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General Mental Ability and pay: Nonlinear effects ☆

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ABSTRACT

While many studies have examined the linear relationship between intelligence and economic success, only few, if any, examined their nonlinear relationships. The current study examines such relationships in a large, nationally representative sample, using pay as an indicator of economic success. The results show that the effect of General Mental Ability (GMA) on pay depends on occupational complexity; the greater the complexity, the stronger the effect. They also show that, by and large, there is a marginally decreasing (concave) effect of GMA on pay. Methodological and practical questions concerning the relationship between cognitive ability and pay are discussed.

1. Introduction

Most, if not all studies that examined the effect of intelligence on wealth estimated linear models, both on the individual level (e.g., Ganzach, 2011; Herrnstein & Murray, 1994; Ng, Eby, Sorensen, & Feldman, 2005) and on the national level (e.g., Kanazawa, 2006; Lynn & Vanhanen, 2002; Meisenberg, 2012). In the current study we examine nonlinear models of wealth using pay as a dependent variable. We suggest that the effect of intelligence on pay is not uniform (as would be suggested by a linear effect), and we examine two nonlinear hypotheses regarding this effect. First, we examine an interactive hypothesis about the effect of intelligence on pay: the higher the mental requirement of the occupation (i.e., the higher the occupational complexity), the stronger the effect of intelligence on pay (*H1*). This hypothesis suggests an interaction between intelligence and occupational complexity in the determination of pay. Second, we examine a curvilinear hypothesis about the effect of intelligence on pay: the effect of intelligence on pay is concave — it is stronger when intelligence is low than when it is high (*H2*).

As we discuss below, the rationale for these two hypotheses is based on evidence regarding non-linear effects of intelligence on performance. Since in many contemporary economies pay is related to performance, we expect that in such economies the nonlinear effects of intelligence on performance will be manifested in nonlinear effects of intelligence on pay. Note that in this respect the rationale underlying our argument regarding the *nonlinear* effects of intelligence on pay is not different from the rationale underlying the *linear* effect of intelligence on pay: intelligence is a good predictor of pay because it is a good predictor of performance (e.g., Gottfredson, 2002), and because performance is rewarded by pay (e.g., Herrnstein & Murray, 1994).

In the following paragraphs we first elaborate on the conceptualization of pay as an indicator of performance, and then proceed to develop the two hypotheses regarding the nonlinear effects of intelligence on *pay* based on the literature about the nonlinear effects of intelligence on *performance*. We subsequently test these hypotheses using a large nationally representative American sample.

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1.1. Pay as an indicator of performance

One novel aspect of the present study is its reliance on the view, adopted from economics, that pay is an indicator of performance. This is a somewhat unusual indicator of performance in the applied psychology literature that commonly use either output (e.g., number of units produced or services provided, level of quality achieved) or supervisory evaluation ratings (of behaviors, approach or output) as indicators of performance.[1] However, although pay is not often used in the applied psychology as an indicator for performance, there is much literature suggesting that in most work environments pay is strongly related to performance (Baker, Jensen, & Murphy, 1988; Bonner & Sprinkle, 2002; Prendergast, 1999) despite the finding that this relationship may be weaker when it relates to performance quality as opposed to performance quantity (Jenkins, Mitra, Gupta, & Shaw, 1998). Thus, for example, on the basis of 77 empirical studies, Heneman (1990) found that performance ratings were positively and usually significantly related to pay increases. Although there are some experimental studies showing that under certain situations there may be weak, and even negative, relationships between pay and performance (Gneezy & Rustichini, 2000; Heyman & Ariely, 2004) these studies were usually conducted in situations that do not represent typical work environments.

In sharp contrast to that, pay is the single most common measure of performance in economics. From an economic perspective, pay is a universal measure for performance because it expresses the utility obtained from one's work as measured by the market (Lazear, 2000). It enables comparing the performance of people in different occupations, whose 'raw' performance is measured in different units, by scaling them on a common scale representing the benefit that their employer obtains from their work. The logic behind this view of the relationship between pay and performance is that in equilibrium there is no reason to assume that people will not be paid according to their performance. To see why this is the case, consider person A who is paid less than the utility her employer obtains from her performance. A is likely to seek and be hired by another employer who will be willing to pay according to the utility he might gain from her performance. Similarly, consider person B who is paid more than the utility his employer obtains from his performance. B is likely to be laid off and be re-hired only by an employer who is willing to pay (less) according to the utility gained from B's performance. As a result, over time pay reflects employees' performance, namely the utility they bring to their employers.

1.2. Occupational complexity as a moderator of the relationship between intelligence and performance

Intelligence is more crucial for performing complex as opposed to simple occupations. Therefore, it is natural to expect that the higher the complexity of the occupation, the higher the validity of intelligence in predicting performance. This expectation is supported by Hunter and Hunter (1984), who present two sets of relevant correlations. One set, obtained from studies conducted by the United State Employment Service, shows correlations of .56, .58, .51, .40, and .23 between intelligence and job performance for five occupational families arranged by *decreasing* order of complexity. The other set, obtained from re-analysis of data collected by Ghishelli (1973), likewise arranged by decreasing order of complexity, shows correlations of .53, .54, .61, .42, .48, .46, .37, .28, and .27. Thus, despite the small number of correlations and the rough pattern of the results, the trend in these data is consistent with the expected positive relationship between the complexity of the occupation and the validity of intelligence as a predictor of performance (see also Hulsheger, Gunter, & Stumpp, 2007, for a recent replication). These findings regarding the relationship between intelligence and performance provide support to our hypothesis about the interaction between intelligence and occupational complexity with regard to pay (*H1*).

1.3. Concave relationships between intelligence and performance

The relationship between intelligence and performance is concave if the higher the intelligence, the lower its effect on performance. Such a relationship is consistent with the Spearman view of intelligence, which distinguishes between General Mental Ability (GMA, or g) and specific abilities, where GMA is a major determinant of specific abilities — each specific ability is related both to a factor common to all abilities (GMA) and to a unique factor that characterizes this ability. These specific factors are particularly relevant to job performance since general ability may be invested in specific experiences and crystallizes to specific abilities, which may add to the prediction of performance (Cattell, 1987). Indeed, even studies that argue for the central role of GMA in predicting performance note that specific abilities contribute a significant, though small, amount to the prediction of job performance. Thus, for example, even when stating that there is not "much more than g" in predicting job performance, Ree, Earles, and Teachour (1994) stated that specific factors "added to the accuracy of prediction, but only by a small amount" (p. 520). Similarly, in reviewing the literature about the predictive power of cognitive ability, Kuncel, Hezlett, and Ones (2004) say, "We believe that the ability determinants of creative work are mainly composed of g, related specific abilities, and acquired domain specific knowledge" (p. 153).

Spearman's view also proposes that the higher a person's level of intelligence, the weaker its effect of GMA on specific abilities, indicating a concave relationship between GMA and specific *abilities*. This latter proposal, known in the intelligence literature as "Spearman's law of diminishing returns", is explained as a result of the fact that "High-g persons have more diversified abilities, with more of the total variance in their abilities existing in non-g factors" (Jensen, 1998, p. 585). A relevant example for this law is the threshold theory of creativity which suggests that the relationship between GMA and creativity is weaker in higher than in lower levels of intelligence (Guilford, 1967).

Within the context of the current paper, Spearman's law of diminishing returns is important because it suggests that – if performance depends to some extent on specific abilities

[1] We are aware of only one study in the applied psychology literature that used pay to measure performance (Hunter, Schmidt, & Judiesch, 1990), but even there pay was considered to be an appropriate measure only among non-salaried workers (this study, however, focused on the estimation of the ratio of the standard deviation of output to mean output, and did not involve an examination of the relationship between ability and performance per se).