Examining the AFQT as a Proxy for Human Capital

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Abstract

I examine whether the Armed Forces Qualifications Test (AFQT) is a suitable proxy for human capital skills by testing the hypothesis that those factors most germane to human capital skills acquisition will most affect AFQT score. Using data from the National Longitudinal Survey of the Youth and OLS regression analysis, I find that strict and loose human capital factors are robust determinants of AFQT score, and thus the AFQT is a suitable proxy for human capital skills. However, its use as such requires specification that the AFQT is not a catchall for human capital factors, as it is significantly related to only some human capital factors considered in this study.

I. Introduction

The Armed Services Vocational Aptitude Battery (ASVAB) is an aptitude test traditionally administered by the U.S. Military to determine basic enlistment eligibility. It is comprised of 10 sections each designed to test a specific aspect of aptitude. The Armed Forces Qualifications Test (AFQT) is the composite score of four of its sections: word knowledge, paragraph comprehension, arithmetic reasoning, and numerical operations. The introduction of the National Longitudinal Survey of the Youth 1979 Cohort (NLSY) made AFQT data widely available and has thus dramatically increased its use (Blackburn, 2004). Resultantly, there has been much debate regarding what the AFQT is a suitable proxy for. The purpose of my research is to address exactly that question. The impetus for my research is straightforward: a coherent account of what the AFQT measures and can be a proxy for is a *prerequisite* to understanding past and future research utilizing the AFQT.

II. Literature Review

The human capital theory interpretation is the prevailing account of what the AFQT is a measure for, and how it can be used as a proxy. Blackburn (2004) aptly notes that the AFQT is generally assumed to measure human capital skills in the AFQT literature and, as a result, is often used as a proxy for human capital skills. According to this interpretation, AFQT scores are determined by human capital investment and factors affecting said investment, e.g. education, access to physical resources, family background, psychological support, personal choices and social circumstances. Influential research in accord with this interpretation by Neal & Johnson (1996) posits that the AFQT is a racially unbiased test of pre-labor market human capital skills. Regarding the black-white wage gap for teens, Neal & Johnson (1996) find that those skills measured by the AFQT are determined by educational attainment and family circumstances, and primarily that the black-white wage gap is almost fully explained by the differences in AFQT scores. The human capital interpretation of AFQT has gained wide acceptance, particularly amongst those emphasizing the importance of socioeconomic background factors and education. Caspi, Moffitt, Silva, and Wright, (1998), Currie (2009), Currie & Thomas (1999), Cordero-Guzman (2001), and Israel & Seeborg (1998) argue that socioeconomic background factors are central to interpreting AFQT. Similarly, Cascio & Lewis (2006), Goldberger & Manski (1995), Griliches & Mason (1972), Cordero-Guzman (2001), Hansen, Heckman, & Mullen (2003), Hause (1972), and Munday (2001) demonstrate how AFQT can be understood as a function of educational attainment.

There are also specific issues with using the AFQT as a proxy. Bollinger (2003) argues that the inclusion of the AFQT in linear regression equations biases the estimated coefficients of other independent variables, thus making its use as a proxy a cause for concern. However, the applicability of this concern to the research at hand is limited. What the AFQT can suitably be used as a proxy for is dependent on what the AFQT measures and, therefore, the elucidation of what the AFQT measures will enable future researchers to develop an account of the AFQT such that biases in regression models can be reduced.

III. Theory & Hypothesis

Human capital theory is uniquely suited for the study of the AFQT. The theory states that investments in certain skills and knowledge should increase individuals' income generating ability (Rosen, 2008). The reasoning behind the theory is that investments in activities, such as formal education, improve individuals' knowledge, ability to learn and utilize skills, and ultimately be productive, thus increasing their income. As a corollary, the theory applied to the AFQT provides a critical framework for explaining AFQT scores in relation to specific human capital investments. In fact, the four sections comprising the AFQT—word knowledge, paragraph comprehension, arithmetic reasoning, and numerical operations—are factors to which the theory is uniquely attuned. Investments that expand individuals' capacity to comprehend increasing amounts of information, for example, should increase performance on the word knowledge and paragraph comprehension components of the AFQT, and resultantly increase total AFQT scores. Moreover, the human capital interpretation of the AFQT is well founded in the literature (Blackburn, 2004). The utilization of the theory, then, allows a greater degree of comparison between the results of existing research and those of this paper.

   Finally, human capital theory offers robust explanations for various factors, whether social or personal, that can be said to either directly or indirectly increase human capital skills, and these explanations serve as a basis for determining the factors deserving of inclusion in the empirical model. Using the theory, social and personal factors can be explained in terms of their effect on human capital skills and knowledge acquisition that would contribute to AFQT scores. For example, the theory offers a robust explanation for how educational attainment is positively related to the development of skills and knowledge likely to generate a higher AFQT score. Conversely, other factors may find little support under the theory, and as such, can be excluded from inclusion in the empirical model. Human capital theory should clearly suggest some factors that most contribute to the AFQT score. Thus, it leads to the hypothesis that: those factors—whether personal or social—germane to human capital skills acquisition will most determine AFQT scores.

IV. Data

The National Longitudinal Survey of the Youth (NLSY) 1979 cohort is a natural fit for this study. The NSLY is a panel dataset, which periodically surveyed a cohort of 12,686 individuals between the ages 14 to 22 from 1979 until 2010 (Bureau of Labor Statistics, 2012). The data used in this paper is mainly from 1980, and the rest of the data is from 1979 and relates to race, sex, and other factors that are unchanging over time. These two years are from early in the survey and, consequently, my sample size remains fairly large at 6,766 individuals. Additionally, the richness of the dataset, i.e. its inclusion of myriad variables germane to analyzing AFQT and its determinants, makes it uniquely appropriate for this research. There are, in fact, many unique personal and social factors made measurable by the variables included the dataset that otherwise would not be available in conjunction with this area of economics research.

V. Empirical Model

A. Overview

Using OLS regression analysis, this paper elucidates those factors that most determine AFQT scores. The regression equation includes two types of factors: strict and loose human capital factors. Strict human capital factors are well founded in the literature and are central to human capital explanations of the AFQT, e.g. educational attainment. Loose human capital factors are often included in the literature as pertinent to understanding the AFQT and can be reasonably explained by human capital theory. Additional explanation for these variables is in the next section. Table 1 is a summary table of all the variables used along with a brief description and their expected sign in the model.

Table 1: Summary Table of Variables

Variable	Description	Expected Sign
AFQT	Dependent variable; AFQT composite score as a percentile rank; continuous.	N/A
Strict Human Capital Factors		
YEARSEDUC	Years of formal schooling at time of taking AFQT; continuous: each additional unit equates to an additional year of schooling.	Positive
FATHEREDUC	Highest grade completed by father; continuous: each additional unit equates to an additional year of schooling.	Positive
MOTHEREDUC	Highest grade completed by mother; continuous: each additional unit equates to an additional year of schooling.	Positive
FAMINCOME	Total net family income; continuous: each unit increase equates to a 1000-dollar	Positive

	increase in family income.	
HOMELANG	Foreign language spoken in home: Yes = 1, No = 0.	Negative
NUMSIBS	Total number of siblings; continuous: each additional unit equates to an additional sibling.	Negative

Loose Human Capital Factors

LIBRARY	Household has library card: Yes = 1, No = 0	Positive
NEWSPAPER	Household has newspapers present in home: Yes = 1, No = 0.	Positive
MAGAZINES	Household has newspapers present in home: Yes = 1, No = 0.	Positive
ROTTER	Rotter Scale Score; continuous: each additional unit equates to a falling locus of control, i.e. feeling of inefficacy.	Negative
ROSENBERG	Self-esteem score; continuous;	Positive

	each additional unit equates to a greater self-esteem level.	
CAREEREXP	Expected ability to achieve occupational aspirations by age 35; continuous: each additional unit equates to a greater degree of optimism.	Positive
ILLEGALACT	Charged for non-traffic offense: Yes = 1, No = 0.	Negative
Control Variables		
MALE	Gender of correspondent: Male = 1, Female = 0.	Positive
HISPANIC	Whether individual is Hispanic: Hispanic = 1, Not Hispanic = 0.	Negative
BLACK	Black = 1, Not Black = 0.	Negative
URBAN	Correspondent's geographic setting at age 14: Urban = 1, Rural = 0.	Positive

B. Loose Human Capital Factors

LIBRARY, NEWSPAPER, and MAGAZINE indicate access to information independent of formal education in 1980. The presence of such materials could expand individuals' knowledge base, increase the amount of time dedicated to intellectual development outside of school, and resultantly increase human capital skills acquisition. Specifically, AFQT scores are likely to increase as access to such materials would likely aid in developing word knowledge and paragraph comprehension. Blackburn (2004) utilized NEWSPAPERS and LIBRARY, and found them to be important factors in predicting labor market performance. The AFQT was also used in Blackburn's regression equation without co-linearity issues, thus providing evidence for the inclusion of both NEWSPAPERS and LIBRARY as unique independent variables. Further, Cancio, Evans, and Maume (1996) yielded similar results using both of these variables along with MAGAZINES.

ROTTER tests individuals' locus of control, or how much control individuals feel they have over the course of their lives and outcomes. Individuals contending that they can affect their lives and outcomes should be more inclined to spend time investing in the skills necessary to do so. This may be a result of increased optimism and ambition, both of which play an important role in the determination of this variable. Thus, a greater sense of control incentivizes investment in those skills that may indirectly result in a higher AFQT score. Dunifon & Duncan (1998) confirm that ROTTER is a robust positive predictor of labor market success. Additionally, they find that the consideration of ROTTER alongside another cognitive abilities test much like the AFQT does not bias the results of either test. Farkas & Hall (2011) similarly make this conclusion, and also do so while treating AFQT and ROTTER as unique explanatory variables. The same human capital arguments similarly apply to ROSENBERG, a test of self-esteem. Farkas & Hall (2011) also include ROSENBERG in their analysis, and find similar results for ROSENBERG as they did for ROTTER. Heckman, Stixrud, & Urzua (2006) utilized both ROTTER and ROSENBERG alongside AFQT in predicting wages, and found that ROTTER and ROSENBERG encapsulate unique facets of human capital skills.

CAREEREXP indicates individuals' beliefs about whether they will achieve their career goals by age 35. Farkas & Hall (2011) examine CAREEREXP in relation to the AFQT, and find that both are simultaneously related to labor market outcomes. They are treated as independent explanatory variables, yet there is also reason to argue that CAREEREXP may aid in explaining AFQT scores. Similar to the explanations for ROTTER and ROSENBERG, the more individuals think they can achieve their future career goals, the more likely they are to make the investments necessary to increase their AFQT score.

Finally, ILLEGALACT measures whether individuals have been charged with non-traffic related offenses. Such a variable can be used to proxy how individuals spend their time. Individuals who have been charged with a non-traffic related

offense were probably spending their time engaging in activities not conducive to their future, not acquiring human capital skills, and thus probably not taking action that would increase their AFQT score. In fact, they are likely partaking in activities that directly trade off investment in human capital skills. Heckman, Stixrud, & Urzua (2006) utilize ILLEGALACT in their wage regression, and find that the variable helps account for differences in wages, and thus likely is a contributing factor to different levels of human capital attainment.

D. The Empirical Model

The following regression equation will be used to predict AFQT and test my hypothesis. The original AFQT scores have been transformed twice, and I use the most recent 2006 version of the transformed AFQT variable from the NLSY 1979 cohort. This data for this variable measures scores on the AFQT as a percentile rank on a scale of 0 to 100. As such, the coefficients of the left-side independent variables directly correspond to percentile changes in the AFQT. For example, a coefficient of positive five is interpreted as an improvement in one's percentile rank by five percentiles relative to the reference group.

$$(i) \; AFQT = \alpha_1 + \beta_1(YEARSEDUC) + \beta_2(MOTHEREDUC) + \beta_3(FATHEREDUC) + \beta_4(FAMINCOME) + \beta_5(NUMSIBS) + \beta_6(HOMELANG) + \beta_7(LIBRARY) + \beta_8(MAGAZINE) + \beta_9(NEWSPAPER) + \beta_{10}(CAREEREXP) + \beta_{11}(ROSENBERG) + \beta_{12}(ROTTER) + \beta_{13}(ILLEGALACT) + \beta_{14}(HISPANIC) + \beta_{15}(BLACK) + \beta_{16}(MALE) + \beta_{17}(URBAN).$$

YEARSEDUC, MOTHEREDUC, FATHEREDUC, FAMINCOME, NUMSIBS, and HOMELANG are strict human capital factors, while LIBRARY, MAGAZINE, NEWSPAPER, CAREEREXP, ROSENBERG, ROTTER, and ILLEGALACT are the loose human capital factors in the regression equation. Should most of these variables be statistically significant, and have coefficients with the right sign (see Table 1) and a sizeable magnitude, then the model largely confirms my hypothesis.

VI. Results

A. Strict Human Capital Factors

The results for the strict human capital factors strongly support my hypothesis. As shown in Table 2 below, all the variables except for HOMELANG are significant at the .01 level and have the predicted sign. The insignificance of HOMLANG can be explained by the fact that the language proficiency of the individual taking the AFQT may not be reflected by whether there was a foreign language spoken in the home. Generally speaking, many children of immigrants have strong English proficiency due to their educational experiences and even act as

translators for their foreign language-speaking parents. The results for YEARSEDUC are notable as well, as each additional year of schooling garners a 3.77 percentile increase in AFQT score. Given the central role that educational attainment plays in the human capital framework, this result strongly supports the hypothesis that those factors most germane to human capital theory will most determine AFQT scores. Indeed, this result is consistent with the conclusions drawn by Cascio & Lewis (2006), Goldberger & Manski (1995), Griliches & Mason (1972), Cordero-Guzman (2001), Hansen, Heckman, & Mullen (2003), and Hause (1972).

The results for NUMBSIBS, FATHEREDUC, MOTHEREDUC, and FAMINCOME represent the importance of family resource in determining AFQT scores. Israel and Seeborg's (1998) work on the intergenerational transmission of socioeconomic status support the conclusion suggested by these results. Further, it is important to make clear that these seemingly small coefficients do appear to be quite impactful upon further analysis. For example, FAMINCOME suggests that each additional $1,000 of income a family earns should increase AFQT score by .15 of a percentile. As such, the size of this coefficient is quite large considering that an individual whose parent's earn $100,000, compared to an individual whose parents earn $50,000, is expected to have a 7.5 higher percentile test score. Along this same analysis, each additional year of schooling a parent acquires should increase the child's AFQT score by almost a whole percentile.

Table 2: OLS Regression Results

Variable	Coefficient (t-statistic)
CONSTANT	-27.592*** (-9.881)
Strict Human Capital Variables	
YEARSEDUC	3.768*** (24.058)
MOTHEREDUC	0.853*** (7.418)
FATHEREDUC	0.857*** (9.589)
NUMSIBS	-0.688*** (-6.212)
FAMINCOME	0.155*** (7.402)
HOMELANG	-0.704 (-.795)
Loose Human Capital Variables	
LIBRARY	2.657*** (4.227)
MAGAZINE	6.108***(10.441)
NEWSPAPER	1.051 (1.478)
CAREEREXP	1.704*** (5.282)
ROSENBERG	0.7*** (10.331)
ROTTER	-1.166*** (-10.373)
ILLEGALACT	-3.077*** (-3.6)
Control Variables	
HISPANIC	-5.505*** (-5.296)
BLACK	-20.103*** (-30.383)
MALE	0.925* (1.797)
URBAN	-1.722*** (-2.678)

N: 6,766; Adjusted R-Squared: .497; *Significant at .1 level; **Significant at .05 level; ***Significant at .01 level.

B. Loose Human Capital Factors

The results for the loose human capital factors also strongly support my hypothesis. Each of these factors, except for NEWSPAPER, are significant at the .01 level and have the predicted sign. The insignificance of NEWSPAPER can be explained in context of MAGAZINES and LIBRARY, which are similar variables in that they deal with access to information but have significant impacts on AFQT. Access to magazines and library cards is less prevalent than the presence of newspapers in a home because they require additional effort to procure. While newspapers are delivered to the home for free or close to it, magazines require subscriptions and library cards renewal. As such, it may very well be the widespread ease of access to newspapers as opposed to the extra effort required to gain access to magazines and library cards that accounts for the difference in results amongst similar variables.

Interestingly, whether an individual has been charged with non-traffic related offense proves to be substantially negative and significant. Having been charged with such an offense should decease performance on AFQT by 3.1 percentiles. Contributing to the relative size of this coefficient is the fact that it is a non-continuous variable; you either have or have not been charged with a non-traffic related offense. Conversely, ROTTER and ROSENBERG have much smaller coefficients, but may very well be more important in determining AFQT scores. Since each additional point on ROTTER and ROSENBERG's scales contributes the amount of the coefficient to the AFQT score, an especially poor performance on either one should result in substantially worse total outcomes than 3.1 percentiles. A three-point increase in ROTTER, for example, would have a more negative impact on AFQT than ILLEGAL ACT. Regardless, the results for all three of the aforementioned variables are supported by the conclusions of Heckman, Stixrud, & Urzua (2006) and Farkas & Hall (2011).

C. Control Variables

The control variables HISPANIC and BLACK are significant at the .01 level, have the predicted sign, and sizeable coefficients that warrant further analysis. As shown in Table 2, Hispanics are expected to have a score 5 percentiles lower on the AFQT than white test takers, while blacks are expected to have a score 20 percentiles lower. As Neal & Johnson (1996) point out, the AFQT is administered pre-entry into the labor market in this sample, and as such, any likely discrimination is likely to impact individuals pre-market entry. Along these same lines, Carniero, Heckman, & Masterov (2002) argue that HISPANIC and BLACK can be interpreted as measuring school quality to a large extent, since the NLSY does not have a variable to measure school quality. They also point to the fact that there are achievement gaps in other test scores recorded much earlier in childhood between races, thus suggesting that other factors, such as health and socioeconomic background, are affecting minorities' AFQT. Future research

should focus on the interaction between race and educational attainment in order to further elucidate the nature of this relationship.

VII. Conclusions

These results support my hypothesis that those factors—whether social or personal—most germane to human capital skills acquisition will most determine AFQT scores. The primary conclusion that can be drawn is that human capital factors mostly determine AFQT scores, and as such, the AFQT can be suitably used as a proxy for such factors. Moreover, it is clear that those factors determining AFQT score are complex and varied. Indeed, the importance of loose human capital factors in conjunction with strict human capital factors in determining AFQT score suggests that the scope of human capital theory is much broader than traditionally thought. One limitation to this consideration, however, is the AFQT is not a catchall for human capital factors, since it measures a specific set of skills that are a part of a much larger framework. Returning to the AFQT debate, these results further support the human capital interpretation of the AFQT, and in turn, supports the assumptions made by economists in past research that the AFQT is a proxy for human capital skills.

There are three policy interpretations that result from these findings. First, since AFQT is generally accepted in the literature as a robust positive predictor of income (Blackburn, 2004; Caspi, Wright, Moffitt, & Silva, 1998; Farkas & Hall, 2011; Griliches & Mason, 1972; Hause, 1972; Heckman, Stixrud, & Urzua, 2006; Kanarek, 2013; Neal & Johnson, 1996; Rogers III & Spriggs, 1996), this research helps to elucidate those factors that may contribute to higher incomes in the future. For example, if it is the case that self-esteem (ROSENBERG) affects AFQT score, which in turn affects income attainment, then it can be inferred that self-esteem may be an important factor in income attainment. As such, this research gives impetus for making investments in those factors contributing to higher income attainment and labor market success. This could take the form of increasing educational investment, investing in programs aimed at improving self-esteem, or perhaps increasing access to information. Second, this research may provide the U.S. Armed Forces, which uses the AFQT as a test for enlistment eligibility, with additional insight into those factors that are most significant in determining eligibility for, and success in, service. Resultantly, the U.S. Armed Forces may be able to tailor their eligibility standards in light of further understanding of what exactly the AFQT measures.

However, there are a couple considerations important to interpreting these results. For one, the results are for test takers from the late 1970s and early 1980s, and as such, may not represent the current state of affairs. For example, the relevance of access to information through magazines and libraries may be much less important now than it was before given the advent of the internet. Additionally, great advances have been made in equalizing the quality of education received by minorities. Thus, it is likely that the coefficient for BLACK would be much smaller today than it is in these results, but it is still likely to be negative and significant.

Finally, there is a broader philosophical significance found in these results. Generally, the strict human capital factors are social factors, i.e. an individual has very little, if any, control over them, while the loose human capital factors are personal, i.e. an individual is able to affect them through choices. Given that my results suggest the importance of both strict and loose human capital factors on AFQT scores, it appears that chosen and un-chosen facets of individuals' lives are important in determining their outcomes. In evaluating human action, achievement, and relative life positions, my results lead to the conclusion that it would be wrong to treat these things as fully open or fully closed to individual's volitional pursuits. Instead, it should be recognized that a mix of factors are at play in the lives of individuals. Such recognition should greatly impact discourse surrounding these issues, especially when dealing with wage-regressions and those labor economics studies focused on predicting labor market success.

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