Optimal Compensating Wages for Military Personnel

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Abstract

The current U.S. military pay structure offers inequitable and inefficient wages across locations. Military personnel are paid less competitive wages in high-cost and/or low-amenity locations compared to low-cost and/or high-amenity locations. This pay system results in unequal reenlistment rates across locations, which leads to production inefficiencies caused by short-term manning shortages in high-turnover locations. Wages set according to local civilian compensating wage differentials would result in a more stabilized force (across locations) by equalizing the opportunity cost of staying in the military at each location. Additionally, more personnel would volunteer to serve in the high-cost and/or low-amenity locations because wages would be more commensurate with local costs and amenities. This would result in fewer non-volunteer assignments to undesirable locations and a minimized opportunity cost for personnel serving at each location. Reenlistment simulations on first-term Air Force personnel show that the proposed wage structure would better equalize reenlistment rates across locations. This proposal could be implemented at no cost to the government by cutting wages in low-cost and/or high-amenity locations. A gradual implementation in which such wages are frozen or increased slowly may be more politically palatable. © 2005 by the Association for Public Policy Analysis and Management

INTRODUCTION

U.S. military compensation and retention has been debated since the onset of the all-volunteer force in the 1970s. Since 2002, all branches of the armed services have resorted to "stop-loss" policies to keep personnel in critically undermanned areas from leaving the military. Numerous changes have been adopted to increase retention, such as increases in basic pay, reenlistment bonuses, and increases in the retirement system. However, these changes fail to address the structural problems with the military pay table (Asch, 1993; Asch & Warner, 2001b).

It has long been recognized that the military compensation system does not adequately distinguish between occupational subgroups within the services (Asch, 1993; Rosen, 1992), resulting in shortfalls and surpluses within specific occupations. These shortfalls and surpluses result in an inefficient military labor market (Rosen, 1992). To help alleviate these issues, occupation-specific bonuses and spe-

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cial payments have been implemented throughout the services. Although these bonuses tend to alleviate compensation problems across occupations, problems with compensation across geographic locations still persist.

Since 1980 military wages have included a housing allowance that varies by location, but recent Department of Defense (DoD) policy initiatives hint more geographic variation in pay is needed. Both the Army and Navy have implemented programs to entice personnel to volunteer for less desirable assignments. The Army implemented the Targeted Selective Reenlistment Bonus (TSRB) program in 1999, while the Navy implemented the Assignment Incentive Pay (AIP) program in 2003. Although these programs introduce further geographic variation into total military pay, they are not a systematic approach to adjusting military pay that a soldier/sailor/airman could rely upon when making long-term plans whether or not to reenlist. Specifically, wage adjustments in the Army are made only for eligible reenlisting personnel, while the Navy system currently covers only a small subset of the total number of assignments. Both systems fall short of fully flexible wages, as wages cannot be adjusted downward for overstaffed positions.

Since military wages (not including bonuses) are set nationally and are only adjusted locally for housing costs, military wages are less competitive with civilian wages in areas that exhibit high costs of living or low natural/public amenities, and are more competitive in low-cost and/or high-amenity locations. Carrell (2004) examined Air Force first-term reenlistments and showed that the geographic variation in the military to civilian wage difference across locations significantly affects first-term Air Force personnel's decision to reenlist. That is, the probability of reenlistment increases (or decreases), as military wages become more (or less) competitive with civilian wages at the location of assignment. Given this, can or should policymakers introduce systematic geographic adjustment in military pay to better equalize military and civilian wages?

To address this question, we analyze the current military wage structure and show why the system pays an inequitable and inefficient wage across locations. We propose an alternative wage structure that yields more equitable and efficient wages. Coupled with an all-voluntary system of assignments, the proposed wage structure would result in better geographic sorting of personnel, a more stabilized force, decreased moving expenses, and an increase in retention. We calculate wages using our proposed wage structure and simulate first-order retention effects on first-term Air Force reenlistments from 1996–2001. Finally, we discuss political considerations of our proposed system, and possible transitions from the current system to our proposal.

LITERATURE REVIEW

Past studies indicate that the traditional military compensation system does not optimally recruit and retain qualified military personnel. Asch (1993) suggested that the current military pay table is inappropriate because it is a product of the pre–World War II era when military members were typically unskilled workers. The modern military force requires many highly technical and varied skills. Because of this, Asch argues "compensation should differ across occupations and services."

For much the same reasons that wages vary across occupations in the private sector, wages also vary across geographic locations. Economic models predict that market-determined (civilian) wages are compensating in nature. That is, wages are higher in places with a higher cost of living and/or lower level of amenities. Hoch and Drake (1974), Izraeli (1974), Getz and Huang (1978), and Roback (1982) show significant differences in wages with various levels of amenities. Other evidence suggests that variation in wages across locations fully compensates for differences in the cost of living. 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 [to] the elasticity of the cost of living with respect to the agricultural land prices."

A vast amount of literature exists regarding the effects of military compensation on enlisted retention. Military retention studies were first of interest post-1973 during the early years of the all-volunteer force. All early studies examined retention from a national labor market and did not account for the reenlisting individual's location of assignment or the differences in missions across locations.

Most studies have found that retention is elastic with respect to military pay, holding civilian pay constant. Warner and Goldberg (1984), Hosek and Peterson (1985), Saving, Stone, Looper, and Taylor (1985), Daula and Moffit (1995), and Asch and Warner (2001b) estimated the first-term military pay elasticity of retention and all found it to be greater than one.

In one of the first studies on enlistments utilizing state-level as opposed to national-level data over time, Brown (1985) states, ". . . military pay does not vary across areas, so one must assume that the ratio of military to civilian pay (which does vary geographically) determines enlistments if one is to estimate the effect of military pay" (parentheses appear in original article). He finds the ratio of military to civilian pay by state to be a significant variable in explaining military enlistments by state from 1976–1982.

One aspect of the retention problem has been related to personnel being assigned to remote locations either within the United States or abroad. Hogan and Mackin (2003) examine this in the context of heterogeneous preferences, voluntary assignments, and flexible wages. They compare overseas relocation practices of the U.S. military to large corporations with expatriate workforces, most of which have historically offered premiums and expense allowances for employees assigned to overseas posts. They show that the Navy's Assignment Incentive Pay program, which allows sailors to bid online for the bonus amount they require to accept an overseas assignment, will allow the Navy to boost retention and reduce costs compared to a general pay increase. We discuss the Assignment Incentive Pay program in more detail below.

CURRENT MILITARY WAGE STRUCTURE

The current military wage structure compensates personnel according to their occupation, rank, number of years of service, and for the cost of housing at the location of assignment. Reenlistment bonuses are used as the primary means of stabilizing manning levels across occupations. Bonuses are given at the time of reenlistment in career fields that have low reenlistment rates. Additionally, special payments such as "aircrew hazardous duty incentive pay" are given to aircrew members as a further compensating differential. Previous analysis has shown the potency and cost effectiveness of bonuses in retaining Air Force pilots. Fullerton (2003) estimates that for every dollar paid in bonuses under the Aviation Continuance Pay program, approximately $10 in training and replacement costs were avoided due to increased pilot retention. Consistent with Warner (1981), Lakhani (1988), and Asch and Hosek (1999), we hold that reenlistment bonuses and special payment programs are an efficient and effective way to stabilize the force across occupations in the short run. However, to the extent bonuses and special payment programs are seen as changeable or temporary, the possibility of future reduction or cancellation can make reenlistment less attractive relative to civilian career options. "The added uncertainty (of bonuses) can adversely affect risk-averse personnel, potentially reducing their retention and productivity" (Asch & Hosek, 1999).

The Department of Defense has also recognized the need to adjust wages according to the cost of living at the location of assignment. Since 1980, the DoD has paid military personnel a location-specific housing allowance to help cover the cost of housing, utilities, and rental insurance.[1] Basic Allowance for Housing (BAH) is paid to all personnel not residing in government-owned housing, with "rates established such that members in each pay grade, independent of location, pay approximately the same out-of-pocket (housing) costs."[2] Additionally, since 1997, modest[3] Cost of Living Allowances (COLAs) have been paid in high-cost locations. However, COLAs are only paid when the non-housing costs of a location exceed 108% of the national average.[4] As a result, COLAs are only paid to a small percentage of military personnel.

Although the housing allowance and COLA system adjust wages across locations, adjusting for differences in housing costs is but one component of geographic variation in civilian wages. Adjustment based on only one component of geographic variation must be less than complete. As evidence, regressions of military and civilian wages on the price level and a measurement of amenities revealed that "military wages compared to civilian wages are less elastic with respect to the price level and are not adjusted downward for positive amenities" (Carrell, 2004).

In an attempt to boost manning levels at locations experiencing chronic shortages, the Army and Navy have recently offered bonus programs that vary by location. In 1999 the Army began offering bonuses to personnel who reenlist and volunteer to serve in certain locations with low manning levels, called the Targeted Selective Reenlistment Bonus program (TSRB). The Army varies bonus amounts on a quarterly basis depending on current manning levels and projected requirements, rank, and reenlistment term. For example, in 2002, a Sergeant (E–5) in the Infantry with four years of service would receive an additional reenlistment bonus of $3,657 with a four-year reenlistment to Fort Drum, NY.[5] During the third quarter of 2002, the Army made 181 changes to the bonus multiples across occupations and locations.[6] The total cost of the SRB/TSRB program was over $112 million in FY01, $89 million in FY02, and over $110 million in FY03.[7]

[1] Before 1980, housing allowances varied according to rank and dependency status, but did not vary across duty location.
[2] Information reference from http://militarypay.dtic.mil/pay/bah/index.html, retrieved October 1, 2003.
[3] For example, in 2001, junior enlisted personnel received $19 per month in COLA in Los Angeles.
[4] For more information regarding COLA computations reference: http://www.dtic.mil/perdiem/ccola.html, retrieved October 1, 2003.
[5] Calculation of the bonus is based on the 2002 Military Pay Table and the October 2002 SRB/TSRB bonus multiples (MILPER MESSAGE NUMBER: 02–255). The total reenlistment bonus for the individual would be approximately $10,971, of which $3,657 is given for volunteering to serve at Fort Drum, NY. The amount of the bonus is computed by multiplying the Bonus Multiple (1.5) by the monthly Base Pay ($1,828.5) by the number of years of reenlistment (4). The same individual would receive a bonus of $7,314 for a four-year reenlistment without volunteering to go to Fort Drum. The bonus is paid 50 percent upon reenlistment with the remaining 50 percent paid annually over the next three years. The TSRB program requires personnel to serve a minimum of two years at the specified location. Total SRB/TSRB payments are capped at $40,000.
[6] The 181 changes do not include the number of changes made within each rank or term of reenlistment. Additionally, the number of bonus changes is a consistent trend over time with 189 changes made from April to June 2002. Data obtained from MILPER MESSAGES 02–225 and 02–174.
[7] Figures from Department of the Army, FY03 Budget Estimates, submitted to Congress, February 2002.

The Navy implemented a more market-based approach in 2003, called the Assignment Incentive Pay program (AIP). Sailors submit bids online for the amount of additional compensation they would require to accept an assignment listed in AIP up to a preset maximum. The Navy selects the "winner" based on the total cost to the Navy, defined to be the sum of AIP payments, training costs, Permanent Change of Station costs, and costs of any "gap" in the billet.[8] Since May 2004, more than 2,400 AIP bids have been received by the Navy. In total, 644 sailors have received an average of $245 in extra pay per month (MCPON Minute, 16 May 2004). The Navy plans to eventually expand AIP to cover all enlisted assignments (Hogan & Mackin, 2003). The system stops short of fully flexible wages, as sailors are not permitted to enter negative bids for positions that are overstaffed (Jaffe, 2003).

INEFFICIENCIES IN MILITARY PAY STRUCTURE

The need for and existence of the Army's TSRB and the Navy's AIC are evidence that the current military pay system does not adequately adjust wages for geographic variation, and in its current form must be supplemented by spot cash payments in certain locations to avoid chronic manning shortages. The implication is that in locations considered undesirable by virtue of high costs or low amenities, DoD is paying military personnel below the wage that would exist in a free market with upward and downward wage flexibility. Inefficiencies can be further compounded by the need to send personnel to undesirable locations on a non-voluntary basis. Currently, Air Force personnel fill out an assignment preferences worksheet, in which they list their most preferred assignments. Only if volunteers are insufficient will military detailers resort to non-voluntary assignments. A non-voluntary system of assignments is inefficient for the same reasons the military draft is inefficient.[9] That is, those personnel who are assigned to a location on a non-voluntary basis are not necessarily those with the lowest opportunity cost for serving at that location (based on non-pecuniary taste preferences). In essence, non-volunteers pay a "tax" equal to their disutility from serving at an undesirable location.

However, if wages were set at the level required to induce enough volunteers, then the total opportunity cost of persons serving at each location would be minimized. Figure 1 graphically depicts this relationship for locations with not enough volunteers.[10] W_R represents the wage required to induce enough volunteers to meet the total labor requirement, L_R. Area A + B + C under the supply curve represents the opportunity costs for persons who would serve voluntarily at that wage. However, the actual military wage, W_A, induces L_A volunteers, which is less than the total labor requirement, L_R. Therefore, the Air Force must non-volunteer ($L_R - L_A$) personnel to serve. Each of the non-volunteer opportunity costs lies above the supply curve (otherwise they would have volunteered), with the average depicted by AOC. The area A + B + C + D + E represents the total opportunity cost for those serving at wage W_A, which will always be greater than or equal to that for personnel serving under the all-volunteer wage, W_R.

If the value to DoD of having additional personnel in this location exceeds the reservation wages of personnel who could be reassigned to this location, a clear gain is possible for both DoD and military personnel by raising wages in this location.

[8] Navy detailers have the option of selecting other than the low-cost sailor with a documented rationale. See Hogan and Mackin (2003) for more detail.
[9] See Fisher (1969) and Asch and Warner (2001b).
[10] Asch and Warner (2001a) used this graphical analysis to portray the inefficiencies of the military draft.

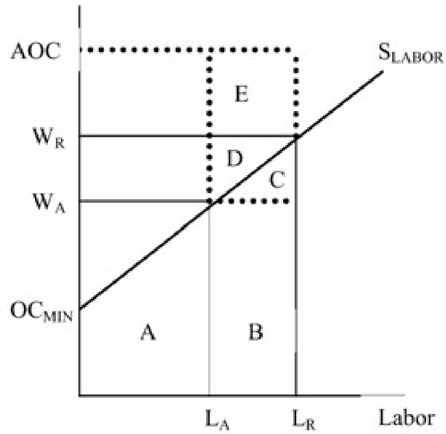

Figure 1. Inefficiency for locations without enough volunteers.

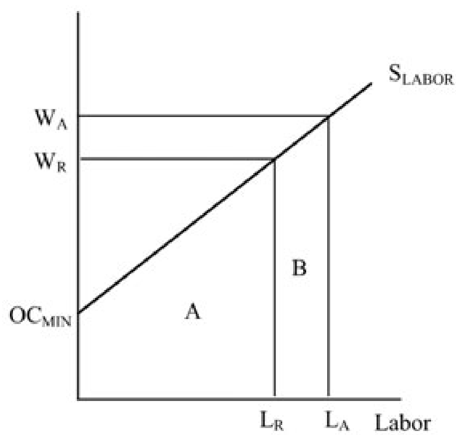

Figure 2. Inefficiency for locations with too many volunteers.

In locations characterized by low costs or high amenities, nationally determined military pay is above the market clearing wages that would exist in such local markets. By paying above market clearing wages, DoD receives more volunteers for such assignments than is necessary. This situation leads to inefficiencies because wages could be lowered while still inducing enough volunteers to meet manning requirements. Figure 2 graphically depicts this relationship for locations with too many volunteers. W_R represents the wage required to obtain the needed number of volunteers, L_R. The area A under the supply curve represents the total opportunity cost for personnel who would serve at this wage. However, the DoD pays wage W_A, inducing L_A volunteers, which is greater than the labor requirement, L_R. With too many volunteers, the Air Force must randomly choose among these volunteers. The resulting opportunity cost for personnel serving at wage L_A will be a convex combination of areas A and B, which will always be greater than or equal to the opportunity cost for those who would have served at wage W_R.

By reducing the wage in low-cost/high-amenity locations, DoD can be assured the lowest-cost personnel would volunteer to serve, freeing up the higher-cost personnel to serve in other locations where they might be more needed.

This analysis shows that the current wage system leads to inefficiencies by not minimizing the opportunity costs of personnel serving at each location regardless of whether military wages offered are too high or too low in the local area. This effect is further compounded by the fact that not all assignments are currently voluntary. A possible objection to this analysis is that opportunity cost inefficiency should be considered irrelevant to DoD because military personnel with time remaining on their enlistment must serve at their assigned location regardless of taste preference. While this objection is perhaps valid in the short run, personnel who are assigned at a location on a non-voluntary basis might have lower morale, which could adversely affect their probability of future reenlistment. Additionally, approximately 2,000[11] Air Force personnel per year, without sufficient time on their enlistment, decline a non-voluntary assignment and choose to exit the Air Force. Arguably, some of these personnel may have remained in the Air Force had they not been presented with an involuntary assignment and, instead, the Air Force had offered sufficiently large financial incentives to induce enough volunteers.

To further illustrate the effects of inefficient sorting resulting from military wages that do not vary by location and non-voluntary assignments, consider three hypothetical airmen, identical with respect to rank, years of service, and career fields, whose monthly reservation wages of serving at three Air Force bases are in Table 1.[12]

Dyess AFB is located in a relatively low cost of living area. The value to the Air Force of a single airman serving there, and hence maximum willingness to pay, is $3,000. Elmendorf AFB is located in a relatively high cost-of-living area. The value to the Air Force of having a single airman serving there is $5,000. Fairchild AFB is located in a more average cost-of-living area, with a value to the Air Force of $4,000. Let the value to the Air Force of additional airmen at each location be zero.

Suppose the Air Force set a wage of $3,000 per month for airmen of Ann, Bruce, and Charles's attributes regardless of station of duty. Ann would request Dyess, as she would gain $1,000 per month surplus for so doing. Bruce would likewise request Dyess. Charles would request Fairchild. As a group, the airmen accrue a surplus of

Table 1. Sorting example.

Airman	AF Base Value	Dyess 3,000	Elmendorf 5,000	Fairchild 4,000
Ann		2,000	4,000	3,500
Bruce		2,500	4,000	2,900
Charles		3,000	3,500	2,500

[11] Statistic obtained from the Air Force Personnel Center, Enlisted Assignments Branch. This represents approximately 3.3 percent of all enlisted personnel who receive an assignment (voluntary or non-voluntary) in a given year.

[12] Hogan and Mackin (2003) contains a related example.

$2,000. Since the Air Force pays Ann its maximum willingness to pay, no surplus is accrued. If Bruce is considered the second airman assigned to Dyess, the Air Force receives no benefit from his being stationed there, and counts his salary a total loss. It accrues $1,000 surplus from Charles serving at Fairchild, but loses $5,000 from not being able to place an airman at Elmendorf. Air Force surplus is –$7,000. The Air Force and the airmen together have a gross surplus of –$5,000. Table 2 represents this scenario. The top line in each cell is the respective airman's reservation wage, the number below and left is surplus to the airman of accepting this assignment, and below and right is the Air Force's surplus. Reservation wages are as given in Table 1.

Now suppose the Air Force were to non-volunteer Bruce to serve at Elmendorf. Since his reservation wage exceeds the $3,000 salary offered, Bruce would exit the

Table 2. $3,000 offered at all locations.

Airman	Base Value (Wage)	Dyess 3,000 (3,000)	Elmendorf 5,000 (3,000)	Fairchild 4,000 (3,000)
Ann		2,000	4,000	3,500
		1,000 0	–1,000 2,000	–500 1,000
Bruce		2,500	4,000	2,900
		500 0	–1,000 2,000	100 1,000
Charles		3,000	3,500	2,500
		0 0	-500 2,000	500 1,000

Table 3. $3,000 offered at all locations, $1,001 bonus at Elmendorf.

Airman	Base Value (Wage)	Dyess 3,000 (3,000)	Elmendorf 5,000 (4,001)	Fairchild 4,000 (3,000)
Ann		2,000	4,000	3,500
		1,000 0	1 999	–500 1,000
Bruce		2,500	4,000	2,900
		500 0	1 999	100 1,000
Charles		3,000	3,500	2,500
		0 0	501 999	500 1,000

Table 4. Fully flexible wages.

Airman	Base Value (Wage)	Dyess 3,000 (2,599)	Elmendorf 5,000 (4,001)	Fairchild 4,000 (3,000)
Ann		2,000	4,000	3,500
		599 401	1 999	–500 1,000
Bruce		2,500	4,000	2,900
		99 401	1 999	100 1,000
Charles		3,000	3,500	2,500
		–401 401	501 999	500 1,000

Air Force. As a result, Ann and Charles's surplus is $1,500, Air Force surplus is –$2,000, for a total of –$500. If instead the Air Force were to offer supplemental pay in return for being assigned to Elmendorf, such as the Army's TSRB, the Air Force would have to offer a bonus large enough so that Charles would gain as much from going to Elmendorf as Fairchild, or a minimum of $1,001. This would induce Charles to volunteer for Elmendorf, but does not address the overstaffing at Dyess or now understaffing at Fairchild. The airmen's surplus is now $2,001. Air Force surplus is –$2,001. Total surplus is 0. Table 3 represents this scenario. The top line in each cell is the respective airman's reservation wage, the number below and left is surplus to the airman of accepting this assignment, and below and right is the Air Force's surplus.

If, in addition to the supplemental pay at high-cost Elmendorf, the Air Force were to drop wages at low-cost Dyess to $2,599, Ann would remain at Dyess and Bruce would now choose Fairchild. With the bonus, Charles would choose Elmendorf. Airmen surplus would be $1,200. The Air Force's surplus would be $2,400. Total surplus would now be $3,600. Note that in each successive scenario, total surplus as a measure of efficiency has risen.

In the previous illustration, wage adjustments upward for the high-cost base and downward for the low-cost base were necessary to induce efficient sorting among the airmen and bases. If the illustration were extended to consider the choice of whether or not to reenlist, the airmen weigh expected future surplus of remaining in the Air Force against expected surplus as a civilian. Under the current system of insufficient geographic variation of wages, uncertainty of future assignments, and the possibility of non-voluntary assignments, a rational airman should demand a premium to compensate for the possibility of a "bad" future assignment. Existing bonuses and special payments can help, but to the extent they are seen as temporary or changeable, retention can be adversely affected (Asch & Hosek, 1999).

The current military wage system also creates other inefficiencies in the military labor market. Reenlistment rates vary significantly across locations because the opportunity cost for staying in the military varies from location to location.[13] Unequal reenlistment rates lead to production inefficiency caused by short-term manning shortages (or surpluses) in locations with excessively high (or low) turnover. Analysis has also shown that Air Force bases with low reenlistment rates are likely to have a lower overall quality workforce.[14] Additionally, locations with high turnover and manning shortages place an added work burden on those personnel who remain and serve. This added burden could be considered a "tax" on personnel, thus perpetuating the low reenlistment rate at that location. Finally, the need to move personnel to balance manning requirements causes additional inefficiencies by increasing the DoD's moving expenses.[15] To help combat this problem, the Air Force implemented the Voluntary Stabilized Base Assignment Program

[13] Retention is also affected by the differences in missions across locations. However, analysis of reenlistments in Carrell (2004) controlled for this variation by including command and base fixed effects.
[14] Results from Carrell (2004) showed that the probability of being eligible to reenlist increases with previous year's base reenlistment rate and decreases as military wages increase relative to civilian wages. Assuming a uniform distribution of personnel across locations according to "ability," these results indicate that locations with higher turnover are likely to have lower quality standards when determining reenlistment eligibility.
[15] Movement of personnel is necessary in the DoD due to the rotational system of overseas assignments. However, in FY99 the Air Force expended $60.8 million in "Enlisted Operational Travel (EOT), which is primarily CONUS to CONUS movement of personnel. Theses EOT expenses could be reduced with a more stabilized force across locations.

(VSBAP), which offers stabilized tour lengths of four to five years in locations with historically high turnover. Current VSBAP locations include: Los Angeles, CA; Minot AFB, ND; Grand Forks AFB, ND; Cannon AFB, NM; and Limestone, AFB, ME. All of these locations are either high-cost (Los Angeles) or arguably (the remaining four) low-amenity locations.

PROPOSED WAGE STRUCTURE

The preceding theory indicates that the current military wage structure is both inequitable and inefficient. The "first best" solution to this problem would be to establish wages so that the exact number of personnel required at each location would volunteer. Such a wage structure would minimize the total opportunity costs for personnel serving at each location through sorting and would lead to a more stabilized force by equalizing reenlistment rates across locations. Unfortunately, such a wage would be difficult to determine because the preferences of military personnel are not known with certainty.

However, civilian preferences for locations are approximately known through civilian compensating wage differentials. Civilian wages, we would argue, are a better measure of equity than housing costs because of the equilibrium nature in which civilian wages are adjusted. That is, civilian wages adjust from the national average (by occupation) to keep workers indifferent between locations. For example, wages in "desirable" locations are lower (while simultaneously adjusting for the price level) because persons are willing to accept a lower wage for living in these locations.

As a "second best" alternative, military wages could be set according to civilian taste preferences. Such a wage would result in military-to-civilian wage equity across locations, leading to a more stabilized force, as the opportunity cost of staying in the military would be the same regardless of where personnel are assigned. Additionally, this wage structure would result in better sorting of military personnel across locations, because more personnel would volunteer to serve in the high-cost and/or low-amenity locations. A fully efficient system would result in an all-volunteer system of assignments with personnel serving in locations with the lowest opportunity costs at each location.

Adjusting military wages according to civilian compensating wage differentials makes the implicit assumption that military and civilian taste preferences for locations are the same. Although actual taste preferences of military personnel for amenities and locations are not known, to the extent that military personnel are a cross-section of the larger populace, this assumption would be justified. But even if military personnel are not a representative cross-section of the larger populace, we argue that military wages adjusted by civilian wage differentials would need less adjustment from a program such as the Navy's AIP or the Army's TSRB because civilian wage differentials respond to differences in the total cost of living and amenities across locations as opposed to housing alone. Additionally, such a system would result in a more equitable wage compared to the aforementioned Navy and Army systems because wage adjustments would be across the board versus the arbitrary spot market changes.

A second assumption in adjusting wages according to civilian compensating wage differentials is that location patterns of military and civilian employment are the same. That is, the supply-and-demand relationship for military and civilian labor is similar across locations. This assumption is less likely to hold because many military bases are located in rural areas where the civilian population is relatively small compared to the military population. In such locations, civilian compensating wage differentials may underestimate the wage required to induce the needed number of volunteers. This may occur because civilian wages do not have to be very high in low-populace areas because there is no need to attract a lot of people to live there. Table 5 shows the population, number of military personnel, and percentage of military personnel for each Air Force base.[16] The number of military personnel as a percentage of the total population ranges from 0.03% in Los Angeles, CA, to 10.8% in Fayetteville, NC, with an average of 1.81% and a standard deviation of 1.93%. In locations with a high proportion of military personnel, civilian compensating wage differentials may not be a fully accurate measure of the wage required to induce enough volunteers. To help correct for this problem, civilian wage estimates from the nearest metropolitan area are used to calculate the civilian compensating wage differentials for bases in rural locations. Using wage estimates from the nearest metropolitan area with similar characteristics[17] likely adjusts wages upward compared to the actual local civilian wages, but does not adjust wages for any amenities or dis-amenities associated with living in that rural location.

In order to adjust military wages according to civilian compensating wage differentials, civilian wages across locations must be known. Fortunately, since 1997, the Bureau of Labor and Statistics (BLS) has collected wage data for 330+ metropolitan areas across 700+ occupations.[18] These data, therefore, can be used to measure the compensating differential for each location by comparing relative wages in each location (by occupation) to the national average wage. A location-specific wage index is computed by summing the weighted averages of the ratio of the local to national wage for each occupation. The index is computed as follows:

$$I_t = \Sigma_t\, \alpha^i_t / \beta_t{}^* (W^i_t / N^i), \text{ where,}$$

I_t = Wage index for location, t
α^i_t = # of persons employed in occupation, i at location, t
β_t = Total # of persons employed at location, t
W^i_t = Wage for occupation, i at location, t
N^i = National average wage for occupation, i

Table 6 shows the average civilian wage index from 1997–2000 for the 67 Air Force bases located in the United States. For comparative purposes a similar wage index is shown for military wages in each location.[19,20] Of note is the relatively tighter distribution of the military wage indexes compared to civilian wage indexes across locations as indicated by the smaller standard deviation of the military wage

[16] Civilian populations are for the respective MSA. If the base is not located in an MSA, the respective County population is shown. The military population includes the number of personnel from all the military branches of service. Also note that in several locations (for instance, San Antonio and Washington, DC) there is more than one Air Force base.

[17] The replacement metropolitan areas were chosen based on distance, size, and geographic characteristics (that is, proximity to coast, mountains, and so on).

[18] The data collected by the BLS is referred to as the Metropolitan Area Occupational Employment and Wage Estimates. For more information: http://www.bls.gov/oes/oes_ques.htm, retrieved October 1, 2003.

[19] The local wages used to calculate the military wage index include Base Pay, BAH, BAS, COLA, and the tax advantage from not paying income tax on BAH or BAS. The national military wage replaces BAH with BAH II and does not include a COLA. BAH II is the "national" housing allowance given to personnel who are in transit from overseas assignments. Reenlistment bonuses and special payments are not included because these rates are occupation-specific at the national level.

[20] Fifty-eight of the 67 bases are located in a metropolitan area with OES wage estimates. Estimates for the remaining 9 bases use OES wages for the nearest small metropolitan area.

Table 5. Civilian and military population.

Base	Location	Civilian Population (Thous)	Military Population (Thous)	%Military
Altus AFB, OK	Altus, OK	28.6	0.8	2.64%
Andrews AFB, MD	Washington, DC	7,255.7	39.4	0.54%
Barksdale AFB, LA	Shreveport, LA	385.9	4.5	1.17%
Beale AFB, CA	Yuba County, CA	132.5	1.6	1.19%
Bolling AFB, VA	Washington, DC	7,255.7	39.4	0.54%
Brooks AFB, TX	San Antonio,TX	1,485.3	20.6	1.39%
Cannon AFB, NM	Clovis, NM	43.9	1.2	2.66%
Charleston AFB, SC	Charleston, SC	532.2	5.1	0.96%
Columbus AFB, MS	Columbus, MS	60.7	0.8	1.35%
Davis-Mothan AFB, AZ	Tucson, AZ	773.0	4.9	0.63%
Dover AFB, DE	Dover, DE	120.4	2.2	1.82%
Dyess AFB, TX	Abilene, TX	123.8	3.2	2.56%
Edwards AFB, CA	L.A. Cty/Kern Cty/Mohave Cty, CA	118.3	1.3	1.12%
Eglin AFB, FL	Fort Walton Beach, FL	159.8	11.0	6.89%
Eielson AFB, AK	Fairbanks, AK	80.8	2.3	2.87%
Ellsworth AFB, SD	Rapid City, SD	85.7	1.3	1.48%
Elmendorf AFB, AK	Anchorage, AK	246.7	5.7	2.33%
F.E. Warren AFB, WY	Cheyenne, WY	78.2	2.5	3.14%
Fairchild AFB, WA	Spokane, WA	395.3	1.8	0.46%
FT Meade, MD	Baltimore, MD	7,255.7	4.9	0.07%
Goodfellow AFB, TX	San Angelo, TX	101.8	1.4	1.38%
Grand Forks AFB, ND	Grand Forks, ND	99.8	1.1	1.09%
Hanscom AFB, MA	Boston, MA	5,673.6	1.3	0.02%
Hickam AFB, HI	Honolulu, HI	860.2	15.4	1.79%
Hill AFB, UT	Ogden, UT	1,229.2	3.0	0.24%
Holloman AFB, NM	Alamagordo, NM	58.2	1.7	2.88%
Hurlburt Field, FL	Fort Walton Beach, FL	159.8	11.0	6.89%
Keesler AFB, MS	Biloxi, MS	343.3	5.1	1.49%
Kelly AFB, TX	San Antonio, TX	1,485.3	20.6	1.39%
Kirtland AFB, NM	Albuquerque, NM	663.3	2.8	0.42%
Lackland AFB, TX	San Antonio, TX	1,485.3	20.6	1.39%
Langley AFB, VA	Hampton, VA	1,519.0	13.7	0.90%
Laughlin AFB, TX	Del Rio, TX	42.4	0.5	1.29%
Little Rock AFB, AR	Little Rock, AR	555.6	3.3	0.60%
Los Angeles AFB, CA	Los Angeles, CA	15,636.8	4.8	0.03%
Luke AFB, AZ	Phoenix, AZ	2,846.5	5.8	0.20%
MacDill AFB, FL	Tampa, FL	2,264.8	6.0	0.26%
Malmstrom AFB, MT	Great Falls, MT	79.3	2.1	2.60%
Maxwell AFB, AL	Montgomery, AL	316.8	3.8	1.21%
McChord AFB, WA	Tacoma, WA	655.0	12.6	1.92%
McClellen AFB, CA	Sacramento, CA	1,670.6	1.3	0.08%
McConnell AFB, KS	Wichita, KS	521.2	2.1	0.41%
McGuire AFB, NJ	Trenton, NJ	412.1	2.7	0.65%
Minot AFB, ND	Minot, ND	58.4	1.7	2.95%
Moody AFB, GA	Valdosta, GA	85.7	3.2	3.79%
Mountain Home AFB, ID	Mountain Home, ID	26.0	2.1	8.25%
Nellis AFB, NV	Las Vegas, NV	1,279.1	5.8	0.46%
Offutt AFB, NE	Omaha, NE	686.0	5.4	0.79%
Patrick AFB, FL	Cape Canaveral, FL	445.3	1.2	0.27%
Pentagon, DC	Washington, DC	7,255.7	39.4	0.54%
Peterson AFB, CO	Colorado Springs, CO	469.0	18.9	4.02%

(continued)

Table 5. *(continued)*

Pope AFB, NC	Fayetteville, NC	291.6	29.4	10.08%
Randolph AFB, TX	San Antonio, TX	1,485.3	20.6	1.39%
Robins AFB, GA	Macon, GA	309.9	3.9	1.25%
Scott AFB, IL	O'Fallon, IL	2,559.2	4.4	0.17%
Seymour Johnson AFB, NC	Goldsboro, NC	109.9	2.7	2.42%
Shaw AFB, SC	Sumter, SC	103.8	2.6	2.54%
Sheppard AFB, TX	Wichita Falls, TX	136.5	3.2	2.37%
Shriever AFB, CO	Colorado Springs, CO	469.0	18.9	4.02%
Tinker AFB, OK	Oklahoma City, OK	1,033.5	7.6	0.73%
Travis AFB, CA	Fairfield, CA	372.9	3.9	1.05%
Tyndall AFB, FL	Panama City, FL	139.7	3.3	2.37%
US Air Force Academy, CO	Colorado Springs, CO	469.0	18.9	4.02%
Vance AFB, OK	Enid, OK	57.4	0.9	1.51%
Vandenberg AFB, CA	San Luis Obispo Cty, CA	234.9	1.1	0.46%
Whiteman AFB, MO	Johnson County, MO	1,698.8	1.8	0.11%
Wright-Patterson AFB, OH	Dayton, OH	950.8	4.4	0.46%

index (0.067) compared to the civilian wage index (0.095), which holds at a 1% level of significance.[21]

The civilian wage index can then be used to adjust military wages across locations. This is accomplished by multiplying the civilian wage index by the national military wage.[22,23] Table 7 shows the average indexed military wage (monthly wage excluding reenlistment bonuses and special payments) for each Air Force base within the United States from 1996–2001 and compares this to the average military wage for each location under the current system.

We have calculated the proposed wage structure such that the total military pay expenditure is constant across the six-year period of the analysis. The result is a transfer of wages from low-cost and/or high-amenity locations to high-cost and/or low-amenity locations with the purpose of equalizing the military-to-civilian wage differences across locations.

We use the proposed wage structure to simulate Air Force first-term reenlistment effects from 1996–2001. The simulations only estimate the short-term reenlistment effects from changing the wage structure and do not estimate the long-term effects attributed to better sorting (that is, how personnel would change their decision to volunteer for a location), decreased turnover, lower moving costs, and decreased uncertainty.

REENLISTMENT SIMULATIONS OF PROPOSED WAGE STRUCTURE

Using the proposed military wage structure, we simulate reenlistment effects using Carrell (2004), Specifications 5, Table 6. To calculate the simulated effect on reenlistment, we subtract the predicted probability of reenlistment under the current wage structure from the predicted probability of reenlistment under the proposed

[21] Using a Goldfeld-Quandt test, the test statistic of 2.01 is distributed under the null hypothesis that both standard deviations are equal. The null hypothesis is rejected at a 1 percent level of significance.
[22] After multiplying the national military wage by the civilian wage index, wages were then multiplied by a factor of 1.133257816. This was done in order to keep total military wage expenditures constant.
[23] Reenlistment bonuses and special payments are then added back into this wage to calculate the occupational specific wage. Bonuses and special payments were not adjusted by the civilian wage index because they are assumed to be an efficient way to stabilize reenlistment rates across occupations at the national level.

Table 6. Civilian and military wage indexes.

Base	Civilian Index	Military Index	Base	Civilian Index	Military Index
Altus AFB, OK	0.87	1.00	Los Angeles AFB, CA	1.08	1.21
Andrews AFB, MD	1.08	1.19	Luke AFB, AZ	0.97	1.09
Barksdale AFB, LA	0.87	1.03	MacDill AFB, FL	0.93	1.10
Beale AFB, CA	1.00	1.05	Malmstrom AFB, MT	0.85	1.00
Bolling AFB, VA	1.08	1.19	Maxwell AFB, AL	0.88	1.03
Brooks AFB, TX	0.90	1.07	McChord AFB, WA	1.08	1.08
Cannon AFB, NM	0.85	0.99	McClellen AFB, CA	1.08	1.09
Charleston AFB, SC	0.89	1.04	McConnell AFB, KS	0.94	1.03
Columbus AFB, MS	0.89	1.00	McGuire AFB, NJ	1.15	1.16
Davis-Mothan AFB, AZ	0.91	1.08	Minot AFB, ND	0.87	0.99
Dover AFB, DE	0.95	1.09	Moody AFB, GA	0.88	1.02
Dyess AFB, TX	0.84	1.01	Mountain Home AFB, ID	0.93	1.02
Edwards AFB, CA	1.08	1.07	Nellis AFB, NV	1.07	1.14
Eglin AFB, FL	0.88	1.04	Offutt AFB, NE	0.94	1.05
Eielson AFB, AK	1.16	1.19	Patrick AFB, FL	0.90	1.06
Ellsworth AFB, SD	0.87	1.03	Pentagon, DC	1.08	1.19
Elmendorf AFB, AK	1.16	1.22	Peterson AFB, CO	0.97	1.08
F.E. Warren AFB, WY	0.86	1.02	Pope AFB, NC	0.88	1.05
Fairchild AFB, WA	1.00	1.05	Randolph AFB, TX	0.90	1.07
FT Meade, MD	1.02	1.18	Robins AFB, GA	0.90	1.06
Goodfellow AFB, TX	0.84	1.00	Scott AFB, IL	1.00	1.03
Grand Forks AFB, ND	0.90	1.01	Seymour Johnson AFB, NC	0.85	1.03
Hanscom AFB, MA	1.13	1.20	Shaw AFB, SC	0.84	1.01
Hickam AFB, HI	1.10	1.28	Sheppard AFB, TX	0.86	1.02
Hill AFB, UT	0.95	1.06	Shriever AFB, CO	0.97	1.08
Holloman AFB, NM	0.83	1.00	Tinker AFB, OK	0.89	1.01
Hurlburt Field, FL	0.88	1.04	Travis AFB, CA	1.09	1.16
Keesler AFB, MS	0.88	1.05	Tyndall AFB, FL	0.85	1.05
Kelly AFB, TX	0.90	1.07	US Air Force Academy, CO	0.97	1.08
Kirtland AFB, NM	0.92	1.08	Vance AFB, OK	0.82	1.00
Lackland AFB, TX	0.90	1.07	Vandenberg AFB, CA	1.03	1.13
Langley AFB, VA	0.90	1.06	Whiteman AFB, MO	0.99	1.00
Laughlin AFB, TX	0.84	1.00	Wright-Patterson AFB, OH	1.00	1.04
Little Rock AFB, AR	0.90	1.02	Standard Deviation	0.095	0.067

Standard deviations differ at a 1 percent level of significance.

wage structure. We sum the differences in the two predicted probabilities to show the total change in reenlistment from changing the wage structure. Additionally, we set the wages such that the annualized cost to the DoD from the change in the wage structure is zero.

Due to the linearity[24] of the retention model, a zero change in total wages results in a zero change in reenlistment, as increased retention in one location from higher wages is offset by reduced retention in locations where wages are cut. Since changes in aggregate retention will not be observed given the model's specification, we propose that stabilization of estimated reenlistment rates across locations would be indicative of the desired effect of our proposed wage adjustment. To measure this effect, we sum the squared deviations of the base reenlistment rates from the overall Air Force reenlistment rate for the current wage structure and our proposed wage structure.[25] Tables 8 and 9 show results from this analysis. Table 8 shows results for

[24] We also conducted the simulation using a non-linear (probit) model. Results were similar with a zero change in reenlistment associated with a zero change in overall wages.

Table 7. Proposed wages (monthly average, 1996–2001).

Base	Actual Wages	Proposed Wages	Change	Base	Actual Wages	Proposed Wages	Change
Altus AFB, OK	2,164.50	1,988.35	(176.15)	Los Angeles AFB, CA	2,641.85	2,620.14	(21.71)
Andrews AFB, MD	2,581.20	2,632.85	51.65	Luke AFB, AZ	2,364.65	2,376.55	11.90
Barksdale AFB, LA	2,242.19	2,106.02	(136.17)	MacDill AFB, FL	2,386.40	2,302.08	(84.32)
Beale AFB, CA	2,278.58	2,491.04	212.46	Malmstrom AFB, MT	2,162.96	2,055.42	(107.54)
Bolling AFB, VA	2,581.20	2,632.85	51.65	Maxwell AFB, AL	2,241.39	2,184.99	(56.40)
Brooks AFB, TX	2,323.48	2,211.49	(111.99)	McChord AFB, WA	2,337.28	2,684.92	347.64
Cannon AFB, NM	2,159.90	2,067.05	(92.84)	McClellen AFB, CA	2,375.41	2,681.58	306.17
Charleston AFB, SC	2,272.40	2,177.61	(94.79)	McConnell AFB, KS	2,238.27	2,374.59	136.32
Columbus AFB, MS	2,164.30	2,151.00	(13.31)	McGuire AFB, NJ	2,515.84	2,839.94	324.10
Davis-Mothan AFB, AZ	2,341.82	2,224.55	(117.27)	Minot AFB, ND	2,140.92	2,111.68	(29.24)
Dover AFB, DE	2,363.13	2,342.78	(20.34)	Moody AFB, GA	2,221.14	2,188.84	(32.30)
Dyess AFB, TX	2,201.23	2,035.37	(165.86)	Mountain Home AFB, ID	2,219.52	2,276.46	56.94
Edwards AFB, CA	2,324.40	2,620.14	295.74	Nellis AFB, NV	2,473.87	2,595.22	121.36
Eglin AFB, FL	2,267.94	2,167.50	(100.44)	Offutt AFB, NE	2,274.18	2,333.82	59.64
Eielson AFB, AK	2,581.27	2,838.28	257.01	Patrick AFB, FL	2,301.78	2,238.13	(63.65)
Ellsworth AFB, SD	2,232.33	2,126.81	(105.52)	Pentagon, DC	2,581.20	2,632.85	51.65
Elmendorf AFB, AK	2,653.75	2,838.28	184.53	Peterson AFB, CO	2,345.25	2,403.22	57.97
F.E. Warren AFB, WY	2,212.64	2,080.23	(132.41)	Pope AFB, NC	2,286.32	2,162.71	(123.62)
Fairchild AFB, WA	2,271.48	2,497.80	226.32	Randolph AFB, TX	2,323.48	2,211.49	(111.99)
FT Meade, MD	2,565.35	2,504.29	(61.06)	Robins AFB, GA	2,300.22	2,191.61	(108.61)
Goodfellow AFB, TX	2,172.08	2,010.19	(161.89)	Scott AFB, IL	2,236.43	2,474.80	238.37
Grand Forks AFB, ND	2,195.47	2,181.38	(14.09)	Seymour Johnson AFB, NC	2,238.52	2,040.77	(197.75)
Hanscom AFB, MA	2,621.73	2,798.00	176.27	Shaw AFB, SC	2,204.37	2,077.91	(126.47)
Hickam AFB, HI	2,778.34	2,636.37	(141.97)	Sheppard AFB, TX	2,226.42	2,090.71	(135.71)
Hill AFB, UT	2,306.63	2,338.65	32.03	Shriever AFB, CO	2,345.25	2,403.22	57.97
Holloman AFB, NM	2,165.07	1,967.54	(197.54)	Tinker AFB, OK	2,191.04	2,141.94	(49.09)
Hurlburt Field, FL	2,267.94	2,167.50	(100.44)	Travis AFB, CA	2,525.99	2,695.48	169.49
Keesler AFB, MS	2,288.83	2,110.36	(178.47)	Tyndall AFB, FL	2,286.32	2,073.98	(212.35)
Kelly AFB, TX	2,323.48	2,211.49	(111.99)	US Air Force Academy, CO	2,345.25	2,403.22	57.97
Kirtland AFB, NM	2,351.62	2,232.53	(119.09)	Vance AFB, OK	2,163.73	2,007.29	(156.44)
Lackland AFB, TX	2,323.48	2,211.49	(111.99)	Vandenberg AFB, CA	2,462.78	2,576.02	113.23
Langley AFB, VA	2,298.36	2,229.82	(68.54)	Whiteman AFB, MO	2,163.54	2,431.71	268.17
Laughlin AFB, TX	2,178.30	2,010.19	(168.11)	Wright-Patterson AFB, OH	2,264.34	2,462.99	198.66
Little Rock AFB, AR	2,212.48	2,181.52	(30.96)	Standard Deviation	146.0214219	242.3180331	149.78

Standard deviations differ at a 1 percent level of significance

all occupations and locations and Table 9 shows results for selected AFSCs at the two-digit level. In Table 8, the 22 Air Force bases with the lowest actual reenlistment rates on average increase their reenlistment rate by 0.4% as a result of our proposed wage adjustment. The reenlistment rates of the 22 bases with the highest actual reenlistment rates correspondingly decline by 0.4%. The sum of squared deviations declines from 15.0% for the current wage structure to 13.6% for the proposed wage structure. This is indicative of better equalization of reenlistment rates, although the difference is not statistically significant.

Table 9 reports similar results for the Aviation Maintenance, Civil Engineering, and Security Forces occupations. For the Aviation Maintenance career field, the proposed wage structure results in net gain of nearly five reenlistments and a sum of squared deviations of 177.4% compared to 180.1% for the current wage structure. For the Civil Engineering career field, the proposed wage structure results in a net gain of nearly two reenlistments and a sum of squared deviation of 25.5% compared to 25.6% for the current wage structure. Finally, for the Security Forces career field, the proposed wage structure results in a net loss of four reenlistments and a sum of

[25] The squared difference is preferred to the absolute value of the difference because the squared measure applies more (negative) weight to locations with excessively high or low reenlistment rates.

Table 8. Proposed wage simulation, all occupations by base.

Base	Actual Eligible	Actual Reenlist	Actual Reen Rate	Dev	Actual Squared Dev	Proposed Total Wage Change	Predicted Reen Change	Predicted Reen Rate	Predicted Squared Dev
Altus AFB, OK	814	478	58.7%	6.5%	0.4%	(1,459,820)	(9.2)	57.6%	0.29%
Andrews AFB, MD	1,399	756	54.0%	1.8%	0.0%	728,595	4.6	54.4%	0.05%
Barksdale AFB, LA	2,448	1,329	54.3%	2.1%	0.0%	(3,316,047)	(20.8)	53.4%	0.01%
Beale AFB, CA	1,419	686	48.3%	-3.9%	0.2%	3,163,334	19.9	49.7%	0.06%
Bolling AFB, VA	460	249	54.1%	1.9%	0.0%	240,692	1.5	54.5%	0.05%
Brooks AFB, TX	343	159	46.4%	-5.9%	0.3%	(397,216)	(2.5)	45.6%	0.44%
Cannon AFB, NM	1,582	760	48.0%	-4.2%	0.2%	(1,512,431)	(9.5)	47.4%	0.23%
Charleston AFB, SC	1,722	1,025	59.5%	7.3%	0.5%	(1,464,272)	(9.2)	59.0%	0.46%
Columbus AFB, MS	323	185	57.3%	5.0%	0.3%	(50,499)	(0.3)	57.2%	0.24%
Davis-Mothan AFB, AZ	2,351	1,271	54.1%	1.8%	0.0%	(3,025,072)	(19.0)	53.3%	0.01%
Dover AFB, DE	1,657	967	58.4%	6.1%	0.4%	(355,684)	(2.2)	58.2%	0.36%
Dyess AFB, TX	2,099	1,112	53.0%	0.7%	0.0%	(3,632,329)	(22.8)	51.9%	0.00%
Edwards AFB, CA	1,549	728	47.0%	-5.2%	0.3%	4,835,330	30.4	49.0%	0.11%
Eglin AFB, FL	2,749	1,480	53.8%	1.6%	0.0%	(2,706,422)	(17.0)	53.2%	0.01%
Eielson AFB, AK	1,050	608	57.9%	5.7%	0.3%	2,733,246	17.2	59.5%	0.53%
Ellsworth AFB, SD	1,445	797	55.2%	2.9%	0.1%	(1,454,516)	(9.1)	54.5%	0.05%
Elmendorf AFB, AK	2,193	1,299	59.2%	7.0%	0.5%	3,675,891	23.1	60.3%	0.65%
F.E. Warren AFB, WY	1,423	628	44.1%	-8.1%	0.7%	(1,842,238)	(11.6)	43.3%	0.79%
Fairchild AFB, WA	1,563	829	53.0%	0.8%	0.0%	3,547,790	22.3	54.5%	0.05%
FT Meade, MD	885	379	42.8%	-9.4%	0.9%	(525,829)	(3.3)	42.5%	0.96%
Goodfellow AFB, TX	393	232	59.0%	6.8%	0.5%	(669,883)	(4.2)	58.0%	0.33%
Grand Forks AFB, ND	1,573	712	45.3%	-7.0%	0.5%	(216,160)	(1.4)	45.2%	0.50%
Hanscom AFB, MA	430	207	48.1%	-4.1%	0.2%	881,017	5.5	49.4%	0.08%
Hickam AFB, HI	1,103	684	62.0%	9.8%	1.0%	(1,504,744)	(9.4)	61.2%	0.80%
Hill AFB, UT	1,605	700	43.6%	-8.6%	0.7%	576,443	3.6	43.8%	0.70%
Holloman AFB, NM	1,684	851	50.5%	-1.7%	0.0%	(3,425,559)	(21.5)	49.3%	0.09%
Hurlburt Field, FL	2,655	1,494	56.3%	4.0%	0.2%	(2,640,467)	(16.6)	55.6%	0.12%
Keesler AFB, MS	1,494	854	57.2%	4.9%	0.2%	(2,456,876)	(15.4)	56.1%	0.15%
Kelly AFB, TX	1,206	608	50.4%	-1.8%	0.0%	(1,256,812)	(7.9)	49.8%	0.06%
Kirtland AFB, NM	1,226	652	53.2%	0.9%	0.0%	(1,517,659)	(9.5)	52.4%	0.00%
Lackland AFB, TX	2,091	1,147	54.9%	2.6%	0.1%	(2,466,050)	(15.5)	54.1%	0.04%
Langley AFB, VA	2,832	1,450	51.2%	-1.0%	0.0%	(2,051,139)	(12.9)	50.7%	0.02%
Laughlin AFB, TX	255	135	52.9%	0.7%	0.0%	(448,266)	(2.8)	51.8%	0.00%
Little Rock AFB, AR	1,614	1,011	62.6%	10.4%	1.1%	(367,631)	(2.3)	62.5%	1.05%
Los Angeles AFB, CA	138	74	53.6%	1.4%	0.0%	(31,152)	(0.2)	53.5%	0.02%
Luke AFB, AZ	2,189	1,142	52.2%	-0.1%	0.0%	138,207	0.9	52.2%	0.00%

(continued)

squared deviation of 34.2% compared to 37.8% for the current wage structure. The reported changes in sum of squared deviations are not statistically significant.

Results from these analyses indicate that the proposed wage structure would lead to more equalized reenlistment rates across locations, without affecting the overall reenlistment rate or increasing wage expenditure to the government. More equalized reenlistment rates lead to production efficiency by stabilizing manpower levels across locations and would reduce the overall moving costs of the government. Additionally, because the proposed wage structure matches civilian compensating wage differentials, the long-term effect would be better geographic sorting of per-

Table 8. *(continued)*

MacDill AFB, FL	993	510	51.4%	-0.9%	0.0%	(713,666)	(4.5)	50.9%	0.02%
Malmstrom AFB, MT	1,468	754	51.4%	-0.9%	0.0%	(1,624,470)	(10.2)	50.7%	0.02%
Maxwell AFB, AL	1,060	522	49.2%	-3.0%	0.1%	(549,560)	(3.4)	48.9%	0.11%
McChord AFB, WA	1,476	702	47.6%	-4.7%	0.2%	5,208,282	32.7	49.8%	0.06%
McClellen AFB, CA	721	324	44.9%	-7.3%	0.5%	2,329,507	14.6	47.0%	0.28%
McConnell AFB, KS	1,041	545	52.4%	0.1%	0.0%	1,438,420	9.0	53.2%	0.01%
McGuire AFB, NJ	2,054	960	46.7%	-5.5%	0.3%	7,001,678	44.0	48.9%	0.11%
Minot AFB, ND	1,898	936	49.3%	-2.9%	0.1%	(586,200)	(3.7)	49.1%	0.10%
Moody AFB, GA	1,594	780	48.9%	-3.3%	0.1%	(455,988)	(2.9)	48.8%	0.12%
Mountain Home AFB, ID	1,787	781	43.7%	-8.5%	0.7%	1,126,089	7.1	44.1%	0.66%
Nellis AFB, NV	2,946	1,446	49.1%	-3.2%	0.1%	3,799,576	23.9	49.9%	0.05%
Offutt AFB, NE	2,831	1,547	54.6%	2.4%	0.1%	1,463,305	9.2	55.0%	0.07%
Patrick AFB, FL	537	294	54.7%	2.5%	0.1%	(335,040)	(2.1)	54.4%	0.05%
Pentagon, DC	271	122	45.0%	-7.2%	0.5%	131,948	0.8	45.3%	0.48%
Peterson AFB, CO	1,278	576	45.1%	-7.2%	0.5%	734,126	4.6	45.4%	0.46%
Pope AFB, NC	1,863	1,020	54.8%	2.5%	0.1%	(2,118,335)	(13.3)	54.0%	0.03%
Randolph AFB, TX	793	448	56.5%	4.3%	0.2%	(896,100)	(5.6)	55.8%	0.13%
Robins AFB, GA	1,257	701	55.8%	3.5%	0.1%	(1,362,787)	(8.6)	55.1%	0.08%
Scott AFB, IL	1,478	765	51.8%	-0.5%	0.0%	3,540,322	22.2	53.3%	0.01%
Seymour Johnson AFB, NC	2,045	1,101	53.8%	1.6%	0.0%	(4,012,281)	(25.2)	52.6%	0.00%
Shaw AFB, SC	2,494	1,274	51.1%	-1.2%	0.0%	(3,178,280)	(20.0)	50.3%	0.04%
Sheppard AFB, TX	661	404	61.1%	8.9%	0.8%	(897,819)	(5.6)	60.3%	0.65%
Shriever AFB, CO	822	373	45.4%	-6.9%	0.5%	473,147	3.0	45.7%	0.42%
Tinker AFB, OK	2,715	1,416	52.2%	-0.1%	0.0%	(1,248,728)	(7.8)	51.9%	0.00%
Travis AFB, CA	3,137	1,658	52.9%	0.6%	0.0%	6,066,926	38.1	54.1%	0.03%
Tyndall AFB, FL	1,261	675	53.5%	1.3%	0.0%	(2,607,409)	(16.4)	52.2%	0.00%
US Air Force Academy, CO	413	208	50.4%	-1.9%	0.0%	235,935	1.5	50.7%	0.02%
Vance AFB, OK	141	77	54.6%	2.4%	0.1%	(225,061)	(1.4)	53.6%	0.02%
Vandenberg AFB, CA	964	457	47.4%	-4.8%	0.2%	1,292,770	8.1	48.2%	0.16%
Whiteman AFB, MO	1,287	692	53.8%	1.5%	0.0%	3,580,300	22.5	55.5%	0.11%
Wright-Patterson AFB, OH	1,306	689	52.8%	0.5%	0.0%	2,663,789	16.7	54.0%	0.03%
Total	96,554	50,435	52.2%		15.0%	168.27	0.00	52.2%	13.64%

Table 9. Proposed wage simulation, selected occupations.

Occupation	Actual Eligible	Actual Reenlist	Actual Reen Rate	Actual Sqrd Dev	Proposed Total Wage Change	Predicted Reen Change	Predicted Reen Rate	Predicted Sqrd Dev
Aviation Maintenance	21,918	11,553	52.7%	180.0%	308,495	1.9	52.7%	177.4%
Civil Engineering	7,283	3,130	43.0%	26.6%	786,530	4.9	43.0%	25.5%
Security Forces	9,330	3,549	38.0%	37.8%	(642,624)	(4.0)	38.0%	34.2%

sonnel according to taste preferences, thus minimizing the total opportunity cost of personnel serving at each location.

POLITICAL CONSIDERATIONS

For this proposal to adjust military wages according to geographic variation in comparable civilian wages to be implemented, it would have to gain Congressional approval and be signed into law by the President of the United States. While increased efficiency from better sorting of military personnel, reduced attrition, reduced training of replacements, and reduced moving expenses are attractive, they have little chance of overcoming objections from a member of Congress who stands to see wage cuts in his/her home district. This need not be so. Our calculations of proposed Air Force enlisted pay reported in Table 8 were calculated assuming revenue neutrality for DoD for ease of computation. As a more politically palatable alternative, a gradual transition could be implemented in which some wages are frozen instead of cut while the remaining wages rise more rapidly. Or an even more gentle transition could be implemented in which all wages rise, but some more rapidly than others. All the efficiency gains we discussed previously would still be realized under such a transition, but at a higher wage bill to DoD.

As an illustration, consider again the example centered around Tables 1 through 4, in which three airmen were to be assigned among three bases. Suppose instead the Air Force wanted to adjust wages in such a way to induce optimal sorting while not reducing each airman's surplus from the original scenario of $3,000 per month paid to all and voluntary assignments. Ann is the low-cost airman at Dyess. To maintain Ann's original $1,000 surplus, airmen at Dyess would need to be offered $3,000. If airmen at Fairchild were offered $3,401, Bruce would choose Fairchild over Dyess and exceed his original surplus level by $1. To induce Charles to choose Elmendorf over Fairchild, airmen at Elmendorf must be offered a minimum of $4,402. Under this scenario, the airmen as a group realize $2,403 in surplus. The Air Force realizes $1,197 in surplus. Total surplus is $3,600. Note this is the same total surplus as the final scenario presented above. Only the distribution differs. This scenario is illustrated in Table 10.

CONCLUSIONS

Military personnel are paid less-competitive wages in high-cost and/or low-amenity locations compared to low-cost and/or high-amenity locations. This pay system results in unequal reenlistment rates across locations, which leads to production inefficiencies caused by short-term manning shortages in excessively high-turnover locations. Additionally, because wages are not set at the level required to induce enough volunteers to serve in each location the total opportunity cost for personnel serving in each location is not minimized.

Wages should be set according to civilian compensating wage differentials. Such a wage would result in a more stabilized force (across locations) by equalizing the opportunity cost of staying in the military at each location. Additionally, more personnel would volunteer to serve in the high-cost and/or low-amenity locations because wages would be more commensurate with local costs and amenity levels.

Table 10. Fully flexible wages with original airman surplus maintained.

Airman	Base Value (Wage)	Dyess 3,000 (3,000)		Elmendorf 5,000 (4,402)		Fairchild 4,000 (3,401)	
Ann		2,000		4,000		3,500	
		1,000	0	402	598	–99	599
Bruce		2,500		4,000		2,900	
		500	0	402	598	501	599
Charles		3,000		3,500		2,500	
		0	0	902	598	901	599

This would result in an all-volunteer system of assignments and a minimized opportunity cost for personnel serving at each location. Additionally, overall moving expenses would decrease because there would be less of a need to backfill locations.

Our reenlistment simulations showed that the proposed wage structure would better equalize reenlistment rates across locations. This could be done at no or modest cost to the government, depending upon congressional desires.

As a second-best solution to the problem of geographic variation in wages, we recognize that our proposed adjustment would not completely correct the imbalance and the need for programs such as the Navy's Assignment Incentive Pay or Army's Targeted Selective Reenlistment Bonus may remain to ensure all billets are filled voluntarily. However, by providing a more equitable and efficient initial wage from which to adjust, our proposal would be of significant benefit to both DoD and enlisted personnel.

DISCLAIMER

The views expressed in this article are those of the authors and do not necessarily reflect the official policy or position of the United States Air Force, Department of Defense, or the U.S. Government.

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