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The national internal labor market encounters the local labor market: Effects on employee retention ☆

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Abstract

Formal salary systems are commonplace among medium to large-sized firms and within the United States government. However, there is little evidence regarding the costs, if any, of such systems. This study analyzes the effects on retention within the United States Air Force from an inflexible wage system failing to adequately compensate personnel for local compensating wage differentials. Using location-specific Air Force personnel records, I compare the differences between military and civilian wages, by occupation, across locations to determine if local labor markets play a significant role in the stay or leave decisions for personnel. Results show that rigid wage constraints do in fact impose costs on the firm through increased turnover in locations that fail to adequately adjust wages for the cost of living and amenities.

Keywords: Retention; Compensating wages; Internal labor market

1. Introduction

Although formal salary systems are commonplace among medium to large-sized firms and within governments, there is little evidence regarding the costs, if any, of such systems. In fact, in studying internal labor markets, economists are unsure "whether personnel policies have real effects, or are just a veil through which the pressures of the external labor market act relatively unimpeded" (Gibbs and Hendricks, 2004).

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Economic theory would suggest that rigid pays systems are likely inefficient because salaries are determined by the position versus the individual characteristics of the employee. Such a system would likely underpay high performers and overpay low performers. As evidence, Baker et al. (1994a) found that those who are promoted the fastest also exit more often. Additionally, large corporations and government organizations with employees in multiple locations, may fail to compensate individuals adequately for the cost of living and amenities of the location due to the rigidity of the pay system.

The U.S. Department of Defense is one such organization, which employs personnel in locations around the world and has a historically inflexible wage system. Economists have long pointed out that the military pay table does not adequately distinguish among occupational subgroups within the services (Rosen, 1992; Asch and Warner, 2001; Asch, 1993). This incomplete pay distinction results in specific occupational shortfalls and surpluses, resulting in inefficiencies in the military labor market (Rosen, 1992). Additionally, one could argue that military wages are also out of line with local labor market wages. With the exception of housing allowances, military wages do not vary across locations within the United States.[2] However, the theory of compensating wage differentials predicts that wages adjust according to the cost of living and amenities of a location (Rosen, 1979; Haurin, 1980; Roback, 1982; Blomquist et al., 1988; Graves et al., 1999). Other evidence suggests that wages are adjusted to fully compensate workers for the cost of living in a location (Aggarwal and Kenny, 1996; Kenny and Denslow, 1980). This leads one to ask whether the retention of military personnel is significantly affected by the rigid pay structure, which fails to fully adjust wages for the local labor market where personnel are assigned. That is, are personnel more likely to exit the military when local civilian wages are relatively higher than military wages (or more likely to stay when civilian wages are relatively lower) at the location of assignment?

To determine if external local labor market pressures significantly affect employee retention, this study analyzes personnel records for 95,000+ first-term U.S. Air Force personnel across 67 locations from 1996 through 2001. Results show evidence of the costs associated with a rules-based compensation system, which fails to fully adjust wages for local labor market conditions. Retention is significantly lower in locations in which military wages are less competitive with local civilian wages after controlling for all occupational differences at the national level.

2. Background

Traditional labor economic theory suggests that wages should be determined individually in a spot market (Baker et al., 1994a). However, this is not the case in many firms where compensation is often rules-based. Doeringer and Piore (1971) describe the idea of an internal labor market as:

> …an administrative unit, such as a manufacturing plant, within which the pricing and allocation of labor is governed by a set of administrative rules and procedures. The internal labor market, governed by administrative rules, is to be distinguished from the *external labor market* of conventional economic theory where pricing, allocating, and training decisions are controlled directly by economic variables.

[2] Modest Cost of Living Allowances (COLAs) are provided in high cost areas of the country. These COLAs do not affect a high percentage of military personnel in the Air Force, the organization studied here, with only 2 of 67 bases receiving a COLA (Los Angeles AFB, CA and Hanscom AFB, MA). For example in 2001, junior enlisted personnel received $19 per month in COLA in Los Angeles.

Although the theory of an internal labor market has been written about quite extensively, there is a relatively small body of empirical literature examining its actual existence and potential adverse effects. Baker et al. (1994a,b) provide a comprehensive quantitative analysis of the existence of an internal labor market and wage formation for a single firm. Gibbs and Hendricks (2004) examined compensation within a firm and found strong evidence of the workings of an internal labor market in finding that supervisors had very little discretion regarding employee pay. Studies have concluded that the use of rules-based compensation "must have benefits" through reduced administrative costs, perception of equity, and reduced favoritism (Gibbs and Hendricks, 2004; Milgrom, 1988; Milgrom and Roberts, 1988; Prendergast, 1993; Prendergast and Topel, 1996).

Although the potential benefits of rules-based compensation systems have been well documented, the costs of such systems has received relatively little attention. Gibbs and Hendricks (2004, p. 71) found that wage constraints, "apparently did not impose important costs on the firm in the form of increased turnover". Baker et al. (1994a) found that those who are promoted the fastest also exit more often. This result hints at the possibility that rules-based wage structures cannot adequately adjust wages upward for high performers.

The Department of Defense provides an ideal framework to analyze an internal labor market with an inflexible wage system. Asch (1993 p.1) suggested that "the current compensation method is inappropriate for the modern military" because the system is a product of the pre Word-War II era where military members were typically unskilled "cadre-type" forces. Additionally, because "military occupations and branches of service differ in their non-pecuniary characteristics, theoretical analysis suggests compensation should differ across occupations and services." This incomplete pay distinction results in specific occupational shortfalls and surpluses, resulting in inefficiencies in the military labor market (Rosen, 1992).

With the exception of housing allowances, military wages do not vary considerably across locations within the United States. This study analyzes the effects on retention from the Department of Defense failing to adjust wages for local labor market conditions.

3. Data

To analyze the local labor market effect on retention, grouped retention statistics by six-digit Air Force Specialty Code (280+ occupations), location, and year were collected from Headquarters Air Force Personnel, Retention Status Reports (R-STATUS) for 96,554 first-term Air Force personnel from fiscal year 1996–2001.[3] In total, the data provide retention data for 22,935 distinct occupation by location by year groups. Because employment data[4] were not available, first-term airmen were assumed to be of the rank of E-4 (Senior Airman) with 4 years active military service.[5]

Military wage estimates were computed for each fiscal year and included basic pay, Basic Allowance for Housing (BAH), Basic Allowance for Subsistence (BAS), reenlistment bonuses, special payments, and the tax advantage from not paying federal income tax on BAH and BAS.[6] Basic pay varies by rank and the number of years of service. BAH varies by rank, location, and dependency status. BAS is a flat rate paid to all service members regardless of rank.[7] Reenlistment

[3] Data for years 2002-present were not used because of the stop-loss policies implemented in these years by the DoD to prevent military service from exiting the service.

[4] Employment data such as rank, years of service, age, race and sex were not available for this data set.

[5] Assumption based on typical 4-year enlistment and average promotion times. Current demographic data shows that 91% of Air Force enlisted members with less than six years military service are the rank of Senior Airmen or below.

[6] All members were assumed to be in the 15% Federal Income Tax bracket for calculating the tax advantage.

[7] The BAH rate for "with-dependents" and the BAS rate "when authorized to mess separately" were assumed for all wage calculations.

bonuses vary by occupation (AFSC), length of reenlistment, rank, and time in service.[8] Special payments included in wage calculations were: hazardous duty-pay for flying and foreign language pay.[9] Because military personnel must reenlist for a fixed period of time (typically 4–6 years), wage estimates were calculated for the present value of a four-year enlistment. Calculations assumed annual pay increases of 3.5% in addition to the projected time-in-service, promotion pay increases and with a discount value of 10%.[10,11]

Civilian wage estimates were computed using the Bureau of Labor and Statistics (BLS), Occupational Employment Statistics (OES), Occupational Wage Estimates.[12] Mean wage data were collected at the metropolitan and national level.[13] The OES occupational codes were matched to the Air Force Specialty Codes (AFSCs) using job titles and duty description in Air Force Manual 36-2108, *Enlisted Classification*. Air Force Bases were then matched to the closest metropolitan area with OES wage estimates, with 58 of 67 bases located in a metropolitan area. All other bases were found to be within 100 miles of a metropolitan area with wage estimates except Eielson AFB, AK, Columbus AFB, MS, Minot AFB, ND, and Laughlin AFB, TX.[14]

Unlike civilian wage estimates used in previous military retention studies, the OES wages provide an occupation by location estimate. Variation in civilian wages across locations is required to determine if the local labor market affects the decision to stay or leave the Air Force. However, the OES metropolitan area wages in the sample are reported to have relative standard errors ranging from 1% to 30%. Due to the relatively high standard error in some estimates, as an alternative specification, the local civilian wage is replaced with the national civilian wage multiplied by a location wage index. The index is computed as follows:

I_t	$\Sigma_t\, \alpha_t^i / \beta_t * (W_t^i / N^i)$, where,
I_t	Wage index for location, t
α_t^i	# of persons employed in occupation, i at location, t
β_t	Total # of persons employed at location, t
W_t^i	Wage for occupation, i at location, t
N^i	National average wage for occupation, i

This specification has the advantage of eliminating much of the measurement error bias, but restricts the compensating variation in wages to that of the average for each location. Additionally,

[8] Reenlistment bonuses were calculated using a 4-year reenlistment and the previously assumed years of military service, and rank. These bonuses are paid over a four-year period with one-half of the bonus being paid in the first year and the remaining paid equally over the next three years.

[9] First-term members in flying AFSCs were assumed to have 3 years of flying time. All members in "foreign language" career fields were assumed to receive the foreign language bonus.

[10] Based on promotion statistics, first-term reenlisters were assumed to make Staff Sergeant in the sixth year of service.

[11] A 10% discount rate was chosen because most prior military retention literature assumed this value. However, Warner and Pleeter (2001) calculated military discount values to be as high as 20%; therefore, the model was also tested using a discount value of 20% with no significant changes in results.

[12] The OES provides wage estimates for approximately 700 different occupations. Wage estimates were only available for 1997–2000; therefore, the 1996 estimates were computed by discounting the 1997 estimates by the Employment Cost Index and 2001 wage estimates were computed by inflating the 2000 estimates. For more information see http://www.bls.gov/oes/.

[13] Median wages were also tested in the analysis with no significant changes in results compared to mean wages.

[14] The closest metropolitan area to Eielson AFB, AK was Anchorage, AK (357 miles), for Columbus AFB, MS was Jackson, MS (174 miles), Minot AFB, ND was Bismarck, ND (110 miles) and for Laughlin AFB was San Angelo, TX (156 miles). Substitute metropolitan areas were chosen both by proximity and characteristics (i.e., size and amenities).

Table 1
Summary Statistics by occupation by location by year

Variable	Obs	Mean	Std. Dev.	Min	Max
Number of Eligible Personnel	22,935	4.21	6.50	1.0	124.00
Number who Reenlist	22,935	2.20	3.45	0	59.00
Military Local Wage	22,935	24.93	3.32	20.61	40.12
Military National Wage	22,935	23.48	2.80	20.61	33.67
Civilian Local Wage (actual)	18,285	35.57	11.66	12.92	99.40
Civilian Local Wage (indexed)	22,935	35.99	11.15	15.63	100.37
Civilian National Wage	22,935	38.11	11.22	18.70	87.02
National Unemployment	22,935	4.65	0.47	4.00	5.40
Local Unemployment>National Unemployment (dummy)	22,935	0.29	0.45	0	1.00
Price level (total)	21,914	0.05	0.11	(0.16)	0.41
Price level (housing and utilities)	21,914	0.01	0.06	(0.09)	0.22
Price Level (all other goods)	21,914	0.05	0.07	(0.10)	0.27
January average temperature	22,935	38.53	12.91	4.30	71.40

due to the large number (700+) of OES occupations across locations, the wage index provides a robust estimate of the compensating wage variation for each location.

To analyze the effects on turnover from location-specific variables, unemployment, price level, and amenity variables are used in the analysis. Monthly unemployment statistics for each location were collected from the Bureau of Labor and Statistics from 1996–2001. The average percent monthly unemployment for each fiscal year was used for this measure. Price-levels were computed for each location by year using fair market rents[15] from 1996–2001 and the American Chamber of Commerce Researchers Association (ACCRA) data from 1996–1999. The total price level was computed using the weighted price levels (local price/national average price) of housing (22%), utilities (11%), grocery (17%), transportation (13%), health care (7%) and miscellaneous goods and services (30%). Additionally, separate price levels for housing and utilities and all other goods were computed using the same data.[16] ACCRA data were unavailable for 2000 and 2001; therefore, the 1999 data were inflated using the percent increase in the national Consumer Price Index (CPI). Additionally, ACCRA data were unavailable for 3 of 67 locations; therefore, these locations have been omitted from the price level analysis. Finally, to measure an amenity effect on wages, the 1997 January average temperature for each location was obtained from the Bureau of Economic and Business Research, University of Florida. Table 1 shows a complete list and summary statistics of the variables used in the study.

4. Methods and results

4.1. Price level and amenity affects on wages

Before analyzing the external local labor market effects on turnover, I first compare differences in military and civilian wages across locations. Economic models predict that civilian wages are

[15] Fair market rent (FMR) for 2-bedroom apartments are published annually by the US Department of Housing and Urban Development. Additionally, price levels using the Department of Defense housing allowances and ACCRA housing prices were tested in the model with no significant changes in results.

[16] The housing and utility price level was computed as follows: 0.67+0.22*housing price index +0.11*utility price index. The all other goods price index was computed as follows: 0.33+0.17*grocery price index +0.07*medical price index +0.13*transportation price index +0.30*miscellaneous goods and services price index.

compensating in nature. That is, wages will be higher in places with a higher cost of living and with lower amenities. Hoch and Drake (1974), Izraeli (1974), Getz and Huang (1978), Roback (1982) all showed significant variation in wages with changes in various amenities. Additionally, Graves et al. (1999) showed that returns to education and union membership are likely overstated due to researchers failing to control for compensating wage differentials.

Other evidence suggests that wages fully compensate for differences in the cost of living in locations. Aggarwal and Kenny (1996 p.13) and Kenny and Denslow (1980) show evidence of this in finding that "the elasticity of wages with respect to agricultural land prices is equal the elasticity of the cost of living with respect to the agricultural land prices."

However, unlike civilian wages, military wages are only adjusted for housing and utility prices. This suggests that military wages, compared to civilian wages, are not fully adjusted for the cost of living or amenities within a location. To test this hypothesis, Table 2 shows regressions of log of military wages, log of civilian wages and the log difference of military and civilian wages on the log of the price level and the log of the January average temperature for 1996–2001. The regressions include an occupation by year fixed effect. The fixed effect is used to control for the national variation in wages across occupations and years (i.e., military reenlistment bonuses). Standard errors are clustered by location.

Specifications 1–3 regress wages on the total price level and January average temperature. Results show the cost of living elasticity of military wages to be 0.479 compared to an elasticity of 0.782 for civilian wages. Additionally, the negative and significant coefficient (−0.3075) for the price level in the wage difference specification shows that the military wages are less competitive with civilian wages in places with a higher cost of living. Results for the January average temperature are insignificant in the military wage specification and significantly negative (−0.0410) in the civilian wage specification. The positive and significant coefficient (0.0398) in the wage difference specification indicates that military wages compared to civilian wages rise 0.04% with a 1% increase in the average January temperature.

Finally, Specification 4 regresses the wage difference variable on separate price levels (housing/utilities and all other goods) and the January temperature. The log difference of military and civilian wages is regressed on separate price levels because military wages are only adjusted for housing and utility prices, while civilian wages are adjusted for the price level of all goods.

Table 2
Local wages on price levels and January average temperature

Dependent variable	Military Wage	Civilian Wage	Mil-Civ Wage	Mil-Civ Wage
Specification	1	2	3	4
Price level	0.4788***	0.7819***	−0.3075***	
(total)	(15.53)	(12.93)	(−4.17)	
Price level				0.1340
(housing and utilities)				(0.60)
Price Level				−0.7631***
(all other goods)				(−3.09)
January average temperature	0.0011	−0.0410***	0.0398**	0.0329**
	(0.17)	(−2.98)	(2.59)	(2.03)
R-Sqr	0.9624	0.8068	0.7784	0.7821
Observations	21,914	17,628	17,628	17,628

Note - All specifications include an occupation by year fixed effect. t-statiscitcs are in parentheses and robust standard errors are clustered by location.
* Significant at the 0.10 level, ** Significant at the 0.05 level, *** Significant at the 0.01 level.

Results confirm this fact as shown by an insignificant coefficient for the housing and utility price level and a significantly negative coefficient (−0.7631) for the all other goods price level. Additionally, the coefficient for the January average temperature (0.0329) is positive and significant.

Results from Table 2 show that military wages relative to civilian wages are not fully adjusted for price level and amenity differences across locations. Military wages are less elastic with respect to the price level and are not adjusted downward for positive amenities. Further analysis will determine if external pressures from the local labor market significantly affect the retention of Air Force personnel.

4.2. National and local wage effects on employee retention

To determine if employee retention should be analyzed as a purely national labor market or within the context of the local labor market, I estimate the following equation:

$$\begin{aligned}\Pr(Staying_{jct}) = {} & \beta_0 + \beta_1 Mil\ Local_{jct} + \beta_2 Mil\ National_{jt} + \beta_3 Civ\ Local_{jct} \\ & + \beta_4 Civ\ National_{jt} + \beta_5 Unemployment\ National_t \\ & + \beta_6 High\ Local\ Unemployment_{ct} + \varepsilon_{jct}, \end{aligned} \quad (1)$$

where the probability of staying in the Air Force in occupation j, location c, and in year t is a function of the military and civilian wages at the current location of assignment (*Mil Local* and *Civ Local*) and the military and civilian national average wages (*Mil National and Civilian National*). Both local and national wages should play a role in the decision to stay in the Air Force because individuals who stay may be reassigned to a new location and individuals who leave the Air Force may choose to relocate. *Unemployment National* represents the national unemployment rate by year and *High Local Unemployment* is an indicator variable for locations where the local unemployment rate is greater than the national unemployment rate.[17]

Because the retention and wage data are aggregated to occupation by location by year cells (22,935 groups representing 96,554 individuals), I estimate the model using weighted least squares using the grouped logistic transformation of the dependent variable suggested by Cox (1970)[18] with analytic weights by group size.[19] The error term is represented by ε_{jct} and standard errors are clustered by base by occupation. Standard errors are clustered at this level to control for potential error correlation within locations and occupations across years.

Results for both the local and national military wage variables are expected to be positive as the probability of staying in the Air Force should increase with increased military pay. Results for the civilian wage variables are expected negative as better paying civilian employment opportunities should lure members to leave the Air Force. Results for the national and local unemployment variables are expected to be positive as retention should increase with fewer civilian job opportunities.

Table 3a presents results for the analysis. All specifications include an occupation fixed effect to control for mean differences in retention rates across occupations. For comparative purposes, Specification 1 includes only the national-level wage and unemployment variables, while

[17] When the local unemployment rate is entered separately, the results are insignificant in all specifications.

[18] Specifically, the dependent variable is computed as follows: $\log(p+1/2n) - \log(1-p+1/2n)$, where p represents the proportion of individuals in the occupation by location by year cell who stay in the Air Force and n is the cell size.

[19] Due to potential concerns with heteroskedasticity across locations (Dickens, 1990), I also estimated the models using Feasible GLS. Results were consistent with those estimated with WLS.

Table 3a
National and local wage and unemployment effects on retention

Specification	1	2	3	4	5
Military Local Wage		0.0363***	0.0161**	0.0227***	0.0679
		(9.75)	(2.03)	(2.96)	(1.46)
Military National Wage	0.0534***		0.0368***		
	(7.89)		(3.31)		
Civilian Local Wage		−0.0115***	−0.0096***	−0.0104***	−0.0046***
		(−7.25)	(−5.70)	(−6.38)	(−2.80)
Civilian National Wage	−0.0210***		−0.0130**		
	(−4.00)		(−2.36)		
National Unemployment	0.2828***	0.2835***	0.2907***		
	(13.25)	(13.33)	(12.97)		
Local Unemployment>National Unemployment (dummy)		0.0360*	0.0407*	0.0333	
		(1.73)	(1.93)	(1.64)	
# of Groups	18,285	18,285	18,285	18,285	18,285
# of Individuals	75,665	75,665	75,665	75,665	75,665
R-Sqr	0.1894	0.1912	0.1922	0.3238	0.3558
Fixed effects[1]	1	1	1	2	2,3
Civilian Local Wage		Actual	Actual	Actual	Actual

[1] Fixed effects: 1=Occupation, 2=Occupation by Year, 3=Location by Year.
Notes: t-staticics are in parentheses and robust standard errors are clustered by occupation by location. * Significant at the 0.10 level, ** Significant at the 0.05 level, *** Significant at the 0.01 level. All specifications are computed with weighted least squares using a grouped logistic transformation where the dependent variable is log (p+1/2n)−log (1−p+1/2n) with analytic weights by group size, n.

Specification 2 includes only the local-level wage variables. Results for both specifications indicate that the decision to stay in the Air Force is significantly affected by both military and civilian wages. The positive and significant coefficient in Specification 1 for the military national wage (0.0534) implies that a 1-percent increase in military pay increases retention by 0.73-percent. The negative and significant coefficient for the civilian national wage (−0.021) implies that a 1-percent increase in the civilian wage decreases retention by 0.43-percent. The large, positive, and significant coefficient for the national unemployment rate (0.2828) indicates that retention increases 16.8-percent with a 1-point increase in the national unemployment rate. Similar results are found when using the local wage data in Specification 2; however, the magnitudes of the coefficients are slightly smaller and the model has a slightly better fit to the data. Additionally, the dummy variable for high local unemployment is positive and significant (0.0360), indicating that locations with higher than the national level of unemployment have a 2.1-percent higher retention rate.

Specification 3 includes all four national and local wage terms in the regression. All four wage variables exhibit the expected signs and are statistically significant at the 0.05-level. The significant results for the military local wage (0.0161) and the civilian local wage (−0.0096) indicate that the local labor market plays an important role in employee retention after controlling for the variation in wages at the national level. Additionally, the positive and significant coefficient on the high local unemployment variable (0.0407) indicates that locations with a higher than the national average unemployment rate have a 2.4 percent higher retention rate, providing further evidence of a local labor market effect on employee retention.

I sequentially add occupation by year and location by year fixed effects to the model in Specifications 4 and 5. The occupation by year fixed effect in Specification 4 controls for all yearly occupational variation at the national level; therefore, only the covariates on the local

Table 3b
National and local wage and unemployment effects on retention

Specification	1	2	3	4
Military Local Wage		0.0500***	0.0473***	0.0600***
		(11.89)	(5.02)	(6.38)
Military National Wage	0.0554***		0.0047	
	(9.13)		(0.39)	
Civilian Local Wage		−0.0240***	−0.0229***	−0.0265***
		(−8.62)	(−6.26)	(−7.19)
Civilian National Wage	−0.0230***		−0.0030	
	(−4.96)		(−0.53)	
National Unemployment	0.2838***	0.2741***	0.2732***	
	(14.17)	(14.18)	(13.35)	
Local Unemployment>National Unemployment (dummy)		0.0555***	0.0546***	0.0446**
		(2.87)	(2.81)	(2.41)
# of Groups	22,935	22,935	22,935	22,935
# of Individuals	96,554	96,554	96,554	96,554
R-Sqr	0.1783	0.1810	0.1810	0.3118
Fixed effects[1]	1	1	1	2
Civilian Local Wage		Indexed	Indexed	Indexed

[1] Fixed effects: 1 = Occupation, 2 = Occupation by Year, 3 = Location by Year.
Notes: t-staticics are in parentheses and robust standard errors are clustered by occupation by location. * Significant at the 0.10 level, ** Significant at the 0.05 level, *** Significant at the 0.01 level. All specifications are computed with weighted least squares using a grouped logistic transformation where the dependent variable is log (p+1/2n)−log (1−p+1/2n) with analytic weights by group size, n.

wages and unemployment variables are estimated. The statistically significant results for both the military local wage (0.0227) and the civilian local wage (−0.0130) provide strong evidence of a local labor market effect on employee retention. The magnitude of the effect implies that a 1-percent increase in military pay increases employee retention by 0.33-percent. Additionally, the coefficient on the high local unemployment variable is positive (0.0333) but is not statistically significant at conventional levels (p-value=0.102). Finally, the location by year and occupation by year fixed effects in Specification 5 control for all unobserved variation at the national and local level by year, leaving only the intra-occupational variation in wages at each location. The coefficient for the military local wage is positive (0.0679), but is not statistically significant at conventional levels (p-value=0.145).[20] The coefficient for the civilian local wage (−0.0046) is small, negative, and statistically significant at the 0.01-level, providing further evidence of a local labor market effect on employee retention.

Compared to previous U.S. military retention studies, the magnitudes of the local wage elasticities estimated are relatively small[21]; however, the elasticities must be viewed in the context of the analysis. The models control for all variation in wages by occupation at the national level; therefore, the elasticity represents only the wage effect attributed to the geographic variation in wages. Additionally, Hansen and Wenger (2005) found military pay elasticities to be sensitive to

[20] The insignificant result for the local military wage variable is not entirely surprising because all members at a given location receive the same basic pay and housing allowance. Hence, reenlistment bonuses and special payments represent the only intra-occupational wage variation at each location in military wages.
[21] Warner and Goldberg (1984), Hosek and Peterson (1985), Saving et al. (1985), Smith et al. (1991), Daula and Moffitt (1995), and Asch and Warner (2001) estimated the first-term military pay elasticity of retention to be 1.0–2.0, 3.5, 4.4, 1.3, and 2.14, respectively.

model specification. Excluding race/ethnicity and age controls resulted in a 25% decrease in the pay elasticity (1.6 to 1.2). Finally, nearly all past retention studies have reported wage elasticity's for the U.S. Navy and Army. Historically, the Navy and Army have significantly lower retention rates than the Air Force (approximately 32% for the Navy compared to 52% for the Air Force). Mackin (1996) found a pay elasticity of 0.5 for Air Force personnel from 1978–1972.

Results in Table 3b repeat the preceding analysis when replacing the actual civilian local wage with the indexed civilian wage as computed in Section III. The indexed civilian wage is advantageous as it eliminates much of the reported measurement error in the actual civilian wage estimates and computes wages for all occupations across locations resulting in no missing data. However, the compensating variation for each wage is restricted to that of the average for each location; therefore, estimates including the location by year fixed effect cannot be computed. Results for this analysis are generally consistent with those in Table 3a using the actual civilian local wage.[22] In all specifications, the coefficients for both the military and civilian *local* wages are statistically significant and increase in magnitude compared to those in Table 3a. For Specification 4, with the occupation by year fixed effect, the positive and significant coefficient (0.0600) for the military local wage indicates that a 1-percent increase in military local pay increases retention by 0.86-percent. The positive and significant coefficient (0.446) for the high local unemployment variable indicates that locations with higher than the national average unemployment rate have a 2.6-percent higher retention rate.

Results from Tables 3a and b show that employee retention is likely a function of the national and local labor markets. When controlling for all variation at the national level, both military and civilian wages at the *local-level* significantly affect the retention decisions of Air Force first-term personnel. Higher levels of local unemployment were also shown to significantly increase retention.

4.3. Military and civilian wage difference effects on employee retention

To further test the local labor market effect on retention, a more restrictive model is implemented, where employee retention is a function of the difference between military and civilian wages at the national and local levels. This model is akin to the traditional Annualized Cost of Leaving (ACOL) military retention model first developed by Warner and Goldberg (1984) and restricts the military and civilian wage coefficients to be equal in absolute value.[23] Specifically, I estimate the following equation:

$$\begin{aligned}\Pr(Staying_{jct}) = {} & \alpha_0 + \alpha_1 (Mil{-}Civ\ Local)_{jct} + \alpha_2 (Mil{-}Civ\ National)_{jt} \\ & + \alpha_3 Unemployment\ National_t + \alpha_4 High\ Local\ Unemployment_{ct} \\ & + \varepsilon_{jct}, \end{aligned} \tag{2}$$

where the probability of staying in the Air Force is a function of the difference in local military and local civilian wages (*Mil - Civ Local*), the difference in national average military and civilian

[22] One noticeable difference is in Specification 3, where all four-wage variables are estimated, the coefficients on the military and civilian *national* wages exhibit the expected signs, but are not statistically significant. This may be due to the fact that the civilian and military local wage estimates are picking up all the relevant wage variation at both the national and local level.

[23] Developed by Warner and Goldberg (1984), the decision to reenlist is a function of observable monetary factors and unobserved taste factors. To measure the observable monetary factors, the Annualized Cost of Leaving (ACOL) is calculated for each individual by subtracting the annualized present value (PV) of the wage of a military enlistment from the annualized PV of the estimated wage of a civilian employment opportunity.

Table 4
Military and civilian wage difference effects on retention

Specification	1	2	3	4	5
Military - Civilian (local wage)	0.0100***	0.0098***	0.0046***	0.0204***	0.0177***
	(5.98)	(6.00)	(2.80)	(6.15)	(5.24)
Military - Civilian (national wage)	0.0206***			0.0093	
	(3.35)			(1.59)	
National Unemployment	0.2055***			0.1999***	
	(9.82)			(10.45)	
High Local Unemployment (dummy)	0.0327	0.0387*		0.0513***	0.0507**
	(1.56)	(1.90)		(2.64)	(2.72)
# of Groups	18,285	18,285	18,285	22,935	22,935
# of Individuals	75,665	75,665	75,665	96,554	96,554
R-Sqr	0.1877	0.3236	0.3558	0.1761	0.3106
Fixed effects[1]	1	2	2,3	1	2
Civilian Local Wage	Actual	Actual	Actual	Indexed	Indexed

[1] Fixed effects: 1 = Occupation, 2 = Occupation by Year, 3 = Location by Year.
Notes: t-staticics are in parentheses and robust standard errors are clustered by occupation by location. * Significant at the 0.10 level, ** Significant at the 0.05 level, *** Significant at the 0.01 level. All specifications are computed with weighted least squares using a grouped logistic transformation where the dependent variable is $\log(p+1/2n)-\log(1-p+1/2n)$ with analytic weights by group size, n.

wages (*Mil - Civ National*), and the national and local unemployment measures. Again, standard errors are clustered by occupation by location and the error term is represented by ε_{jct}. All specifications include an occupation fixed effect and subsequent specifications add occupation by year and location by year fixed effects to the model.

Results for the both local and national wage difference variables are expected to be positive as the probability of staying in the Air Force should increase with increases in the military wage relative to the civilian wage. Results for the national and local unemployment variables are also expected to be positive as retention should increase with decreased civilian job opportunities.

Table 4 presents results for this analysis, which support the conclusions found in the preceding results. Specifications 1–3 present results using the actual civilian local wage and Specifications 4–5 present results using the indexed civilian wage. The positive and statistically significant coefficients for both the national (0.0206) and local (0.0100) wage difference variables in Specification 1 provide further evidence that both the national and local play an important role in employee retention. Additionally, the coefficient on the national unemployment variable (0.2055) is large, positive, and statistically significant and the coefficient on the high local unemployment variable (0.0327) is positive and insignificant. However, the linear restrictions imposed on the military and civilian wage coefficients are rejected at the 0.01-level, implying that employees respond differently to changes in military pay versus civilian pay.[24]

Specifications 2 and 3 sequentially add the occupation by year and location by year fixed effects to the model. These specifications control for all occupational wage variation at the national level and; therefore, only estimate the coefficients on the local wage difference variable. For Specification 2, the coefficients for both the local wage difference (0.0098) and high local unemployment (0.0387) variables are positive and significant. For Specification 3, the local wage

[24] The differences in military and civilian pay elasticities could be attributed to greater measurement error in the civilian wage estimates.

difference variable (0.0046) remains positive and significant but diminishes in magnitude. These results provide further evidence of a local labor market effect on employee retention.[25]

To correct for the measurement error bias in the local civilian wage estimates, Specifications 4 and 5 replace the actual local civilian wage with the indexed civilian wage. In both specifications the coefficient on the local wage difference and high local unemployment variables are large, positive, and statistically significant. The magnitude of the local wage variable (0.0204) in Specification 4 is roughly double that found using the actual civilian wage. The model estimates that a 1-percent increase in local military wages increases employee retention by 0.26-percent. The positive and significant coefficient (0.507) for the high local unemployment variable indicates that locations with higher than the national average unemployment rate have a 3.0-percent higher retention rate.[26]

Results from Table 4 provides further evidence that the retention of Air Force personnel is significantly affected by the variation in wages across locations after controlling for occupational wage variation at the national level. That is, first-term airmen are more likely to stay in locations where *local* military wages are more competitive relative to *local* civilian wages.

5. Conclusions

This study analyzed the effects on turnover from an inflexible wage system failing to adequately compensate personnel for local labor market conditions. Although formal salary systems, with rule-based compensation, likely have benefits such as reduced administrative costs, increased perception of equity, and reduced favoritism, this study provides evidence that rigid wage constraints do in fact impose costs on the firm through increased turnover in locations that fail to properly adjust wages for local compensating wage differentials.

Military wages are not in equilibrium with local civilian labor markets. The cost of living elasticity of military wages is significantly less than civilian wages and military wages are not adjusted for location amenities. Employee retention is significantly higher in locations where military wages are more competitive with the civilian labor market after controlling for occupational wage variation at the national level and when controlling for wage variation across locations. Additionally, the magnitude of the effects found in this study may be a lower bound to those that actually exist within other government and civilian sectors with rigid pay structures. Military members expect to move to different geographic locations throughout their career; therefore, some members may view a lower than market current wage as only temporary.

This study provides evidence that large firms and governmental organizations with rigid wage policies likely have unintended consequences through increased turnover. Some organizations have recognized this potential cost and systematically adjust wages for the cost of living and amenities at each location. For example, the state of Florida adjusts local pay for teachers using a price level index (Florida DOE, 2006). Carrell and West (2005) detail a proposal for the U.S. Department of Defense, which adjusts the rules-based wages by a location wage index. Doing so enables the firm to maintain the benefits of the rules-based compensation system, but provides a market-based mechanism to adjust wages across locations.

[25] For Specification 2, the linear restriction on the wage variables is rejected at the 0.05-level. For Specification 3, the F-statistic fails to reject the restriction.

[26] Again, both specifications reject the linear restrictions on the wage variables, indicating that employees respond differently to changes in military and civilian pay.

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