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THE RETURNS TO SENIORITY IN THE LABOR MARKET FOR ACADEMIC ECONOMISTS

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Abstract

This paper empirically explores the idea that the labor market for academic economists is possibly monopsonistic whereby employers can exploit the heterogeneity of employees to lower the returns to seniority. We estimate the returns to seniority in wage equations from censored salary data generated by grant applications submitted to the National Science Foundation Economics Program. Our results reveal that for academic economists, the returns to seniority are negative. This suggests that the labor market for economics faculty is monopsonistic with employers able to engage in salary discrimination as a result of heterogeneity in employee moving costs.

JEL Classification: *J0, J3, J4, J6*

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Abstract

This paper empirically explores the idea that the labor market for academic economists is possibly monopsonistic whereby employers can exploit the heterogeneity of employees to lower the returns to seniority. We estimate the returns to seniority in wage equations from censored salary data generated by grant applications submitted to the National Science Foundation Economics Program. Our results reveal that for academic economists, the returns to seniority are negative. This suggests that the labor market for economics faculty is monopsonistic with employers able to engage in salary discrimination as a result of heterogeneity in employee moving costs.

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I. Introduction

In this paper, we examine the labor market for university economics professors and test the hypothesis that employers act as monopsonists and exploit heterogeneity in individual moving costs to lower the returns to seniority. Central to theories of compensation is the idea that wages and compensation rise with job seniority, defined as the number of years an individual has been employed by a particular employer. In human capital theory, for example, the positive correlation between wages and tenure results from the worker and the firm sharing the difference between the worker's productivity at the firm where he has obtained tenure and his productivity elsewhere (Weiss, 1995). Sorting theories of compensation, while providing alternative rationales for the wage-seniority and wage-experience profiles, also predict a positive relationship between seniority and wages.[1]

The nature of the wage-seniority profile is of interest as it provides insight into the structure of labor markets, and how movements through the wage distribution are realized (Buchinsky, *et al*, 2001). A positive wage-seniority profile suggests that a movement up in the wage distribution is realized through wage increases within the firm, and that firms have little market power to engage in wage discrimination based on worker heterogeneity. An implication of a negative wage-seniority profile, on the other hand, is that a movement up in the wage distribution is realized when workers are mobile across firms and/or firms have sufficient market power to engage in wage discrimination on the basis of workers' heterogeneity.[2]

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[1]Sorting theories of compensation refer to models where firms use signalling and screening to sort workers according to desired, but unobserved, abilities. For example, when hiring and training costs are high, it can be optimal for firms to offer increasing wage-seniority profiles to deter workers with high propensities to quit from applying elsewhere (Salop and Salop, 1976). Other sorting theories rationalize a positive wage-seniority profile as the result of good job matches (Jovanovic, 1979), and of firms motivating workers to be productive (Lazear, 1981).

[2]Firms with market power have an incentive to pay for employee general training in order to reduce the

For labor markets in general, empirical evidence suggests that the relationship between wages and seniority is positive, even though there is disagreement concerning the magnitude of this effect. Whereas the analyses of Neal (1995), Altonji and Williams (1997), Altonji and Shakotko (1987), Abraham and Farber (1987), and Williams (1991) find a small positive relationship between wages and seniority, the analyses of Topel (1991) and Buchinsky *et al.* (2001) find that the relationship between wages and seniority is positive and large. Utilizing data from German Social Security records, Dustman and Meghir (2001) find that there are small but significant returns to sector-specific seniority.

With respect to the labor market for university professors, the empirical evidence on the relationship between wages and seniority is mixed and contradictory. The analyses of Hoffman (1976), Barbezat (1989), Ransom (1993), and Brown and Woodbury (1998) suggest that for university faculty, the relationship between wages and seniority is negative. McNabb and Wass (1997) also find a negative relationship between wages and seniority when disaggregating by faculty rank. Hallock (1995) in response to Ransom (1993) finds that for a sample of faculty professors at a particular university, a negative wage-tenure profile is not robust, and that in general it appears to be concave with wages increasing with seniority.

Identifying empirically, and determining whether or not the wage-seniority profile for university professors is negative is important for several reasons, as noted by Brown and Woodbury (1998). A negative wage-tenure profile would suggest that university faculty face differential costs to move to alternative jobs, and that universities act monopsonistically and exploit faculty heterogeneity in moving costs to reduce the returns to seniority. In addition, a negative wage-seniority profile would imply that university-specific skills in the academic labor market are unimportant.[3] The relative unimportance of university-specific skill for

returns to seniority (Bhaskar, Manning and Lee, 2002). If the wage paid is below the marginal product, firms are willing to subsidize general training to provide workers with an incentive not to search for other jobs. In this case, turnover is costly.

[3]For university professors, a flat or negative wage-tenure profile suggests, for example, that teaching and

academics would also suggest that for university professors, earnings growth and movement up in the wage distribution is best realized by frequently changing jobs.

Our data, generated from NSF grant applications submitted to the Economics Program, allows us to identify a rich set of individual characteristics. The set of individual characteristics we measure is larger and includes many more individual characteristics than those identified and used by previous analyses of the wage-seniority profile for university professors. As such, our data allows us to better identify the returns to experience and tenure for university economics faculty as a result of being able to measure individual characteristics unobserved in previous analyses. For example we measure and observe both the quantity and quality of individual publications, which are an important measure of individual economics faculty ability and productivity.[4] The data also contains information that allows us to construct a measure to approximate the moving costs for each individual in the sample. Being able to obtain a measure of individual moving costs allows us to empirically examine the hypothesis suggested by Ransom (1993) that the returns to seniority for university faculty are conditioned upon moving costs.

The remainder of this paper is organized as follows. Section II describes the data, the theoretical framework, and our estimation methodology. Our theoretical model follows Ransom (1993) and Boal and Ransom (1997) in which the labor market for economics faculty is

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research skills are general skills and not university-specific, and, therefore, are transferable from a college or a university to another (Brown and Woodbury, 1998). This is probably only approximately true as there is differentiation among colleges and universities with respect to faculty expectations for the mix of teaching, research, and service that professors are supposed to perform. A negative wage-seniority profile for university professors would also be consistent with universities acting as monopsonists and capturing all the returns to university-specific training (Bhaskar, Manning and Lee, 2002).

[4]The analyses of Hallock (1995) and Ransom (1993), on the other hand, utilized a self-reported interval-based measure of individual research productivity, which is possibly biased, not verifiable, and not amenable to quality adjustments.

monopsonistic.Given the top-coding of our salary observations, and the likely correlation between the unobserved error components and experience/seniority, our econometric approach will accommodate both the censoring and the possible inconsistencies that may result from nonlinear estimation with instrumental variables. In Section III, we report our results. Our main finding is that for university economics faculty, returns to seniority are negative, and they appear to vary inversely with individual moving costs. We interpret this as evidence that the labor market for university faculty is monsopsonistic, and employers are able to exploit heterogeneity in employee moving costs. The last section concludes.

II. Data, Theoretical Framework, and Methodology

A. The Data

The data are based on confidential NSF administrative data generated by research proposals submitted to the Economics Program that requested salary funding for the 2001 and 2002 fiscal years. Across these two fiscal years, the NSF Economics Program received between 200 and 400 grant proposals per year. Research proposals are reviewed in two cycles, starting respectively in mid-January and mid-August. Each research proposal contains a budget section, and a biographical sketch section–essentially a curriculum vita. The grant applicant or Principal Investigator (PI) reports information on his/her current salary, personal characteristics such as the year and the institution where academic degrees where earned, the last place of employment and employment history, current and past faculty ranks, citizenship status, gender and race.

We limited the sample to only those grant applicants who are affiliated with a college or a university, are tenured or on a tenure track appointment, and requested summer salary support for the 2002 fiscal year as part of the submitted proposal budget. As a result of NSF

Economics Program norms, summer salaries for faculty are capped.[5] Therefore, as a result of this cap, many applicants with salaries that exceed the program caps, instead of asking for their actual salary, include in the proposed budget the current cap. In this way, the salary data generated by the sample is top-coded or censored. In our analysis, we will accommodate this salary censoring within the methodology for estimating the wage equation.

Given the information reported on individual grant applications, and, where necessary, what we could derive by accessing the web pages of the grant applicant, we were able to obtain 423 individual observations with the following variables: monthly salary (WAGE), years of experience since earning an economics doctorate (EXP), seniority as measured by the number of years on the current academic job (SNRTY), total number of publications in refereed economics journals (TJEL), total number of publications in the top six refereed economics journals (TOPJEL), the total number of published and/or edited book volumes (BOOKS), the indirect cost rate charged by the university where the faculty member or PI is employed (IDR), the total dollar amount of NSF funding received by the PI in the last ten years (TAWD), faculty rank measured as an ordered variable (RNK), the number of different jobs held by the faculty member since earning the doctorate (MOB), and binary variables indicating whether or not the faculty member: had been previously awarded a research grant from the NSF Economics Program (PAWD), has reviewed grant proposals for the NSF Economics Program (RNSF), is a research associate of the National Bureau of Economic Research (NBER), is a female (GNDR), is a white male (WHTM), is a native-born American (NBORN), is employed in a business school (BSC), is tenured (TNR), and is employed in a private college or university (PRV).[6]

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[5]The summer salary cap imposed by the Economics Program was $25,000 for the 2002 fiscal year. This figure represents the maximum amount that can be paid as salary for two summer months.

[6]WAGE is measured in monthly dollars, based upon what the PI has requested for the two-month of summer support in the proposed budget. In cases where the monthly salary exceeds the Economics Program salary cap, it is recorded as $12,500. EXP is measured as the difference between the fiscal year of grant

The variable MOB reports the number of different jobs held by the PI. To complement MOB we constructed for each observation an additional variable (RELOC). RELOC takes into consideration the cost of moving from one university to another university geographically distinct. More precisely, the variable RELOC measures the salary increment that a faculty member would need if he were to move from the state in which his job is currently located, to a job in another state. The variable RELOC may take both negative and positive values. If positive, (as in the case of Mississippi) it indicates that an economics faculty member, say at the University of Mississippi, would need a salary increase to move away from the current institution to some other benchmark university in the U.S and be able to keep a purchasing power comparable to that in his current job. If RELOC is negative, the opposite is true.[7] To calculate the variable RELOC, as a salary increment or decrease, we used the Intercity Cost-of-living index of the *American Chamber of Commerce Researchers Association*. The items and weights used to compute RELOC reflect the typical expenditure of a household headed by a middle-management executive.

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submission and the year the economics doctorate was earned, as reported in the Biographical Sketch Section in the proposal. The three publication variables were obtained from the American Economic Association's EconLit database, and are measured for each individual up to the fiscal year of submission. As of July of 2002, the EconLit Compact Disc included all indexed publications for the time period 1986 - 2001. TJEL excludes working papers books, and book chapters. TOPJEL includes publications in the following journals: *American Economic Review, Econometrica, Review of Economics and Statistics, Review of Economic Studies, Journal of Political Economy, Quarterly Journal of Economics*. BKS includes only volumes edited by a faculty member, and excludes authored book chapters. MOB is obtained from information reported in the Biographical Sketch Section, and includes all geographically distinct positions, including visiting appointments, held by the PI up to the fiscal year of grant submission. TAWD, PAWD, RNSF, GNDR, and WHTM are not reported on the grant application per se, and were obtained from other internal NSF Administrative data that complements all grant applications to the NSF.

[7]We constructed this variable from the American Federation of Teachers Survey 2000, based on a survey of teacher salaries (Nelson, Drown, and Howard, 2000). The report can be obtained at www.aft.org/research.

B. Theoretical Framework

Our theoretical framework follows the approach of Ransom (1993), and Boal and Ransom (1997). Universities are assumed to have monopsonistic power in the market for faculty. Each university faces a trade-off whenever one of its faculty members receives an outside offer. On one hand, the university wants to minimize the employment cost associated to retaining the faculty member, while on the other hand, the offer has to be adequate to retain the person. Given uncertainty about the faculty member's willingness to actually move, the expected cost (EC) for the university to keep the faculty member with an outstanding offer is:

$$EC(w_o) = p(w_o - w_a + \delta m)w_o + [1 - p(w_o - w_a + \delta m)]w_a \tag{1}$$

where w_o is the wage offered by the university to the faculty member, and w_a is the outside offer. $p(\cdot)$ is the probability that the faculty member will accept, w_o, the wage offered by the university. The probability that a faculty member will accept an offer is a function of moving costs (m), discounted at the rate δ. The probability that the offer from the current institution is accepted increases as the differential in annual income, w_o - w_a, more than compensates the annualized costs of moving given by δm.

Minimization of (1) yields the following first order condition:

$$p'(\cdot)(w_o^* - w_a) + p(\cdot) = 0. \tag{2}$$

Since both p' $(\cdot)$ and $p(\cdot)$ are positive, the optimal wage the university will offer will always be less than the outside offer w_a.

Ransom (1993) shows that for a faculty member, expected seniority at a given institution is a function of the probability of moving $p(\cdot)$. Observing that an individual with T years of seniority must have accepted w_o for T years, assuming that all faculty members have the

same value for $p(\cdot)$, and ignoring retirement, Ransom (1993) shows that expected seniority is given by:

$$E^*(S) = \frac{p(\cdot)}{1 - p(\cdot)}$$

Substituting the expression for expected seniority in the first order condition in (2), the equilibrium offered wage becomes:

$$w_o^* = w_a - \frac{1 - p(\cdot)}{p'(\cdot)} \times E(S) \tag{3}$$

From (3) we can see that for a newly hired faculty member, with zero expected seniority ($E(S) = 0$), the offered wage by the university always matches the outside offer. However, as seniority increases, the annual wage offer decreases; that is, $\partial w^*{}_o \; / \; \partial E(S) < 0$. Therefore, since moving costs positively affect the probability, $p(\cdot)$, of remaining at the current institution, there is an inverse relationship between seniority and moving costs. That is, universities are able to exploit differentials in moving costs among faculty members, and the wage offered decreases as the seniority at the institution increases.[8]

C. Empirical Wage Model/Equation

We use the following empirical specification of the process that determines wages in a cross-section of economics faculty:

$$lnW_{ij} = \beta_o + \beta_1 E_{ij} + \beta_2 S_{ij} + \sum_{i=3}^{K-1} \beta_i X_{ij} + \epsilon_{ij}, \tag{4}$$

where the error term is decomposed as:

[8]As Ransom (1993) shows, $\partial p(\cdot) \; / \; \partial m > 0$. That is, as moving costs increase, the probability of accepting a given w_o increases. Seniority also increases with moving costs through its effect on $p(\cdot)$.

$$\epsilon_{ij} = \mu_i + \theta_{ij} + \eta_{ij} + u_{ij}.$$

In equation (4), lnW_{ij} is the log wage of faculty member i in university j; E_{ij} is total labor market experience; S_{ij} is seniority at university j; and the X_{ij} are control variables. In the error term ϵ_{ij}, μ_i is a fixed individual-specific error component, θ_{ij} is a fixed job match error component, η_{ij} is an employer-varying job match specific error component, and u_{ij} is the sum of measurement errors in the wage and individual-specific error components that affect the wages of all employers.

We follow the convention in the literature that η_{ij} and u_{ij} are zero. Then, OLS estimates of the average return to experience and seniority are given by the coefficients β_1 and β_2 respectively, and are likely to be biased.[9] Altonji and Williams (1997) show that the bias in the OLS estimates derive from the correlation of the unobserved error components with both experience and seniority.[10]

This bias, however, can be eliminated if valid instruments for experience and seniority are available. We utilize two instruments to identify the returns to experience and seniority. Again, following Altonji and Shakotko (1987), for each sample observation, we instrument seniority by its deviation from the sample average. In this way, we use a variable that is orthogonal to the error terms, as job match and individual effects are not time varying, and the deviation of seniority from its sample mean is uncorrelated with the error components. The university indirect cost rate is utilized as an instrument for experience. Indirect cost

[9]Topel (1991) provides evidence for η_{ij} being a random walk, implying that the returns to experience and seniority are not sensitive to changes in η_{ij}. Altonji and Shakotko (1987) assume that movements in η_{ij} are small and/or transitory, and unlikely to have an effect on turnover behavior that in turn affects the returns to experience and seniority.

[10]For an estimation of the likely magnitude and sign of the relationships between seniority, experience and unobserved error components, see Altonji and Williams (1997) and Topel (1991).

rates have in general increased over time (see Ehrenberg and Mykula 1999), for a discussion. Indirect cost rates, even though correlated with individual job experience, are uncorrelated with fixed job match and individual effects, and this makes indirect cost rates a valid instrument for experience.

D. Nonlinear Instrumental Variables Censored Regression Estimation

Because of budget norms established in the Economics Program at NSF, the salary data from grant applications are censored or top-coded at the salary cap. When there is censoring, OLS estimations of the wage equation specified in (4) would result in biased parameter estimates. Given the top-coding of the salary data, a Tobit censored regression specification is more appropriate:

$$w_{ij}^{*} = \beta_o + \beta_1 E_{ij} + \beta_2 S_{ij} + \sum_{i=3}^{K-1} \beta_i X_{ij} + \epsilon_{ij}. \tag{5}$$

In (5) $w_{ij}^{*} = lnW_{ij}^{*}$ is a latent index function of the form:

$$w_{ij} = \begin{cases} w_{ij}^{*} & \text{if } w_{ij}^{*} \leq a \\ 0 & \text{otherwise} \end{cases}$$

where a is the upper tail censoring threshold that results from individual salary observations with a value equal or below the salary cap.

The use of instruments in a nonlinear censored wage equation such as (5) does not yield consistent instrumental variable (IV) parameter estimates. A fundamental source of the inconsistency is the fact that in a nonlinear regression specification, the errors due to omitted variables are no longer additively separable from the omitted variables. This distorts the true relationship between the instrument and the errors (Iwata, 2001).

To obtain consistent IV parameter estimates in a nonlinear regression framework, Iwata

(2001) shows that replacing the dependent variable with a rescaled or recentered variable will permit consistent IV estimations under the assumption that the instruments and the latent variables are jointly normal:

$$\tilde{w}^*_{ij} = \Psi_1^{-1}(w_{ij} - \Psi_2) \tag{6}$$

where

$$\Psi_1 = Cov(w_{ij}, w^*_{ij})/Var(w^*_{ij})$$

$$\Psi_2 = E(w_{ij}) - \Psi_1 E(w^*_{ij})$$

Implementation of (6) follows from replacing the Ψ_i with consistent estimates,$(\hat{\Psi}_i)$, in a Tobit censored regression specification.[11]

III. Results

Table 1 reports the definition, the sample mean, and standard deviation for all variables utilized to estimate the wage equation. In general, the typical faculty member in the sample is a white male, born in the U.S., tenured, reviews grant proposals for the NSF Economics Program, and has previously submitted at least one grant application to the NSF Economics

[11]Estimates of the Ψ_i from the censored Tobit specification in (2) are [See Iwata (2001)]:

$$\hat{\Psi}_1 = \hat{\Phi} = (1/n)\sum 1(w_{ij} < a)$$

$$\hat{\Psi}_2 = \hat{\sigma}^*_w \phi(\Phi^{-1}(\hat{\Psi}_1))$$

where Φ is a standard normal distribution function, ϕ is a standard normal density function, and $\hat{\sigma}^*_w$ is an estimate of the standard deviation of w_{ij} from:

$$\hat{\sigma}^*_w = \frac{(1/n)\sum(w_{ij} - \bar{w}_{ij})^2}{[\hat{\Phi} - (\hat{\phi} - \Phi^{-1}(\hat{\Phi}) \cdot (1 - \hat{\Phi})][\hat{\phi} + \Phi^{-1}(\hat{\Phi}) \cdot \hat{\Phi}]}$$

Program. In terms of job mobility as measured by the variable MOB, the typical faculty member in the sample has held on average 3 jobs since earning his/her doctorate.

The mean monthly salary of approximately ten thousand dollars is downwardly biased, as the salary data are censored at $12,500. The mean monthly salary, however, is high relative to the national average for economics professors.[12] This suggests that our sample is not representative of the entire economics faculty population, and reflects instead the salaries of economics faculty predisposed towards engaging in, and being successful at research. This implies that any parameter estimates of the wage-experience and the wage-seniority profile could suffer from selection bias. However, to the extent that the returns to seniority are negative, which is the primary interest of this paper, if we can show that this is true for a sample of research active economics professors, then the returns to seniority are also likely to be negative for research inactive economics professors. If for example, teaching effectiveness is correlated with research productivity (Agesa, Granger, and Price 2001), then conditional on research productivity, the returns to experience and seniority for for both research active and research inactive economics faculty would be similar if salary is at least partially determined by research productivity.

Parameter estimates of the wage equation based on the specifications in equations (4) and (5) are reported in Tables 2 to 4. In each case, instruments are used for experience (EXP_{iv}), and seniority ($SNRTY_{iv}$).[13] As it is conventional in the literature, quadratic terms for experience and seniority are added to the specification, in addition to several control variables described in Table 1.[14] To examine the sensitivity of experience and seniority to

[12]The *Chronicle of Higher Education* reports that for the academic year 2001-2002, the average monthly salary for economics faculty at all 4-year institutions was approximately $9,000 (See: *Chronicle of Higher Education*, "Law Professors Again Get Top Pay, Faculty-Salary Survey Finds", August 12, 2002.)

[13]Both experience and seniority are positively and significantly correlated with their respective instruments.

[14]The instrument for experience, the university indirect cost rate, was scaled up by 100 so as to mimic the quadratic form of experience.

the other variables in the specification, we report parameter estimates in Tables 2 to 4 across four different specifications. To examine the sensitivity of the results to the estimation procedure and the data censoring, Table 2 reports linear instrumental variable estimates on just the uncensored observations in the sample. Table 3 reports for all the observations, the censored regression nonlinear instrumental variable estimates with an untransformed dependent variable. Table 4 reports for all the observations, censored regression nonlinear instrumental variable estimates with the dependent variable transformed according to equation (6).

Most of the control variables are included to mitigate unobserved individual and firm heterogeneity. Both may affect the returns to experience and seniority. Two of the control variables, MOB and RELOC, are added to control for heterogeneity in moving costs, which Ransom (1993) argues can bias the returns to seniority downward if not included in a wage equation. Presumably, MOB is inversely related to individual moving costs, and RELOC approximates geographical moving costs. If universities as employers have monopsony power, they can offer lower salaries to employees with high moving costs. Holding all other unobserved factors constant, Ransom (1993) shows that high moving costs are positively related to seniority, and inversely related to the salary paid by the current institution. Thus, the sign and the significance of MOB and RELOC, as well their effect on seniority, can be indicative of the extent to which the academic labor market is monopsonistic.

For the uncensored observations, the linear instrumental variable parameter estimates in Table 2 suggest that for academic economists, the returns to seniority are negative and concave, once controls for individual and job heterogeneity are added. In terms of magnitude, the coefficients on both experience and seniority are similar to those reported by Ransom (1993) and Hallock (1995). The positive coefficient on seniority in the parsimonious specification in column (1) suggests that unobserved heterogeneity biases the returns to seniority, while all the other specifications in columns 2 - 4 estimate the returns to seniority as negative. Moving costs, as measured by the MOB and RELOC variables, while not significant,

also seem to matter. The difference in the magnitude in the returns to seniority between columns 3 and 4 suggest that unobserved heterogeneity in moving costs may bias downward the returns to seniority. The inclusion of moving cost variables in the specification in column (4) results in the returns to seniority slightly increasing.

The censored Tobit parameter estimates in Table 3, with the dependent variable untransformed, are approximately similar to the OLS results. The high Pseudo-R^2s of the specifications with the controls suggests that the censored specification explains the data well.[15] One difference between the results in Table 3 relative to Table 2 is that the moving cost variable RELOC becomes significant on its own. Otherwise, the results in Table 3 are similar to those of Table 2. Except for the parsimonious specification in column (1), the returns to seniority are again estimated to be negative for academic economists, and moving costs, given by the significance of the variable RELOC, seem to matter.

With the dependent variable transformed by equation (4), the censored Tobit parameter estimates in Table 4 are approximately similar to the estimates in Tables 2 and 3. The similarity of these results suggests that the censored Tobit instrumental variables specification adequately captures the process determining the returns to experience and seniority, given censoring.[16] The approximate similarity between the parameter estimates in Tables 2 - 4 suggest that the censored specification accommodates instruments well and/or the returns to experience and seniority for academic economists are robust with respect to the instruments.

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[15]The Pseudo-R^2 is computed as one minus the ratio of the unconstrained log-likelihood (the censored Tobit estimate with only the intercept term included), over the constrained log-likelihood. Pseudo-R^2 and R^2 are not directly comparable, so the fit of the OLS specification in Table (2) cannot be judged inferior or superior to the specifications reported in Tables 3 - 4. Pseudo-R^2 measures how much of the latent index explaining w_{ij} is explained by the right-hand side variables, whereas R^2 explains how much of the variation in w_{ij} is explained.

[16]Although not reported here for sake of brevity, truncated regression estimates of the uncensored sample also produce parameter estimates approximately similar to the results reported in Tables 2 - 4.

In general, robustness does seem attractive as an interpretation, as the sign on seniority stays negative and significant across the different estimation procedures in Tables 2 - 4, once the controls are added.

Overall, the parameter estimates reported in Table 2 - 4 suggest that for academic economists, while the wage-experience profile is positive, the wage-seniority profile is negative. The significant seniority quadratic term in all the specifications suggests that the negative returns to seniority start to become positive after approximately 12 years. These parameter estimates of the moving cost variables also suggest that universities have some monopsonistic power in their ability to offer lower wages to faculty with high moving costs. If universities offer wages that vary inversely with faculty moving costs, and faculty acceptance of offers varies directly with moving costs, the returns to seniority will vary inversely with moving costs. As Ransom (1993) notes, wages need not fall with seniority if employers are monopsonistic, and are able to drive a wedge between an offer from an outside university, and the wage they must pay. Heterogeneity in moving costs simply implies that the return to seniority, conditioned on moving costs, will vary inversely with moving costs.

To explore the effects that conditioning the returns to seniority on moving costs have for academic economists, we utilize the parameter estimates in column (4) of Table 4. If moving costs matter and if universities have monopsonistic power, the identified returns to experience and seniority, given by the coefficients in column (4) of Table (4), should vary inversely with individual moving costs. In principle, the actual marginal effects of the parameters should be utilized, however the scale factor is approximately 99 percent, as indicated by the similarity of the OLS estimates in Table 2 with the censored Tobit estimates of Tables 3 - 4 .[17]

Given individual faculty moving costs as measured by the variables RELOC and MOB, we

[17]In a censored Tobit model, the marginal effect of a parameter is $\partial \mathrm{E}[\mathrm{y} \mid \mathrm{x}] \partial \mathrm{x} = \beta \times \mathrm{Prob}[y^* \leq \mathrm{a}]$ where y^* is the latent dependent variable, and a is the upper censoring point. For the results reported in Tables 3 - 4, a marginal effects decomposition reveals that $\mathrm{Prob}[y^* \leq \mathrm{a}] \sim .99$ and $\beta \sim \beta_{OLS}$.

partition the sample around the midpoint of both variables. Those with moving costs values below the midpoint are classified as having low moving costs, and those with values above the midpoint are classified as having high moving costs. If RELOC and MOB are adequate measures of moving costs faced by economic faculty, if universities have monopsony power and can offer lower wages to faculty with high moving costs, then the returns to seniority for the low cost group should be higher than the returns to seniority for the high cost group.

Table 5 reports the returns to seniority for the moving cost groups for 5, 10, 15 and 20 years of seniority. Consistent with universities having monopsony power that allows them paying faculty lower salaries as their tenure increases, the returns to seniority are negative, but high for faculty with low moving costs, as measured by both RELOC and MOB. The percentage differences in returns are more dramatic with respect to RELOC than for MOB. This may also account for the insignificance of MOB in the wage equations reported above. Nonetheless, the inclusion of MOB does cause the returns to seniority to increase in the specifications, suggesting heterogeneity in such costs is an important determinant of the returns to seniority, as well as of those moving costs measured by RELOC. The results in Table 5 do suggest, however, that high moving costs lower the returns to seniority, which support the universities as monopsonists thesis of Ransom (1993).

In Table 6, the returns to seniority for the nonwhite economics faculty in the sample are reported. Relative to the estimates in Table 5, the negative returns to seniority for the nonwhite faculty in the sample are higher in absolute value. This suggests that relative to economics faculty in general, nonwhite economics faculty have higher moving costs which universities as monopsonists are able to exploit.

Table 7 reports the returns to seniority by moving cost group for the females in the sample. Relative to the sample and nonwhites estimated reported in Tables 5 and 6, the negative returns to seniority for the females in the sample are even higher in absolute value. This suggests, not surprisingly, that relative to economics faculty in general and minority

male faculty, female economics faculty have higher moving costs which universities as monoposonists are able to exploit.

IV. Conclusion

This paper has explored the idea that the labor market for academic economists is monopsonistic, with universities exploiting heterogeneity in faculty moving costs to lower the returns to seniority. Our results show that for economics faculty employed in colleges and universities, the returns to seniority are negative, and vary inversely with individual moving costs. The finding of a negative return to seniority appears to be robust across different specifications that instrument for experience and seniority, given unobserved heterogeneity in individual and job match characteristics.

Our results have several broad implications about the academic labor market in general. Our finding of positive returns to experience and negative returns to seniority suggests that for university faculty, human capital investments and returns are general, and not specific. This implies that for university faculty the costs caused by a job loss, say as a result of tenure denial, are low as the skills and returns embodied in faculty human capital are portable among other different universities. Our finding of an inverse relationship between the returns to seniority and moving costs suggest that for economics university faculty movements up in the wage distribution can be constrained by moving costs. We find in fact that the returns to experience are positive, implying that movements up in the wage distribution occur mostly through job changes. However, the inverse relationship between the returns to seniority and moving costs also suggests that not all university faculty can realize such increase in wages through job changes. Thus over time, moving costs can determine the distribution of income among university faculty.

There are possible limitations of our results. Our interpretation of high moving costs

lowering the returns to seniority for university faculty assumes that the variables RELOC and MOB are adequate measures of such costs. This need not be the case, and if not, other sources of individual heterogeneity could be responsible for the negative wage-seniority profile we have found for university economics faculty. We are confident however, that the variables RELOC and MOB are at least reasonable proxies for moving costs, since, as Ransom (1993) notes, more detailed measures of moving costs are in general difficult to obtain. To the extent that RELOC and MOB eliminate some of the unobserved heterogeneity that results from unobserved moving costs, our results provide evidence of monopsonistic salary discrimination by universities on the basis of individual moving costs.

Our results also suggest that the negative returns to seniority vary by race and gender, with female economics faculty having the lowest returns to seniority. Given the theoretical framework of our analysis, a reasonable interpretation is that moving costs are conditioned on race and gender, and universities as monopsonists simply exploit this in their own best interest. Of course it could also reflect the fact that nonwhite and female economics faculty face discrimination in the academic labor market, which manifests itself in fewer offers from alternative employers, which limits their mobility. Our analysis cannot address this possibility.

Finally, our dependent variable measures only compensation in the form of salary. Indeed, we do not observe nonsalary measures of compensation such as retirement benefits, housing allowances, or other academic perquisites such as departmental sponsored research grants. Thus, it is possible that over time, nonsalary compensation increases or at least offsets the negative returns to seniority based on salary. In other words, empirical evidence for a negative return to seniority may be the result of measurement error due to not observing nonsalary compensation. Examining this would be a fruitful avenue for future research.

Table 1
Variable Definitions, Sample Means and Standard Deviations

Variable	Definition	Mean	Standard Deviation
WAGE	Monthly salary	10068.05	2325.82
EXP	Years of experience since earning doctorate	10.28	49.98
SNRTY	Number of years on current job	7.46	7.14
TJEL	Total number of publications in economics journals	11.91	13.08
TOPJEL	Total number of publications in top six economics journals	2.40	3.70
BOOKS	Total number of published and/or edited book volumes	1.002	2.37
IDR	University indirect cost rate	50.83	9.69
TAWD	Dollar amount of NSF funding in past ten years	154836.67	273282.56
PAWD	Binary: Equals one if faculty member has previous NSF funding	.489	.501
RNSF	Binary: Equals one if faculty member has reviewed NSF grant proposals	.759	.428
NBER	Binary: Equals one if faculty member is an NBER research associate	.219	.415
GNDR	Binary: Equals one if faculty member is a female	.120	.326
WHTM	Binary: Equals one if faculty member is a white male	.775	.418
NBORN	Binary: Equals one if faculty member is native born	.612	.672
BSC	Binary: Equals one if faculty member is employed in a business school	.194	.396

Table 1 cont.
Variable Definitions, Sample Means and Standard Deviations

Variable	Definition	Mean	Standard Deviation
PRV	Binary: Equals one if faculty member is employed at a private college/university	.470	.499
PSUB	Binary: Equals one if faculty member had previously submitted a research proposal	.780	.415
TNR	Binary: Equals one if faculty member is tenured	.629	.484
RNK	Ordered: Assistant = 1 Associate = 2 Full = 3	2.06	.891
MOB	The number of different jobs a faculty member has held since earning doctorate	3.05	2.02
RELOC	The salary increment a faculty member would need to relocate from current job to another job	- 1636.75	3837.57
Number of Observations = 423			

Table 2
Linear IV Parameter Estimates

Specification:	(1)	(2)	(3)	(4)
Variable :				
Constant	8.76	8.64	8.54	8.54
	(.088)[a]	(.081)[a]	(.085)[a]	(.085)[a]
EXP_{iv}	.010	.005	.008	.008
	(.004)[b]	(.004)	(.004)[b]	(.004)[b]
EXP^2_{iv}	- .00009	- .00003	- .00009	- .00009
	(.00005)[c]	(.00004)	(.00004)[c]	(.00005)[c]
$SNRTY_{iv}$	.011	- .004	- .007	- .006
	(.002)[a]	(.002)[b]	(.003)[b]	(.003)[b]
$SNRTY^2_{iv}$	- .0002	.0002	.0003	.0003
	(0002)	(.0002)	(.0002)	(.0002)
Control Variables :				
TJEL	-	.004	.005	.004
	-	(.002)[b]	(.002)[b]	(.002)[b]
TOPJEL	-	.036	.021	.022
	-	(.002)[b]	(.009)[b]	(.009)[b]
BOOKS	-	- .018	.007	.006
	-	(.012)	(.012)	(.012)
TNR	-	- .038	- .060	- .061
	-	(.045)	(.043)	(.043)
RNK	-	.096	.105	.099
	-	(.032)[a]	(.031)[a]	(.032)[a]
PAWD	-	-	- .022	- .023
	-	-	(.026)	(.026)
PSUB	-	-	.029	.029
	-	-	(.027)	(.026)
TAWD	-	-	.00000001	.00000001
	-	-	(.000000005)[b]	(.000000005)[b]
RNSF	-	-	.064	.065
	-	-	(.024)[b]	(.024)[b]
NBER	-	-	.067	.068
	-	-	(.029)[b]	(.029)[b]
GNDR	-	-	- .037	- .036
	-	-	(.027)	(.027)
WHTM	-	-	- .017	- .016
	-	-	(.023)	(.023)
NBORN	-	-	- .004	- .005
	-	-	(.014)	(.015)
PRIV	-	-	.073	.069
	-	-	(.022)[a]	(.022)[a]
BSC	-	-	.014	.018
	-	-	(.025)	(.026)
Moving Costs :				
MOB	-	-	-	.005
	-	-	-	(.006)
RELOC	-	-	-	- .000001
	-	-	-	(.000002)
Adjusted R^2	.104	.353	.428	.426
N	269	269	269	269

Notes:
* Standard errors are in parentheses.
[a] Signifcant at the .01 level.
[b] Significant at the .05 level.
[c] Significant at the .10 level.
N = number of observations.

Table 3
Censored Regression Parameter Estimates
(w_{ij} **untransformed**)

Specification:	(1)	(2)	(3)	(4)
Variable :				
Constant	8.75 (.102)^a	8.54 (.079)^a	8.47 (.078)^a	8.47 (.077)^a
EXP_{iv}	.014 (.004)^a	.007 (.003)^b	.008 (.003)^b	.006 (.003)^b
EXP^2_{iv}	- .00009 (.00005)^c	- .00003 (.00004)	- .00006 (.00004)	- .00004 (.00004)
SNRTY_{iv}	.010 (.002)^a	- .007 (.002)^a	- .008 (.002)^a	- .007 (.002)^a
SNRTY^2_{iv}	- .0002 (0001)^b	.0002 (.0001)^b	.0003 (.0001)^a	.0003 (.0001)^a
Control Variables :				
TJEL	- -	.002 (.001)^b	.002 (.001)^b	.002 (.001)^b
TOPJEL	- -	.011 (.003)^a	.005 (.003)^c	.005 (.003)^c
BOOKS	- -	- .002 (.004)	-.003 (.004)	-.003 (.004)
TNR	- -	- .023 (.039)	- .049 (.038)	- .053 (.038)
RNK	- -	.172 (.023)^a	.159 (.022)^a	.156 (.023)^a
PAWD	- -	- -	- .012 (.021)	- .011 (.021)
PSUB	- -	- -	.031 (.025)	.029 (.025)
TAWD	- -	- -	.00000007 (.00000003)^b	.00000007 (.00000003)^b
RNSF	- -	- -	.077 (.022)^a	.078 (.022)^a
NBER	- -	- -	.059 (.020)^a	.061 (.020)^a
GNDR	- -	- -	- .066 (.025)^b	- .068 (.025)^b
WHTM	- -	- -	.002 (.020)	.006 (.020)
NBORN	- -	- -	- .008 (.012)	- .009 (.012)
PRIV	- -	- -	.040 (.018)^b	.032 (.018)^c
BSC	- -	- -	.043 (.019)^b	.048 (.020)^b
Moving Costs :				
MOB	- -	- -	- -	.002 (.005)
RELOC	- -	- -	- -	- .000004 (.000002)^b
Pseudo-R^2	.475	.938	.947	.948
N	423	423	423	423

Notes:
* Standard errors are in parentheses.
^{a} Significant at the .01 level.
^{b} Significant at the .05 level.
^{c} Significant at the .10 level.
N = number of observations.

Table 4
Censored Regression Parameter Estimates
(w_{ij} **transformed**)

Specification:	(1)	(2)	(3)	(4)
Variable :				
Constant	8.71 (.102)^a	8.50 (.078)^a	8.44 (.079)^a	8.44 (.079)^a
EXP_{iv}	.014 (.004)^a	.007 (.003)^b	.008 (.003)^b	.008 (.003)^b
EXP^2_{iv}	- .00009 (.00005)^c	- .00004 (.00004)	- .00006 (.00004)	- .00007 (.00004)^c
SNRTY_{iv}	.010 (.002)^a	- .007 (.002)^a	- .008 (.002)^a	- .007 (.002)^a
SNRTY^2_{iv}	- .0001 (0001)	.0002 (.0001)^b	.0003 (.0001)^a	.0003 (.0001)^a
Control Variables :				
TJEL	- -	.002 (.001)^b	.002 (.001)^b	.002 (.001)^b
TOPJEL	- -	.011 (.003)^a	.005 (.003)^c	.005 (.003)^c
BOOKS	- -	- .002 (.004)	-.003 (.004)	-.003 (.004)
TNR	- -	- .023 (.039)	- .049 (.038)	- .053 (.038)
RNK	- -	.172 (.023)^a	.159 (.022)^a	.156 (.023)^a
PAWD	- -	- -	- .011 (.021)	- .007 (.021)
PSUB	- -	- -	.031 (.025)	.028 (.025)
TAWD	- -	- -	.00000007 (.00000003)^b	.00000007 (.00000003)^b
RNSF	- -	- -	.080 (.022)^a	.080 (.022)^a
NBER	- -	- -	.058 (.020)^b	.058 (.020)^b
GNDR	- -	- -	- .062 (.025)^b	- .060 (.025)^b
WHTM	- -	- -	.003 (.019)	.004 (.019)
NBORN	- -	- -	- .010 (.012)	- .012 (.012)
PRIV	- -	- -	.040 (.018)^b	.032 (.018)^c
BSC	- -	- -	.043 (.019)^b	.048 (.020)^b
Moving Costs :				
MOB	- -	- -	- -	.003 (.005)
RELOC	- -	- -	- -	- .000004 (.000002)^b
Pseudo-R^2	.475	.938	.948	.948
N	423	423	423	423

Notes:
* Standard errors are in parentheses.
^{a} Signifcant at the .01 level.
^{b} Significant at the .05 level.
^{c} Significant at the .10 level.
N = number of observations.

Table 5
Returns To Seniority and Moving Costs

Years of Seniority:	5 years	10 years	15 years	20 years
Moving Costs = RELOC :				
High	- .00301	- .00438	- .00410	- .00219
Low	- .00134	- .00195	- .00183	- .00009
Moving Costs = MOB :				
High	- .00302	- .00440	- .00412	- .00220
Low	- .00295	- .00429	- .00402	- .00214

Notes:
The returns to seniority are computed from the estimates in column (4) of Table 4. The moving cost grouping is based upon whether or not moving costs for an individual is below (Low), or above (High) the sample median. For each group predicted average log-earnings, and holding all other variables constant, except for the seniority variables, Table 5 estimates the proportional returns to 5, 10, 15, and 20 years of seniority. The quadratic term is added starting at 15 years, given that the negative returns to seniority begin to turn positive at approximately 12 years.

Table 6
Returns To Seniority and Moving Costs
For NonWhites

Years of Seniority:	5 years	10 years	15 years	20 years
Moving Costs = RELOC :				
High	- .00306	- .00446	- .00428	- .00223
Low	- .00171	- .00249	- .00234	- .00124
Moving Costs = MOB :				
High	- .00305	- .00444	- .00416	- .00223
Low	- .00297	- .00432	- .00405	- .00216

Table 7
Returns To Seniority and Moving Costs
For Females

Years of Seniority:	5 years	10 years	15 years	20 years
Moving Costs = RELOC :				
High	- .00401	- .00802	- .00430	- .00229
Low	- .00265	- .00531	- .00284	- .00152
Moving Costs = MOB :				
High	- .00391	- .00782	- .00419	- .00224
Low	- .00379	- .00759	- .00408	- .00219

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