Earnings, Rents, and Competition in the Airline Labor Market
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Transformation of the airline labor market continues long after
deregulation. Airline wages changed little immediately following
deregulation, implying either the absence of regulatory rents or
maintenance of product market power and union strength. Analysis
for 1973–97, however, indicates that prior to recent gains, the relative
earnings of air transport workers decreased markedly during the
latter half of the 1980s and the early 1990s. Some of the earnings
advantage of airline workers represents returns to occupational skills
and worker-specific quality. Labor rents are attributable largely to
union bargaining power, which, in turn, is constrained by the finan-
cial health of carriers.

I. Introduction

During the 20 years in which airline deregulation has been in effect, few
industries have witnessed the turmoil that has been evident in the airline
product and labor markets. Bankruptcies, poor financial performance by
carriers, and corporate restructuring during the deregulation era have
focused management attention on labor costs. It is not surprising that
attempts to change the level and structure of remuneration have encoun-
tered considerable resistance in an industry with substantial union strength and a labor relations environment characterized neither by cooperation nor trust. The very public push by carriers to lower compensation has been predicated on the assumption that their employees are realizing rents. The creation and dissipation of rents in the airline industry is central to economists’ understanding of how regulation and deregulation work. Moreover, the level of labor rents will affect the industry’s future. If substantial rents exist, then airlines may have the opportunity to increase profitability and lower prices through reductions in compensation. But if rents are modest and a union strike threat is present, a continuing push for lower wages may entail unacceptably high costs.

Until recently, there was a consensus that relative earnings in the airline industry had changed little following deregulation in 1978, with real changes through the mid- to late-1980s largely reflecting economywide changes (see Card 1986, 1989; Johnson 1991, 1995; Hendricks 1994; and a survey on deregulation by Winston 1993). The apparent absence of falling wages in airlines is something of a puzzle, especially given the experience of the motor carrier industry, where a large decrease in union density and relative wages among union (and to a lesser extent, nonunion) truck drivers occurred shortly following deregulation (Rose 1987; Hirsch 1988; Hirsch and Macpherson 1998a). Card (1989) concludes that either airline industry employees were never earning substantial rents or union strength and worker rents have been maintained following deregulation. He emphasizes the former explanation. Hendricks (1994) concludes that union strength and a concentrated product market have allowed labor to retain high wages in the airline (and other previously regulated) industries, with trucking being more the exception than the rule.

Results from recent studies suggest that such conclusions about airline deregulation were premature (Hirsch and Macpherson 1995; Crémieux

1 Rents here are defined as payments to labor beyond long-run opportunity costs. Employees may realize short-run premiums or quasi-rents owing to costs associated with job mobility, firm- and industry-specific skills, and implicit contracts that allow earnings to deviate from spot marginal products. Note also that in settings where monitoring is costly (e.g., flight attendants), “efficiency wages” may be consistent with both profit maximization and worker rents (see Weiss 1990).

2 Quoting Johnson (1995): “Reports of wage cuts and wage freezes and of other forms of wage concessions in the airline industry have been heard frequently since deregulation. . . . This chapter will provide a body of evidence that, when taken together, indicates that airline workers, on average, have not experienced a significantly larger erosion in their real wages than workers in other industries (p. 101).

3 The uniqueness of the airline labor market is emphasized in a newspaper quotation from Peter Cappelli: “This is an industry where unions are surging in power. I can’t think of any other one” (McCartney 1995 at A-1).
Using 1980 and 1990 Census of Population data, Card finds an approximate 10 percentage point decline in relative airline earnings between 1979 and 1989. A more limited analysis using the March Current Population Survey (CPS) and a small sample of air transport workers for 1993–94 suggests little change since 1989. Contract data indicate increased wage dispersion across carriers. Card characterizes these results as indicating relatively small rents in the airline industry from regulation, although he notes that the airline labor market may not have yet fully adjusted to deregulation. Crémiieux (1996b), examining annual reports to the Department of Transportation from carriers for 1959–92 finds substantial declines in pay awarded by carriers to pilots and flight attendants, with relatively little change among mechanics, relative to selected control groups.

This article examines the transition of the labor market in the air transport industry as it evolved from the 1970s period, which was characterized by price and entry regulation, to a more competitive environment following deregulation in 1978. Using various methods, we evaluate the magnitude of relative earnings and rents in the airline industry during the 1973–97 period. We first estimate “standard” earnings differentials based on comparisons of airline employees with alternative comparison groups, after controlling for typically measured worker characteristics. We then present “expanded” differentials that take into account skill requirements and working conditions in airline and nonairline occupations. A separate analysis attempts to gauge how much of the airline premium is a result of labor union effects on union and nonunion earnings. We briefly discuss longitudinal analysis of airline entrants and leavers, as well as changes over time in earnings dispersion in the industry.

II. The Airline Labor Market and Deregulation’s Effects on Wages and Employment

The evolution of labor relations in the airline industry has been well documented (see, among others, Northrup 1983; Cappelli 1987, 1992; Crémiieux 1996b; and Card 1998). Following the efforts of the Air Line Pilots Association (ALPA), created in 1931, the Railway Labor Act (passed in 1926) was extended in 1936 to cover the airline industry. The Civil Aeronautics Act of 1938 established the Civil Aeronautics Board (CAB) as the industry’s chief regulatory body and, in so doing, the CAB assumed responsibility for ruling on and enforcing labor law provisions. The bargaining structure that evolved was highly decentralized, with there being separate unions by craft and carrier-by-carrier bargaining. Although there were notable exceptions, the regulatory period was most often characterized by “pattern bargaining,” whereby contract settlements at one airline served as a starting point for negotiations at the next airline. Because airline rates were determined (or approved) by the CAB,
largely on the basis of costs, and entry and price (but not nonprice) competition was restricted, carrier resistance to union wage demands was muted. Of course, individual carriers benefited by lower labor costs owing to regulatory lag, costs being determined on an industry rather than a carrier-specific basis (Ehrenberg 1979), and lower prices to consumers producing a larger volume of traffic. Carriers’ bargaining power also may have been enhanced by the Mutual Aid Pact, a strike insurance plan created in 1958, through which a struck carrier was compensated by nonstruck carriers based on increases in traffic the latter realized during a strike. While union bargaining power during the regulatory period was clearly constrained, carriers’ survival and growth were not ultimately threatened by the existence of rents for airline employees.

The Airline Deregulation Act of 1978 facilitated competition in the industry, abolishing most restrictions on entry and price competition. Deregulation forced carriers to make the transition to an environment in which financial performance was driven by cost, price, and service. In such an environment, one might expect labor unions to maintain long-run rents for their members only if there were substantial barriers to entry (e.g., owing to command over airport gates and scale economies from hubs) or if they were able to organize industrywide and raise costs at most carriers. Unions retained substantial bargaining power following deregulation, benefiting from the price-driven expansion of the industry, from increased employment that accompanied the elimination of regulatory inefficiencies, and, possibly, from abolition of the Mutual Aid Pact. The Railway Labor Act, which encourages firmwide rather than site-specific contracts, has made it difficult for airlines to create “double-breasted” nonunion operations that operate alongside firms’ union operations, as common in the trucking and construction industries. While unions retained the ability to impose losses on carriers, increased competition, fuel price increases, and the 1979, 1981–82, and 1990–92 recessions put strong financial pressures on carriers and their workers. Wage concessions, particularly at carriers threatened by bankruptcy, became common (Nay 1991). Pattern bargaining became less a union goal and more a lever for carriers eager to match concessions received by other carriers. The risk of job loss became the key element restraining union demands.

The deregulation period has been characterized by considerable variation across carriers in wage and work rule changes. A detailed picture of the airline labor market (see, e.g., Cappelli 1992) would emphasize the financial problems of specific carriers, the effects of mergers and bank-

4 Crémieux (1996a) provides evidence, however, that suggests that the Mutual Aid Pact was ineffective.
ruptcies on labor, the adoption of two-tier wage agreements ("B" scales) that lowered wages for new hires relative to incumbent workers, corporate strategies intended to lower labor costs, the effects of major confrontations (e.g., the 1989 Eastern strike) on relative bargaining power and labor relations strategies, and the extent of cooperation and coordination among unions across crafts and across carriers. A common thread running through these events has been the attempt by carriers to lower compensation and decrease labor costs relative to productivity. This force is not unique to the airline industry. But the strength of this effort, the magnitude of the changes, and the turbulence with which these changes have occurred reflect the industry's history of regulation and subsequent deregulation and the inevitable movement from a high-wage industry to one where labor compensation more closely reflects opportunity costs.

Theory provides a rough guide to the expected effects of product market regulation and deregulation on labor earnings. In a competitive labor market, compensation would be determined in the long-run by opportunity-cost wages and not by firm- and industry-specific financial performance, average labor productivity, or market structure. But if worker rents exist owing to regulation, market structure, or union bargaining power, the macroeconomy and changes in industry structure and performance will influence both the level of and changes in worker earnings. Regulation made possible widespread unionization, the capture of rents for union members, and nonunion rent sharing, given the absence of a large nonunion or unregulated segment of the market. Deregulation is likely to have put downward pressure on earnings in those market sectors most affected by entry. Entry in the airline industry has often proven difficult, however, owing to economies of scale and scope, licensing barriers for workers and airlines, the scarcity of airport gates, and, concomitantly, the ability of unions to maintain a strike threat and considerable bargaining power. We would expect, therefore, that deregulation would lower average industry earnings through the entry and expansion of low-cost nonunion (and some union) carriers and financial pressures on some incumbent carriers. At the same time, union workers at relatively healthy carriers might maintain for some time relatively high earnings. Industrywide earnings variance should increase. In the long run, entry and price competition might be expected to lower the industrywide

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5 This contrasts with the trucking industry, where there was a large nonregulated sector (i.e., own-company transport rather than the use of common carriers) and little rent sharing among nonunion drivers and drivers outside of the trucking industry (Rose 1987; Hirsch 1988). Following deregulation, entry occurred rapidly in the common carrier truckload sector market, with union density and wages falling substantially.
earnings level as carriers with high labor costs obtain concessions from their workers or expand more slowly than do lower cost carriers.

An explicit linkage between industry performance and changes in relative airline earnings is beyond the scope of this article. Card (1998, table 1) provides a succinct overview of industry performance, however, which we summarize below (also see Cappelli 1992). Although airline traffic is cyclically sensitive, secular changes in price and traffic were roughly similar before and after deregulation. Revenue passenger miles (RPM) grew at an average 7.1% per year from 1968 to 1978 and an average 5.3% during 1978–94; freight ton miles grew at average rates per year of 5.7% and 5.5% during the regulatory and deregulatory periods, respectively. Much of the increase in traffic has been fueled by technological change and concomitant price declines. Constant dollar price per mile decreased by 2.3% annually during 1968–78 and 2.4% annually during 1978–94. Employment growth has been substantially faster since deregulation, 2.0% annually since 1978 versus only 0.5% annually in the decade prior to deregulation. Average labor productivity growth (measured by RPMs per worker), thus, has slowed, from 6.5% annually during 1968–78 to 3.3% annually from 1968–94 (figures for the latter period exclude Federal Express employees), reflecting in part the movement to large passenger jets that occurred prior to deregulation.

The linkage between industry performance and wage outcomes is not straightforward. In a competitive labor market, wage changes should not be related to industry-specific average productivity growth (driven in part by technological change) but, rather, to economywide changes in productivity. Employment should then adjust such that marginal revenue products roughly equal opportunity-cost compensation. Likewise, changes in price need not be closely correlated with wage changes since higher prices could be the result of higher wages or increased product demand, leading to a positive correlation, or result from increases in fuel or other costs that would result in lower traffic and a negative correlation between product price and wages (for evidence on input and product price changes, see Krueger 1997). Worker rents and union wage demands should be most heavily influenced by (unobservable) potential profits (i.e., profits that would exist absent worker rents). Card (1998, table 1) presents an accounting measure of the return on investment (ROI) for 1968 and even years beginning in 1978. The ROI was 4.9% in 1968 and 13.3% in 1978 (an average 9.1% across the 2 years), versus an average 2.9% for even years during 1980–94 (the high was 10.8% in 1988, and the low was −9.3% in 1992). Lower average returns and greater variance following deregulation could be expected to put a squeeze on extant worker rents. Also relevant for union bargaining power are product market structure and shareholder rents. Market shares of entrants and small incumbents increased modestly following deregulation, but the
shares of the largest carriers rose beginning in the mid- to late 1980s (Card 1998, fig. 1), owing in part to the prevalence of hub-spoke arrangements and limited access to airport gates by entrants and smaller carriers.

III. Method, Data, and Descriptive Evidence

A. Method

The principal method used in our study is a change-in-differential approach. We examine changes over time in the earnings of air transport industry workers relative to the earnings of appropriate comparison groups of workers, first controlling for worker and job characteristics. Changes in relative earnings are attributed to deregulation and other industry-specific factors. The choice of comparison group has little effect on changes in relative earnings. The level of relative earnings is affected by the choice, although rather modestly once controlling for worker characteristics, job skill requirements, and working conditions. For some airline occupations (e.g., mechanics), there are workers in similar occupations outside of the industry that serve as a natural comparison group. But in the case of other airline groups (e.g., pilots and attendants), relatively broad comparison groups are employed since few directly comparable occupations exist. We initially provide standard controls for measurable worker and labor market characteristics. For the years beginning in 1983, our measures of comparability are enhanced by the inclusion of occupational skill requirements and working conditions.

We first calculate changes over time in the real earnings of airline employee groups, absent use of comparison groups. An “adjusted earnings index” is constructed for the airline industry and each airline craft by estimating for each group a log earnings regression, pooled over the 1973–97 period. That is,

$$\ln EARN_{ijt} = \sum \beta_{jk} X_{ijtk} + \sum \phi_{jy} \text{YEAR}_{jty} + \epsilon_{ijt},$$

where $\ln EARN_{ijt}$ is the log of usual weekly earnings for individual $i$ in airline craft group $j$ in year $t$, $X_{ijtk}$ includes variables (indexed by $k$) measuring worker and market characteristics, and $\beta_{jk}$ are the corresponding coefficients ($X_0$ equals unity and $\beta_0$ is the intercept), YEAR is a set of dummy variables (indexed by $y$) for 1973–74 through 1997 (1977–78 is the reference year), and $\epsilon$ is an error term assumed to have zero mean and constant variance. For each airline group $j$, we construct the adjusted earnings index from $\phi_{jy}$, the year dummy coefficients. Values of $\phi_{jy}$ measure the logarithmic earnings differentials relative to the base period; these are converted to a percentage index by $100[\exp(\phi) - 1] + 100$, with $1977–78 = 100$. Pooling over years assumes a stable wage structure over
time, an assumption that we relax below. The industry index is based on the sample of all air transport workers.

We next estimate annual measures of “relative earnings differentials” for 1973–97. These measures reflect the log earnings differential for each airline group relative to a comparison group of nonairline employees, controlling for worker and job characteristics. The annual earnings differential for each airline group is extracted from a log earnings regression including all full-time employed wage and salary workers. We include all workers to better estimate the appropriate labor market earnings structure, allowing coefficients to vary by year. We do not, however, compare the earnings of each airline craft relative to the entire labor force but, rather, calculate each differential by comparing the earnings for the airline craft to a subset of nonairline workers. This is accomplished by including dummies for each of the airline craft groups, along with occupational dummies for nonairline groups of workers. Each airline craft differential is calculated either as (1) the difference between the airline craft coefficient and a single nonairline dummy coefficient when the latter corresponds exactly to the comparison group, or (2) the difference between the craft coefficient and a weighted combination (using nonairline sample sizes as weights) of nonairline dummy coefficients when the comparison group spans two or more occupational categories. The earnings differential for the air transport industry is a sample-weighted average of the composite craft differentials. This method permits the wage structure, determined largely by the nonairline sample, to be determined economy-wide and to vary by year.

We estimate two measures of airline earnings differentials, a “standard” measure and an “expanded” measure. The standard measure controls for individual and labor market characteristics typically included in household surveys. The expanded measure controls for occupational skill requirements and working conditions, allowing us to compare both similar workers and jobs. Letting equations (2) and (3) be the standard and expanded specifications, respectively, estimated separately by year $t$, we have

$$\ln EARN_{it} = \sum \beta_{ki} X_{kit} + \sum \theta_{jt} AIR_{jt} + \sum \omega_{ct} OCC_{cit} + \epsilon_{it}, \quad (2)$$

6 As widely recognized, use of narrow occupational samples will bias, among other things, the estimated returns to schooling (since schooling provides mobility across as well as within occupations) and the wage differentials associated with job skills and working conditions.

7 Because of heterogeneous worker tastes and sorting as well as correlation between job characteristics and unmeasured worker skills, coefficients on job characteristics are unlikely to precisely measure compensating differentials for either the average or the marginal worker.
and

\[
\text{In } \text{EARN}_{it} = \sum \beta'_k X_{kt} + \sum \Gamma_{mt} Z_{mt} + \sum \Theta'_j \text{AIR}_{jt} + \sum \Omega'_c \text{OCC}_{ct} + \varepsilon'_{it},
\]

where \( i \) designates individual, \( t \) is year, \( k \) indexes the standard worker and labor market control variables in \( X \), with \( \beta_k \) and \( \beta'_k \) being the corresponding coefficients from equations (2) and (3), and \( m \) represents the expanded occupational skill and working conditions variables in \( Z \), with \( \Gamma_m \) being the corresponding coefficients. The AIR is a set of six dummy variables, indexed by \( j \), representing airline craft groups, with \( \Theta_j \) (or \( \Theta'_j \)) being their respective coefficients. The OCC is a set of nonairline occupational control group dummies, indexed by \( c \), representing (along with an omitted reference group) all nonairline employees, with \( \Omega_c \) (or \( \Omega'_c \)) being the coefficients.

The standard earnings differential, \( d_{jt} \), for each airline group \( j \) in year \( t \), based on equation (2), is calculated as the difference between the appropriate airline dummy and the weighted average of either the single or multiple nonair occupational comparison groups. Expanded earnings differentials \( d'_{jt} \) are calculated similarly based on coefficient estimates from equation (3). That is:

\[
d_{jt} = \Theta_j - \sum \omega_c \Omega_c,
\]

and

\[
d'_{jt} = \Theta'_j - \sum \omega_c \Omega'_c,
\]

where \( \omega_c \) represents the sample proportion of comparison group workers in \( \text{OCC}_c \) (\( \omega_c = 1.0 \) where a single occupational category comprises the comparison group). The all-industry differential is the weighted average across the craft differentials \( d_j \) or \( d'_j \), with airline sample proportions as weights. Highly similar all-industry differentials are obtained from a specification including a single dummy variable for the air transport industry (compare col. 6 in table 5 to the standard differential estimates in table 2).

B. Data

Primary data are drawn from the Current Population Survey (CPS) May earnings files for 1973–78 and the monthly CPS Outgoing Rotation Group (CPS ORG) earnings files for January 1979 through October
1997. For the post-1983 period, we estimate an “expanded” model that supplements data from the CPS ORG with variables measuring occupational characteristics. These variables are either calculated from special CPS supplements on job training and computer use or are obtained from England and Kilbourne (1988), who provide a weighted mapping of 1977 fourth edition *Dictionary of Occupational Titles (DOT)* variables to 1980 Census occupation codes.\(^9\)

The analysis includes employed full-time wage and salary workers ages 16 and over. Additional exclusions are for public sector air transport workers and individuals whose principal activity is schooling, whose implicit real hourly earnings are less than one dollar, and whose industry or occupation of employment has been allocated (i.e., assigned) by the U.S. Census. Earnings for both salaried and hourly workers is measured by usual weekly earnings on the primary job, inclusive of tips, commissions, and overtime. Full time is defined as at least 35 usual hours worked per week for all control groups and airline occupational groups, with the exception of pilots and flight attendants. We include pilots and attendants who report at least 15 usual hours per week since some pilots and attendants report actual flight hours rather than a broader measure of work hours.\(^{10}\) Two features of the CPS—“earnings allocation” and “top-coding”—turn out to be important factors with which we had to deal in order to reliably analyze airline earnings. (See appendix for definitions of these terms.) Airline workers for whom earnings have been allocated by the U.S. Census are deleted where possible, while earnings

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\(^8\) The 1979–97 ORG files include the quarter sample of each monthly CPS who are asked questions about such things as current earnings, hours worked, and (beginning in 1983) union status. Between 1973 and 1978, the earnings supplement questions were administered only in the May surveys, but to all rotation groups. The October 1997 data were the most recent available when our empirical work was completed.

\(^9\) England and Kilbourne provide means of DOT variables for approximately 500 1980 Census occupational categories, calculated as weighted averages across roughly 12,000 DOT occupations (special Census projects mapped CPS workers to DOT occupations and 1980 Census of Population respondents to both 1970 and 1980 Census occupational codes). We matched the England-Kilbourne data to 497 time-consistent 1980/1990 Census occupational codes and reassigned occupational codes for a few small occupations for which England and Kilbourne have missing data. Because some of the Census occupations mix air transport and nonairline industry workers (e.g., flight attendants are drawn from the Census occupation “public transportation attendants”), we explicitly assign the DOT values to most airline craft workers based on the primary DOT airline occupation assigned to the Census occupational categories. For a description and analysis of the DOT, see Miller et al. (1980).

\(^{10}\) Reported hours worked per week by pilots and attendants are not highly correlated with weekly earnings. Hence, our analysis is for weekly earnings rather than implied hourly earnings. Contract schedules indicate that there are few part-time pilots and attendants among the certificated air carriers.
adjustments are made in years in which there is incomplete designation of earnings allocations. Workers with top-coded earnings are assigned the estimated mean earnings above the earnings cap. The appendix provides further description.

In our analysis, we identify the five largest employee groups in the “air transportation” industry, based on Census occupation and industry codes. These “craft” groups account for 64% of the air transport sample, with the remaining 36% being included in the “other” category. The estimation sample includes the airline sample and all full-time wage and salary workers outside of the airline industry. Air transport industry earnings differentials are calculated as weighted averages of the craft (and “other”) airline group differentials, each of which is computed by comparing that group’s earnings to earnings among those in its nonair comparison group. The comparison groups are intended to be sufficiently broad to reflect economywide trends and, concurrently, to represent the types of occupations that the air transport industry workers might have entered had they not been airline employees. Explicit controls for worker and occupational characteristics further enhance comparability. The selected comparison groups are as follows:

Pilots.—Comparison group includes full-time professional and specialty occupations outside of air transportation.

Flight attendants.—Comparison group includes full-time workers in sales, administrative support, and service occupations other than protective and private household services, all outside of air transportation.

Mechanics.—Comparison group includes full-time mechanics and repairers outside of air transportation.

Fleet service (ramp) workers.—Comparison group includes full-time workers in material moving occupations, handlers, equipment cleaners, helpers, and laborers, all outside of air transportation.

Ticket and reservation agents and traffic, shipping and receiving clerks.—Comparison group includes full-time information clerks, records processing occupations, communications equipment operators, and traffic, shipping, and receiving clerks, all outside of air transportation.

Other airline employees.—Comparison group includes full-time workers outside of air transportation in the same broad occupational category as the airline workers.

C. Descriptive Evidence

We first provide (see table 1) descriptive evidence on employment, earnings, and union density in the air transportation industry, averaged over selected years and based on calculations from the CPS ORG files. Employment figures indicate substantial growth in the air transport industry, from an average 407 thousand employees during the 1973–78 regulatory period to an average 805 thousand employees in 1995–97. Growth occurred in most
Table 1
Air Transportation Employment and Weekly Earnings, 1973–97

<table>
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<tbody>
<tr>
<td>1973–78</td>
<td>407.0</td>
<td>808</td>
<td>...</td>
<td>49.2</td>
<td>39.5</td>
</tr>
<tr>
<td>1979–83</td>
<td>505.5</td>
<td>856</td>
<td>11.0</td>
<td>60.2</td>
<td>58.7</td>
</tr>
<tr>
<td>1984–87</td>
<td>554.0</td>
<td>828</td>
<td>11.4</td>
<td>77.7</td>
<td>72.8</td>
</tr>
<tr>
<td>1988–91</td>
<td>698.8</td>
<td>814</td>
<td>14.9</td>
<td>61.9</td>
<td>46.7</td>
</tr>
<tr>
<td>1992–94</td>
<td>744.5</td>
<td>787</td>
<td>8.5</td>
<td>71.0</td>
<td>46.1</td>
</tr>
<tr>
<td>1995–97</td>
<td>804.8</td>
<td>767</td>
<td>18.1</td>
<td>33.7</td>
<td>30.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>36.1</td>
<td>37.5</td>
<td>22.0</td>
</tr>
</tbody>
</table>

Sources.—Data sources are the 1973–78 May Current Population Survey (CPS) and the 1979–97 (through October 1997) Current Population Survey Outgoing Rotation Group (CPS ORG) files. Industry employment represents all private wage and salary workers, ages 16 and over, in thousands. Mean weekly earnings are calculated as described in the text and Appendix; they are in October 1997 dollars indexed by the Consumer Price Index for All Urban Consumers—Experimental (CPI-U-X1). Occupation sample shares are calculated from the 1983–97 CPS ORG files. The mean employment shares by craft and the mean union densities by craft are calculated from the CPS files listed above.

individual years, the exceptions being the recessionary periods 1981–83 and 1990–92 (figures for individual years are not shown). The CPS sample shares by craft, calculated from the CPS ORG files for 1983–97, are also shown in table 1. Pilots and flight attendants each account for 11% of the industry sample; mechanics, 15%; fleet service workers (a category not defined precisely in the CPS), 9%; and agents and clerks, 18%. Among the 36% of airline industry workers spread across other occupations, the largest categories are “managers and administrators” and “secretaries.” We detected no significant changes in the craft composition of airline industry workers over the 1973–97 period.

Table 1 also presents mean real weekly earnings, expressed in October 1997 dollars using the consumer price index for all urban consumers—experimental (CPI-U-X1), for all airline industry employees; it also presents union density by craft. Real earnings increased following deregulation, from an average $808 per week during 1973–78 to $856 during 1979–83. Since the mid-1980s (1984–87), real earnings fell gradually from $828 per week to $767 per week during 1995–97. One sees broadly similar patterns among the airline craft groups. Union density and air transport earnings are examined in Section V.

The weekly earnings measure does not include compensation for health insurance, pensions, government-mandated payroll taxes, or other fringes. Data from the March CPS for 1980 forward indicate significantly higher pension and
IV. Real and Relative Earnings in the Airline Industry

The “adjusted earnings index” for the airline industry during 1973–97 is shown by the squares in figure 1 (see table 2 for full details). Index values are derived from a log earnings regression (eq. [1]) pooled over the 1973–97 period, with controls included for years of schooling completed, potential experience and its square, gender and gender-experience interaction terms, race (two dummy variables), marital status (two), region (eight), large metropolitan area, and year (1977–78 is the omitted base year). The index is constructed from the year dummy coefficients $f_y$. Since annual sample sizes prior to 1979 are small, we use 2-year periods during 1973–78.

Standard and expanded “relative earnings differentials” by airline group and year ($d_j$ and $d'_j$) are shown in figure 1 by diamonds and triangles, respectively (also see table 2). The “standard” specification is estimated for the years 1973–97, while the “expanded” specification including occupational variables (based on 1980/90 Census codes) is estimated for years since 1983. Included in the standard specification are variables measured at the individual level: years of schooling completed and potential experience and its square (separately and interacted with gender); and dummies for gender, marital status, public sector, region, large metropolitan area, and occupation (some of which represent the comparison groups for the airline crafts). Differential estimates based on the weighted health coverage among air transport workers than among workers outside of the industry (see Hirsch and Macpherson 1995). A fringe benefit unique to the airline industry is free or subsidized travel.
average from separate female and male earnings functions are approximately .01 log points higher using the standard or expanded specification.

The expanded specification adds variables measuring the mean level of job characteristics at the occupational level. Variables included are: OCC-Training, the proportion of workers reporting formal or informal training on the current job; OCC-Computer, the proportion of workers using a computer on the job; DOT-SVP, representing specific vocational preparation and measured by years of training required for proficiency in an occupation;
Table 3
Means and Average Coefficients of Occupational Skill and Working Condition Variables, 1983–97

<table>
<thead>
<tr>
<th>Variable</th>
<th>Air Transport</th>
<th>Not Air Transport</th>
<th>Average Regression Coefficient</th>
<th>Average Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>OCC-Training</td>
<td>.575</td>
<td>.413</td>
<td>.386</td>
<td>(.0123)</td>
</tr>
<tr>
<td>OCC-Computer</td>
<td>.548</td>
<td>.332</td>
<td>.349</td>
<td>(.0088)</td>
</tr>
<tr>
<td>DOT-GED</td>
<td>3.796</td>
<td>3.792</td>
<td>.021</td>
<td>(.0048)</td>
</tr>
<tr>
<td>DOT-SVP</td>
<td>1.771</td>
<td>2.129</td>
<td>.026</td>
<td>(.0040)</td>
</tr>
<tr>
<td>DOT-SVP-SQ</td>
<td>5.502</td>
<td>7.163</td>
<td>−.002</td>
<td>(.0005)</td>
</tr>
<tr>
<td>DOT-Physical</td>
<td>2.056</td>
<td>1.697</td>
<td>.022</td>
<td>(.0025)</td>
</tr>
<tr>
<td>DOT-In &amp; Out</td>
<td>.119</td>
<td>.186</td>
<td>.109</td>
<td>(.0068)</td>
</tr>
<tr>
<td>DOT-Outdoors</td>
<td>.021</td>
<td>.049</td>
<td>.110</td>
<td>(.0124)</td>
</tr>
<tr>
<td>DOT-Strength</td>
<td>2.097</td>
<td>2.224</td>
<td>.024</td>
<td>(.0032)</td>
</tr>
</tbody>
</table>

Source.—The OCC variables are calculated at the occupational level by the authors from the Current Population Survey (CPS) supplements listed below. The DOT variables are calculated from the Dictionary of Occupational Titles (England and Kilbourne 1988). Variable OCC-Training is the proportion of workers receiving formal or informal training on the current job (calculated from the January 1983 and 1991 CPS); OCC-Computer is the proportion of workers using a computer on the job (calculated from the October 1984 and 1989 CPS); DOT-GED is a 1–6 index of general educational development measuring necessary reasoning, writing, and mathematical skills; DOT-SVP and its square, represent specific vocational preparation and are measured by years required for proficiency in an occupation; DOT-Physical is the number of physical demand, measured from 0 to 4; DOT-In & Out, measures the proportion of jobs requiring considerable time indoors and outdoors; DOT-Outdoors, measures the proportion of jobs that are primarily outdoors; and DOT-Strength, a 1–5 index, measures required strength on job. Means are calculated for individuals over the 1983–97 period (N = 2,054,562 nonair and N = 12,593 air transport industry). “Average” regression coefficients and standard errors are mean values from the annual 1983–97 expanded regressions.

DOT-Physical, the number of physical demands ranging from 0 to 4; DOT-In & Out, measuring the proportion of workers in jobs that require significant time both indoors and outdoors; DOT-Outdoors, measuring the proportion of workers in jobs that are primarily outdoors; and DOT-Strength, a 1–5 index of required strength. Variables designated OCC- are calculated by the authors from special CPS supplements and matched to individuals in the CPS ORG files based on designated occupation. All occupational characteristics are treated as time-invariant over the 1983–97 period. Table 3 lists the sources and provides means of the occupational variables for airline and nonairline workers.

A. All Airline Employees

The adjusted earnings index for the airline industry (1977–78 = 100) indicates little change in real earnings between 1973 and approximately 12 There is substantial collinearity among several included and excluded occupational variables. We do not include the DOT variable measuring the presence of hazards since its coefficient is incorrectly signed. The DOT rates pilots and attendants as hazardous occupations. Not accounted for is the fact that flight personnel spend much of their working time away from home but also receive long blocks of leisure time. Standard errors on occupation or group variables matched to individual data are biased downward (Moulton 1990).
1983–84, followed by a decline during the remainder of the 1980s and the 1990s. Relative to the regulatory base period, 1977–78, adjusted weekly earnings fell by about 20% by 1996–97, with much of the decline occurring in the 1990s, that is, many years after deregulation.

Although a 20% decrease in real earnings is substantial, the effects of deregulation are best assessed by comparing airline earnings to those among comparable workers and jobs outside of the airline industry. Figure 1 presents two measures of “relative” earnings differentials. Using the standard specification, we find what appear to be sizable earnings premiums for airline employees. Differentials were about .22 log points or 25% prior to deregulation and increased following deregulation to over 30% (the peak was .30 log points or 35% in 1982). The 1979–83 rise in relative earnings following deregulation primarily reflected a decrease in real earnings outside of the industry, one associated with two recessions and high rates of inflation, and did not reflect an increase in real airline salaries. Since the mid-1980s, the differential has fallen to about 15% (.13 and .15 log points in 1996 and 1997, respectively). In short, we find that relative earnings in the industry have fallen since the mid-1980s but that airline workers remain well paid compared to workers with similar measured characteristics.13

An alternative measure of relative earnings based on the expanded specification accounting for occupational differences in skill requirements and working conditions is also shown in figure 1 for the period beginning in 1983. About .10 log points of the airline wage advantage is accounted for by relatively high skill and training requirements in airline occupations. Following control for occupational characteristics, earnings premiums remain, but these were on the order of about 10% during the late 1980s and early 1990s, and roughly 5% during 1996–97. The smaller differential reflects the fact that for most, although not all, airline occupations, job training and skill requirements exceed those for the average worker.14

13 Subsequent analysis (not shown) using the CPS for full-year 1997 and the first half of 1998 indicates a moderate increase in relative airline earnings, particularly among union workers. This evidence supports the thesis that airline unions retain substantial bargaining power, with wage demands varying with the financial health of the industry. Card (1998), who examines Census data for 1979 and 1989, finds an approximate 10% decline in relative earnings. He finds little change between 1989 data and estimates based on a small March 1994–95 CPS sample. The 1979–89 comparison masks the increase and subsequent decrease in relative earnings during the 1980s.

14 The two variables that most affect the expanded estimates are OCC-Training and OCC-Computer. Absent those two variables, there is little difference between the standard and expanded estimates. The strong relationship between earnings and these measures suggests that in general they provide good proxies for
Longitudinal analysis provides an alternative approach to measuring earnings differentials between airline and nonairline employment. In an earlier version of our paper (Hirsch and Macpherson 1995), we constructed multiple CPS panels to measure the earnings gains and losses of workers moving into and out of the air transport industry. The analysis provides a control for fixed worker-specific differences in unmeasured skills and preferences whose effects are transferable across jobs, as well as provides a natural measure of alternative labor market opportunities for airline workers. The panel analysis is limited by what are relatively small sample sizes of air industry joiners and leavers, sensitivity to measurement error, and the possibility of bias resulting from endogenous job switching.

Panel evidence indicates small earnings premiums among joiners and leavers. Estimates from the standard model indicate average gains of about 4% for workers joining the airline industry and losses of about 8% among those leaving. Gains and losses are 2% and 6%, respectively, using the expanded specification, which accounts for changes in job skills and working conditions. The lower premium estimates for entrants than for leavers is consistent both with steep experience and tenure profiles in the industry and with the nontransferability of industry and occupation specific skills (Neal 1995). Card (1998) uses the CPS Displaced Worker Surveys (DWS) to measure earnings losses among workers displaced from air transport jobs, thus providing a measure approximating exogenous job change (Gibbons and Katz 1992). He finds that a high percentage (39%) of reemployed workers remain in the air transport industry but that earnings losses are small, surprisingly, for reemployed displaced air transport workers whether they stay in the industry or leave it; moreover, losses are similar to losses among workers displaced from jobs in other industries.

The longitudinal evidence from the DWS and our CPS panels supports the thesis that a sizable portion of the earnings advantage observed among airline industry employees is due to high unmeasured skills and that much of that portion is transferable across jobs. Surprisingly, neither we nor Card find a downward time trend in longitudinal air transport differentials. The absence of such a finding might simply result from what are occupational and worker skills. Computer use by occupation, averaged across the June 1984 and 1989 CPS Computer Use Supplements, is used as an index of relative occupational skills for the entire 1983–97 period. Its coefficient is relatively stable over time, whereas inclusion of a computer index that is allowed to increase over time produces coefficients that steadily decline. For a recent analysis of individual computer use and the earnings distribution, see Autor, Katz, and Krueger (1998).
small sample sizes. Alternatively, it could reflect what were higher unmeasured skills during the regulatory years than during recent years. If this is so, then the decline in relative earnings shown in figure 1 may overstate the decline in quality-adjusted differentials. Even if the decline in relative airline compensation has been accompanied by the hiring of workers with lower (unmeasured) quality, it is not clear whether this has translated into a significant productivity decline.

The conclusion reached in earlier CPS studies of the airline industry was that declines in earnings had been small and had largely paralleled economy-wide movements. The evidence provided here, in addition to recent work by Card (1998) and Crémioux (1996b), causes us to modify that conclusion. It is unlikely that the decline in relative earnings since the 1980s could have occurred had airline employees not been realizing substantial rents prior to and shortly following deregulation. Part of the measured earnings advantage of airline industry employees, however, is the result of compensating differentials for high skills and other job characteristics. By the mid-1990s, the earnings premium for the average airline industry employee was rather modest. Of course, part of this decline may reflect the intense competition and low profits in the industry during much of the period. The increase in relative earnings during 1997 suggests that airline earnings are not determined independent of firms’ financial performance.\(^{15}\)

B. Airline Crafts

We examine briefly wage differentials among the major airline crafts. Table 4 presents the earnings index and earnings differentials from the standard specification by craft for three selected time periods, 1973–78, 1981–83, and 1994–97, to be referred to as the “regulatory,” “peak premium,” and “current” periods, respectively. Evidence for pilots is the most problematic, owing to both the high proportion of pilots with top-coded and allocated earnings and the uniqueness of the occupation. The earnings of pilots relative to a comparison group of full-time workers in professional specialty occupations are large, suggesting premiums of .40 and .54 log points prior to and shortly following deregulation, using

\(^{15}\) See, also, n. 13 above. Firm and establishment size, which are not controlled for directly in our analysis, are associated economy-wide with high wages. As shown by Brown and Medoff (1989), among others, some of the size-wage advantage appears to reflect worker rents whose origins cannot be readily identified. Airline carriers are large companies, but their workers need not work in large establishments. Although some of the airline wage differential may reflect the effects of employer size, much of this is likely to constitute a rent. The training and computer variables in our expanded specification are likely to be positively correlated with employer size and to capture size effects reflecting higher skills.
standard control variables. Although the premium has declined since the early 1980s, it remains high (.36 log points). Inclusion of occupational variables in our expanded model reduces by roughly .08 log points estimates of the pilot premium. It is, of course, difficult to assess whether some of the measured premium reflects a compensating differential for skills or working conditions that remain unmeasured.16

Relative earnings for flight attendants are based on a comparison with similar full-time workers in sales, administrative support, and service occupations outside of air transportation. Flight attendants realized substantial premiums, before and following deregulation, standard estimates

\[16\] In the Wealth of Nations, Adam Smith argues: “The wages of labour vary according to the small or great trust which must be reposed in the workmen” (Smith [1976] 1937, p. 105). Although we can be sure that Smith was not referring to pilots (his examples are jewelers, physicians, and lawyers), great trust is obviously placed in pilots. What is not clear is the degree of scarcity (and price) associated with labor in whom great trust can be given or how much of the pilot premium is associated with such trust.

Table 4  
Adjusted Earnings Index and Relative Earnings Differentials by Craft Group and Period

<table>
<thead>
<tr>
<th>Time Period and Craft Group</th>
<th>Adjusted Earnings Index</th>
<th>Standard Earnings Differential</th>
</tr>
</thead>
<tbody>
<tr>
<td>1977–78</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Air transport industry</td>
<td>99.9</td>
<td>.216</td>
</tr>
<tr>
<td>Pilots</td>
<td>99.4</td>
<td>.403</td>
</tr>
<tr>
<td>Flight attendants</td>
<td>98.2</td>
<td>.401</td>
</tr>
<tr>
<td>Mechanics</td>
<td>96.4</td>
<td>.165</td>
</tr>
<tr>
<td>Fleet service workers</td>
<td>99.3</td>
<td>.036</td>
</tr>
<tr>
<td>Agents and clerks</td>
<td>101.8</td>
<td>.269</td>
</tr>
<tr>
<td>All other occupations</td>
<td>101.7</td>
<td>.135</td>
</tr>
<tr>
<td>Peak premium period, 1981–83:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air transport industry</td>
<td>101.8</td>
<td>.295</td>
</tr>
<tr>
<td>Pilots</td>
<td>110.5</td>
<td>.545</td>
</tr>
<tr>
<td>Flight attendants</td>
<td>96.4</td>
<td>.453</td>
</tr>
<tr>
<td>Mechanics</td>
<td>96.6</td>
<td>.195</td>
</tr>
<tr>
<td>Fleet service workers</td>
<td>99.4</td>
<td>.141</td>
</tr>
<tr>
<td>Agents and clerks</td>
<td>105.4</td>
<td>.367</td>
</tr>
<tr>
<td>All other occupations</td>
<td>104.0</td>
<td>.201</td>
</tr>
<tr>
<td>Current period, 1994–97:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air transport industry</td>
<td>82.1</td>
<td>.131</td>
</tr>
<tr>
<td>Pilots</td>
<td>89.3</td>
<td>.364</td>
</tr>
<tr>
<td>Flight attendants</td>
<td>74.5</td>
<td>.139</td>
</tr>
<tr>
<td>Mechanics</td>
<td>88.3</td>
<td>.169</td>
</tr>
<tr>
<td>Fleet service workers</td>
<td>76.8</td>
<td>.049</td>
</tr>
<tr>
<td>Agents and clerks</td>
<td>74.9</td>
<td>.107</td>
</tr>
<tr>
<td>All other occupations</td>
<td>86.2</td>
<td>.064</td>
</tr>
</tbody>
</table>

indicating differentials of .40 and .45 during the 1973–78 and 1981–83 periods, respectively. Their earnings fell sharply after 1993, however, with our estimate of the 1994–97 differential being just .14. Estimates from the expanded specification are about .10 log points lower.17

The earnings of airline mechanics relative to full-time mechanics outside of the airline industry have been relatively stable over the deregulation period. Estimates from the standard model indicate differentials of about .17 log points during the regulatory period, followed by a moderate increase to about .20 following deregulation and a subsequent decline to about .17 currently. A portion of the earnings advantage among airline mechanics reflects a compensating differential for greater training requirements and, to a lesser extent, relatively high physical demands, with estimates from our expanded model indicating a current premium of roughly .13.18

Fleet service (ramp) workers service airplanes and facilitate passenger and cargo service (e.g., baggage and material handling and directing plane movement on the ground). They are scattered across several airline crafts and a large number of CPS occupational categories; this makes estimates more difficult to interpret. Standard estimates indicate differentials of .04, .14, and .05 in the regulatory, peak, and current periods, while estimates from the expanded model indicate a differential that is slightly negative during 1994–97. The latter result is driven by the fact that a high proportion of ramp employees perform work outdoors and their occupations require relatively high levels of strength. Working in the opposite direction are relatively low levels of required training.

Earnings differentials among ticket and reservation agents and traffic, shipping, and receiving clerks are based on a comparison group of full-time nonair industry information clerks, record processing clerks, and communication equipment operators. Estimates from the standard specification indicate substantial premiums of .27 and .37 during the regulatory and peak periods, with a sharp decline to .11 during the mid-1990s. Controlling for occupational skills and working conditions reduces the differential estimates markedly, a result driven entirely by the high level of computer use among agents and clerks and the high proportion of

17 A high proportion of attendants receive some training on the job, but the length of required training, measured by DOT-SVP, is short—2 months for attendants compared to about 3 years for pilots and mechanics. Absent inclusion of OCC-Training, the standard and expanded premium estimates for attendants are similar.

18 Crémieux (1996b) also concludes that relative earnings declined less for mechanics than for pilots or flight attendants. When we use an alternative comparison group consisting of full-time blue-collar workers in manufacturing, differentials are moderately higher.
employees receiving formal job training. Values of the DOT skill variables, however, are not high for agents and clerks, while working conditions are relatively less demanding for agents and clerks than among the labor force as a whole.

Finally, we examine the earnings of the 36% of air transport industry workers not included in our five craft categories. Because of this group’s diversity, adjustment for worker characteristics and broad occupational category is important. The relative earnings advantage for the noncraft (and largely nonunion) airline employees are lower than for the industry as a whole, .14 and .20 during regulation and shortly after deregulation and .06 during 1994–97. The expanded specification suggests an earnings differential for noncraft employees of close to zero. Noncraft airline employees shared in industry rents made possible by regulation and market power, but such rents appear now to be gone. If relative labor costs among airlines are to decline further, it must come from concessions among pilots, attendants, and mechanics. But these are the crafts where union bargaining power remains an important factor, a topic to which we turn below.

V. Union Differentials and Earnings Dispersion in the Air Transport Industry

Unions provide an institutional mechanism that facilitates the transfer of rents from shareholders to workers. Twenty years following deregulation, the air transport industry remains highly unionized (see table 1). Based on calculations from the CPS, 49% of all air transport employees were union members in 1973–78, with the figure falling to 39% in 1997. As long as unions are organized throughout much of the industry and maintain similar labor costs across carriers, individual firms are not at a competitive disadvantage. And a strike against a hub-based airline, at least by flight personnel, prevents a company from maintaining full operations. Deregulation, however, allowed expansion of existing carriers, facilitated entry of new carriers (some being nonunion), and increased route and price competition. Competition of this kind not only exerts downward pressure on wage rates but also increases the dispersion in wages between low- and high-wage carriers (Card 1998) and between union and nonunion workers (see below). Although unions have maintained the ability to impose large costs on carriers, their bargaining power has been constrained by intense product market competition, new corporate strategies,

19 Prior to deregulation, unionization among craft workers at the major carriers was almost universal. In a prescient paper appearing shortly after deregulation, Hendricks, Feuille, and Szerszen (1980) provide arguments as to why changes in union power might occur slowly. Northrup (1983) also provides an early analysis of expected changes in the labor relations environment following deregulation.
and the weak financial conditions of carriers during much of the deregulatory period.

We examine the effect of unions on earnings in the airline industry by estimating both the within-industry union-nonunion differential and the effects of industry union density on the industry earnings level. Our analysis relies on the economywide sample of full-time workers. Previously (eqq. [2] and [3]), the airline industry premium was calculated as the weighted average of the individual air industry craft groups. Here we use a simpler specification that includes a single dummy variable for employment in the air transport industry. The following models are estimated by year (we omit time subscripts), with results being presented in table 5:

$$\ln EARN_i = \sum \beta_k X_{ik} + \Theta AIR_i + \epsilon_i$$  (6)
\[
\ln \text{EARN}_i = \sum \beta_k X_{ik} + \Theta' \text{AIR}_i + \Phi' \text{AIR} \cdot \text{Union}_i + \varepsilon_i \\
\ln \text{EARN}_i = \sum \beta'' X_{ik} + \Theta'' \text{AIR}_i + \Phi'' \text{AIR} \cdot \text{Union}_i + \tau' \text{Ind-\%Union}_i + \varepsilon_i
\]  

(7)  

(8)

Following previous notation, \( X \) represents control variables defined at the individual level, \( \text{AIR} \) is a dummy variable equal to one if employed in the air transport industry, \( \text{Union} \) is a dummy variable designating individual union membership, and \( \text{Ind-\%Union} \) is the proportion of a workers’ three-digit industry that is unionized in each year (based on our calculations from the CPS).

Table 5 provides estimates from the “standard” specification for the entire 1973–97 period. Data prior to 1983 are based on the availability of union status information from the May CPS.\(^{20}\) The first column presents coefficient estimates of \( \Theta \) from equation (6), which measure annual industry wage differentials between similar airline and nonairline workers. Results are virtually identical to those presented previously and do not warrant discussion.\(^{21}\) Equation (7), shown next in table 5, adds the interaction of \( \text{AIR} \) and \( \text{Union} \), the latter designating individual union membership. The coefficient \( \Theta' \) now represents the industry earnings differential for nonunion airline workers relative to nonair union and nonunion workers, \( \Phi' \) is the within-industry union-nonunion differential, and \( \Theta' + \Phi' \) is the industry earnings differential for union workers.\(^{22}\) Equation (8), shown on the right-side of table 5, adds industry union density, \( \text{Ind-\%Union} \), intended to reflect the effects of organizing strength on the level of nonunion and union wages. The reduction in the

\(^{20}\) The sample size for 1979–81 is about half that of the earlier 2-year periods. Roughly half of the 1979–81 sample is for 1979, since one-half of the CPS rotation groups were asked the earnings question in 1979 and one-quarter in 1980 and 1981. There was no union question in the 1982 surveys.

\(^{21}\) Although airline craft dummies are not included, airline industry workers are coded as members of the occupational control groups with whom they are compared. Where the comparison group corresponds to a single control dummy, the appropriate airline workers are coded as a one. Where the comparison group is spread across several control dummies, the airline workers are coded as \( \alpha_w \) for each, where \( \alpha_w \) is the proportion of the nonairline sample in each of the categories (\( \sum \alpha_w = 1 \)).

\(^{22}\) We do not include \( \text{Union} \) separately. To do so would have the effect of comparing union (nonunion) air industry workers to union (nonunion) nonair workers. This is appropriate only if one regards union status as a transferable skill-related attribute such as schooling (for a discussion of this issue in the context of federal pay comparisons, see Linneman and Wachter 1990). Our industry differentials represent a comparison of air transport workers to an implicitly sample-weighted combination of nonair union and nonunion workers.
coefficient on the air industry dummy between equations (6) and (8), \( \Theta - \Theta'' \), provides an estimate of how much of the industry earnings advantage is accounted for by both the within-industry union earnings premium and the extent of industry union density, assuming that the economywide effect of the latter applies to the air transport industry. The coefficient \( \Theta'' \) represents an estimate of any remaining airline earnings differential resulting from factors other than unionization and measured characteristics.

Results indicate that much of the earnings advantage of airline employees, particularly for recent years, is associated with unionization. Looking at results for 1983, for example, we find that the substantial .29 air industry log earnings advantage is reduced to .185 for nonunion airline workers, following an accounting for within-industry union-nonunion differentials, and to .12, after accounting for industry union density. In 1997, the total industry earnings premium from the standard model is .15. Adding the union dummy reduces \( \Theta \) to .05, while addition of the density variables reduces it further to .01. In short, the results suggest not only that the airline industry wage advantage has fallen over time but also that all of any remaining premium is union related. Union bargaining power is reflected in both an earnings advantage for union compared to nonunion workers and in a higher earnings level for nonunion workers owing to the high industry union density.23

Much of our attention has focused on industry wage levels. Yet the identification of within-industry earnings differentials helps us to understand labor market behavior in the airline industry. As seen in table 5, during and immediately following the regulatory period, the within-industry union differential was only about .10, while the industry earnings premium was large, reflecting substantial nonunion rent sharing and limited wage competition within the industry. Following deregulation, the union-nonunion differential rose to as high as .25 in 1985, while entry and price competition in product markets spurred relative earnings decreases among nonunion workers. Over time, competitive forces placed downward pressure on union as well as nonunion earnings and brought about a narrowing of the union-nonunion differential to a level around .15 during the early 1990s, a period of financial distress in the industry. During the 1996–97 rebound in airline profitability, however, the union premium returned to mid-1980s levels. This pattern is consistent with

23 Our analysis does not address the possibility of union-related skill upgrading by which union wage premiums lead firms to hire and retain higher quality workers. Wessels (1994) shows that skill upgrading need not follow from standard theory. Card (1996) and Hirsch and Schumacher (1998) conclude that unions are associated with positive selection among workers with low measured skills and vice-versa but unions have little effect on average skill levels.
there being continued union bargaining strength but a willingness to moderate demands when employment or bankruptcy is threatened.\textsuperscript{24}

It is instructive to note differences between the airline and trucking industries following deregulation in each. As documented by Rose (1987), Hirsch (1988), and Hirsch and Macpherson (1998), union membership and wages among truck drivers fell quickly toward competitive levels following deregulation, while nonunion wages, already close to competitive levels, changed little. By contrast, deregulation in the airline industry initially had a large effect on nonunion earnings, while union earnings eroded slowly. This is consistent with evidence in table 5 indicating that during the regulatory period, union and nonunion workers were earning rents and that union bargaining power has been able to slow the long-run transition to competitive wage levels for its members. In contrast to trucking, airline unions maintained bargaining strength owing to higher levels of coverage, a more specialized workforce requiring training and in some cases certification (e.g., pilots), sizable market shares among major carriers, and a hub system vulnerable to strikes (Cappelli 1992). Over time, union power may have eroded in the face of price competition spurred by low-cost carriers, gradually declining membership density, and falling relative wage levels and cost differentials within the industry. That being said, unions continue to have a major presence in airline labor markets, and their bargaining power has been recently enhanced by robust product market conditions and an easing of competition from low cost carriers.

The increase in within-industry earnings dispersion following deregulation can be seen not only in union-nonunion differences, but also by differences in wage payments across carriers and in industry earnings dispersion. Other studies have demonstrated an increased dispersion in contractual wages across carriers following deregulation (Johnson 1991, pp. 158–59; Card 1998, tables 7a–7c). We examine changes in earnings dispersion in the airline industry relative to economy-wide dispersion using individual data from the CPS. We provide two alternative measures, the variance in the log of weekly earnings and the variance of the residuals from log earnings regressions, which we have estimated separately for the

\textsuperscript{24} Nay (1991) concludes that financial conditions or “ability to pay” is the primary determinant of whether airline unions grant concessions, while Thomas, Officer, and Johnson (1995) provide evidence that the capital market has responded positively to airline wage concessions. Flanagan (1984) provides economywide evidence suggesting that unions provide concessions when employment for the “median” member is threatened. Freeman and Kleiner (1999) conclude that unions in U.S. manufacturing will push firms to the brink of bankruptcy to acquire wage gains but rarely push them to the point of failure.
airline industry and economy-wide (excluding air transport). The regression residuals account for changes over time in measurable labor force composition and earnings structure. Comparison of airline dispersion to that elsewhere in the economy is important since earnings inequality (particularly for males) increased economywide during this period.

Rather than present results for each year, table 6 provides the averages across years for three periods: 1973–78, 1986–88, and 1995–97 (the same pattern is evident using annual figures for the entire period). Earnings dispersion increased throughout much of the period. Economywide variances in earnings equation residuals increased from .09 in 1973–78 to .12 in 1986–88 to .13 in 1995–97, while air transport residual variances grew significantly more, from .052 to .087 between 1975–76 and 1979. The evidence is consistent with

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Table 6
Variance of Log Earnings and Residuals of Air Transport versus Nonair Workers

<table>
<thead>
<tr>
<th>Year</th>
<th>Air Transport Industry</th>
<th>Nonair Workers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\sigma^2(\ln E)$</td>
<td>$\sigma^2(\varepsilon)$</td>
</tr>
<tr>
<td>1973–78</td>
<td>.096</td>
<td>.056</td>
</tr>
<tr>
<td>1986–88</td>
<td>.158</td>
<td>.100</td>
</tr>
<tr>
<td>1995–97</td>
<td>.196</td>
<td>.121</td>
</tr>
</tbody>
</table>

**Note.** —Data are from the 1973–78 May Current Population Survey (CPS) and 1986–88 and 1995–97 Current Population Survey Outgoing Rotation Group (CPS ORG) files. They include workers with weekly earnings in the fifth through ninety-fifth percentiles. Columns marked $\sigma^2(\ln E)$ provide the variance of the log of real weekly earnings, unadjusted for worker characteristics, for, respectively, air transport industry workers and all wage and salary workers outside of the air transport industry. Columns marked $\sigma^2(\varepsilon)$ provide the variance of the regression residual from separate log earnings regressions using the standard specification (see table 2) estimated separately for airline and nonairline workers.

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25 Omitted from the analysis are the bottom and top 5% of earners in the combined air industry and economy-wide samples. Analysis of dispersion using the fifth through ninety-fifth percentiles of the earnings distribution eliminates top-coded earners and prevents attaching undue weight to outliers resulting from measurement error.

26 The latter results are not shown in table 6. Card (1998) uses decennial Census data to compare dispersion within the air transport industry and economywide between 1979 and 1989, and he concludes that relative changes were roughly similar. This comparison misses the increase in dispersion prior to 1979.
the thesis that regulation, coupled with substantial union bargaining power, compressed earnings differentials within the industry. Deregulation lessened wage uniformity within the industry as labor costs became an important dimension over which airlines struggled to gain a competitive advantage.

VI. Conclusion

The magnitude of labor market rents and their relationship to product market structure, the regulatory environment, and labor unions are topics at the core of labor economics. Twenty years after deregulation, the airline industry may not yet have settled into what can be considered a steady state. The conclusion that deregulation had little effect on relative airline earnings (e.g., Winston 1993), however, can no longer be maintained. In contrast to steady or rising relative earnings in the years immediately prior to and following deregulation, relative earnings have fallen significantly during the latter half of the 1980s and the 1990s. Workers in the airline industry remain highly compensated. Much of the high pay, however, is the result of worker attributes and job characteristics. Wage premiums remain, but they appear modest for most airline employees, with the notable exception of pilots.

Labor unions provide the key institutional force through which rents have been maintained. Following deregulation, earnings dispersion increased as the pay gap between unionized carriers and employees and an increasing number of nonunion carriers and employees expanded. Worker rents remained sizable and initially rose in the face of expanding traffic, a less than perfectly elastic supply of workers, and sustained union power. This experience contrasts with that in the motor carrier industry, where union strength and rents quickly eroded following deregulation (Rose 1987; Hirsch and Macpherson 1998a). Beginning in the mid-1980s, worker rents in air transport fell substantially, however, first for nonunion workers and eventually for union employees. Unions’ ability to impose costs on carriers remains substantial, but bargaining power has been constrained by the poor financial performance of carriers during much of the period. Such constraints eased after 1995, with a subsequent increase in the union premium. The industry’s history of contentious labor relations and the shallow reservoir of trust held by all parties suggest that current earnings outcomes need not represent a steady state. Absent greater cooperation, attempts by management or labor to significantly alter compensation levels may produce long-run outcomes at individual carriers that are attractive neither to firms’ shareholders nor employees.
Appendix

Earnings Allocation and Top-Coding in the CPS

This appendix describes two features of the CPS that we addressed—“earnings allocation” and “top-coding.” Among workers for whom an earnings measure is not reported, the Census assigns earnings by an allocation procedure, which assigns each nonreporting individual the reported earnings of a “donor” selected on the basis of individual and job characteristics. If an employee group within an industry or occupation realizes a premium, inclusion of workers with allocated earnings will cause the premium to be understated because most workers are assigned donors without a detailed industry or occupation match. We find that all groups of air transport workers with allocated earnings (and, in particular, pilots) have mean earnings lower than airline workers without allocated earnings. Where possible, we exclude air transport workers with allocated earnings. During the years 1973–78, workers who do not provide earnings information have no earnings value included in the May CPS public use files. For the CPS-ORG files for 1979–88, an accurate earnings allocation flag is included. During 1989–93, an allocation flag is included, but it designates only a minority of workers whose earnings are allocated. There is no earnings allocation flag in the 1994 through August 1995 CPS-ORG. Beginning in September 1995, a comprehensive earnings allocation flag is included. We exclude from the analysis all air industry workers with allocated earnings in 1973–88 and from September 1995 forward, some with allocated earnings in 1989–93, and none during 1994 through August 1995. For those years in which not all allocated earners can be identified, we utilize information from years with complete information to predict the proportion of allocated air industry earners and the craft-specific log earnings gap between those with and without allocation. For 1989 through August 1995, we then select the predicted proportion of airline workers in each year to whom earnings are allocated (accounting for the fact that some allocated workers in 1989–93 are already omitted), choosing those workers with the highest likelihood of allocation based on out-of-sample probit equation parameters. Selected individuals then have their CPS log earnings inflated by the craft-specific average gap between allocated and nonallocated workers. Among workers outside of the air industry, average earnings for those with and without allocated earnings are roughly equivalent. While our method involves individual measurement error, it allows us to correctly measure changes over time in absolute and relative air industry earnings.

Weekly earnings in the CPS are top-coded at $999 for 1973–88 and $1,923 beginning in 1989 (the latter corresponds to $100,000 in annual earnings). An unedited earnings field, top-coded at $1,999, is provided in 1986–88. We use this value where available for workers whose edited earnings are capped at $999 during 1986–88. Apart from pilots, few airline craft workers are at the earnings cap. Top-coding is a serious problem, however, for pilots. Although few pilots were at the $999 cap in the early 1970s (e.g., 4% in 1973–74 and 6% in 1975–76), more than 40%
of pilots were top-coded in the years 1981–85. Pilots for whom we had to assign earnings dropped sharply (to about 20%) beginning in 1986, when the unedited earnings field included weekly earnings up to $1,999, and it has crept upward over time.

Earnings to top-coded workers are assigned as follows. For the economywide control group and airline workers other than pilots, top-coded workers are assigned estimated mean earnings above the cap, based on the assumption that the upper tail of gender-specific annual earnings distributions follows a Pareto distribution. These values, available for 1973–97 in Hirsch and Macpherson (1998b, p. 6), increase slowly over time, being approximately $1,400 for women and $1,500 for men during 1973–88, when the cap is $999, and averaging roughly $2,900 and $3,100 for women and men during 1989–97, when earnings are capped at $1,923 (the mean rise gradually over time). Workers whose unedited fields are capped in 1986–88 are assigned the Pareto value corresponding to the $1,923 cap in 1989. The mean of earnings for pilots at the cap is assigned based on information derived from the U.S. Department of Labor, Bureau of Labor Statistics, Industry Wage Surveys (IWS) of the airline industry, for the years 1975, 1980, 1984, and 1989 (these surveys have been discontinued). For the period 1973 through 1988, we calculate a time-series index of mean earnings above the $999 weekly earnings cap based on data provided for pilots and navigators in the IWS. These values are assigned to pilots who are at the $999 cap for 1973–85 and to those pilots during 1986–88 with missing earnings in the unedited earnings field but at $999 in the edited field. Pilots whose unedited earnings are at or above $1,923 during 1986–88 or at the $1,923 cap during 1989–97 are assigned the mean real earnings above $1,923 calculated from the 1989 IWS. This latter assumption appears reasonable given the constant real wage observed in labor contracts at 11 carriers for Boeing 727 captains between December 1987 and January 1995 (Card 1998, table 7a).

References


