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RISING INEQUALITY IN A SALARY SURVEY: ANOTHER PIECE OF THE PUZZLE

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Abstract

Studies of wage inequality based solely on the Bureau of Labor Statistics' Current Population Survey have concluded that the recent rising trend has made family income less equally distributed. To investigate the sources of rising wage variance, this paper examines data from a private salary survey conducted for a panel of firms and occupations in Cleveland, Cincinnati, and Pittsburgh over a 33-year period. These data allow examination, for the first time, of the role of occupational distinctions and employer compensation practices in the recent rise in wage inequality.

The results confirm the existence of rising inequality and reject one important hypothesis. Because wage disparity among nonproduction workers rises even when companies and occupations are held constant over time, the increase is not solely attributable to the direct effects of industrial restructuring (i.e., the net creation of unusually unequal jobs).

During the 1960s, inequality rose mainly as a result of increasing occupational wage differentials and internal labor market variations, and this pattern continued throughout the 1970s. In addition, wage differences among employers underwent a large, apparently permanent increase in dispersion as union and industry wage differentials expanded in the late 1970s. During the 1980s, the only evident source of rising inequality was the widening of occupational wage differentials, a phenomenon that can be linked to increased returns to general education. Finally, despite reports suggesting otherwise, growing use of merit raises had no noticeable impact on wage variation during the 1980s or before.

1. INTRODUCTION

Between 1963 and 1988, wage inequality reported in the Bureau of Labor Statistics' Current Population Survey (CPS) grew.[1] This increase is apparently at the root of much of the recent rise in the inequality of family income (Blackburn and Bloom [1990] and Bradbury [1990]) and has fueled debate about the shrinking middle class.

Almost all previous studies of rising wage inequality have been based on the CPS, with two consequences. First, this highly publicized phenomenon has not been confirmed in alternative data sources, even though all data sets have some limitations. Second, the reasons behind the rise in wage dispersion are still not fully understood because much of the increase cannot be captured by the variables available in the CPS.

Thus, if we are ever to understand this phenomenon, we need to reach beyond the CPS. This paper provides a foray in that direction by studying the pattern of wage dispersion over time in data that include fine detail on both occupation and employer.

One large component of wages is reasonably well understood as reflecting market prices for human capital. Starting from that assumption, Murphy and Welch (1990) find that the economic returns to education grew substantially over the 1980s. However, this factor alone cannot account for the bulk of the growth in inequality during that decade, let alone during the 1960s and 1970s, when estimated returns to education were unchanged. Another component of usual human capital models, the return to experience or age, has also widened recently in the CPS, but much of the increase in wage variance is within age group. Recent changes in the patterns of other less-understood differentials (such as race) are covered in Bound and Johnson (1989), but the story is consistent: increasing dispersion both within and between groups.

It is precisely the pervasiveness of the increased dispersion that has proved most consistent across studies, defeating attempts to identify its source. In one approach to this puzzle, Juhn, Murphy, and Pierce (1989) attribute the unexplained increase in dispersion to growth in the "skill differential," where skill is defined as an employee attribute that is unobserved by the CPS but rewarded by higher wages in the labor market.

Two other studies of widening wage inequality using employer-based data contribute importantly to our understanding of this phenomenon, but they are limited by their inability to control for occupation. Leonard and Jacobson (1990) find that between 1973 and 1988, the dispersion of earnings covered by unemployment insurance in Pennsylvania was unaffected by job distribution changes resulting from establishment births, deaths, or size changes. Davis and Haltiwanger (1990) merge aggregate industry information obtained from the CPS with manufacturing establishment observations reported in the Longitudinal Research Datafile. They conclude that within-plant wage dispersion accounted for most of the growth in wage inequality among nonproduction manufacturing workers between 1963 and 1988. For production workers, the role of between-plant wage dispersion and its growth was much stronger.

This paper adopts an approach that complements that of previous studies by investigating the role of occupational wage differentials and employer wage policies simultaneously. Essentially, the results show that the wages of two hypothetical nonproduction workers who differed in both occupation and employer would have pulled apart over the past three decades even if neither changed occupation or employer.

The analysis then asks which aspects of the differences between their jobs matters most. For instance, if the increasing dispersion is due to expansion of skill differentials, is it skill differences within or between narrowly defined occupations that have grown most? Does the highly publicized move toward merit pay and pay for performance explain some part of the increasing inequality? Alternatively, since employer differentials are an important part of wage dispersion (Groshen [1991]), the growth could stem from changes in wage policies, such as increases in interemployer wage differentials between or within industries. Finally, internal pay relationships among occupations may have diverged more among firms or regions during this period because of rapid technological change, workers' quest for job security, or differences in local labor market conditions.[2]

To explore these issues, I use employer wage records for a sample of occupations in large firms in Cleveland, Cincinnati, and Pittsburgh from 1957 through 1990. These data allow a close focus on the role of changing returns to occupation and employer attributes, but are not well suited to a study of the changing composition of jobs over time, since the sample is not randomly drawn; that is, entry and exit from the sample do not necessarily reflect the birth or death of jobs in the economy. The main omitted effects are probably employment shifts among occupations (since Leonard and Jacobson [1990] rule out much of the impact of employment shifts among firms) and changes in regional differentials (Eberts [1989]).

In brief, this paper reports that occupational wage differentials among nonproduction workers diverged steadily over the past three decades as the returns to training grew. In contrast, wage differences among employers underwent a large, apparently permanent increase in dispersion as union and industry wage differentials expanded in the late 1970s, but otherwise showed no trend. Internal labor markets grew more idiosyncratic over the 1960s and 1970s, but ceased to diverge in the 1980s. Finally, despite reports suggesting otherwise, the growing use of merit raises had no noticeable impact on wage variation.

The remainder of the paper is organized as follows. Section 2 outlines the components of wage variation investigated below and presents the hypotheses associated with each. Section 3 introduces the data set. Section 4 considers trends in five components of wage variation, and section 5 concludes.

2. THE COMPONENTS OF WAGE VARIATION

Research using household surveys is most naturally directed at identifying the role of human capital variables in wage determination. That is, wages are determined by an equation such as

$$(1) \qquad w_{0i} = \beta_0 * H_i + \epsilon_i,$$

where w_{0i} is the log of wages of individual i at time 0, β_0 is the return to human capital, H_i is the amount of human capital that i possesses, and ϵ_i is an orthogonal, randomly distributed error term. Then, the variance of wages at time 0 is

$$(2) \qquad \sigma^2(w_0) = \beta_0^2 * \sigma^2(H_0) + \sigma^2(\epsilon_0).$$

An increase in the variation of wages could be caused by changes in any of the three right-hand variables in equation (2). Thus, if the variance of wages rises to $\sigma^2(w_1)$, the change can be decomposed as follows:

$$(3) \qquad \sigma^2(w_1) - \sigma^2(w_0) = [\beta_1^2 - \beta_0^2]*\sigma^2(H_1) + \beta_0^2*[\sigma^2(H_1) - \sigma^2(H_0)] + [\sigma^2(\epsilon_1) - \sigma^2(\epsilon_0)].$$

In empirical application, H_i is unknown, so proxies such as years of education and age are generally used instead. Some previous studies, such as Murphy and Welch (1990), have focused on the role of increased returns to measured human capital (the first term) while controlling for the effect of changes in the variation of human capital (the second term). Others have examined the second term either by estimating the impact of "new jobs" being created through studying net employment changes in occupations and industries, or by looking at the impact of changing demographics, e.g., race, gender, region, or age (see the summary in Loveman and Tilly [1988]).

This paper focuses on the third term in equation (3): the change in variance of the error term, which usually accounts for 70 percent of the wage variation in household data. Since, by definition, nothing is known about the error term in those data, little can be gleaned from focusing on it, even if one is willing to assume that it primarily captures returns to unmeasured skill (as do Juhn, Murphy, and Pierce [1989]).

To better understand what is happening in the error term, this paper looks at an employer wage survey. Such surveys, rather than consisting of a household-stratified sample of working individuals, are a census of individuals working in selected occupations at selected employers. This strategy allows the effects of employer wage policies to be examined through studying the variations within and between two well-identified characteristics of employment: occupation and employer (neither of which is well identified in household data). It also allows a more direct investigation of the role of recent employer wage policies on wage variation.

Within this framework, wages may be understood as the sum of four components:

$$(4) \qquad w_{ijk} = \beta{*}H_i + \alpha{*}E_j + \gamma{*}E_jH_i + \epsilon_{ijk},$$

where

w_{ijk} = the log wage of employee k in occupation i with employer j (hereafter called "job cell ij"),

$\beta{*}H_i$ = the return to the mean amount of human capital vested in occupation i, plus any compensating differentials,

$\alpha{*}E_j$ = the average wage differential associated with working for an employer with the attributes of employer j,

$\gamma{*}E_jH_i$ = the specific return to occupation i paid by employer j beyond what j pays to the average occupation (this is the internal labor market [ILM] component), and

ϵ_{ijk} = employee k's deviation from the mean wage in job-cell ij (due either to k's skills or to other factors that affect k's wage).

Then, the variance of wages is

(5) $$\sigma^2(w) = \beta^2*\sigma^2(H) + \alpha^2*\sigma^2(E) + 2\alpha\beta Cov(H,E) + \gamma^2*\sigma^2(EH) + \sigma^2(\epsilon_0).$$

In practice, as with H_i in the household survey, H_i and E_j are not observed directly in employer wage surveys. However, vectors of dummy variables for occupation and employer can be used to capture all wage-relevant differences among occupations and establishments.

In equilibrium, the wages of an occupation are largely composed of returns to the human capital required to perform the duties of the position, plus some compensating differentials for the job's characteristics. Even fairly broad occupational categories, such as those found in the CPS, capture almost all of the variation picked up by education and age, the standard measures of human capital (see Groshen [1991]). Thus, narrowly defined occupation can proxy at least as well for human capital as the standard measures, and the estimated coefficient for an occupation reflects the product of the average human capital in the occupation times the return to human capital. Similarly, the coefficient on an establishment dummy estimates the establishment's level of wage-relevant attributes multiplied by the return to those attributes.

The following wage equation is estimated in the analysis below:

(6) $$w_{ij} = \sum_i \mathbf{b}_i O_i + \sum_j \mathbf{a}_j E_j + \mathbf{g}_{ij}.$$

where

w_{ij} = log mean (or median) wage of employees in occupation i with employer j,

b_i = estimated occupation i wage differential (which estimates $\beta * H_i$),

O_i = occupation i dummy variable,

a_j = estimated employer j wage differential (which estimates $\alpha * E_j$),

E_j = employer j dummy variable, and

g_{ij} = the ILM wage differential for occupation i with employer j (which estimates $\gamma * E_j H_i$).

In this context, if the data are unbalanced (that is, if all occupations are not equally represented within each employer), the variance of wages is

$$(7) \qquad \sigma^2(w) = \sigma^2(b) + \sigma^2(a) + 2\text{Cov}(b,a) + \sigma^2(g).$$

Thus, a change in the variance of wages is composed of changes in one or more of these terms.[3] Employer wage surveys are best suited to exploring changes in the returns to attributes rather than in the distribution of jobs. This is because such surveys are not random samples of the population, and entry and exit from the sample is not necessarily the result of market forces. When the composition of jobs is held constant over time, the change in any term in equation (7) will be due to changes in either the returns to attributes or the attributes of occupations and employers over time.

How do these terms translate into more familiar terms and hypotheses? The first component is the occupation term. Based on previous research, this term is expected to rise over the 1980s because the returns to education increased in the CPS over the decade. If returns to skills that are captured in detailed occupation, but not in education, rose in the 1970s and before, this measure should reflect the increase in this skill differential.

Next is the employer wage differential. Previous studies suggest that wage variation by employer accounts for a large part of the residual variation. Although much of this variation has been linked to observable employer characteristics (such as industry, size, method of pay, etc.), no single theoretical source for these differentials has gained a consensus. Thus, this study takes an agnostic approach as to their source by using employer dummies to control fully for any attribute of employers that affects wage level.

This method allows us to identify what has happened to employer wage differentials without imposing a structure or forcing an interpretation on them. For instance, an increase in the variation of these differentials may even be consistent with the "skill differential" story, if employers sort workers consistently across occupations by skill. Alternatively, increased variation in this term could arise from changes in the compensating differential, the efficiency wage, or the implicit profit-sharing premia paid by employers.

The covariance term reflects the extent to which companies with attributes associated with high wages also tend to employ more workers in high-human-capital occupations. In previous estimates, this term has always been positive, meaning that high-wage firms encompass a disproportionate share of high-wage occupations. If this term grows while the distribution of jobs is held constant, it is because the firms with high and growing returns to their attributes also have more than their share of occupations with high and growing returns to their attributes. Such a shift might occur, for example, if the use of efficiency wages has grown mostly among employers with high-skill occupations. Or, it might mean that competitive pressures have lowered wages mostly for low-skilled workers in low-wage firms.

The ILM component measures the uniformity of internal pay relationships among firms. One hypothesis is that workers' quest for job security in the high-unemployment periods of the late 1970s and early 1980s increased the insulation of firms' internal labor markets from outside influences. This diminution of external pressures would have allowed internal pay relationships to deviate substantially from overall market averages, perhaps increasing wage variation stemming from the ILM component. Alternatively, rapid technological change during these years could have created a temporary period of uncertainty, causing relative pay relationships to vary substantially among companies. Third, increases in employer wage differentials may buy a degree of insulation from market pressures, so an increase in the dispersion of these differentials could have allowed a corresponding increase in ILM variation.

Finally, returning to a specification based on individual data introduces a fifth component of variance that captures wage variation among individuals within job cell. According to many reports, merit raises have increasingly replaced promotions and uniform cost-of-living adjustments as the main vehicle for wage adjustment, allowing firms to reward performance directly by raising wages of workers within job cell. Such a change should be reflected as an increase in the individual component of wage variation and could be considered an increase in the return to skill.

3. DESCRIPTION OF THE DATA

Only a few publicly available wage data sets provide information on employers, and none of these offer occupational detail plus the ability to track a sample over a long period.[4] This study uses a data set with both desired features, constructed from an annual private wage and salary survey conducted by the Federal Reserve Bank of Cleveland (FRBC) personnel department for at least 33 years. The survey covers firms in Cleveland, Cincinnati, and Pittsburgh, and its purpose is to assist in annual salary budgeting at the Bank. In return for their participation, surveyed companies are issued result books for their own use.

Participants in each city are chosen by the FRBC to be representative of employers in the area. The number of companies participating on an ongoing basis has grown over time, from 66 to 96 per year, for an overall average of 83. Cincinnati companies usually make up about one-quarter of the sample, with Cleveland and Pittsburgh evenly represented in the balance. Overall, about 200 companies have taken part in the survey at one time or another, for an average of just under 13 years each (the range is one to 32 years).

Each participating firm judges which of its establishments to include in the survey, depending on its internal organization. Some include workers in all branches in the metropolitan area, while others report wages only for the office surveyed. The discussion below uses "employer," a purposely vague term, to mean the employing firm, establishment, division, or collection of local establishments for which the participating entity chooses to report wages.[5]

The industries included vary widely, although the emphasis is on obtaining employers with many "matches," i.e., employees in the occupations surveyed. Included are government agencies, banks, manufacturers, wholesale and retail trade companies, utilities, universities, hospitals, and insurance firms. These are generally large employers.

The number of occupations surveyed each year ranges from 43 to 100. (See Appendix A for a comprehensive list of all occupations ever included.) On average, each employer reports wages for 27 occupations per year. The surveyed jobs are almost exclusively nonproduction, since these are the positions that can be found in all industries. Included are office (e.g., secretaries and clerks), maintenance (e.g., mechanics and painters), technical (e.g., computer operators and analysts), supervisory (e.g., payroll and guard supervisors), and professional (e.g., accountants, attorneys, and economists) personnel. Many of these categories are further divided into a number of grade levels, depending on required responsibilities and experience. Job descriptions for each are at least two paragraphs long.

One reasonable concern is that the survey could be an unrepresentative sample of the areas' employers. To check this, I compared wages in the survey with Bureau of Labor Statistics' Area Wage Surveys (AWS) conducted in the same years for the same cities. (The AWS also oversamples large employers.) The results show that movements of mean wages for similar occupations are highly correlated across the two surveys, with levels generally within 5 percent of each other.

The complete data set has 75,078 job-cell-years of observations.[6] Each observation gives the mean or median salary for all individuals employed in an occupation by an employer in a given city.[7] Cash bonuses are included as salary, but fringe benefits are not. For the years 1980 through 1990, data on individual salaries within job cell are available. The results of this analysis are presented at the end of section 4.

From these data, employer and occupational wage differentials are estimated independently for each city and year using wage equation (6) (following Groshen [1991]). The estimated coefficients on occupation reflect the average wage differences (over the mean occupation in the city) paid to the occupation by an employer in a city in a particular year. The estimated coefficient on each employer dummy (after standardizing the mean to zero for each city-year) is the average wage differential paid to the average occupation by that employer in that year. Log-point wage differentials can be interpreted as approximate percentage-point differences from the mean if they are about 10 percent or less.

In general, Cleveland, Cincinnati, and Pittsburgh are more urban, have more cyclically sensitive employment, and have undergone more industrial restructuring than the nation as a whole. Prior to the 1980s, wages in these three cities were higher than the national average. Now, they are approximately average for the country.

4. COMPONENTS OF WAGE VARIATION OVER TIME

A. Total Variation

Table 1 describes the dimensions of the data set and presents the pattern of wage variation over time. The increase in the size of the sample is clearly visible. Variation in the number of employers and occupations is the result of occasional missing data, changes in employer participation over time, and periodic decisions by the FRBC to expand (or contract) the survey's coverage.

The fourth column of table 1 shows that wage variation increases substantially over time in all three cities, from a standard deviation of about .33 log points to about .45 log points. Since these standard deviations are taken over the medians (or means) of job cells, with a weight of one per cell, they control for the effect of changes in the distribution of workers.

Occupations and employers are added and deleted from the sample over time, however, so the fourth column does not control for the simple possibility that the survey now includes more-diverse occupations and firms than in earlier years. To control for sample changes, the paper uses a "rolling sample" technique, the results of which are shown in the last column of the table. Between any two years, the change in variation is measured only for the subsamples of job cells that are present in both years. Those changes are then added to the cumulative sum of previous changes plus the initial variance. The square roots of these estimated variances are the rolling sample estimates of the standard deviation of wages in the sample.

Since the rolling samples are occasionally small, are missing for two years, and look noisy, the last column of table 1 reports "smoothed" standard deviations, taken from three-year moving averages of the rolling sample estimates of the wage variance.

The rolling sample method of controlling for compositional changes suggests that wage variation has indeed risen substantially over the sample period, although perhaps not as much as the raw numbers in the fourth column would suggest. Wage variation has increased about nine log points. Although the variation rose in each of the three full decades covered, the rate of increase was clearly highest in the 1970s, particularly during the later years.

Thus, the rise in wage variation over the last three decades can be seen even when occupations and employers are held constant between periods. The increase is not solely a result of the direct effects of industrial restructuring ("deindustrialization"). That is, dispersion has not risen simply because of the net entry of a disproportionate number of very-low-wage and very-high-wage employers or occupations into the labor market over the period.

B. Variation among Employers and Occupations

Table 2 shows what happened to the variation due to occupation, employer, and ILM wage differentials over time. The amount of variation among employers and occupations is consistent with that found in other data sets (see Groshen [1989, 1991]).

Figure 1 plots the movement of standard deviations of the rolling samples over time. Although the variation in all three series rises over the period, the patterns displayed by the occupational and firm differentials are quite different. Occupational wage differentials widen moderately in the 1960s, then expand more rapidly in the 1970s and 1980s. In contrast, employer wage differentials show a period of dramatic widening in the 1970s, surrounded by a slight tendency toward conversion in the 1960s and 1980s. ILM variation increased in the 1960s and 1970s, but was flat in the 1980s.

Which types of occupations gained relative to others during this period? One way to answer this is to identify the occupations that gained or lost most ground relative to others over a given time span. Table 3 presents the winning and losing occupations in each city from 1974 to 1990. Although Cleveland and Cincinnati have a number of losing occupations in common, and two occupations (registered nurses and payroll clerks II) show up as winners in all three cities, it is not easy to draw generalizations from the list.

A more general approach is to look for evidence of an increase in the returns to both formal education and skill in the widening occupation differentials. To do this, I merge information on job attributes with the survey data.[8] Although many attributes could be examined, two generally explain 60 to 70 percent of the variation in occupational wage differentials. These are "specific vocational preparation" (SVP, entered as the midpoint in years for each range) and the average of "general education development" (GED) of three types: reasoning, mathematical, and language.[9] Appendix B contains detailed definitions of these terms.

To discern changes in the rewards to these factors over time, I regress occupational differentials on these characteristics in each year. Figure 2 shows the deviations from the mean of the two estimated coefficients over the sample period. Notice that even before the highly erratic patterns of the mid-1970s, SVP and GED followed quite different courses. Returns to SVP are fairly flat, with the exception of a jump in the mid-1970s. In contrast, the coefficient on GED rises consistently over the sample period, except for a strong dip in the mid-1970s. Both sets of coefficient estimates are statistically significant in almost all years.

Thus, the finding in the CPS of increased returns to education is confirmed in this data set and seems to explain much of the increase in wage variation among occupations during the 1960s and 1980s. Returns to SVP, on the other hand, do not appear to have risen substantially over the last three decades.

Of course, occupational demands have changed over time, but these attributes are entered as if they had remained constant. If the descriptions of occupational responsibilities are less accurate in the earlier years, one would expect a bias toward zero in the coefficients for these years. However, the explanatory power of the model should then be lower in the early years, which it is not.

Turning to employers, what characterizes those showing large increases or decreases in their relative wages? Since most of the increase in the dispersion of employer differentials occurs in the second half of the 1970s, we can rank employers by the size of the change they experienced from 1974 to 1980, and then look for common traits among those with the largest changes. For 38 of the 60 employers included in the sample in both years, estimated wage coefficients changed by less than .04 log points (in either direction), or wound up closer to the mean than they started.

Among the five employers that showed declines of more than .04 log wage points in their wage differentials while increasing their distance from the mean, none is even partially unionized. By industry, four are banks and one is an insurance company.

In contrast, among the 19 employers with increases of more than .04 log wage points that increased their difference from the mean, 14 are at least partially unionized. This is consistent with the high inflation and loose labor markets of the 1970s, and also with the fact that union wages are more likely to have cost-of-living indexing. Nine of these employers manufacture durable goods (including steel), six are utility or telephone companies, three are government agencies, and one is a nondurable-goods manufacturer.

Thus, large increases in employer wage differentials in the late 1970s are mainly due to the widening of the union wage differential and the differentials paid by durable-goods manufacturers and utilities, and perhaps to the effects of bank deregulation and the unionization of federal jobs. Among the many unanswered questions about this result is why the increase in variance in the 1970s appears to be so long-lived.

C. ILM Variations and Interregional Differences in Pay Relationships

The final columns of table 2 show the growth in ILM variation between 1955 and 1990 in the rolling samples. This portion of wage variance grew in the 1960s and 1970s, but, like employer differentials, was flat in the 1980s. Perhaps because of the broad range of occupations and industries included in the sample, this component is larger than that estimated in other studies and thus requires further investigation.

This pattern means that the extent to which internal wage relationships mirrored the wage ratios among occupations in the external market fell during the 1960s and 1970s, generally preceding the increase in wage variation by employer. Thus, we cannot explain the growth in the ILM component by arguing that larger employer wage differentials insulated more employers from market pressures, allowing them to deviate from external market pay ratios. Instead, growth in this component may reflect either varying lags in adjustment to external changes, an increase in uncertainty about market pay ratios, or greater insulation from the market due to a change in worker preferences.

To investigate whether divergence in pay relationships among regions might be contributing to the increase in dispersion, one can correlate city-specific occupation coefficients across city pairs for each year. In results not reported here, the correlations (rank and regular) all fall between .93 and .99, with no obvious temporal pattern to their minimal variation. However, since the three cities are fairly close to each other geographically, this result does not rule out increased differences among broader regions during the period.

D. Covariance

Figure 3 shows the pattern of the variances (rather than standard deviations) reported above, along with the covariance term. Consistent with other studies, the covariance between occupation and employer differentials is positive, suggesting that high-wage employers have a disproportionate number of high-wage occupations within their organizations. Growth in this term while the sample is held constant could arise only from changes in occupational or employer differentials. That is, the employers with rising differentials are those that employ high-wage occupations, and the occupations with rising differentials are those employed mostly by high-wage employers. Note that the covariance term exhibits no trend over the period. Thus, rising covariance does not seem to be a source of increasing wage dispersion.

E. Variation within Job Cell

The data allow investigation of wage variation within job cell only during the 1980s. However, about 80 percent of the employers in this sample report that they implemented or strengthened their form of merit raises and pay for performance during that period. Thus, if these schemes affect the variance of wages, we should see an increase in variation due to this component over the decade.

Table 4 shows a decomposition of wage variation into the portions between and within job cells from 1980 to 1990. In each year, the standard deviation of wages within job cell is very low, as found in Groshen (1991). Even if this component of variation were nonexistent in 1957 and grew steadily until 1980, however, it could not have added much to total variation in the sample. In addition, no sign of an increase in this component or in wage inequality is apparent during the 1980s. Hence, growing use of merit increases or pay for performance appears to have no noticeable impact on wage inequality.

5. CONCLUSION

This study finds that wages of preexisting jobs have diverged in recent years and provides new insight into why they have done so. Figure 3 summarizes these results.

The national trend toward increasing wage inequality between 1957 and 1990 is clear in the FRBC survey, even when controlling for entry and exit of employers and occupations (i.e., the direct effects of deindustrialization). Even if two workers in different jobs did not change jobs over the whole period, they would have seen their wages diverge markedly.

Both occupational and ILM wage differentials widened over the sample period, but showed different patterns. During the 1960s, inequality rose primarily as a result of increasing occupational wage differentials and internal labor market variations. The dispersion of ILM differentials suggests that internal labor markets loosened their ties to external market differentials over the decade.

In the 1970s, occupational and ILM differentials continued to diverge. In addition, wage differences among employers underwent a large, apparently permanent increase in dispersion. This rapid growth seems to reflect a significant rise in the union wage differential, and also in differentials between utility, government, and durable-goods manufacturing.

During the 1980s, the only evident source of increasing inequality was the widening of occupational wage differentials, which can be linked to increased returns to general education. Employer and ILM differentials showed little change.

Two other potential sources of increasing dispersion can be ruled out. First, no trend was obvious in the small amount of variance stemming from the covariance between occupation and employer. Second, wage dispersion among workers within job cell could not account for the change in overall dispersion, and appears to have been unaffected by the adoption of pay for performance and merit-increase programs.

Footnotes

1. For a review of the literature on this subject, see Levy and Murnane (forthcoming).

2. The divergence of regional differentials may well be an important part of the increase in inequality (see Eberts [1989]). However, the geographical proximity of the three cities and the small number of cities covered limit the usefulness of these data.

3. In some of the previous research on this subject, the authors (e.g., Juhn, Murphy, and Pierce [1989]) use interquartile or interdecile ranges to track wage dispersion. Their choice of this robust measure is important in the CPS because of some features of the data, particularly sampling changes and top-coding of high wages. However, top-coding is not an issue in the FRBC data, and sample changes are dealt with in an alternative way. Thus, I use standard deviations and variances to avoid problems with ranges that might occur in small data sets (heaping, for example).

4. See Hotchkiss (1990) for a summary of data sets that include information on employers. For example, microdata reported in Bureau of Labor Statistics' Industry Wage Surveys and Area Wage Surveys have occupational detail, but are not easily linked over time or preserved for long periods. Unemployment Insurance ES-202 data, when available, report individuals' earnings, not wages, and lack occupational detail. The Longitudinal Research Database, maintained by the Center for Economic Studies, goes back to 1972, but covers only manufacturers and provides only mean establishment earnings for production and nonproduction workers, with no occupational detail.

5. Since a participant's choice of the entities to include presumably reflects those for which wage policies are actually administered jointly, the ambiguity here is not particularly troublesome.

6. Unfortunately, records for some cities in some years were not found. Thus, the data set does not include observations on those cities in those years. No observations were available for 1966 and 1970.

7. Medians were recorded from 1974 through 1990. Because medians should be more robust to outliers, this study uses means through 1974 and medians for the years thereafter. Comparison of the coefficients estimated separately for means and medians for the years in which both were available (1974 and 1981-1990) suggests that they are highly correlated (correlation coefficients of .97 to .99). However, coefficients estimated on the medians appear to show more variation than those estimated on means and are more highly correlated over time. The latter two characteristics are consistent with medians being a more robust measure of central tendency.

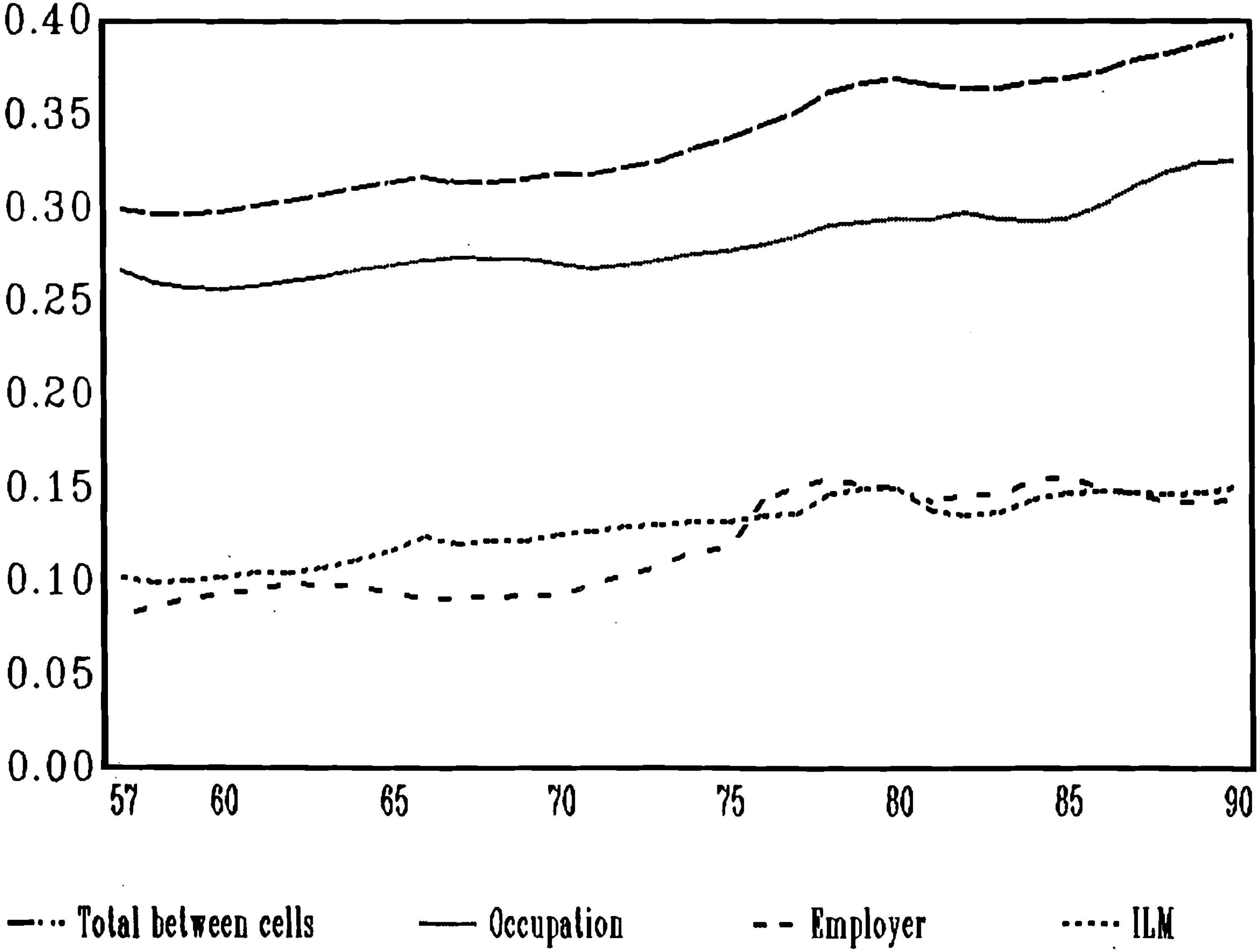
8. The source of these classifications is the National Occupational Information Coordinating Committee at the National Crosswalk Service Center in Des Moines, Iowa (1988 version). Educational, vocational, and physical requirements are listed for each job. Years of specific vocational preparation is entered as the midpoint of the years for each range (see Appendix B) in order to compare these results more directly with those obtained in previous studies. The coefficient on years of SVP ranges from .023 to .064; these values are comparable to those obtained for returns to education in the CPS.

9. While it would be most interesting to discover whether the returns to these three types of education diverged over the period, all three measures are strongly colinear in this sample. Thus, when the measures are entered independently as explanatory variables, much of the intertemporal variation in coefficients is negatively correlated among the three. Since the negative correlation suggests that many of the observed movements are spurious, this paper reports results obtained using the average of the three measures.

Figure 1

Standard Deviation of Wage Components

Rolling Samples: Cleveland, Cincinnati, and Pittsburgh, 1957–90



Source: Author's calculations

Figure 2

Estimated Coefficients on Characteristics of Occupations

Deviations from the Mean: 1955–89

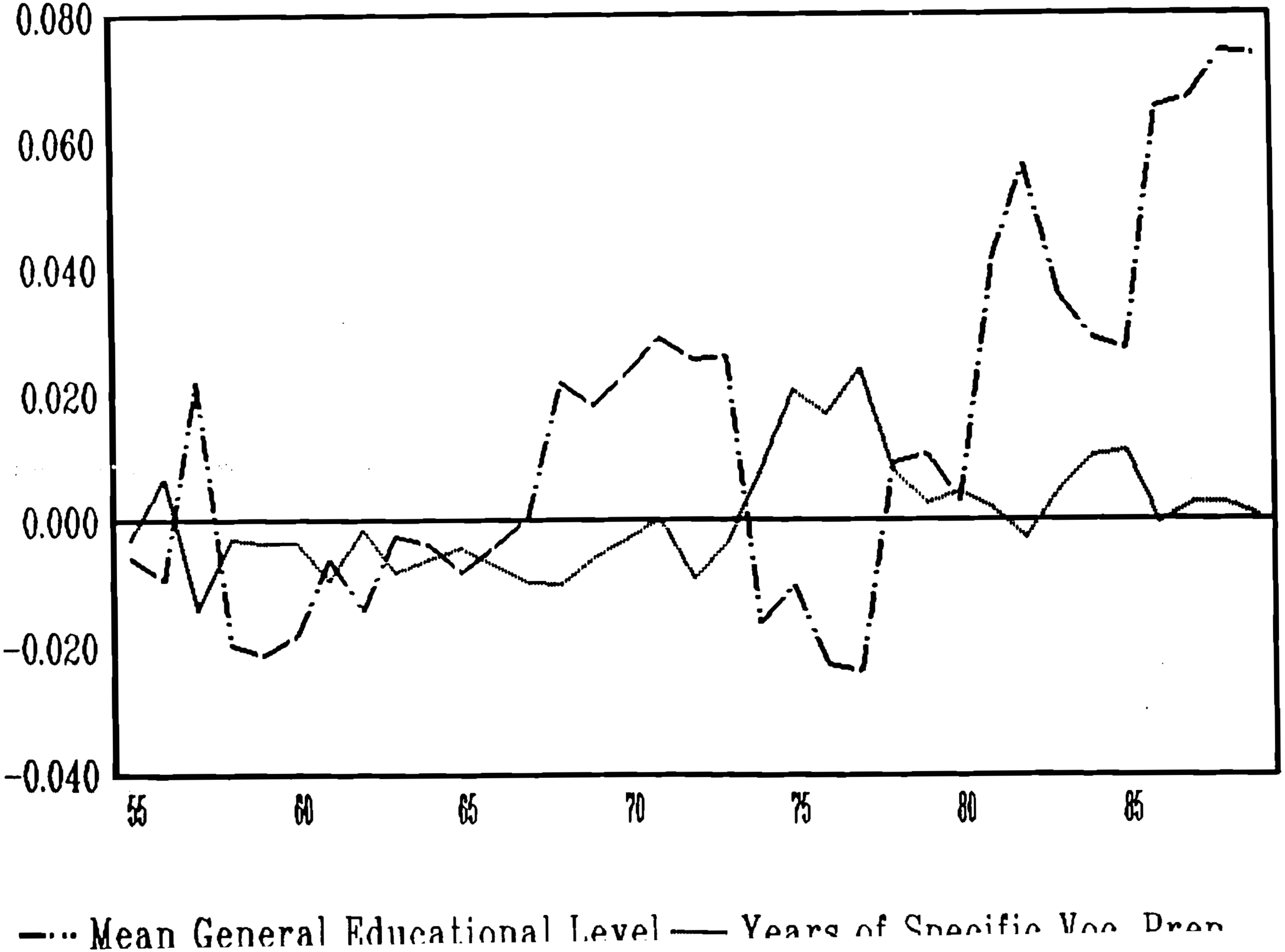


Figure 3

Wage Variance Components

Rolling Samples: Cleveland, Cincinnati, and Pittsburgh, 1957–90

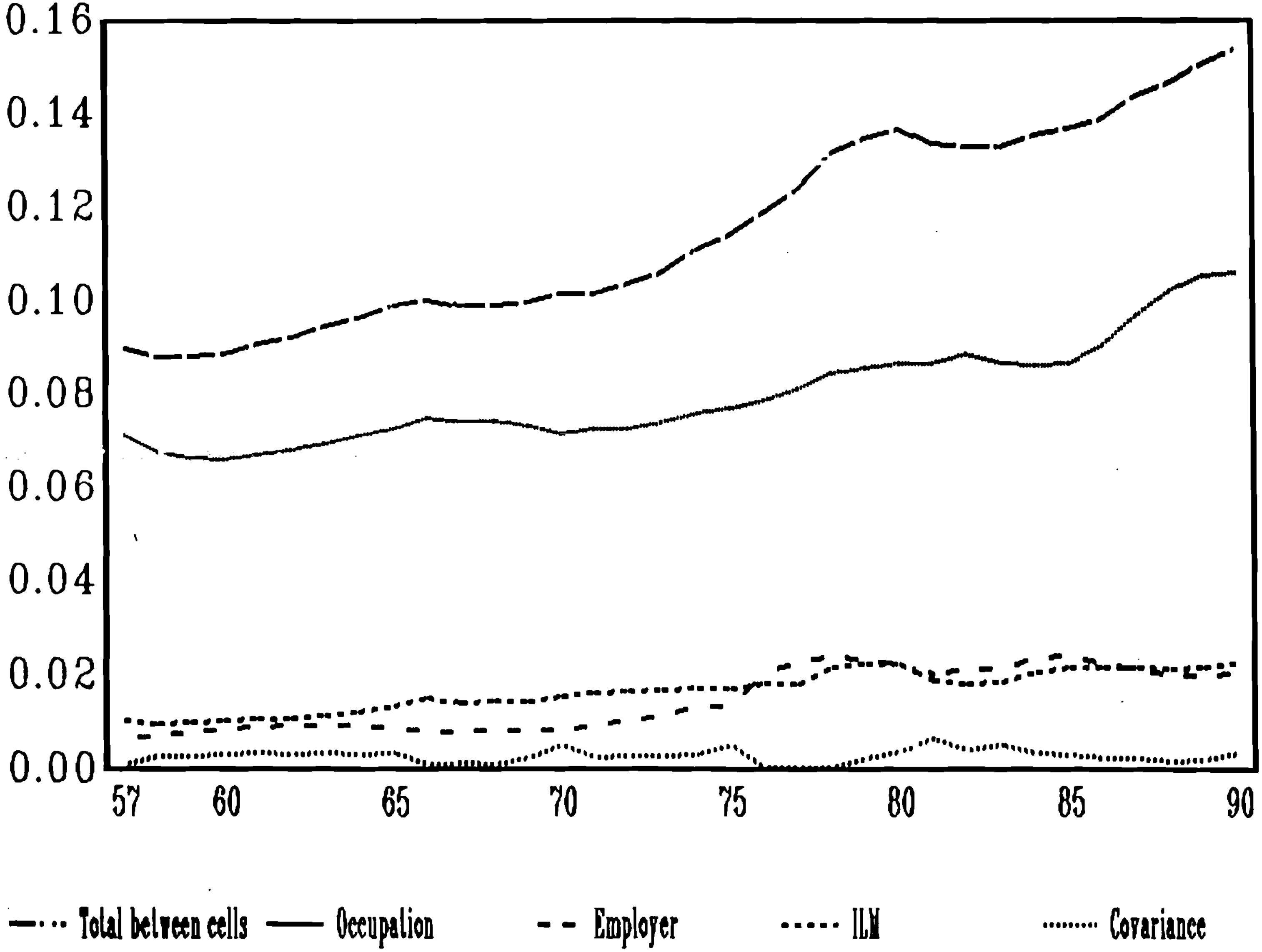


Table 1

Description of FRBC Salary Survey Data

	Total Number of:			Standard Deviation of Log Wages among Job Cells*	
Year	Job Cells	Occupa-tions	Employ-ers	Total Sample	Rolling (Smoothed) Sample
1955	1,375	51	66	.333	.305
1956	1,473	44	77	.314	.304
1957	1,737	47	87	.310	.300
1958	1,737	43	88	.299	.297
1959	1,749	43	88	.296	.297
1960	1,749	43	87	.303	.298
1961	1,993	50	96	.305	.302
1962	1,978	53	94	.311	.304
1963	2,122	53	99	.313	.308
1964	2,250	53	95	.318	.311
1965	2,279	53	97	.323	.315
1966	missing				.317
1967	2,224	53	94	.321	.315
1968	2,383	55	96	.332	.315
1969	2,426	53	97	.333	.316
1970	missing				.319
1971	1,460	66	41	.340	.319
1972	1,954	66	61	.340	.322
1973	2,048	66	66	.342	.326
1974	1,504	40	80	.331	.333
1975	1,215	42	50	.345	.338
1976	1,466	42	75	.344	.345
1977	2,240	72	73	.411	.352
1978	2,635	92	70	.417	.363
1979	3,048	100	83	.425	.367
1980	3,370	100	90	.412	.370
1981	2,477	68	86	.419	.366
1982	2,316	67	84	.417	.365
1983	2,493	76	84	.422	.365
1984	2,748	76	86	.425	.368
1985	2,736	75	88	.417	.370
1986	2,851	76	91	.435	.373
1987	2,742	76	85	.440	.379
1988	2,668	76	84	.447	.383
1989	2,701	76	83	.446	.388
1990	2,931	75	96	.445	.392
Total	75,078			Mean 1960s	.002
Mean	2,208	62	83	annual 1970s	.005
				change 1980s	.002

* In log-wage-point units. Weight: one observation per job cell.
Source: Author's calculations from FRBC salary survey.

Table 2

Standard Deviation of
Occupational, Employer, and ILM Differentials* over Time

Year	Occupational Differentials		Employer Differentials		ILM Differentials	
	Total Sample	Rolling (Smoothed) Sample	Total Sample	Rolling (Smoothed) Sample	Total Sample	Rolling (Smoothed) Sample
1955	.299	.270	.117	.080	.120	.108
1956	.283	.271	.115	.081	.115	.106
1957	.279	.267	.103	.083	.110	.103
1958	.267	.260	.124	.087	.107	.100
1959	.264	.258	.135	.091	.103	.101
1960	.269	.257	.145	.094	.108	.103
1961	.270	.259	.145	.096	.110	.105
1962	.275	.261	.151	.099	.111	.105
1963	.275	.264	.157	.098	.113	.108
1964	.279	.267	.161	.098	.120	.112
1965	.283	.270	.151	.094	.127	.117
1966		.272		.091		.125
1967	.280	.274	.182	.092	.122	.121
1968	.293	.273	.179	.092	.117	.122
1969	.292	.273	.185	.093	.125	.122
1970		.271		.093		.126
1971	.300	.268	.099	.099	.130	.128
1972	.299	.270	.103	.104	.123	.130
1973	.302	.272	.166	.109	.123	.131
1974	.281	.276	.196	.117	.120	.133
1975	.298	.278	.220	.118	.123	.133
1976	.289	.281	.222	.145	.124	.136
1977	.339	.285	.226	.152	.147	.137
1978	.361	.291	.192	.156	.149	.148
1979	.359	.293	.180	.153	.167	.151
1980	.353	.295	.176	.151	.151	.151
1981	.375	.295	.148	.144	.138	.139
1982	.382	.298	.127	.147	.124	.136
1983	.375	.295	.164	.147	.140	.138
1984	.367	.294	.198	.155	.150	.145
1985	.370	.295	.177	.157	.144	.148
1986	.380	.302	.173	.151	.150	.149
1987	.390	.312	.164	.147	.153	.148
1988	.401	.320	.149	.143	.150	.147
1989	.399	.325	.142	.143	.153	.148
1990	.393	.326	.142	.144	.158	.151
Mean annual change						
1960s		.001		.000		.002
1970s		.003		.006		.003
1980s		.003		-.001		.000

* In log-wage-point units. Weight: one observation per job cell.
Source: Author's calculations from FRBC salary survey.

Table 3

Occupation Winners and Losers, 1974-1990

Occupations That Gained at Least Twenty Log Points on Three or More Occupations	Number of Occupations Gained on	Occupations That Lost at Least Twenty Log Points to Three or More Occupations	Number of Occupations Lost to
Cleveland (Total occupations in 1974 and 1990: 18)			
Registered Nurse	10	Painter I	3
Purchasing Clerk	16	Data Entry Operator	3
Payroll Clerk II	16	Administrative Secretary	3
		Stenographer	3
		Computer Operator I	3
		Clerk Typist	3
		Stock Clerk	3
		Executive Secretary	3
		Programmer II	5
		Analyst Programmer I	8
Other occupations included (listed from least to most growth): Telephone Operator, Audit Analyst III, Electrician, Carpenter, Lead Computer Operator.			
Cincinnati (Total occupations in 1974 and 1990: 14)			
Registered Nurse	8	Clerk Typist	3
Audit Analyst III	11	Electrician	3
Payroll Clerk II	11	Stenographer	3
		Painter I	3
		Telephone Operator	3
		Stock Clerk	3
		Carpenter	3
		Computer Operator I	4
Other occupations included (listed from least to most growth): Lead Computer Operator, Data Entry Operator, Payroll Clerk I.			
Pittsburgh (Total occupations in 1974 and 1990: 14)			
Payroll Clerk II	9		
Registered Nurse	12		
Other occupations included (listed from least to most growth): Computer Operator I, Administrative Secretary, Telephone Operator, Lead Computer Operator, Stock Clerk, Carpenter, Data Entry Operator, Painter I, Electrician, Audit Analyst III, Stenographer, Clerk Typist.			

Source: Author's calculations from FRBC salary survey.

Table 4

Wage Dispersion within Job Cell during the 1980s

	Standard Deviation of Log Wages*		
Year	Total	Between Job Cells	Within Job Cell
1980	.353	.343	.003
1981	.355	.344	.004
1982	.348	.339	.003
1983	.352	.344	.003
1984	.355	.347	.003
1985	.362	.354	.003
1986	.378	.370	.003
1987	.384	.375	.003
1988	.396	.387	.004
1989	.384	.375	.003
1990	.388	.379	.003

*In log-wage-point units. The job-cell standard deviations differ fom those in table 1 because individual workers, rather than job cells, are weighted equally here. During these years, the survey covers an average of 20,663 workers in 2,737 job cells, for an average of 7.5 workers per cell.
Source: Author's calculations.

APPENDIX A

All Occupations Ever Included in the FRBC Salary Survey

1 Account Executive
2 Accounting Clerk I
3 Accounting Clerk II
4 Accounting Manager
5 Accounting Supr
6 Accounts Payable Clerk
7 Addressograph Operator
8 Adm Ast I
9 Adm Ast II
10 Adm Ast III
11 Adm Secretary
12 Analyst Programmer I
13 Analyst Programmer II
14 Ast Analyst Programmer
15 Ast Console Operator
16 Ast Dept. Manager
17 Attorney
18 Attorney II
19 Audit Analyst I
20 Audit Analyst II
21 Audit Analyst III
22 Audit Clerk
23 Audit Manager
24 Audit Team Manager
25 Bookkeeping Machine Op
26 Budget Analyst
27 Budget Manager
28 Building Engineer I
29 Building Engineer II
30 Building Equip Mechanic
31 Building Manager
32 Camera Operator
33 Captain of the Porters
34 Carpenter
35 Charwoman-Night
36 Check Adjustment Clerk
37 Check Adjustment Clerk II
38 Check Processing Clerk I
39 Check Processing Clerk II
40 Check Processing Clerk III
41 Check Processing Supr
42 Chief Building Engineer
43 Chief Electrician
44 Chief Maintenance Mechanic
45 Chief Mechanic
46 Clerk Typist
47 Clerk Typist C
48 Clerk Typist II
49 Comp & Benefits Adm
50 Comp & Benefits Manager
51 Comp Analyst
52 Computer Operations Mgr
53 Computer Operations Supr
54 Computer Operator I
55 Computer Operator II
56 Console Operator
57 Correspondence Clerk
58 Custodian
59 Custodian II
60 Data Entry Operator
61 Data Processing Manager
62 Data Processing Supr
63 Day Porter
64 Department Manager
65 Department Manager II
66 Department Secretary
67 Department Secretary I
68 Division Head
69 Economic Advisor
70 Economist
71 Economist II
72 Editor, House Publications
73 Edp Audit Analyst I
74 Edp Audit Analyst II
75 Electrician
76 Employee Benefits Counsel
77 Employment Interviewer
78 Employment Supr
79 Executive Secretary
80 File Clerk
81 File Clerk A
82 Forms Designer
83 General Clerk C
84 General Ledger Bookkeeper
85 Graphics Illustrator
86 Guard Supr
87 Head Telephone Operator
88 Internal Audit Manager
89 Inventory Control Clerk
90 Job Analyst
91 Junior Auditor
92 Junior Computer Operator
93 Junior Economist
94 Junior Stenographer
95 Lead Carpenter
96 Lead Computer Operator
97 Lead Mail Clerk
98 Lead Painter
99 Lead Programmer
100 Lead Stock Clerk
101 Librarian
102 Mail Clerk
103 Mail Clerk I
104 Mail Supr
105 Maintenance Mechanic I
106 Maintenance Mechanic II
107 Mechanic I
108 Mechanic II
109 Methods Analyst I
110 Methods Analyst II
111 Night Cleaner-Male
112 Office Equipment Mech I
113 Office Equipment Mech II
114 Operating Engineer
115 Operations Research Anst I
116 Operations Research Anst II
117 Org Development Spec
118 Painter I
119 Paymaster
120 Payroll Clerk I
121 Payroll Clerk II
122 Payroll Supr
123 Personal Interviewer
124 Personnel Interviewer
125 Personnel Manager
126 Personnel Receptionist
127 Programmer I
128 Programmer II
129 Programmer/Analyst III
130 Proof Clerk
131 Proof Machine Checker
132 Protection Manager
133 Purchasing Agent
134 Purchasing Clerk
135 Receptionist
136 Receptionist Clerk
137 Records/Files Clerk
138 Registered Nurse
139 Research Statistician
140 Secretary to Adm Officer
141 Secretary to CEO
142 Security Guard
143 Sergeant of the Guard
144 Sr Audit Clerk
145 Sr Budget Clerk
146 Sr Functional Expense Clerk
147 Sr Keypunch Operator
148 Sr Stenographer
149 Sr Supr
150 Sr Systems Analyst
151 Statistical Clerk
152 Statistical Clerk I
153 Stenographer
154 Stock Clerk
155 Supr
156 Systems Analyst
157 Systems Consulting Analyst
158 Systems Project Manager
159 Tape Librarian
160 Telephone Operator
161 Trainee Keypunch Operator
162 Training Coordinator
163 Unit Head
164 Washroom Maid
165 Charwoman
166 Proof Machine Operato
167 Sen Proof Machine Opc
168 Offset Pressman
169 I.B.M. Unit Head
170 Multilith Operator
171 Personnel Clerk
172 Tabulating Operator
173 Messenger
174 Department Manager
175 Duplicating Operator
176 Press Operator I
177 Press Operator II
178 Operating Engineer
179 Word Processor
180 Securities Proc Clerk
181 Custodian
182 Information Processor II

APPENDIX B

Occupational Characteristic Definitions

General Education Development: The basic concept of General Education Development (GED) is that some general education and/or life experience is necessary for the satisfactory performance of any given job. This amount varies according to the nature and complexity of the job. GED is defined as follows:

> GED embraces those aspects of education (formal and informal) that contribute to the worker's (a) reasoning development and ability to follow instructions and (b) acquisition of "tool" knowledges, such as language and mathematical skills. This is education of a general nature that does not have a recognized, fairly specific occupational objective. Ordinarily, such education is obtained in elementary school, high school, or college. However, it also derives from experience and self-study.

GED is subdivided into three factors: reasoning development, mathematical development, and language development. The chart on pages 33-35 defines the six levels of each of these factors.

GED Scale

Level	Reasoning Development	Mathematical Development	Language Development
6	Apply principles of logical or scientific thinking to a wide range of intellectual and practical problems. Deal with nonverbal symbolism (formulas, scientific equations, graphs, musical notes, etc.) in its most difficult phases. Deal with a variety of abstract and concrete variables. Comprehend the most abstruse classes of concepts.	Advanced calculus: Work with limits, continuity, real number systems, mean value theorems, and implicit function theorems. Modern algebra: Apply fundamental concepts of theories of groups, rings, and fields. Work with differential equations, linear algebra, infinite series, advanced operations methods, and functions of real and complex variables. Statistics: Work with mathematical statistics, mathematical probability and applications, experimental design, statistical inference, and econometrics.	Reading: Read literature, book and play reviews, scientific and technical journals, abstracts, financial reports, and legal documents. Writing: Write novels, plays, editorials, journals, speeches, manuals, critiques, poetry, and songs. Speaking: Be conversant in the theory, principles, and methods of effective and persuasive speaking, voice and diction, phonetics, and discussion and debate.
5	Apply principles of logical or scientific thinking to define problems, collect data, establish facts, and draw valid conclusions. Interpret an extensive variety of technical instructions in mathematical or diagrammatic form. Deal with several abstract and concrete variables.	Algebra: Work with exponents and logarithms, linear equations, quadratic equations, mathematical induction, and binomial theorem and permutations. Calculus: Apply concepts of analytic geometry, differentiation, and integration of algebraic functions with applications. Statistics: Apply mathematical operations to frequency distributions, reliability and validity of tests, normal curve, analysis of variance, correlation techniques, chi-square application and sampling theory, and factor analysis.	Same as level 6.

GED Scale (Continued)

Level	Reasoning Development	Mathematical Development	Language Development
4	Apply principles of rational systems* to solve practical problems and deal with a variety of concrete variables in situations where only limited standardization exists. Interpret a variety of instructions furnished in written, oral, diagrammatic, or schedule form.	Algebra: Deal with systems of real numbers: linear, quadratic, rational, exponential, logarithmic, inverse, and angle and circular functions; related algebraic solution of equations and inequalities; limits and continuity; and probability and statistical inference. Geometry: Deductive axiomatic geometry, plane and solid; and rectangular coordinates. Shop math: Practical application of fractions, percentages, ratio and proportion, measurement, logarithms, slide rule, practical algebra, geometric construction, and essentials of trigonometry.	Reading: Read novels, poems, newspapers, periodicals, journals, manuals, dictionaries, thesauruses, and encyclopedias. Writing: Prepare business letters, expositions, summaries, and reports using prescribed format and conforming to all rules of punctuation, grammar, diction, and style. Speaking: Participate in panel discussions, dramatizations, and debates. Speak extemporaneously on a variety of subjects.
3	Apply common-sense understanding to carry out instructions furnished in written, oral, or diagrammatic form. Deal with problems involving several concrete variables in or from standardized situations.	Compute discount, interest, profit, and loss; commission, markup, and selling prices; ratio and proportion; and percentage. Calculate surfaces, volumes, weights, and measures. Algebra: Calculate variables and formulas; monomials and polynomials; ratio and proportion variables; and square roots and radicals. Geometry: Calculate plane and solid figures and circumference, area, and volume. Understand kinds of angles and properties of pairs of angles.	Reading: Read a variety of novels, magazines, atlases, and encyclopedias. Read safety rules, instructions in the use and maintenance of shop tools and equipment, and methods and procedures in mechanical drawing and layout work. Writing: Write reports and essays with proper format, punctuation, spelling, and grammar using all parts of speech. Speaking: Speak before an audience with poise, voice control, and confidence using correct English and a well-modulated voice.

GED Scale (Continued)

Level	Reasoning Development	Mathematical Development	Language Development
2	Apply common-sense understanding to carry out detailed but uninvolved written or oral instructions. Deal with problems involving a few concrete variables in or from standardized situations.	Add, subtract, multiply, and divide all units of measure. Perform the four operations with like, common, and decimal fractions. Compute ratio, rate, and percent. Draw and interpret bar graphs. Perform arithmetic operations involving all American monetary units.	Reading: Passive vocabulary of 5,000-6,000 words. Read at rate of 190-215 words per minute. Read adventure stories and comic books, looking up unfamiliar words in dictionary for meaning, spelling, and pronunciation. Read instructions for assembling model cars and airplanes. Writing: Write compound and complex sentences using cursive style and proper end punctuation and employing adjectives and adverbs. Speaking: Speak clearly and distinctly with appropriate pauses and emphasis, correct pronunciation, and variations in word order, using present, perfect, and future tenses.
1	Apply common-sense understanding to carry out simple one- or two-step instructions. Deal with standardized situations with occasional or no variables in or from these situations encountered on the job.	Add and subtract two-digit numbers. Multiply and divide 10's and 100's by 2,3,4,5. Perform the four basic arithmetic operations with coins as part of a dollar. Perform operations with units such as cup, pint, and quart; inch, foot, and yard; and ounce and pound.	Reading: Recognize meaning of 2,500 (two- or three-syllable) words. Read at rate of 95-120 words per minute. Compare similarities and differences between words and between series of numbers. Writing: Print simple sentences containing subject, verb, object, series of numbers, names, and addresses. Speaking: Speak simple sentences using normal word order and present and past tenses.

*Examples of rational systems include bookkeeping, internal combustion engines, electric wiring systems, house building, nursing, farm management, and navigation.

SOURCE: National Occupational Information Coordinating Committee.

SPECIFIC VOCATIONAL PREPARATION

The idea underlying Specific Vocational Preparation (SVP) is that time is required to learn the techniques, develop the facility, and gain the knowledge required for acceptable performance in a specific occupation. SVP is defined as follows:

> The amount of time required to learn the techniques, acquire the information, and develop the facility needed for average performance in a specific job-worker situation. This training may be acquired in a school, work, military, institutional, or vocational environment. It does not include orientation training required of a fully qualified worker to become accustomed to the special conditions of any new job.

SVP can include

a. Vocational education (high school, commercial or shop technical school, area school, art school, and that part of college training organized around a specific vocational objective)

b. Apprentice training (obtained in those jobs offering apprenticeships)

c. In-plant training (provided by the employer in the form of organized classroom study)

d. On-the-job training (instruction given to learner or trainee on the job by a qualified worker)

e. Essential experience in other jobs (received in less-responsible jobs or in other jobs that qualify the individual for a higher-grade position)

To express the SVP required by various jobs, the following scale of time periods has been established:

LEVEL	SVP REQUIRED
1	Short demonstration only
2	Anything beyond short demonstration up to and including 30 days
3	Over 30 days up to and including 3 months
4	Over 3 months up to and including 6 months
5	Over 6 months up to and including 1 year
6	Over 1 year up to and including 2 years
7	Over 2 years up to and including 4 years
8	Over 4 years up to and including 10 years
9	Over 10 years

SVP does not represent just the time required to learn a job, but also involves any amount of practice time needed to apply the learning and thus reach a level of average performance. To illustrate this, consider the case of a bus driver. An inexperienced driver may "learn how" to operate a bus within a few days, but it will take several weeks, perhaps months, before he or she develops the competence of average bus driving. It is important to note that SVP is always measured by performance.

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