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WORKER ENDOWMENTS AND THE EFFECTS OF INSTITUTIONS ON EARNINGS REALIZATION: A CROSS-NATION COMPARISON

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ABSTRACT. In this study we investigate how differential institutions, and their observance within regional labor markets, impact potential earnings realization. We investigate institutional linkages to labor market outcomes by means of cross-nation comparisons between the United States and the Netherlands. In this regard, better job-matching (information) programs, higher relative unemployment benefits and minimum wages, and a greater prevalence of both trade unionism and collective bargaining likely work to the favor of Dutch workers, and in turn augment their reservation wages during job search. The predictable outcome of higher earnings realization among Dutch workers is tested econometrically by frontier estimation.

1. INTRODUCTION

Studies of wage determination often attribute variation in labor market outcomes to differences in labor market institutions such as public information provision, social security, rules regarding job acceptance, collective bargaining, and trade unions. The effects of such institutions should vary (like earnings) across workers by human capital endowments, across regions by labor market

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conditions, and across and between occupations.[1] For instance, it has been argued that professional, white collar, blue collar, and service workers employ different job search strategies, and that search outcomes (jobs and earnings) are likely to vary by quantity and quality of labor market information. In a similar manner, variations among workers in the realization of potential (maximum attainable) earnings—the downside of which result in job "mismatches" and unrealized earnings—can be attributed to institutions. Such institutions, and in turn the degree of earnings realization (attainment), vary considerably among countries, and in part reflect important differences in the role and level of effort of national governments in matching workers to job opportunities and providing social security.

In this study we consider and examine this contention by measuring the effects of labor market institutions within the Netherlands and the United States. These countries were selected because of their significant institutional differences and the availability of comparable data sets for each. In this respect, differences among countries in labor market institutions have received little attention within the labor literature, particularly with regard to earnings attainment. This neglect is partly related to the difficulty of measuring public policy impacts within a national setting. In particular, empirical evidence in this area can only be obtained infrequently when institutional changes occur. Moreover, adjustments to institutions often take place with considerable time lags—such that resulting behavioral effects are difficult to disentangle from other changing conditions.

Institutional linkages to earnings attainment may be examined by means of cross-nation comparisons of labor market systems.[2] This approach is used to investigate impacts of labor market institutions on earnings attainment with inferences being drawn from experience in the Netherlands and the United States. We present a brief overview of labor market institutions in the two countries in the following section, along with a general discussion of each country's public employment service. In Section 3 we develop a formal model of job search where differential institutions are shown to affect reservation wages and, in turn, the degree of earnings attainment. The method by which such attainment is obtained from earnings "frontiers" is also discussed. We present and compare separate econometric estimates of these frontiers for the Netherlands and the United States, in both the aggregate and for major occupational groups in Section 4. Finally, we present our conclusions.

[1]For excellent reviews of earnings studies see Ehrenberg and Smith (1991), and Chapters 8, 9, and 11 in Polachek and Siebert (1993). In addition see Devine and Kiefer (1991) for a comprehensive review of empirical job search literature.

[2]Methodological issues associated with this approach are examined in Folmer and Nijkamp (1985) and Folmer (1986).

2. LABOR MARKET INSTITUTIONS

The labor market institutions pertinent to this study are: (1) job search information and costs, (2) unemployment insurance (UI) benefits, and (3) trade unions and collective bargaining. Each will be discussed below. Because the empirical analysis in Section 4 makes use of the period 1980–1985, we describe the institutions most relevant to these years.[3]

In the United States the role of family, friends, and relatives in providing labor market information on employment opportunities and associated job characteristics is often emphasized. Such information networks are cited as particularly important for blue-collar and service workers. For example, Lansing and Mueller (1967) documented the importance of such information sources for search within both national labor markets and economically depressed areas. The dominance of personal information networks also appears in early case studies of (unemployed) workers such as Lurie and Rayack (1966) and Sheppard and Belitsky (1965).

A nationwide public employment service was established in the United States in the 1930s, initially prompted by the Wagner-Peyser Act of 1933 and subsequently by Title III of the Social Security Act of 1935. The U.S. Employment Service is administered at the state level and federally funded through unemployment insurance taxes. Early case studies such as Wilcock and Franke (1963) attribute only modest success to this organization in disseminating employment information.[4] Studies for the 1980s indicate that neither potential employees nor employers rely upon the Service as their primary source of labor market information. For example, in 1982 only 24 percent of unemployed jobs seekers used public employment services whereas 78 percent searched using "employer directed" methods.[5] Data for 1990 reported by Layard, Nickell, and Jackman (1991, pp. 239–240) are very much in line with these percentages, and confirm the greater importance of direct employer contacts in the U.S. as well as the relative unimportance of public employment agencies.[6]

The reliance of blue-collar job-seekers on information provided by friends and relatives on the one hand, and upon employer-directed information (often at the plant gate) on the other, is indicative of a more limited search network

[3]For an earlier treatment of institutional differences between the U.S. and the Netherlands see Van Dijk et al. (1989).

[4]This may be attributed in part to the ever-changing demands placed upon the service. In this regard, see Levitan, Mangum, and Marshall (1976), Chapter 14 and Cassell (1968).

[5]See U.S. Department of Labor (1983), Table 34. The average number of job search methods used was 1.63 so percentages such as these add to more than 100 percent.

[6]After this period the local public employment services in the US invested in computer systems to maintain their data banks on a more systematic basis. This has assisted the matching process in the US but is not relevant for our 1980–1985 empirical analysis which predates these changes. Another factor that has improved the matching process in the U.S. in recent years is the significant growth of private sector employment services specializing in temporary and part-time positions. Some individuals have transformed such positions into a type of full-time work. Finally, the growth of the U.S. economy in recent years has augmented the matching process.

than that utilized by white-collar workers, and particularly by individuals with professional and technical occupations (Swigart, 1984). For the latter, the utilization of local and national newspaper and magazine advertisements, professional organizations, and private employment agencies both broadens the search process and limits the importance of the public employment service. Studies of white-collar workers in other countries, such as Fineman (1983) in Britain, also suggest a reliance on expanded information sources. In this regard, training studies for upgrading blue-collar and service workers recognize the need for expanded job search (Brecher, 1972).

The functioning of the U.S. Employment Service in the period 1980–1985 stands in contrast to its counterpart in the Netherlands, particularly for blue-collar and service workers. Within the Netherlands, and in other countries such as Sweden, computers at local employment offices are used for job-matching. Local databases are interconnected with one another, making it possible to obtain information in each Public Employment Service (PES) concerning vacancies and unemployed individuals elsewhere. Several studies document the importance of the PES in job search. For instance, Heijke (1986) reports that 37 percent of those searching for employment utilized the PES as their primary information source whereas only 7 percent relied on friends and relatives to provide employment information. The importance of the PES in the Netherlands is also reported in a recent report of the European Commission (1994). Of the unemployed, 63 percent rely on the PES as their main instrument of job search. Private employment services and direct application to employers and advertisements are the main method of job search for about 12 percent of the unemployed. Friends and relatives are of limited importance.

It should be noted that benefit entitlement in the Netherlands requires the unemployed to register at the PES and to accept a job offer that matches individual qualifications. However, there is no requirement that an individual accept a job offer that does not match his or her job qualifications or that requires relocation. Most of the unemployed are obliged to register so information maintained by the PES on these individuals is generally complete and up-to-date.

The opposite is true concerning vacancy information because employers are not required to notify the PES of their employment needs. However, because employers must obtain the agency's permission to discharge workers, and thus must maintain satisfactory relations with this body, vacancies for lower skilled workers are often posted with the PES.

Nevertheless, there is evidence that employers prefer to fill vacancies for higher skilled workers through information channels maintained outside the PES, such as informal networks to include friends and relatives as well as formal channels using both local and national newspaper and magazine advertisements. The following provides at least partial support for this circumvention of the PES particularly in filling vacancies for higher skilled workers. Employers have a natural tendency to prefer the employed and recent school graduates to the unemployed because the latter are assumed to be less qualified. This applies

in particular to the medium and long-term unemployed, a group strongly overrepresented among individuals registered at the PES (Folmer and Van Dijk, 1987). Employed workers and recent school graduates usually do not initially register at the PES so employers tend to exploit the personal and formal recruitment channels maintained outside the PES.

A survey of employers by Gaspersz and Van Voorden (1987) indicates that personnel with lower qualifications are primarily recruited by means of the PES (80 percent), on the internal labor market (75 percent), and by employment agencies (66 percent). Personnel with mid-level qualifications are recruited for the most part via advertisements in national newspapers and magazines (83 percent) or internally (75 percent) whereas professional and technical workers are almost always recruited through national newspapers and magazines (90 percent). Furthermore, Gaspersz and Van Voorden (1987) report that employers use on average 2.8 recruitment channels.

In summary, for lower skilled workers and their job vacancies the PES is an important source of information even in cases where employment is ultimately finalized on the basis of other information. For higher skilled jobs, both job-seekers and employers rely on information provided in national newspapers and magazines, a situation not unlike that in the United States. Thus, for jobs at all occupational levels there exists a well-organized information system in the Netherlands. Finally, it should be noted that the PES assists job matching both directly through the provision of specific information to unemployed workers (regarding vacancies) and employers (regarding potential employees), as well as indirectly through the provision of general labor market information and training (Bajema, 1993).

These observations are supported by information provided in the upper portion of Table 1 indicative of public employment effort in the two countries.[7] For instance, both relative expenditures on employment and training services, and employment within benefit administration in the Netherlands, exceed comparable figures for the United States. Selected characteristics of unemployment insurance (UI) are shown in the middle panel. In this regard, the institutional underpinnings of the two systems are similar with respect to eligibility, benefit determination, and taxation. However, both the duration and relative magnitude of UI benefits are significantly higher in the Netherlands than in the United States. As discussed in Section 3, such UI benefits reduce the opportunity cost of unemployment and job search and in turn augment the effects of better labor market information by raising observed wages relative to potential wages.

Indicators of unionism and collective bargaining are provided in the lower panel of Table 1. Notice that trade union density (percent) in the Netherlands is substantially higher than in the U.S. and this holds for collective bargaining as well. Moreover, in the Netherlands bargaining is predominantly sectoral

[7]The comparison is likely to be biased to the extent that the Dutch unemployment rate over this period was higher than that in the United States.

TABLE 1: Comparison of Public Employment Service, Unemployment Insurance, and Wage Bargaining Efforts in the Netherlands and the United States

Characteristic	Netherlands	United States
Public Employment Service[a]		
Labor Market Training Expenditures as Percent of GDP	0.22	0.10
Active Program Expenditures as Percent of GDP	1.07	0.25
Employees in Unemployment Benefit Administration (per 1000 Persons in the Labor Force)	1.30	(0.5–0.8)[b]
Unemployment Insurance[c]		
Maximum Benefit Duration	36 months	12 months[d]
Subject to Income Tax	Yes	Yes
Initial Relation to Earnings	Proportional	Proportional
Initial Gross Replacement Rate (percent at Average Production Earnings, 1988)	70	50
Wage Bargaining		
Trade Union Density (percent)	26	16[e]
Collective Bargaining (percent)	71	18[e]
Predominant Bargaining Level	Sectoral	Company plant[f]
Economy-Wide Bargaining Coordination	Limited	Lacking
Indices for Labor Standards[g] (synthetic index)	5	0

[a]See OECD (1991), Table 7.12 and OECD (1992), Table 2.15 and Table 2.16.
[b]Authors' estimate from Appendix 2, OECD (1992) and national unemployment benefits personnel reported by U.S. Employment Service.
[c]See OECD (1991), Table 7.2 and Table 7.3.
[d]Basic coverage is 26 weeks, current extension is for 52 weeks.
[e]OECD, 1994, p.173
[f]OECD, 1994, p.175
[g]OECD, 1994, p.154. The synthetic index for the stringency of regulations on labor standards covers: fixed term contracts, employment protection, minimum wages, and employees' representation rights. The highest scores are 7–8 and imply strong government regulation.

whereas in the U.S. it is usually at the company or plant level. Finally, the index for labor standards (based upon rules and regulations governing working conditions to include working time, employment stability, and workers' representation rights) is substantially higher for the Netherlands than the U.S. Each of these factors affect wage bargaining and consequently should increase earnings variation in the U.S. relative to that in the Netherlands.

Based upon such differences in labor market institutions, we now develop two hypotheses concerning earnings attainment in the two countries. First, within wage (earnings) regimes undifferentiated by occupation, unrealized earnings will be significantly lower in the Netherlands than in the United States.

Such an expectation derives from the quality of job-matching (information) programs, as well as greater relative UI benefits, minimum wages, trade union density, and collective bargaining efforts in the Netherlands. Second, among occupational groups, differential earnings attainment is expected both within and between the two countries' wage regimes.

Earnings attainment levels in each country are expected to be lowest among blue-collar workers due to the large relative heterogeneity of this group, as well as their division among skilled and unskilled occupations. In addition, each of the institutions mentioned above likely contribute to the blue-collar earnings gap between the U.S. and the Netherlands, in particular to the availability and use of information channels.

Professional and technical workers are highly specialized. In both countries, such workers are expected to achieve higher earnings attainment than their blue-collar counterparts primarily due to better job search skills (a consequence of higher education). As indicated above, although professional and technical workers in the two countries use similar labor market information channels, more generous unemployment benefits in the Netherlands lower the relative cost of job search there, and in turn promote better job matches (and earnings realization).

The occupation category "other white-collar workers" is strongly dominated by public sector workers in the Netherlands and thus exhibits minimal wage differentiation. Hence, this occupation is expected to possess the highest degree of earnings attainment both within the Netherlands and in comparison to the U.S. occupations as well. These hypotheses are investigated below within a formal model of job search, and by an econometric technique explicitly designed to measure potential earnings and earnings realization.

3. LABOR MARKET INSTITUTIONS AND EARNINGS REALIZATION

The Job Search Model

In this study workers are assumed to obtain observed wages W through optimal search activity.[8] Time is represented by a sequence of discrete periods of fixed length. The number of random wage offers "drawn" from the wage distribution $F(W_o)$ per unit time is assumed to follow the Poisson distribution, with parameter λ representing the "offer arrival rate." In addition, λ as well as parameters of $F(W_o)$ are assumed to be known by searchers and unchanging over time. Finally, although workers may choose among offers received during the current time period they are prohibited from "recalling" offers extended during previous periods.

[8]Here we abstract from the excellent literature survey of Mortensen (1986) and to a lesser extent the reviews by Devine and Kiefer (1991) and Lippman and McCall (1976). In these surveys, prospective employers differentially evaluate a given searcher's (invariant) job skills; consequently, potential employers tender different offers W_o to the searcher according to the wage distribution $F(W_o)$.

Given $F(W_o)$, λ, and interest rate δ, the marginal benefit to continued search can be represented as

$$B(W_r) = (\lambda/\delta)\int_{W_r}^{\infty}(W_o - W_r)dF(W_o) \tag{1}$$

$B(\bullet)$ being convex, nonnegative, and strictly decreasing in W_r. Hereafter, W_r is termed the "reservation wage," the optimal value of which is chosen to equate the marginal cost of continued search with $B(W_r)$. With this in mind, the marginal cost of continued search this period can be defined as

$$C(W_r) = c + W_r - \ell - UI \tag{2}$$

The first term on the right-hand side of Equation (2) represents out-of-pocket cost whereas the latter three terms define the opportunity cost of continued search, each expressed per unit of time. In the latter regard, one relinquishes W_r by continued search, an amount reduced somewhat by the value one places on leisure ℓ and by unemployment insurance UI.

As stated, the optimal reservation wage is determined by the searcher to equate the marginal benefits and costs of continued search in Equations (1) and (2), respectively. This also implies that the optimal stopping rule is to accept any offer that either equals or exceeds the reservation wage implied by $B(W_r) = C(W_r)$. Such a determination is illustrated in Figure 1 for a specific individual with (initial) marginal benefit and cost curves B_1 and C_1, respectively. Based upon these two curves, search should terminate when an offer W_o either equals or exceeds W_r'.

Figure 1 may be employed to illustrate several other important points regarding job search. First, for each worker there exists a "potential" or maximum attainable wage offer (W^* in Figure 1) commensurate with his or her job skills. However, with $B'(W_r) < 0$ and $C'(W_r) > 0$ in Equations (1) and (2) respectively, and $B(W^*) \approx 0$, then $W_r' \leq W^*$. Thus, virtually all individuals experience unrealized earnings once they find a job, and the magnitude of this shortfall is related both to labor market information and to search costs. In this regard, better labor market information or lower search costs would improve the job-matching process, a topic that we address below.[9] Second, $E(W \mid W \geq W_r')$ in Figure 1 derives from the optimal stopping rule. Finally, even though "like" individuals will have equivalent W_r' and W^* in Figure 1, their actual (observed) wages obtained during search ($W_r' \leq W \leq W^*$) will probably differ due to the stochastic nature of the search process.[10]

[9]In this model labor market information is imperfect in the sense that while individuals know the parameters of $F(W_o)$ as well as λ (see above), they do not know which offers will be extended by specific firms.

[10]See Ehrenberg and Smith (1991), pp. 607–614.

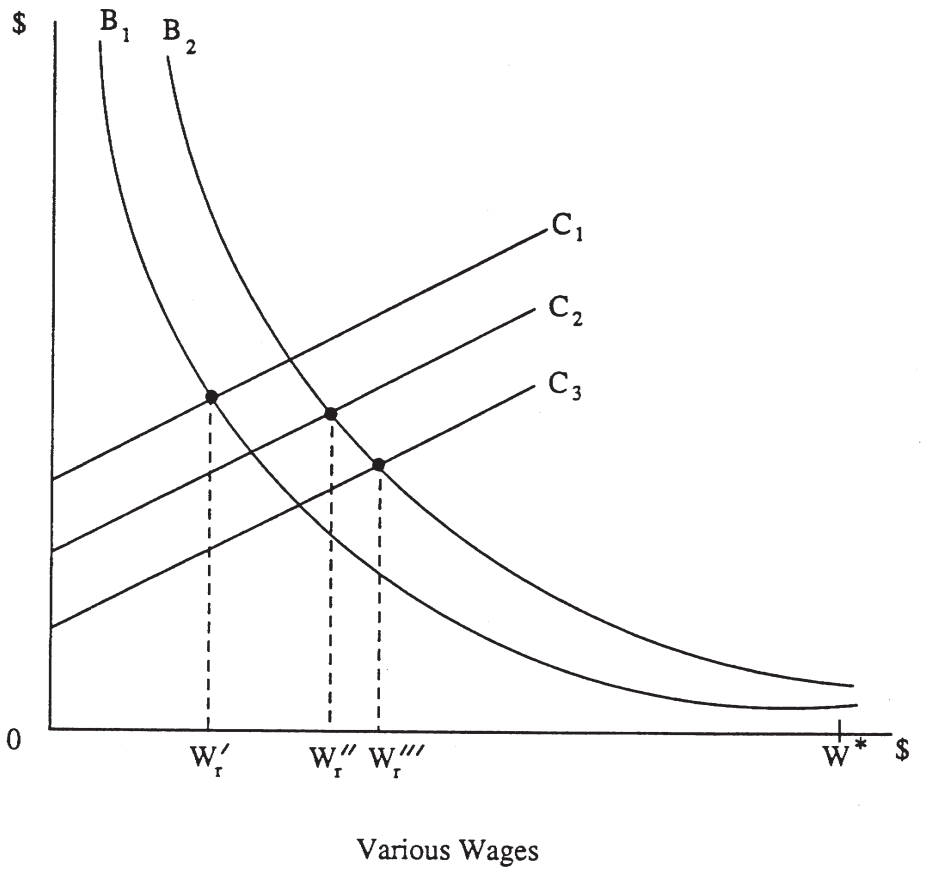

FIGURE 1: Marginal Benefits (B) and Costs (C) of Continued Job Search, and the Determination of Optimal Reservation Wages (W_r).

In Section 2, we noted considerable differences between the Netherlands and the United States in labor market institutions. We are now in a position to demonstrate how such differences affect optimal reservation wages and in turn observed wages. For the individual depicted in Figure 1, it is likely that better labor market information will increase the rate at which offers are extended, λ in Equation (1), and also decrease out-of-pocket search costs, c in Equation (2).

Marginal benefit and cost curves shift to B_2 and C_2 respectively in Figure 1, and the optimal reservation wage is increased from W_r' to W_r''.[11] In this regard, unrealized earnings are reduced to the extent that the optimal reservation wage,

[11]Notice that an increase in the offer arrival rate λ does not affect W^* in Figure 1 the maximum attainable wage instead being determined by the upper tail of the offer distribution $F(W_o)$ which is invariant. For an examination of how the optimal reservation wage would change (up or down) commensurate with changes in the mean or variance of $F(W_o)$ see Mortensen (1986).

and in turn the observed wage, are increased relative to the potential wage W^*. Higher *UI* benefits (per unit time) reinforce the information effects above by reducing the opportunity cost of continued search in Equation (2), and thus by shifting the marginal cost curve in Figure 1 downward from C_2 to C_3. Consequently, the optimal reservation wage is increased to W_r'' and unrealized earnings are further reduced in that the observed wage is increased relative to W^*.

Collective bargaining has no direct effect on the marginal benefits and costs of search. Rather it influences the setting in which search takes place. In the Netherlands collective bargaining occurs at the sectoral level so an individual's bargaining range is quite narrow. On the other hand, in the U.S. collective bargaining generally takes place at either the company or plant level. This means that there likely exists a much larger range of wages for individuals with the same labor market characteristics as well as obvious implications for the marginal benefit of continued search, see Equation (1).

In what follows, it is convenient to measure earnings realization based upon the ratio W/W^* rather than the difference $W^* - W$. Such a comparison, must be ceteris paribus, and it is to that issue that we now turn.

Given the discussion above, observed wages of individuals W are obtained as accepted offers from the distribution $F(W_o)$, and thus are determined by arguments of the latter. In this regard, observed wages are dependent upon: (1) a group of personal attributes ("inputs") traditionally assumed to augment human capital stock H, (2) job characteristics J, and (3) regional labor market conditions R. Inputs in H include education and work experience whereas job characteristics J relate to duties performed, often proxied by industry of employment. However, given $F(W_o)$ and the optimal stopping rule, W is also related to the underlying determinants of job search information and cost in Equations (1) and (2). Although such information and cost likely depend upon H, J, and R above (for example, information is likely to increase with H), they will also vary systematically between the two countries due to institutional differences.

Measuring Unrealized Earnings

With the above in mind

$$W = W(H, J, R) \tag{3}$$

will be estimated for each country with major occupational groups represented initially by binary independent variables and subsequently by individual equations. Also, the "potential" or maximum attainable wage for each worker W^* is solely a function of the offer distribution $F(W_o)$, and thus of its determinants H, J, and R above. Consequently, for each individual characterized by H, J, and R, $W^* = \text{Max}\,[W(H, J, R)]$.

The degree of earnings realization varies directly with W/W^*, and for any group of individuals, with $E(W/W^*)$.[12] Thus, measuring this attainment requires that a potential wage W^* be estimated and compared with the observed wage W for each individual within our research population (described below). In addition, such a determination must be *ceteris paribus* in terms of the inclusion of independent variables for the estimation of Equation (3), as well as the disaggregation of the analysis to accommodate unmeasurable institutional attributes of job search information and cost that vary across countries and occupations. Finally, based upon the job search model outlined above, our estimating equation must explicitly reflect a stochastic wage with a two-sided distribution as well as a separate earnings shortfall term ($W^* - W$) which is nonnegative.

Such a model (wage equation) can be stated as

$$W = f(\mathbf{z}) + v - u \tag{4}$$

where W is again the observed wage, $\mathbf{z}$ is a vector of all wage-determining variables representing human capital stock, job characteristics, and regional labor market conditions, v is a symmetric error, and u is a nonnegative error. In addition

$$W^* = f(\mathbf{z}) + v \tag{5}$$

This model has the same general form as the stochastic frontier production function of Aigner, Lovell, and Schmidt (1977) and is similar to the earnings frontiers developed by Herzog, Hofler, and Schlottmann (1985), Hofler and Murphy (1992), Hofler and Polachek (1985), and Polachek and Yoon (1987). Based upon Equations (4) and (5), notice that $W/W^* = 1 - (u/W^*)$. In addition, note that: $u = 0$ when $W = W^*$; $u > 0$ when $W < W^*$; and u varies across individuals as W/W^* varies. Finally, because the nonnegative error term satisfies these three characteristics, it is asserted that u in Equation (4) captures the effect of unrealized earnings. Thus, this wage frontier, Equation (4), is the explicit equivalent of Equation (3).

For any N individuals within a given country occupational group (professional and technical, other white-collar, or blue-collar and service)

$$E(W/W^*) = (1/N)\sum_{i=1}^{N}\left[1 - u_i/W_i^*\right] \tag{6}$$

When Equation (4) is defined in semilogarithmic form and $-u$ is exponentially distributed, Equation (6) can be expressed as

$$E(W/W^*) = E[\mathrm{Exp}(-u)] = 1/(1 + \mu_u) \tag{7}$$

[12]Hofler and Murphy (1992) interpret W/W^* as an index of *underpayment*, and demonstrate how such underpayment varies with labor market information.

where μ_u is the mean of u. Comparisons of mean earnings realization between countries or among occupational groups may then be made on the basis of Equation (7).

4. ECONOMETRIC RESULTS

Data

A comparative empirical examination of the outcome of the job search process (described above) is made possible by the availability and consistency of survey data in the two nations. The Dutch OSA survey (Vissers, de Vries, and Schepens, 1986) provides labor force data for a national sample obtained in April, 1985 and is the most adequate file of its type in the Netherlands containing wage information. Individual records of the Dutch survey provide information on such characteristics as weekly wages, sex, age, education, occupation, and industry.

Although alternative micro-data sources were available for the United States, this study uses individual records obtained from the Survey of Income and Program Participation (Nelson, McMillen, and Kasprzyk, 1985; U.S. Department of Commerce, 1986). This Survey (SIPP) is the only major U.S. data source that permits wage comparisons with Dutch individuals as of April, 1985 for a large number of observations, and for personal characteristics defined consistently between the two countries.[13]

The hypotheses formulated at the end of Section 2 are expected to hold for both males and females, although not to the same degree. An important reason for gender differences in earnings realization is discrimination (Haagsma, 1995). The analysis is restricted to males because of this and the small number of female observations in the Dutch dataset.

The common universe for our comparative analysis was designed to maximize labor force participation as well as sample consistency. Both samples include white members of the civilian labor force aged 16–60 and exclude individuals attending college, members of the armed forces, and inmates of institutions. The self-employed and part-time workers were also excluded from the research population in order to better represent within our analysis the job search process described in Section 3. Based upon these restrictions the resulting samples consist of 1,141 and 8,087 observations for the Netherlands and United States, respectively.

Table 2 provides information on the industrial and occupational structure of the Dutch and U.S. workforce as tabulated from their respective samples. Of particular interest to the study are variations in earnings realization between the two countries on an occupation-by-occupation basis. In this respect the occupational distribution in Table 2 is essentially the same within the Netherlands and the United States. The distribution of employment by industry is also

[13]The research population for the United States comprises individuals within the sample as of April, 1985 (Wave 6), and allows linked records back to September, 1983 (Wave 1). The Dutch OSA Survey asked individuals for retrospective information as of January, 1980.

TABLE 2: Distribution of Workers by Industry and Occupation in the Netherlands and United States (Proportion)[a]

Characteristic	Netherlands	United States
Industry[b]		
Agriculture, Forestry, and Fisheries	.01	.04
Construction	.11	.10
Manufacturing	.23	.27
Transportation, Communication, and Public Utilities	.10	.09
Wholesale and Retail Trade	.16	.20
Commercial Services and Public Administration	.38	.30
Occupation[c]		
Blue Collar and Service	.50	.52
Professional and Technical	.29	.27
Other White Collar	.22	.21

[a]For a definition of the research population, see the text. Sample observations for the Netherlands and the United States are 1,141 and 8,087 respectively. Characteristics are reported as of April, 1985.

[b]Industry classification is at the three-digit level. This classification was based on the closely matched SBI (Standard Bedrijfsindeling) used by the Dutch Central Bureau of Statistics and the U.S. Standard Industrial Classification System.

[c]Occupational groups are matched at the three-digit level. The Central Bureau of Statistics OSA and Census Occupational Classification System codes were utilized for the Dutch and U.S. data, respectively.

similar between the countries, a notable difference occurring in commercial services and public administration.

Earnings Estimates

Based upon the discussion above, the natural logarithm of 1985 weekly earnings (wage and salary income) was regressed against sets of variables representing both personal and region characteristics as well as industry affiliation. Personal characteristics, H in Equation (3) include age (and age squared), years of education, and household relationships (family size and marital status). Marital status is represented by a binary variable set equal to unity for individuals who are single and to zero otherwise. In addition, given the importance of job transfers for white-collar workers (Schlottmann and Herzog, 1984), a binary variable (mover) was set equal to unity for 1980–1985 inter-province migration in the Netherlands or 1983–1985 interstate migration in the United States.[14] Finally, a variable denoting the number of weeks an individual reported looking for work or on layoff within the above intervals was included as a measure of work interruption.

[14]The Dutch OSA survey provides baseline information as of 1980 while the SIPP sample begins in mid–1983. See footnote 13.

Regional characteristics, R in Equation (3), were included within the analysis to adjust for intracountry differences in local labor market conditions across Dutch provinces and U.S. states. Two of these variables, the 1984 unemployment and 1980–1985 population growth rates, provide controls for disequilibrium conditions.[15] Two other variables adjust for spatial variation in the parameters of Equations (1) and (2) above. In this regard, peripheral areas in the Netherlands and nonmetropolitan areas in the U.S. likely exhibit lower offer arrival rates, λ in Equation (1), than their core (metropolitan) area counterparts. Such areas are distinguished within the estimating equations by a binary variable set to unity for 1985 residences within peripheral (nonmetropolitan) areas and to zero otherwise. On the other hand, both λ in Equation (1) and c in Equation (2) are likely to vary spatially by population density. Consequently, population per square mile (square kilometer in the Netherlands) was included as a fourth regional variable in each country's earnings equation and in each case was entered relative to the national average. Additional variables were added to the U.S. equations to control for any remaining regional heterogeneity. In this regard, eight binary variables were introduced within the earnings estimates to identify the nine U.S. Census Divisions (East North Central excluded).

Finally, job characteristics, J in Equation (3), relate to duties performed while at work and are represented within the earnings analysis by a regime of binary variables. With the exception of manufacturing (the omitted category) these industries correspond to those considered in Table 2.

Separate earnings frontiers were estimated for the Netherlands and the United States by maximum likelihood techniques. This procedure provides consistent estimates of all parameters, after which the two-component error term, v-u in Equation (4), can be decomposed into separate estimates of v and u.[16] In this regard it was assumed that v and u in Equation (4) are independent, that v is normally distributed with a zero mean and finite variance, and that u is derived from an exponential distribution with mean μ_u and variance μ_u^2.

The potential problem of *selectivity* in the earnings estimates was addressed through the application of the Heckman (1979) procedure. Specifically, a probit model of employment was estimated for each country with the appropriate inverse Mill's ratios subsequently included as regressors in the earnings equations. Employment probit estimates for the Netherlands and the U.S. are provided in the Appendix and are consistent with other empirical models such as Devine and Keifer (1991) and Van Dijk and Folmer (1985).

Earnings frontier coefficient estimates are provided in Tables 3 and 4 for the Netherlands and United States, respectively. In both tables estimates

[15]For a discussion of such disequilibrium controls (and measures of excess supply within regional labor markets), see Clark and Kahn (1988).

[16]See Schmidt and Lovell (1979) and Jondrow et al. (1982) for a discussion of the frontier estimation technique. Polache and Yoon (1987) and Herzog, Hofler, and Schlottmann (1985) have also obtained consistent and asymptotically efficient estimates of earnings frontiers by maximum likelihood techniques.

TABLE 3: 1985 Earnings Estimates for Males: The Netherlands[a]
(Dependent Variable is ln Weekly Earnings)

Variables	Total Sample	By Occupation: Blue Collar and Service	Professional and Technical	Other White Collar
Constant	5.02***	5.30***	4.09***	4.88***
Personal Characteristics:				
Age	.04***	.03***	.08***	.05***
Age Squared ($\times 10^{-3}$)	–.41***	–.033***	–.80***	–.52***
Education	.02***	.01**	.03***	.02**
Single	–.08*	–.06	–.10	–.02
Family Size	.01	.01	.01	.02*
Mover	.06***	.06***	.04*	.06**
Work Interruption (Weeks)	–.01*	–.01*	–.01	–.01**
Regional Characteristics:[b]				
Peripheral Area	.04	.04	.08	.01
Unemployment Rate (%), 1984	–.01	–.01	–.01	–.01
Population Change (%), 1980–1985	.01	.02	–.02	.01
Relative Population Density, 1980	.04**	.03	.08*	.02
Industry:				
Agriculture, Forestry, and Fisheries	–.12*	–.08	–.14	–.12*
Construction	.02	.02	.08	.09
Transportation, Communication, and Public Utilities	.01	.04	.01	–.01
Wholesale and Retail Trade	–.01	–.01	–.01	–.02
Commercial Services and Public Administration	.03**	.07***	.02	.03
Occupation:				
Professional and Technical	.18***			
Other White Collar	.06***			
Mill's ratio	–.13	–.20	–.27	–.31
N	1141	565	329	247
Loglikelihood	314	218	56	108
Pseudo[c] R^2	.49	.28	.40	.46

*two-sided t-test significant at the .10 level.
**two-sided t-test significant at the .05 level.
***two-sided t-test significant at the .01 level.
[a]All variables as well as the estimation technique are defined in the text.
[b]The unemployment rate and two population variables pertain to 1985 province of residence.
[c]Defined as the squared correlation between the observed and predicted dependent variable.

shown in the first column were obtained for the entire sample and will later be employed to address the first of the two hypotheses developed in Section 2. In these aggregate equations major occupation groups are represented by dummy variables with blue-collar and service workers comprising the omitted category. The latter three columns of each table provide earnings estimates by occupation and will subsequently be used to investigate how earnings realization is likely

TABLE 4: 1985 Earnings Estimates for Males: The United States[a]
(Dependent Variable is ln Weekly Earnings)

Variables	Total Sample	By Occupation: Blue Collar and Service	Professional and Technical	Other White Collar
Constant	2.63***	3.75***	2.15***	2.43***
Personal Characteristics:				
Age	.14***	.12***	.13***	.17***
Age Squared ($\times 10^{-3}$)	–1.45***	–1.29***	–1.32***	–1.89***
Education	.04***	.02***	.06***	.04***
Single	–.48***	–.30***	–.43***	–.43***
Family Size	–.01*	–.03***	–.03**	–.06***
Mover	.20***	.01	.25***	.41***
Work Interruption (Weeks)	–.01***	–.01***	–.02***	–.02***
Regional Characteristics:[b]				
Nonmetro	–.12***	–.04**	–.27***	–.10***
Unemployment Rate (%), 1984	–.02***	–.01	–.02	–.03
Population Change (%), 1980–1985	–.01***	–.01	–.02***	–.01
Relative Population Density, 1980	.01**	.01**	.01	.01
Industry:				
Agriculture, Forestry, and Fisheries	–.22***	–.30**	–.03	.01
Construction	–.01	.01	–.17***	.22
Transportation, Communication and Public Utilities	.05*	.12***	–.04	.07
Wholesale and Retail Trade	–.23***	–.35***	–.18***	.01
Commercial Services and Public Administration	–.26***	–.31***	–.21***	–.12*
Occupation:				
Professional and Technical	.27***			
Other White Collar	.08***			
Mill's ratio	2.09***	.68*	3.26***	1.04
N	8087	4200	2190	1697
Loglikelihood	–7539	–3548	–1924	–1821
Pseudo[c] R^2	.42	.40	.28	.45

*two-sided t-test significant at the .10 level.
**two-sided t-test significant at the .05 level.
***two-sided t-test significant at the .01 level.
[a]All variables as well as the estimation technique are defined in the text.
[b]Although not shown, eight binary variables were included in each model to represent Census Division of residence (East North Central excluded) in 1985. The unemployment rate and two population variables pertain to 1985 state of residence.
[c]Defined as the squared correlation between the observed and predicted dependent variable.

to vary within each country by job search method and other labor market institutions (the second hypothesis).

We now turn to the estimation results in Tables 3 and 4. Overall, notice that more variables are significant in the U.S. models than in those for the Netherlands,

an outcome probably attributable to the greater number of observations for the former country as well as to a greater regional and industrial heterogeneity there as well. The overall fit of the models is fairly good based upon log likelihood values and pseudo R^2s. Estimates on the Mill's ratios are insignificant for the Netherlands but positive and significant for all U.S. samples other than other white-collar workers.[17] Standard errors have been corrected based upon the Heckman (1979) procedure.

The constant terms in the U.S. equations are lower than those for the Netherlands whereas the effects of the personal characteristics are substantially larger. Although dependent upon exchange rates such differences also imply that U.S. earnings are more closely related to personal characteristics, perhaps indicative of institutional factors, and in particular wage bargaining (Hartog, van Opstal, and Teulings, 1997).

Weekly earnings in Tables 3 and 4 are augmented by additional years of education and age (albeit at a declining rate for the latter), as well as by geographic mobility. Conversely, earnings are depressed among single individuals, by additional weeks of work interruption, and by increased family size in the U.S. Turning to regional characteristics, weekly earnings are uniformly diminished in the U.S. by a nonmetropolitan residence, a result not observed among peripheral areas in the Netherlands. Although earnings are negatively associated with local unemployment rates, statistical significance is obtained only in the U.S. and specifically for the total U.S. sample. In addition, higher rates of population change apparently diminish earnings within the U.S., particularly for professional and technical workers. Conversely, higher local population density significantly augments overall earnings in each country (column 1 of Tables 3 and 4) as well as those of professional and technical workers in the Netherlands and blue-collar and service workers in the U.S.[18]

For the United States (Table 4), earnings within the agriculture, forestry, and fisheries sector; the wholesale and retail trade sector; and commercial services and public administration are in most cases below those in manufacturing (the omitted category) and other industries, *ceteris paribus*. Alternatively, industry affiliation in the Netherlands apparently plays a far smaller role in earnings determination. In this regard, several significant impacts can be discerned in Table 3; these relate to employment within agriculture, forestry, and fisheries on the one hand, and commercial services and public administration on the other. Finally, estimates in the first column of each table indicate, for equivalent H, J, and R in Equation (3), how earnings vary by occupation (under an assumption of equivalent slope coefficients). In both countries earnings of

[17]Although negative selection is not precluded by theory it is difficult to reconcile such negative correlation in most studies of earnings. See for example Podgursky and Swaim (1987).

[18]Although not reported in Table 4, estimates on eight binary Census Division variables indicate, all else held constant, that 1985 weekly earnings within the total sample are diminished by a New England or Middle Atlantic residence and augmented by a West South Central or Pacific residence.

professional, technical, and other white-collar workers are higher than those of comparable blue-collar workers (the reference group).

Unrealized Earnings

Given the earnings estimates in Tables 3 and 4, nonnegative errors u for individuals within each country and model may be determined by Equation (4).[19] Equation (7) may then be employed to estimate $E(W/W^*)$ the mean ratio of actual to potential earnings for Dutch and U.S. workers. These calculations are presented in Table 5. As discussed above, better labor market information and other labor market institutions increase this ratio and in turn decrease earnings shortfalls. Thus, for any model (total sample or major occupational group) differences in the mean level of earnings realization between the countries can be imputed based upon statistically significant differences in $E(W/W^*)$.

Given estimates for the total samples at the bottom of Table 5, Dutch and American males garner, on average, 91.6 and 68.1 percent of their potential 1985 earnings, respectively. A t-test indicates that the above rates for the Netherlands significantly exceed those for the United States.[20] Thus, evidence is provided in support of the first hypothesis, namely that earnings realization in the Netherlands significantly exceeds that in the U.S.

In addition, mean W/W^* ratios were determined based upon occupation-specific earnings estimates in Tables 3 and 4. These ratios (listed in the upper portion of Table 5) provide information relevant to the second hypothesis and indicate significant pair-wise differences in earnings attainment between

TABLE 5. Estimates of Mean 1985 W/W^* by Occupation and Country (Percent)[a]

Occupation[b]	Netherlands[c]	United States[c]
Blue Collar and Service	91.9	68.7
Professional and Technical	93.1	69.5
Other White Collar	95.6	65.4
Total	91.6	68.1

[a]Estimates were obtained from the earnings equations shown in Tables 3 and 4. See Equation (7) in Section 3.

[b]The null hypothesis that mean W/W^* for an occupation in the Netherlands is equal to the corresponding mean in the U.S. was tested by t-statistic. The alternative hypothesis is that these means are not equal. Based upon this test all hypothesis were rejected at the 1 percent level.

[c]Pair-wise differences within countries are significant at the 5 percent level or less, except for blue collar and service and professional and technical workers in the Netherlands, which is significant at the 10 percent level.

[19]These errors were derived from an expression developed by Jondrow et al. (1982). Their method employs the conditional distribution of u, given the estimable total error (v-u), to obtain information about u.

[20]Equality of W/W^* between the two countries is rejected at the 1 percent level. In this regard see the notes below Table 5.

countries (columns). In this regard, earnings realization among Dutch workers is highest for other white-collar occupations, a category dominated by public sector employees. Additionally, comparisons of W/W^* between blue-collar and service workers and professional and technical workers in each country indicate a higher degree of potential earnings attainment for the latter. Thus, in addition to information utilization, within-country variation in W/W^* is probably responsive to other institutional factors that vary in importance by occupation. Based upon such observations the results presented in Table 5 provide credit to the research hypotheses developed above.

Although the W/W^* estimates for the U.S. in Table 5 are lower than those presented elsewhere (for instance, 73.2 percent in Daneshvary et al., 1992), our measure of earnings realization is robust under several sensitivity tests.[21] In the first of such tests the work interruption variable as well as alternative subsets of the regional characteristics variables were deleted from the estimating equations.[22] In a second test earnings estimates were obtained for a geographic region of the U.S. (Connecticut, Massachusetts, Maryland, New Jersey, New York, and Pennsylvania) that better approximates the transportation network and population distribution characteristics of the Netherlands. Under each test the resulting W/W^* estimates were remarkably close to those in Table 5 (deviating by no more than 0.5 percent) and in each case maintained the ordinal ranking by occupation.

5. CONCLUSIONS

In this study we examine how differential institutions and their observance within regional labor markets affect earnings realization. Such institutions relate to job search information and costs, unemployment insurance benefits, and collective bargaining, and they are assumed to influence the degree by which

[21]Alternatively, Hofler and Murphy (1992) find W/W^* for the average U.S. worker to be just over 90 percent. Of course, such a measure of unrealized earnings ("underpayment" in the Hofler and Murphy (1992) study) should vary to some extent with model specification, data source, sample definition and year. In this regard, whereas the current study and that of Daneshvary et al. (1992) employ ln (weekly earnings) as the dependent variable, Hofler and Murphy (1992) utilize ln (hourly wage). In addition, U.S. data in the current study was obtained from the 1985 Survey of Income and Program Participation (SIPP), whereas Daneshvary et al. (1992) employ the Public Use Sample (PUS) from the 1980 Census, and Hofler and Murphy (1992) utilize the January 1983 Current Population Survey (CPS). Also, only the current study corrects the earnings estimates for sample selection bias see Heckman (1979). Finally, Hofler and Murphy (1992) find that the mean W/W^* for males 24 years old and younger is significantly lower (roughly 5 percentage points) than the equivalent measure for prime-age males (age 25–44). Given that the current sample, as well as that employed by Daneshvary et al. (1992) are each confined to male workers, but differ by inclusive age groups, 16–60 and 24–65, respectively, the finding of a lower mean W/W^* in the current study is not unexpected.

[22]As pointed out by a referee, the work interruption variable is likely to be endogenous to the extent that it is a function of other regressors in Tables 3 and 4. However, deletion of this variable from the two sets of estimating equations had little or no effect on earning estimates or resulting W/W^*.

potential (or maximum attainable) earnings are realized. In the past research on this topic has been hampered by the infrequency of institutional change and the difficulty of disentangling such changes from other occurrences within national economies.

However, institutional linkages to earnings realization may be examined by means of cross-nation comparisons, in this case between the U.S. and the Netherlands. In this regard earnings shortfalls among Dutch workers should be diminished in comparison to their American counterparts due to better labor market information, higher relative unemployment benefits, and a greater degree of collective wage bargaining. Moreover, these shortfalls should vary by occupation both within and between countries primarily due to differences in the amount and use of specific information channels.

Earnings frontier models are applied to measure earnings shortfalls. The estimated models for the US and the Netherlands show strong similarities in terms of personal attributes assumed to augment human capital stock (such as age, education, work interruptions, and marital status) but distinct differences in the degree by which weekly earnings vary across regional labor markets and industries. In addition, the findings suggest that such earnings estimates for the U.S. are more sensitive to sample selection bias than is the case for the Netherlands.

Based upon model estimates for the two countries, Dutch and American workers garner, on average, 91.6 and 68.1 percent of their potential 1985 earnings, respectively. Additionally, comparisons of within-country variation in earnings attainment indicate lessor earnings shortfalls in each country for professional and technical workers than for blue-collar and service workers. Consequently, not only does earnings realization differ between the two countries (to the advantage of Dutch workers) but such differences are consistent with job search theory, and, specifically, the formation of occupation-specific reservation wages. In this regard, our findings shed additional light on the importance of labor institutions to labor market outcomes and in turn upon the extent to which worker welfare is responsive to both active and passive labor market initiatives.

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APPENDIX

EMPLOYMENT MODELS

The employment models are based upon earlier work by Van Dijk and Folmer (1985). The probability of being employed and hence observing a wage is assumed to be a function of age, education, marital status, family size, and location of residence in a peripheral or nonmetropolitan area in the Netherlands or the United States.

TABLE A1: Employment Probit Estimates

	Netherlands		U.S.	
	Coefficient	*t*-ratio	Coefficient	*t*-ratio
Constant	1.33	2.97	.36	3.83
Age	–.01	–1.14	.01	5.56
Education	.08	4.55	.04	14.57
Single	–.81	–.81	–.40	–9.09
Family Size	–.06	–.07	.04	2.60
Periphery (Nonmetro)	–.37	–.37	–.09	–2.45
N		1247		9166
Loglikelihood		–325		–3321
Percentage Correctly Predicted		91		88