were 16 years old. The latest major survey was held in 2000 and reviews the members' labor-market status at the age of 30. We selected those cohort members that were in paid work and not self

[26] We use the BCS instead of the earlier NCDS because the NCDS does not contain measures of sociability.

employed in 2000.The average (standard deviation) gross hourly wage is GB£ 7.43 (9.25) in 1997 and increases to GB£ 9.75 (10.95) in 2001.

For some of the empirical analysis we have aggregated the individual data into three-digit 1990 U.K. Standard Occupational Classification (SOC90) codes, of which there are 371.[27] We use all observations for non-self employed workers. For the BSS we selected workers aged 20-60.

In the analysis carried out in Section V.A we appended the 2001 BSS to the 2000 BCS, acknowledging the one-year difference between the two surveys. To do so, we assigned the mean importance of the nine job tasks by occupation from the BSS to each individual cohort member in the BCS working in that occupation. We then estimated the effects of sociability at age 16 on the importance of job tasks. We also estimated the returns to sociability by using log hourly wages from the 2000 BCS. Using log hourly wages from the BSS, adjusted for age, yields qualitatively similar results. Table A2 presents the definitions and some descriptive statistics of our constructs of sociability.

***A.5. BIBB/IAB***

The data collected by the *Bundesinstitut für Berufsbildung* (BIBB) in Berlin and *Institut für Arbeitsmarkt- und Berufsforschung der Bundesanstalt für Arbe*it (IAB) in Nürnberg are representative surveys of the German workforce. This BIBB/IAB database contains four cross-sectional worker surveys conducted in 1979, 1985, 1991 and 1998. The surveys contain standard demographic and labor-market variables and rich information about workers' jobs, job attributes, the tools used in these jobs, the skills necessary to perform a job, and how these skills were obtained. The sampling frame for the survey is the employed German population age 16 to 65. Each survey has about 30,000 respondents. We use the largest sample possible, only removing workers from former East Germany included in the survey since 1991, and the self-employed and unemployed. The questions in the three surveys are similar but not exactly comparable.

To compare occupations across the surveys, we aggregated the data into consistent occupations at the two-digit level. Because of changes in the German occupational classification it is impossible to match the data at a more disaggregated level. All four waves are categorized according to the 1988 German occupational classification, which yields 83 occupations in all four years.

***A.6. Computerization, Organizational Change and Teamwork***

Data on computer use at work in the United States is in the School Enrollment Supplements to the 1984, 1989, 1993, and 1997 October CPS. Individual computer use is calculated as the fraction of currently employed workers who answered yes to the question, "Do you use a computer directly at work?" The survey defines a computer as a desktop terminal or PC with keyboard and monitor and does not include an electronic cash register or a hand-held data-device. 60,396, 58,401, 59,710, and 52,753 observations were used to calculate these frequencies in 1984, 1989, 1993, and 1997, respectively. Since our DOT variables reflect the period 1977-1991, we only use the 1984 and 1993 surveys. When we substitute the 1984-1997 change in computer use the results are qualitatively similar but of a slightly higher magnitude. From this

[27] For Britain samples of the Standard Occupational Classification 1990 (SOC90) are available. The SOC90 was published to replace both the Classification of Occupations 1980 (CO80) and the Classification of Occupations and Dictionary of Occupational Titles (CODOT). The SOC90 includes nine major groups divided into 22 sub-major groups of occupations. These 22 groups can be divided into 371 unit groups, which we define as occupations. These unit groups are the aggregate results of over 26,000 job titles.

constructed variable computer use in the United States increases from 26.1 percent in 1984 to 54.0 percent in 1997.

For Germany the questions on computer use differ slightly between 1979 and the later waves. For the 1979 survey we combine answers to two questions. The first asked about the use of "computers, terminals, or monitors," the second inquired about word processors. In the later surveys there are six categories – computers on shop floors, office computers, PCs, terminals, word processors, and CAD systems – which we combine into one dummy variable. Using this procedure, computer use in Germany increases from 5.6 percent in 1979 to 53.7 percent in1998.

To compute computer use in Britain we use responses to "How important is using a computer or computerized equipment in your job?" in the two waves of the BSS. If the answer is essential, very important, or slightly important computer use is equal to one. If the answer is does not apply, computer use is equal to zero. This yields computer use in Britain equal to 69.2 percent in 1997 and 78.1 percent in 2001. When we use the more gradual scale instead of a dummy variable, the regression results remain similar in qualitative terms, although the significance drops somewhat. The information about the organization of work in teams is taken from the question "How important is working in a team of workers?" We use the five possible answer categories as the independent variable in the regression analysis. Finally, organizational change is measured by the extent to which new organizational practices, such as quality circles, have been introduced in recent years.

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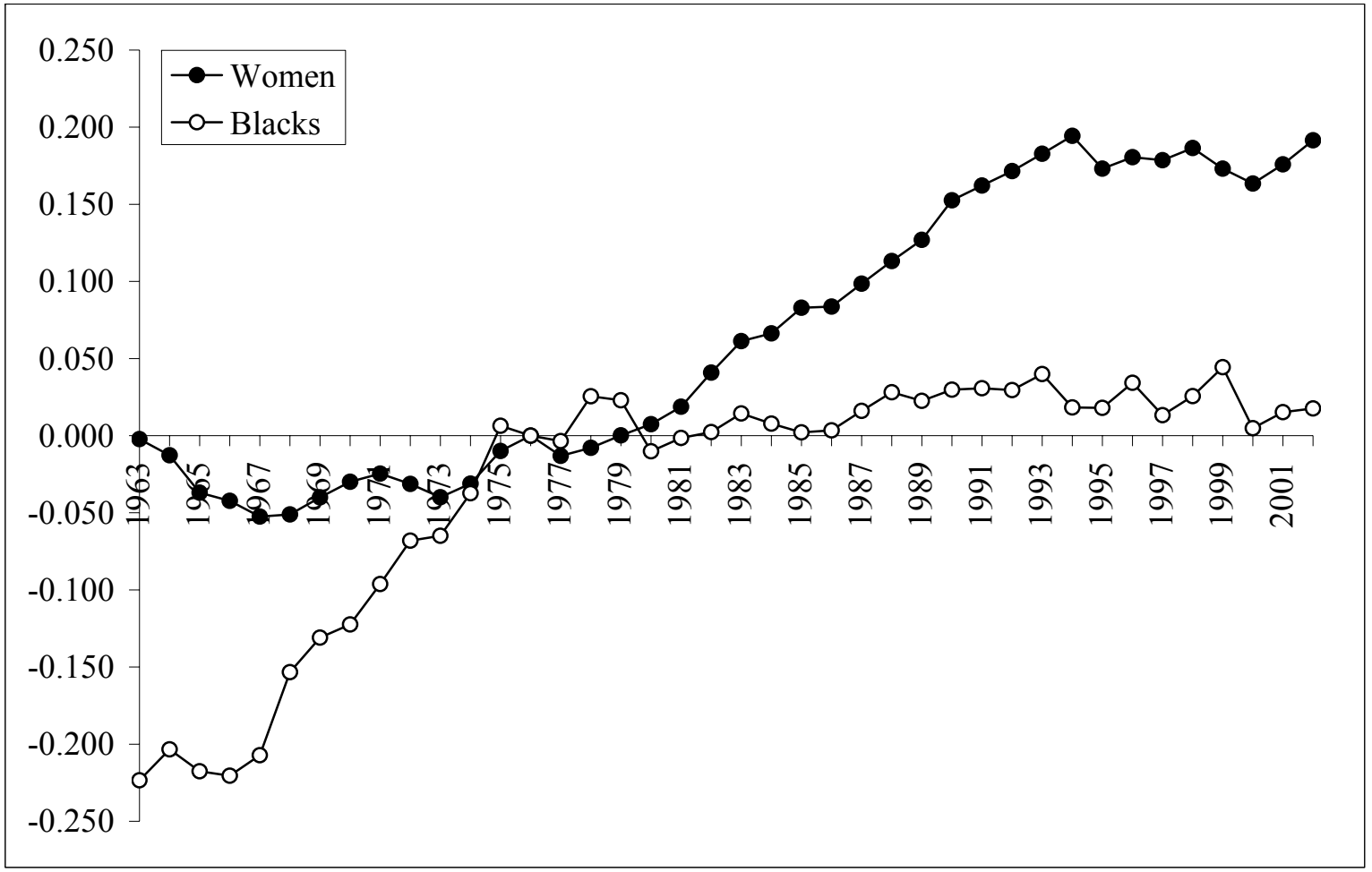
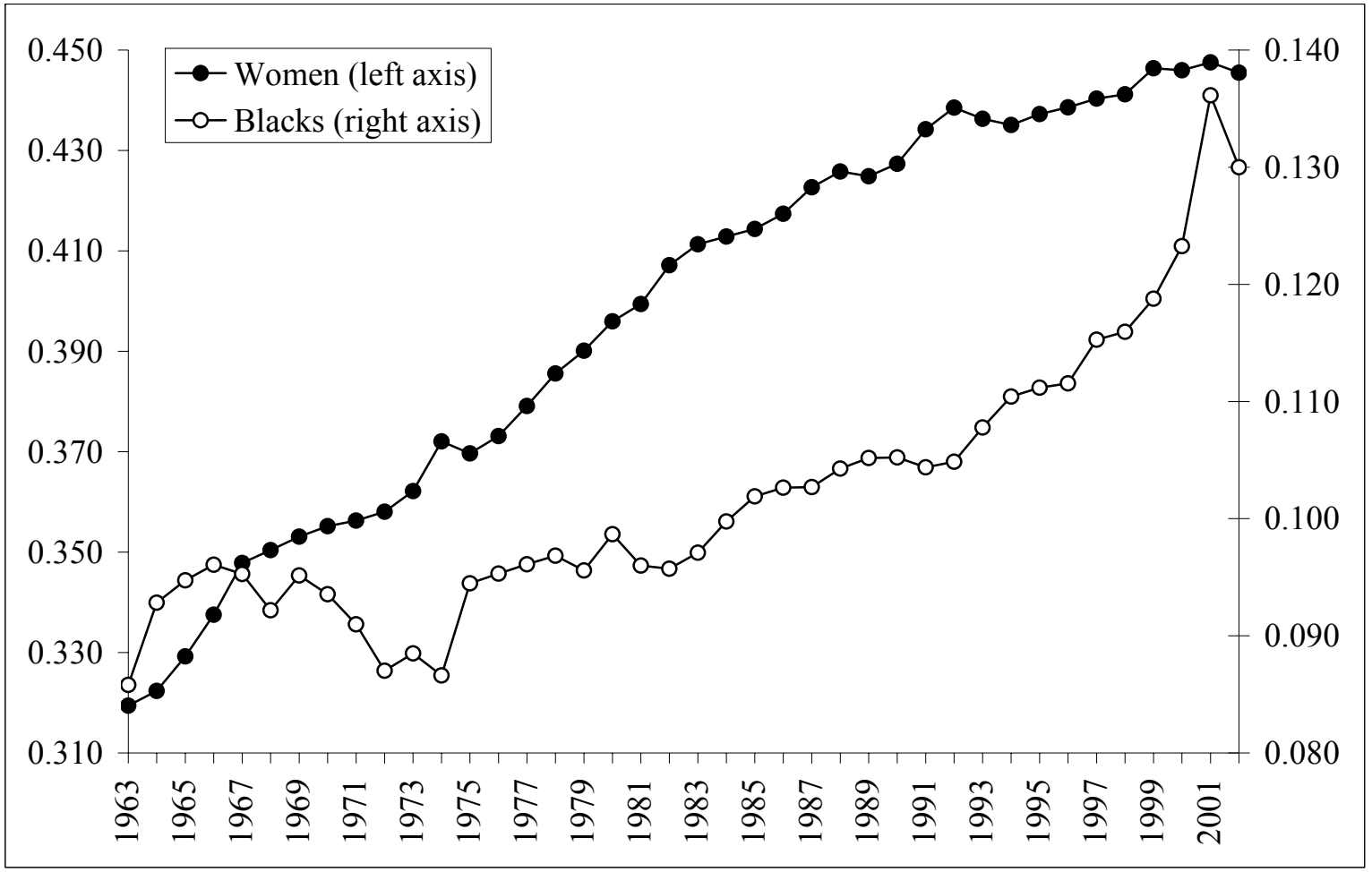
Figure I. Earnings of Women and Blacks, 1963-2002



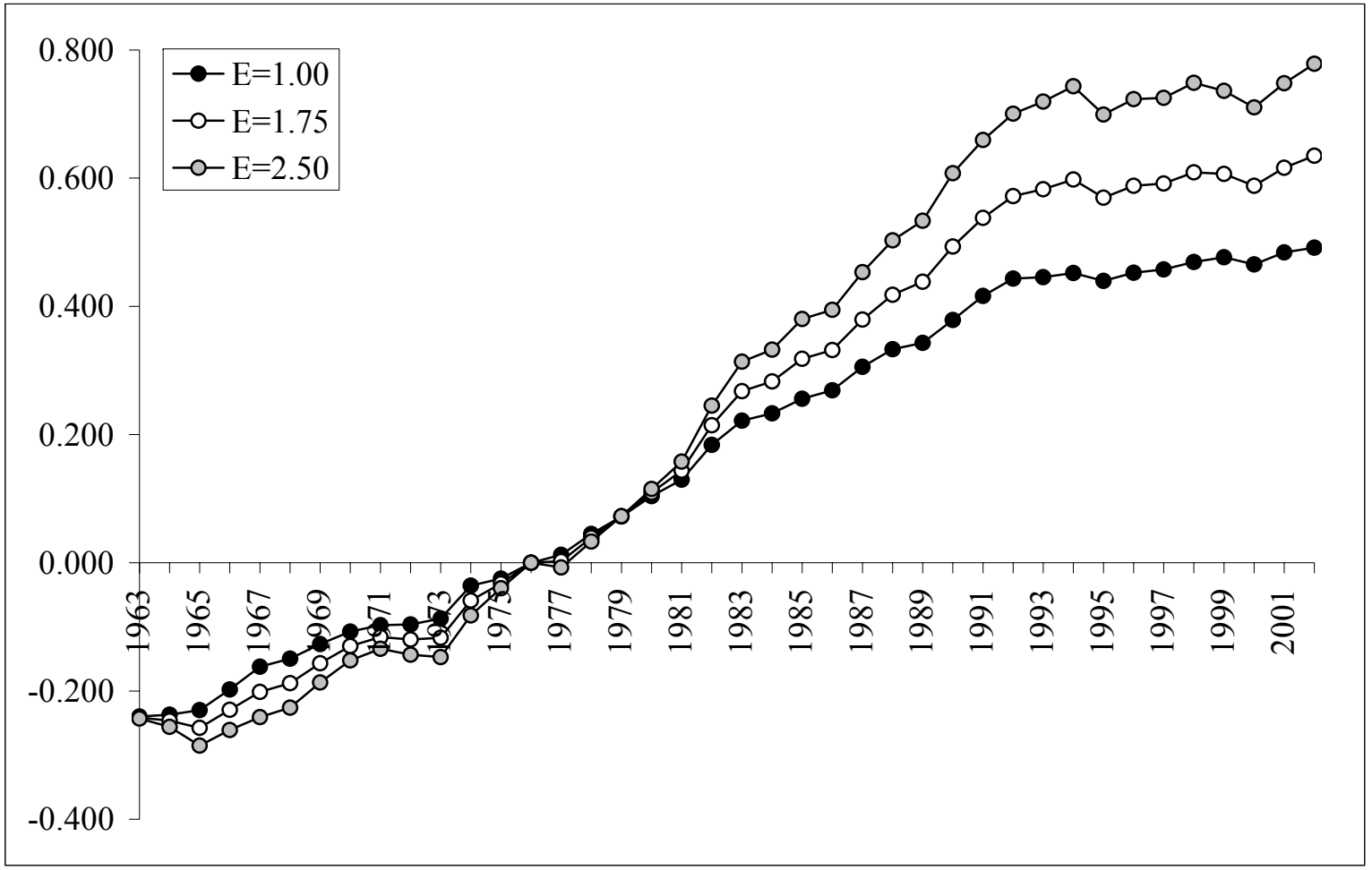

*Note*: Monthly earnings of women and blacks, working full-time, full year, from the CPS March supplements, regression adjusted for educational levels, experience (fourth order polynomial) and states (1976=0).

Figure II. Employment of Women and Blacks, 1963-2002



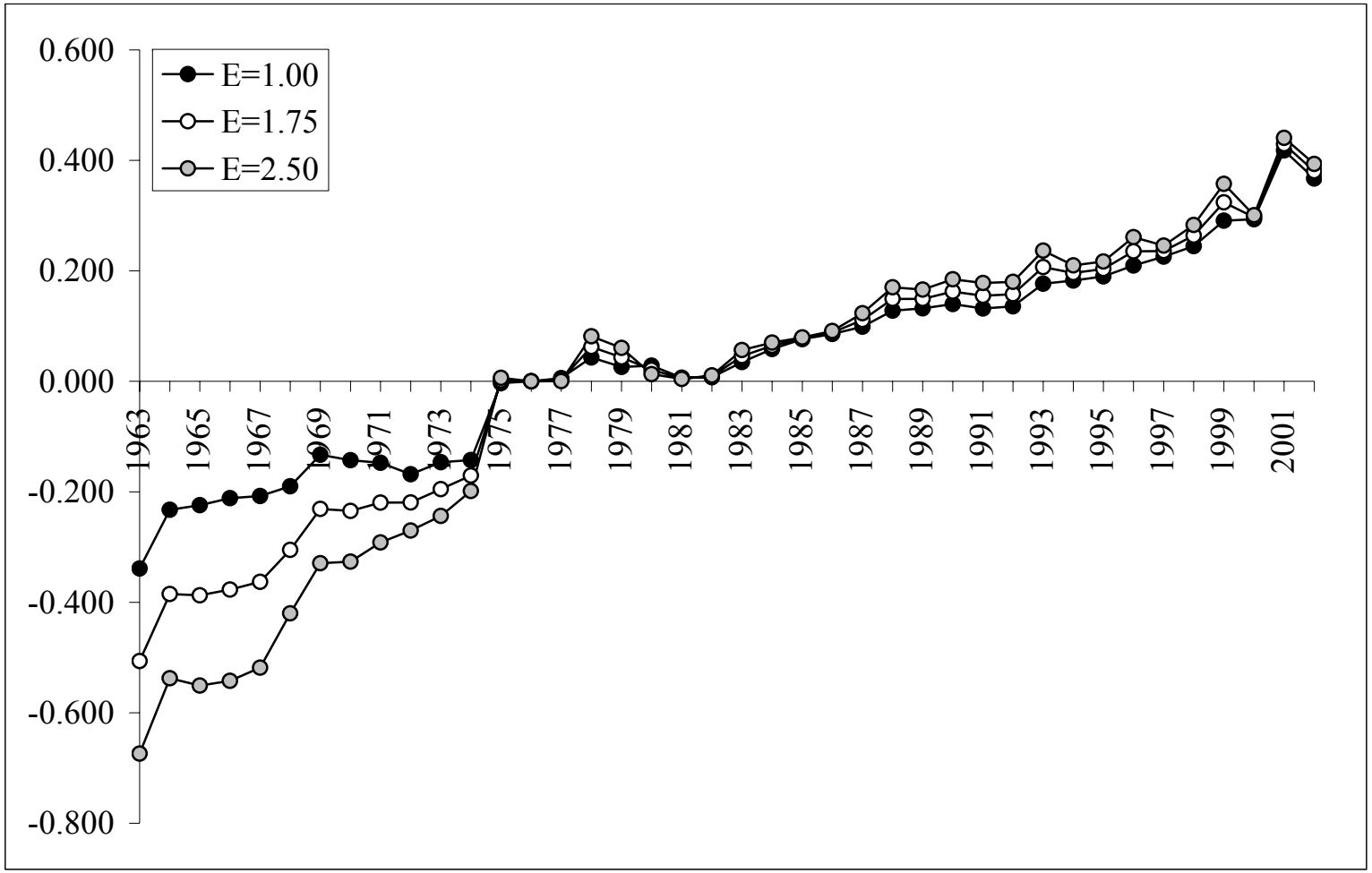

*Note*: Employment of women and blacks, weighted by their hours of work and weeks worked, from the CPS March supplements.

Figure III. CES Demand Indices for Women, 1963-2002



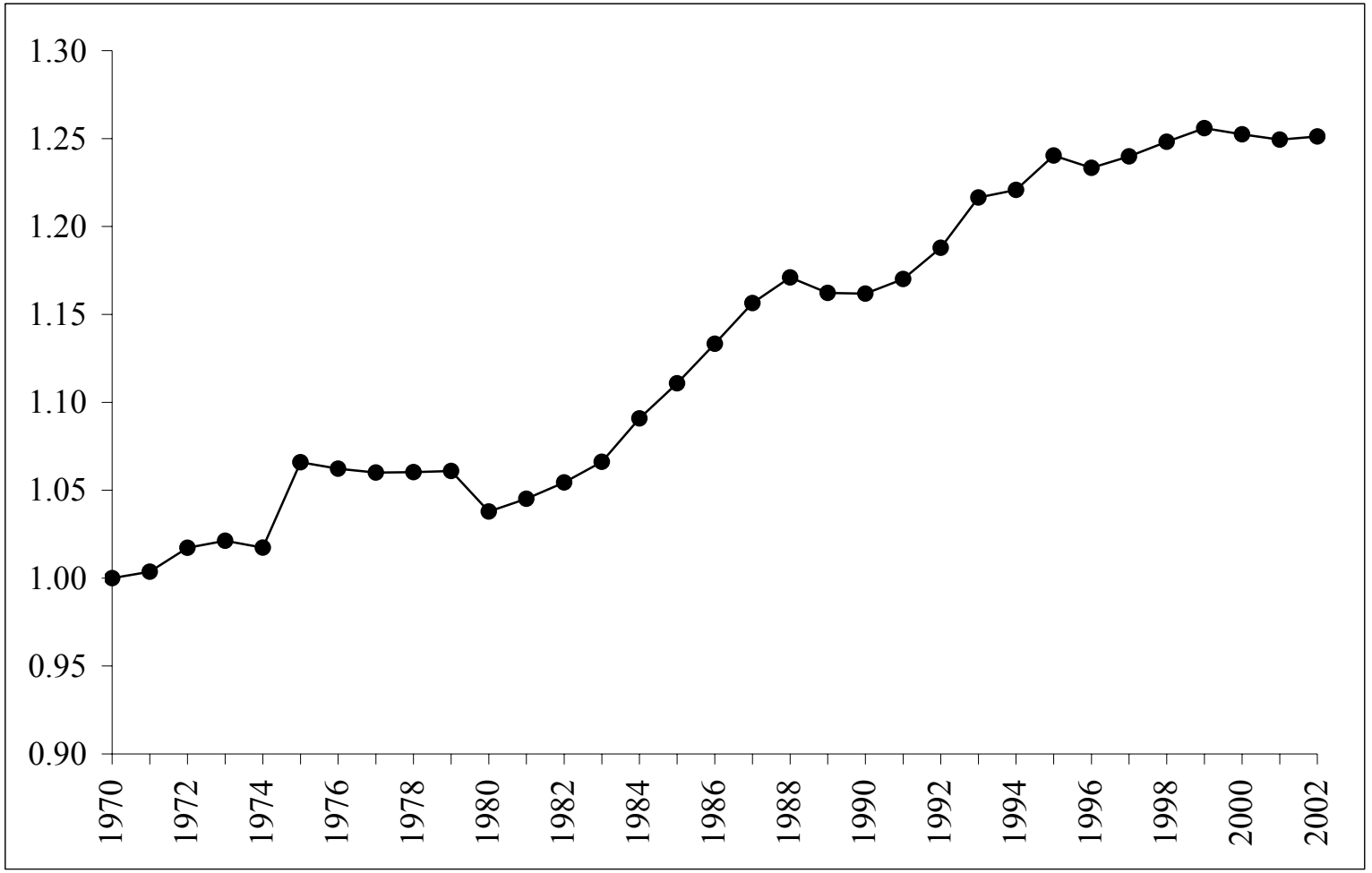

*Note*: Demand for women, based on demand = ln(fraction women/(1- fraction women)) + σ ln(wage), weighted by their hours of work and weeks worked, from the CPS March supplements (1976=0), for σ=1, σ=2.5, and σ=4.

Figure IV. CES Demand Indices for Blacks, 1963-2002




*Note*: Demand for blacks, based on demand = ln(fraction blacks/(1- fraction blacks)) + σ ln(wage), weighted by their hours of work and weeks worked, from the CPS March supplements (1976=0), for σ=1, σ=2.5, and σ=4.

Figure V. Importance of People Tasks, 1970-2002




*Note*: Figure V is constructed using 1977 DOT task measures by occupation paired to employment data from the CPS 1971-2003. All series are weighted by the size of the occupation. See the Data Appendix for the definition of the DOT task measures (1970=1).

Table I
Analysis of Breaks in Imputed Demand for Women and Blacks and in the Importance of People Tasks

| Panel A: Estimation of the Break Years | | | | | | | Panel B: Size of the Breaks Taking 1977 and 1992 as Break Years | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Elasticity | 1st Break | Confidence Interval | 2nd Break | Confidence Interval | $\chi$2-Test | P-Value | 1977 Change | St. Error | 1992 Change | St. Error |
| | | | | Women | | | | | | |
| 1 | 1975 | (1973, 1978) | 1992 | (1991, 1993) | 227.26 | 0.00 | 0.009 | (0.001) | -0.024 | (0.001) |
| 1.75 | 1976 | (1975, 1977) | 1992 | (1991, 1993) | 219.60 | 0.00 | 0.018 | (0.001) | -0.034 | (0.002) |
| 2.5 | 1977 | (1976, 1978) | 1992 | (1991, 1993) | 177.49 | 0.00 | 0.028 | (0.002) | -0.043 | (0.002) |
| | | | | Blacks | | | | | | |
| 1 | 1978 | (1972, 1989) | 1997 | (1993, -) | 12.27 | 0.00 | -0.010 | (0.003) | 0.012 | (0.003) |
| 1.75 | 1977 | (1973, 1981) | 1997 | (1983, -) | 43.03 | 0.00 | -0.023 | (0.003) | 0.011 | (0.004) |
| 2.5 | 1978 | (1969, 1979) | 1983 | (1967, 1996) | 88.23 | 0.00 | -0.035 | (0.003) | 0.010 | (0.004) |
| | | | | People Tasks | | | | | | |
| | 1981 | (1977, 1986) | 1994 | (1987, -) | 14.94 | 0.00 | 0.011 | (0.002) | -0.009 | (0.003) |

*Note*: Panel A reports years of breaks with five percent lower and upper bounds and tests for statistical significance of breaks when break years are estimated. Panel B provides estimates of the break coefficients when 1977 and 1992 are taken as break years, which are the years that are estimated to be the break years when breaks are estimated simultaneously for the three series.

Table II
The Relationship Between Sociability and the Importance of Job Tasks in Current Occupation in the United States
(Dependent Variables: Importance of Job Tasks)

| Dependent Variable | St.Dev. of Dep. Variable | Sociability at Age Six | | | Sociability in Early Adulthood | | | Clubs | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| People Tasks | 2.329 | 0.114 | (0.026) | [0.045] | 0.196 | (0.035) | [0.056] | 0.050 | (0.022) | [0.025] |
| Reasoning | 0.898 | 0.019 | (0.008) | [0.019] | 0.023 | (0.011) | [0.017] | 0.029 | (0.007) | [0.038] |
| Math | 1.003 | 0.009 | (0.009) | [0.008] | 0.016 | (0.013) | [0.011] | 0.020 | (0.008) | [0.023] |
| Language | 1.116 | 0.026 | (0.010) | [0.022] | 0.034 | (0.013) | [0.020] | 0.034 | (0.008) | [0.036] |
| Strength | 0.687 | -0.006 | (0.008) | [0.008] | -0.023 | (0.010) | [0.022] | -0.006 | (0.006) | [0.010] |
| Physical Tasks | 0.289 | -0.001 | (0.003) | [0.002] | -0.011 | (0.004) | [0.025] | -0.003 | (0.003) | [0.013] |
| Specific Training | 1.594 | 0.037 | (0.015) | [0.021] | 0.050 | (0.020) | [0.021] | 0.045 | (0.012) | [0.033] |

*Note*: All data taken from the NLSY79, except for the task measures in the current occupation. These are three-digit occupational averages merged from the 1977 Dictionary of Occupational Titles. All regressions are estimated by GLS and control for gender, education, a quadratic in experience, race, Hispanic background, the score on the Armed Forces Qualifying Test, mother's and father's education, and 3 year averages of family size and household income as a child. Standard errors are reported in parentheses. The predicted effects, reported in brackets, give the share of a standard deviation in the dependent variable explained by a one standard deviation change in the sociability variables. The definitions of the variables are provided in the Data Appendix in Table A1 and A2. All estimates based on 44,036 observations.

Table III
The Relationship Between Sociability at Age 16 and the Importance of Job Tasks in Current Occupation at Age 30 in Britain
(Dependent Variables: Importance of Job Tasks)

| Importance of Job Tasks in Current Job | St.Dev. of Dep. Variable | Behavioral Indicators at Age 16 | | | | |
|---|---|---|---|---|---|---|
| | | Social Behavior During School Term | Social Behavior During Holidays | Social Behavior During Leisure Time | Log of the Number of Friends | Self Description of Character: Outgoing |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| People Tasks | 0.492 | 0.005 (0.001) | 0.005 (0.001) | 0.006 (0.002) | 0.021 (0.012) | 0.017 (0.004) |
| | | [0.047] | [0.003] | [0.043] | [0.002] | [0.422] |
| Math | 0.596 | -0.000 (0.002) | 0.001 (0.002) | -0.005 (0.002) | -0.016 (0.018) | 0.001 (0.005) |
| | | [0.001] | [0.001] | [0.030] | [0.001] | [0.021] |
| Reading | 0.484 | -0.001 (0.001) | 0.001 (0.001) | 0.001 (0.001) | -0.014 (0.011) | 0.002 (0.003) |
| | | [0.010] | [0.001] | [0.007] | [0.001] | [0.025] |
| Writing | 0.590 | 0.001 (0.001) | 0.002 (0.001) | 0.003 (0.002) | -0.006 (0.013) | 0.006 (0.004) |
| | | [0.008] | [0.001] | [0.018] | [0.001] | [0.042] |
| Physical Strength and Stamina | 0.833 | 0.002 (0.002) | -0.001 (0.002) | 0.004 (0.003) | 0.052 (0.021) | -0.001 (0.006) |
| | | [0.011] | [0.001] | [0.017] | [0.006] | [0.088] |
| Problem Solving | 0.502 | -0.001 (0.001) | 0.001 (0.001) | 0.000 (0.002) | 0.005 (0.012) | -0.003 (0.003) |
| | | [0.009] | [0.001] | [0.000] | [0.000] | [0.024] |
| Noticing Mistakes | 0.311 | -0.001 (0.001) | -0.000 (0.001) | -0.001 (0.001) | -0.007 (0.008) | -0.003 (0.002) |
| | | [0.015] | [0.000] | [0.011] | [0.000] | [0.118] |
| Planning of Activities | 0.484 | 0.003 (0.001) | 0.005 (0.001) | 0.005 (0.002) | 0.024 (0.012) | 0.011 (0.003) |
| | | [0.029] | [0.003] | [0.036] | [0.002] | [0.076] |
| Knowledge of the Organization | 0.412 | -0.000 (0.001) | 0.001 (0.001) | -0.001 (0.001) | -0.025 (0.010) | -0.001 (0.003) |
| | | [0.001] | [0.000] | [0.009] | [0.002] | [0.327] |
| *n* | | 3,749 | 3,464 | 3,267 | 3,915 | 3,566 |

*Note*: All data taken from the British Cohort Study, except for the task measures in the current occupation. These are occupational averages merged from the British Skills Survey 2001. All regressions are OLS and control for gender, being married and level of education. The predicted effects, in squared brackets, give the share of a standard deviation in the dependent variable explained by a one standard deviation change in the sociability variables. The definitions of the variables are provided in the Data Appendix in Table A1 and A2.

Table IV
The Relationship Between Sociability and Log Wages in the United States and the United Kingdom
(Dependent Variable: Log Wages)

| United States | Sociability at Age Six | | Sociability in Early Adulthood | | Clubs in High School | |
|---|---|---|---|---|---|---|
| | (1) | | (2) | | (3) | |
| People Tasks | -0.021 | (0.003) | -0.020 | (0.005) | -0.018 | (0.002) |
| People Tasks * Sociability | 0.003 | (0.001) | 0.002 | (0.002) | 0.002 | (0.001) |
| *n* | 38,305 | | 38,305 | | 38,305 | |

| United Kingdom | Social Behavior During School Term | | Social Behavior During Holidays | | Social Behavior During Leisure Time | | Log of the Number of Friends | | Self Description of Character: Outgoing | |
|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | | (2) | | (3) | | (4) | | (5) | |
| People Tasks | -0.013 | (0.011) | -0.019 | (0.010) | -0.010 | (0.004) | -0.013 | (0.005) | -0.021 | (0.010) |
| People Tasks * Sociability | 0.004 | (0.003) | 0.005 | (0.003) | 0.004 | (0.002) | 0.005 | (0.001) | 0.003 | (0.001) |
| *n* | 3,749 | | 3,464 | | 3,267 | | 3,915 | | 3,566 | |

*Note*: United States: All data taken from the NLSY79, except for the task measures in the current occupation. These are occupational averages merged from the 1977 Dictionary of Occupational Titles. All regressions are estimated by including individual dummy variables, year dummy variables, education, a quadratic in experience and occupation random effects. United Kingdom: All data are taken from the BCS, except for the people tasks data, which are from the BSS. All regressions are estimated by including education, a gender dummy, a quadratic in experience, all other tasks from the BSS used in the analysis reported in Table III and occupation random effects. Standard errors are reported in parentheses. The definitions of the variables are provided in the Data Appendix in Table A1 and A2.

Table V
Computerization, Teamwork and Organizational Change Correlated to (Changes in) People Tasks
in Britain, Germany and the United States
(Dependent Variable: (Change in) People Tasks)

| | Cross-Section | | | | Cross-Section | | | | Changes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| **Britain** | 1997 | | | | 2001 | | | | Change 1997-2001 | | | |
| Computer Use | 0.895 | | | 0.664 | 0.772 | | | 0.398 | 0.674 | | | 0.474 |
| | (0.111) | | | (0.113) | (0.081) | | | (0.181) | (0.135) | | | (0.131) |
| Team Working | | 0.445 | | 0.363 | | 0.464 | | 0.273 | | 0.311 | | 0.264 |
| | | (0.051) | | (0.055) | | (0.047) | | (0.051) | | (0.042) | | (0.044) |
| Organizational Change | | | 0.476 | -0.243 | | | 1.215 | 0.694 | | | 0.248 | 0.111 |
| | | | (0.171) | (0.162) | | | (0.129) | (0.136) | | | (0.099) | (0.092) |
| $R^2$ | 0.306 | 0.325 | 0.171 | 0.385 | 0.408 | 0.459 | 0.448 | 0.540 | 0.178 | 0.178 | 0.025 | 0.220 |
| *n* | 294 | 294 | 294 | 294 | 324 | 324 | 324 | 324 | 264 | 264 | 264 | 264 |
| **Germany** | 1979 | | | | 1998 | | | | Change 1979-1998 | | | |
| Computer Use | 0.528 | | | | 0.501 | | | | 0.119 | | | |
| | (0.126) | | | | (0.138) | | | | (0.020) | | | |
| $R^2$ | 0.085 | | | | 0.185 | | | | 0.932 | | | |
| *n* | 87 | | | | 84 | | | | 338 | | | |
| **United States** | 1984 | | | | 1993 | | | | Change 1984-1993 | | | |
| Computer Use | 0.429 | | | | 0.600 | | | | 0.150 | | | |
| | (0.111) | | | | (0.080) | | | | (0.126) | | | |
| $R^2$ | 0.089 | | | | 0.238 | | | | 0.008 | | | |
| *n* | 431 | | | | 421 | | | | 391 | | | |

*Note*: All regressions are OLS and weighted by occupation size, except for the changes in Germany. These are estimated using a panel regression with time fixed effects and occupation fixed effects. All regressions include unreported covariates to control for education and gender. The inclusion of these covariates does not change the estimation results. The coefficients show the impact on the importance of people tasks. The regression results on the changes between 1997 and 2001 also use the changes in the independent variables. For Britain the data are taken from the 1997 and 2001 waves of the BSS. For Germany the Data come from the BIBB/IAB Database in 1979 and 1998. For the United States the people tasks data are taken from the 1977 and 1991 DOT and the information about computerization is taken from the 1984 and 1993 October Supplements to the Current Population Surveys. The data are merged using the same occupational classifications as constructed by Autor, Levy and Murnane [2003]. See the Data Appendix for the exact construction of the variables.

Table VI
Effect of Skills on Female Employment in Britain, 1997-2001

| | A. Means and Standard Deviations | | | | B. Regression Estimates | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1997 | | 2001 | | 1997 | | | 2001 | | | Change 1997-2001 | | |
| | (1) | | (2) | | (3) | | | (4) | | | (5) | | |
| People Tasks | 3.468 | (0.933) | 3.545 | (0.875) | 1.100 | (0.276) | [0.085] | 1.232 | (0.247) | [0.095] | 1.339 | (0.526) | [0.103] |
| Math | 2.753 | (1.291) | 3.130 | (1.108) | -0.177 | (0.130) | [-0.067] | 0.167 | (0.185) | [0.063] | 0.170 | (0.198) | [0.064] |
| Reading | 3.688 | (1.019) | 3.752 | (0.996) | 0.626 | (0.348) | [0.040] | 0.575 | (0.529) | [0.037] | -0.070 | (0.324) | [-0.004] |
| Writing | 3.304 | (1.064) | 3.374 | (1.066) | 0.449 | (0.284) | [0.031] | 0.079 | (0.471) | [0.006] | 0.186 | (0.284) | [0.013] |
| Physical Tasks | 2.807 | (1.213) | 2.893 | (1.197) | -0.083 | (0.120) | [-0.007] | 0.072 | (0.146) | [0.006] | 0.354 | (0.253) | [0.030] |
| Problem Solving | 3.578 | (1.133) | 3.683 | (1.000) | -0.577 | (0.299) | [-0.061] | 0.342 | (0.321) | [0.036] | 0.349 | (0.311) | [0.037] |
| Noticing Mistakes | 4.211 | (0.822) | 4.260 | (0.740) | -0.382 | (0.410) | [-0.019] | -0.897 | (0.451) | [-0.044] | -0.464 | (0.388) | [-0.023] |
| Planning | 3.587 | (1.004) | 3.701 | (0.943) | -1.116 | (0.319) | [-0.127] | -1.016 | (0.311) | [-0.116] | -0.598 | (0.641) | [-0.068] |
| Knowledge of Organization | 3.506 | (0.872) | 3.673 | (0.828) | 0.246 | (0.329) | [0.041] | -0.289 | (0.348) | [-0.048] | -0.871 | (0.623) | [-0.145] |
| $R^2$ | | | | | 0.240 | | | 0.163 | | | 0.089 | | |
| *n* | 2,463 | | 4,470 | | | | | | | | | | |
| Share of Female Workers | 0.472 | (0.499) | 0.479 | (0.500) | | | | | | | | | |
| | Change in the Share of Female Workers | | | | | | 0.066 | | | | | | |
| | Log Wage Change | | | | | | 0.026 | | | | | | |
| | Demand Shift, Elasticity of Substitution = 1 | | | | | | 0.092 | | | | | | |
| | Demand Shift, Elasticity of Substitution = 1.75 | | | | | | 0.112 | | | | | | |
| | Demand Shift, Elasticity of Substitution = 2.5 | | | | | | 0.131 | | | | | | |

*Note*: Panel A reports means and standard deviations (in parentheses) of skill variables. Panel B reports effects of skill variables on women's employment share. Observations are three-digit occupations. Numbers in brackets give the standard errors and the numbers in squared brackets the predicted effects of the change in the variable between 1997 and 2001. Regressions are estimated using 2SLS, with the importance of the job tasks instrumented by the importance of the job tasks among men.

Table VII
The Effects of Job Tasks on Female Relative Employment in Germany, 1979-1998

| | A. Means and Standard | | | | B. Regression Estimates | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1979 | | 1998 | | GLS - Random Effects | | | Within - Fixed Effects | | | IV, Within - Fixed Effects | | |
| | (1) | | (2) | | (3) | | | (4) | | | (5) | | |
| People Tasks | 0.077 | (0.058) | 0.465 | (0.164) | 1.126 | (0.136) | [0.437] | 0.715 | (0.412) | [0.278] | 0.700 | (0.488) | [0.272] |
| Analytic Skills | 0.043 | (0.057) | 0.160 | (0.112) | -0.089 | (0.137) | [-0.010] | 0.388 | (0.431) | [0.046] | 0.372 | (0.515) | [0.044] |
| Routine Cognitive | 0.369 | (0.253) | 0.209 | (0.200) | -0.115 | (0.041) | [0.018] | -0.079 | (0.120) | [0.013] | -0.082 | (0.132) | [0.013] |
| Routine Manual | 0.331 | (0.237) | 0.138 | (0.199) | 0.056 | (0.041) | [-0.011] | 0.058 | (0.115) | [-0.011] | 0.058 | (0.118) | [-0.011] |
| Non-Routine Manual | 0.156 | (0.181) | 0.156 | (0.221) | -0.232 | (0.063) | [0.000] | 0.160 | (0.208) | [0.000] | 0.160 | (0.219) | [0.000] |
| $R^2$ | | | | | .225 | | | .298 | | | .287 | | |
| *n* | 28,337 | | 25,739 | | 306 | | | 306 | | | | | 306 |
| Female Relative Emp. | -1.176 | (2.203) | -0.584 | (1.708) | Change in Share | | 0.592 | | | 0.592 | | | 0.592 |
| Women's Relative Wages | -0.175 | | -0.185 | | | | -0.010 | | | -0.010 | | | -0.010 |
| Change in Demand e=1 | | | | | | | 0.582 | | | 0.582 | | | 0.582 |
| Change in Demand e=1.75 | | | | | | | 0.575 | | | 0.575 | | | 0.575 |
| Change in Demand e=2.5 | | | | | | | 0.567 | | | 0.567 | | | 0.567 |

*Note*: Panel A reports means and standard deviations (in parentheses) of skill variables. Panel B reports effects of skill variables on women's employment share. Observations are two-digit occupations. Numbers in brackets give the predicted effects of the change in the variable between 1979 and 1998. The instrumental variables regressions are estimated by instrumenting for the importance of the job tasks by the importance of the job tasks among men.

Table VIII
The Effect of Job Tasks on Female and Black Employment in the United States, 1980-1990

| | Women | | | | | | Blacks | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1980 Cross section | | | 1980 to 1990 Change | | | 1980 Cross-Section | | | Changes 1980-1990 | | |
| | (1) | | | (2) | | | (3) | | | (4) | | |
| People Tasks | .219 | (.046) | [.506] | .116 | (.062) | [.267] | -.058 | (.015) | [-.135] | -.090 | (.040) | [-.208] |
| Reasoning | -.864 | (.443) | [-.757] | -.137 | (.159) | [-.120] | .266 | (.150) | [.233] | -.092 | (.102) | [-.081] |
| Mathematics | -.214 | (.205) | [-.200] | -.028 | (.093) | [-.026] | -.549 | (.069) | [-.513] | -.079 | (.059) | [-.074] |
| Language | 2.129 | (.272) | [2.279] | .269 | (.095) | [.288] | .047 | (.092) | [.050] | .172 | (.061) | [.185] |
| Strength | -.586 | (.169) | [-.416] | | | | .029 | (.057) | [.020] | | | |
| Physical Tasks | -2.166 | (.411) | [-.669] | | | | .169 | (.139) | [.052] | | | |
| Specific Skills | -.601 | (.121) | [-.955] | | | | -.204 | (.041) | [-.325] | | | |
| $R^2$ | | .499 | | | .144 | | | .503 | | | .119 | |
| *n* | | 484 | | | 483 | | | 482 | | | 478 | |

| | Annual Demand Shift Implied By Change in People Skills Based and Estimates (*100) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | In 1977 | In 1992 | In 1977 | In 1992 | In 1977 | In 1992 | In 1977 | In 1992 |
| Between Occupations | 0.241 | -0.197 | 0.127 | -0.104 | -0.064 | 0.052 | -0.099 | 0.081 |
| Total (Between is .5) | 0.482 | -0.395 | 0.255 | -0.208 | -0.128 | 0.105 | -0.198 | 0.162 |
| Total (Between is .28) | 0.861 | -0.705 | 0.455 | -0.372 | -0.321 | 0.262 | -0.495 | 0.405 |
| Total (Between is .1) | 2.411 | -1.973 | 1.273 | -1.041 | -0.642 | 0.525 | -0.990 | 0.810 |
| Total (Between is .05) | 4.822 | -3.945 | 2.545 | -2.083 | -1.283 | 1.050 | -1.979 | 1.619 |

*Note.* Lower panel gives the implied effect of breaks in the importance of people tasks, given by the estimated effect of people tasks on the employment of women or blacks multiplied by the change in trend increase in the importance of people tasks in 1982 or 1995. The total estimates multiple the breaks in the within trends under the assumption that the within trend breaks are the shown share of the total.

Table IX
The Effects of Job Tasks on Employment by Race and Ethnicity in the United States, 1980-1990

| Panel A: All | Blacks | | | Non-Whites, Non-Blacks | | | Hispanics | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | | | (2) | | | (3) | | |
| People Tasks | -0.090 | (0.040) | [-0.208] | -0.044 | (0.027) | [-0.103] | 0.008 | (0.055) | [0.018] |
| Reasoning | -0.092 | (0.102) | [-0.081] | -0.186 | (0.070) | [-0.163] | 0.060 | (0.141) | [0.053] |
| Mathematics | -0.079 | (0.059) | [-0.074] | 0.021 | (0.041) | [0.020] | -0.146 | (0.082) | [-0.137] |
| Language | 0.172 | (0.061) | [0.185] | 0.051 | (0.042) | [0.054] | -0.095 | (0.085) | [-0.101] |
| $R^2$ | .119 | | | .182 | | | .153 | | |
| *n* | 478 | | | 477 | | | 463 | | |
| Panel B: Men | Black Men | | | Non-White, Non-Black Men | | | Hispanic Men | | |
| People Tasks | -0.204 | (0.053) | [-0.471] | -0.263 | (0.045) | [-0.606] | -0.203 | (0.070) | [-0.470] |
| Reasoning | 0.146 | (0.134) | [0.128] | -0.186 | (0.114) | [-0.163] | 0.221 | (0.178) | [0.193] |
| Mathematics | 0.048 | (0.078) | [0.045] | 0.061 | (0.067) | [0.057] | -0.054 | (0.103) | [-0.050] |
| Language | -0.118 | (0.080) | [-0.126] | 0.110 | (0.069) | [0.117] | -0.138 | (0.106) | [-0.147] |
| $R^2$ | 0.048 | | | 0.216 | | | 0.051 | | |
| *n* | 467 | | | 474 | | | 450 | | |

*Note*: Estimates based on changes between 1980 and 1990. Standard errors are reported in parentheses. Predicted effects of a one standard deviation change in the variable in brackets.

Table A1
Definitions of People Tasks in the United States, Germany, and Britain

| Country | Data Source | Definition of People Tasks | Variable Construction | Mean (Standard Deviation) [Year] | |
|---|---|---|---|---|---|
| United States | Dictionary of Occupational Titles Fourth [1977] and Revised Fourth Edition [1991] | We use three variables from the DOT temperaments: (i) adaptability to situations involving the interpretation of feelings, ideas or facts in terms of personal viewpoint, (ii) adaptability to influencing people in their opinions, attitudes or judgments about ideas or things, and (iii) adaptability to dealing with people beyond giving and receiving instructions. Two variables from DOT interest factors to signify interests, tastes and preferences for certain kinds of activities that are entailed in job performance: (i) a preference for activities involving business contact with people, and (ii) a preference for working for the presumed good of people. | The presence or absence of a given temperament, rather than the level or degree required, is indicated. Temperaments are coded 0 or 1. The interests equal -1, 0, or 1. In constructing the measures we took the mean of the sum of the occupation score on these items. | .9274 [DOT '77 in 1977]<br>.9408 [DOT '91 in 1977] | 1.1499 [DOT '77 in 1991]<br>1.1788 [DOT '91 in 1991] |
| Germany | *Bundesinstitut für Berufsbildung* (BIBB) and *Institut für Arbeitsmarkt- und Berufsforschung der Bundesanstalt für Arbe*it (IAB) [1979, 1985, 1991, and 1998] | We use variables for whether the job involves negotiating, lobbying, coordinating and organizing; teaching or training; selling, buying, advising, or advertising; entertaining or presenting; serving and accommodating; and helping others | The variables are coded 0 or 1. We average across the responses to the questions and multiply by 100 | 9.272 (15.516) [1979] | 21.624 (31.087) [1998] |
| Britain | First [1997] and Second [2001] British Skills Survey | We use variables for the importance of dealing with people; working with a team of people; instructing, training or teaching people; making speeches or presentations; persuading or influencing others; selling a product; counseling, advising or caring for customers or clients; and listening carefully to colleagues | The variables range from 1 (not important) to 5 (essential). We average across the responses to the various questions.. | 3.468 (0.933) [1997] | 3.554 (0.875) [2001] |

Table A2
Definitions of Sociability in the United States, and Britain

| Country | Sociability Variables | | Variable Construction | Mean |
|---|---|---|---|---|
| | Measure | Definition | | (Standard Deviation) |
| United States | Clubs | Respondents were shown cards with 9 types of high school clubs and asked how many of them they participated in during high school. | The sum of the number of different types of clubs is used. | 1.970 (1.183) |
| | Sociability at age 6 | Respondents were asked, "Thinking of yourself when you were 6 years old, would you describe yourself as: (1) extremely shy; (2) somewhat shy; (3) somewhat outgoing; or (4) extremely outgoing?" | The responses are used. | 2.421 (0.912) |
| | Sociability in adulthood | Respondents were asked, "Thinking of yourself as an adult, would you describe yourself as: (1) extremely shy; (2) somewhat shy; (3) somewhat outgoing; or (4) extremely outgoing?" | The responses are used. | 2.949 (0.663) |
| Britain | Social behavior during school term | Stay at home with boy/girlfriend; Stay at home of boy/girlfriend; Go to the cinema etc. with boy/girlfriend; Stay at home with other friends; Spend time at the homes of other friends; Go with friends to cinema, disco etc.; and Go out with friends do nothing special | The questions asked are whether you are engaged in the social activities listed. The responses range from 0 to 5. We construct dummy variables equal to 1 if the response is 1-5. For the number of friends we just use the absolute number of friends, including whether the person has a boy/girlfriend. | 8.764 (4.657) |
| | Social behavior during holidays | Stay at home by yourself or with family; Go out by myself or with family; Go to a friend's house; Have friends round to my house; Go to a youth club/organization; Go out with brothers/sisters; Do community/volunteer work; Go to a meeting/political club; Go out with my boy/girlfriend; and Go out with friends | | 10.574 (5.361) |
| | Social behavior during leisure time | Go to a friend's house; Have friends round to my house; Go to a youth club/organization; Go out with brothers/sisters; Do community/volunteer work; Go to a meeting/political club; Go out with my boy/girlfriend; and Go out with friends | | 17.023 (4.048) |
| | Number of friends | Boy or Girlfriend; Number of best friends; Number of friends in school; and Number of friends outside school | | 11.780 (5.482) |
| | Self description of character: outgoing | We average responses to whether the person is Friendly; Loving; Outgoing; Shy (entered in reverse); and Quiet (entered in reverse). The respondents are asked to react to the statement: "I am …". The response categories are (1) does not apply; (2) applies somewhat; (3) applies very much. | | 2.542 (1.816) |

*Note*: The data source for the United States is the NLSY79 and for Britain the BCS.

Table A3
25 Largest Occupations in 1980 Census Sorted by People Tasks in the United States

| People Tasks | Reasoning | Math | Language | Strength | Physical | Specific Vocational Training | Occupation |
|---|---|---|---|---|---|---|---|
| 4.842 | 3.920 | 2.986 | 3.833 | 1.829 | 0.011 | 5.056 | Sales representatives mining manufacturing and wholesale |
| 4.375 | 3.553 | 2.927 | 3.137 | 1.944 | 0.057 | 3.804 | Sales workers other commodities |
| 3.880 | 4.985 | 3.045 | 4.962 | 1.944 | 0.009 | 6.130 | Teachers elementary school |
| 3.602 | 2.918 | 1.993 | 2.237 | 2.004 | 0.016 | 3.011 | Waiters and waitresses |
| 3.570 | 3.997 | 2.925 | 3.976 | 1.007 | 0.003 | 6.001 | Secretaries |
| 3.525 | 3.259 | 2.262 | 2.574 | 3.025 | 0.764 | 4.251 | Nursing aides orderlies and attendants |
| 2.929 | 4.343 | 3.734 | 3.753 | 1.347 | 0.060 | 6.999 | Supervisors and proprietors sales occupations |
| 2.884 | 4.330 | 3.769 | 3.818 | 1.367 | 0.049 | 7.011 | Managers and administrators n.e.c. |
| 2.654 | 3.137 | 2.470 | 2.178 | 2.000 | 0.009 | 3.003 | Cashiers |
| 2.225 | 3.682 | 2.728 | 3.419 | 1.304 | 0.019 | 4.643 | General office clerks |
| 1.955 | 4.919 | 3.922 | 4.904 | 2.814 | 0.025 | 6.881 | Registered nurses |
| 0.960 | 4.067 | 3.138 | 3.282 | 1.641 | 0.131 | 6.905 | Supervisors production occupations |
| 0.167 | 2.293 | 1.860 | 1.745 | 2.869 | 0.362 | 2.637 | Laborers except construction |
| 0.167 | 2.293 | 1.860 | 1.745 | 2.869 | 0.362 | 2.637 | Stock handlers and baggers |
| -0.395 | 2.956 | 1.809 | 2.126 | 1.900 | 0.516 | 3.455 | Truck drivers light |
| -0.395 | 2.956 | 1.809 | 2.126 | 1.900 | 0.516 | 3.455 | Truck drivers heavy |
| -0.578 | 2.418 | 1.795 | 2.173 | 3.143 | 0.870 | 3.452 | Janitors and cleaners |
| -0.925 | 2.554 | 1.590 | 1.904 | 1.997 | 0.171 | 3.318 | Assemblers |
| -0.925 | 4.000 | 3.703 | 3.073 | 1.018 | 0.005 | 4.834 | Bookkeeping accounting and auditing clerks |
| -1.117 | 3.484 | 2.527 | 2.651 | 2.909 | 0.146 | 5.929 | Short-order cooks |
| -1.296 | 3.265 | 2.368 | 2.387 | 2.088 | 0.475 | 5.454 | Machine operators n.s. |
| -1.577 | 3.887 | 2.915 | 2.956 | 2.870 | 0.883 | 6.750 | Automobile mechanics except apprentices |
| -1.661 | 3.924 | 3.010 | 2.880 | 2.956 | 0.932 | 6.849 | Carpenters except apprentices |
| -1.953 | 4.806 | 4.611 | 4.642 | 0.969 | 0.002 | 7.268 | Accountants and auditors |
| -2.597 | 3.844 | 3.654 | 3.684 | 3.242 | 0.803 | 6.625 | Farmers except horticultural |

Table A4
10 Largest Occupations in 1979 and 1991 BIBB/IAB by People Tasks in Germany

| 10 Largest Occupations in 1979 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Ranked According to the Importance of People Tasks in 1979 | | | | Ranked According to the Importance of People Tasks in 1991 | | | |
| 1979 | 1991 | %Change | Occupation | 1979 | 1991 | %Change | Occupation |
| 0.290 | 0.310 | 0.069 | Registered Nurses and care takers | 0.290 | 0.310 | 0.069 | Registered Nurses and care takers |
| 0.220 | 0.260 | 0.182 | Teachers | 0.190 | 0.260 | 0.368 | Organizers and entrepreneurial occupations |
| 0.190 | 0.260 | 0.368 | Organizers and entrepreneurial occupations | 0.220 | 0.260 | 0.182 | Teachers |
| 0.160 | 0.210 | 0.313 | Sales persons (goods) | 0.140 | 0.250 | 0.786 | Health occupations |
| 0.140 | 0.250 | 0.786 | Health occupations | 0.120 | 0.210 | 0.750 | Secretaries |
| 0.130 | 0.160 | 0.231 | Engineers (chemical, physics, and math) | 0.160 | 0.210 | 0.313 | Sales persons (goods) |
| 0.120 | 0.210 | 0.750 | Secretaries | 0.090 | 0.190 | 1.111 | Sales persons (bank services and insurance) |
| 0.100 | 0.120 | 0.200 | Engineers (technical) | 0.090 | 0.170 | 0.889 | Security persons |
| 0.090 | 0.190 | 1.111 | Sales persons (bank services and insurance) | 0.130 | 0.160 | 0.231 | Engineers (chemical, physics, and math) |
| 0.090 | 0.170 | 0.889 | Security persons | 0.100 | 0.120 | 0.200 | Engineers (technical) |

| 10 Largest Occupations in 1991 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Ranked According to the Importance of People Tasks in 1979 | | | | Ranked According to the Importance of People Tasks in 1991 | | | |
| 0.220 | 0.260 | 0.182 | Teachers | 0.220 | 0.260 | 0.182 | Teachers |
| 0.160 | 0.210 | 0.313 | Sales persons (goods) | 0.140 | 0.250 | 0.786 | Registered Nurses and care takers |
| 0.140 | 0.250 | 0.786 | Registered Nurses and care takers | 0.160 | 0.210 | 0.313 | Sales persons (goods) |
| 0.130 | 0.160 | 0.231 | Engineers (chemical, physics, and math) | 0.130 | 0.160 | 0.231 | Engineers (chemical, physics, and math) |
| 0.100 | 0.120 | 0.200 | Engineers (technical) | 0.100 | 0.120 | 0.200 | Engineers (technical) |
| 0.060 | 0.100 | 0.667 | Secretaries | 0.060 | 0.100 | 0.667 | Secretaries |
| 0.050 | 0.060 | 0.200 | Laborers except construction | 0.040 | 0.100 | 1.500 | Cash operators and book keepers |
| 0.040 | 0.100 | 1.500 | Cash operators and book keepers | 0.050 | 0.060 | 0.200 | Laborers except construction |
| 0.020 | 0.040 | 1.000 | Truck drivers | 0.020 | 0.040 | 1.000 | Truck drivers |
| 0.020 | 0.020 | 0.000 | Machine operators n.s. | 0.020 | 0.020 | 0.000 | Machine operators n.s. |

Table A5
10 Occupations with largest Increases and Decreases in People Tasks in Germany, 1979-1991

| % Change | 10 Occupations with largest increase in people tasks | % Change | 10 Occupations with largest decrease in people tasks |
|---|---|---|---|
| 0.667 | Secretaries | -0.116 | House Painters |
| 0.786 | Registered Nurses and care takers | -0.164 | Glassblowers |
| 0.889 | Security persons | -0.248 | Bricklayers |
| 0.892 | Doctors | -0.254 | Moving men |
| 1.000 | Truck Drivers | -0.257 | Technicians |
| 1.111 | Sales persons (bank services and insurance) | -0.414 | Cleaners |
| 1.258 | Hair dressers | -0.535 | Potters |
| 1.357 | Musicians | -0.561 | Paper constructors |
| 1.500 | Cash operators and book keepers | -0.625 | Rollers |
| 1.940 | Entrepreneurs | -0.899 | Tailors |