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Intelligence, creativity, and innovation

Jay Squalli [a,*], Kenneth Wilson [b]

[a] Department of Economics, American University of Sharjah, P.O. Box 26666, Sharjah, United Arab Emirates
[b] Office of the Provost, Zayed University, P.O. Box 19282, Dubai, United Arab Emirates

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ABSTRACT

This study provides the first test of the intelligence–innovation hypothesis, which contributes to the intelligence–creativity debate in the psychology literature and to the innovation–growth debate in the economics literature. Using U.S. state-level data the study finds that, net of other factors, high-IQ states are more innovative as measured by the important innovation outcome measure, utility patents registered. This study highlights the need for a better understanding of the relationship between intelligence, creative achievement, and innovation, a nascent and under-researched field of inquiry. Our research also begs the question of whether efforts to nurture intelligence are a necessary first step to increasing the capacity to realize innovation improvements.

1. Introduction

The relationship between intelligence, creativity, and innovation is little understood by economists and psychologists alike and is a fertile area for research, particularly interdisciplinary research, where questions abound in terms of the influence of intelligence on both creativity and innovation. Indeed, the major focus of this paper is the question: do more intelligent societies or communities innovate more? Although psychologists have not addressed the intelligence–innovation relationship explicitly, they have made attempts at understanding how intelligence contributes to creativity, a related trait, but mainly at the individual level. However, the absence of a unified definition of creativity has made this task not only challenging but controversial. In addition, related inquiries face further complications arising from the fact that intelligence and creativity are constructed differently and are subjected to varying theoretical and psychometric development (see e.g. Kaufman & Plucker, 2011).

Empirical studies have generally reported little to no correlation between intelligence and creativity. Two notable examples include Wallach and Kogan (1965) and Kim (2005) who report average correlation between intelligence and creativity of 0.09 and 0.17, respectively.[1] The low correlation between intelligence and creativity, to some extent, arises from the confusing array of definitions and measures that are used to represent creativity in empirical studies. Indeed, Nusbaum and Silvia (2011) emphasize that modern creativity research emphasizes the difference between intelligence and creativity and draw particular attention to the work of Kaufman (2009) and Sawyer (2006). However, Nusbaum and Silvia take a different view and assert that intelligence is more central to creative cognition than is more popularly believed.

Just like psychologists, economists have expressed keen interest in the role that innovation plays in stimulating economic growth. There are strong theoretical foundations in four different branches of economic thought: evolutionary (Nelson & Winter, 1982; Schumpeter, 1934); neo-classical (Solow, 1956, 1957); post-Keynesian (Kaldor, 1957); and

* Corresponding author. Tel.: +971 65152318.
E-mail addresses: jsqualli@aus.edu (J. Squalli), Kenneth.Wilson@mcycd.gov.ae, kenneth.wilson@zu.ac.ae (K. Wilson).

[1] Wallach and Kogan (1965) correlate five different measures of creativity with ten measures of intelligence, whereas Kim (2005) undertakes a meta-analysis of 21 studies.

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0160-2896/

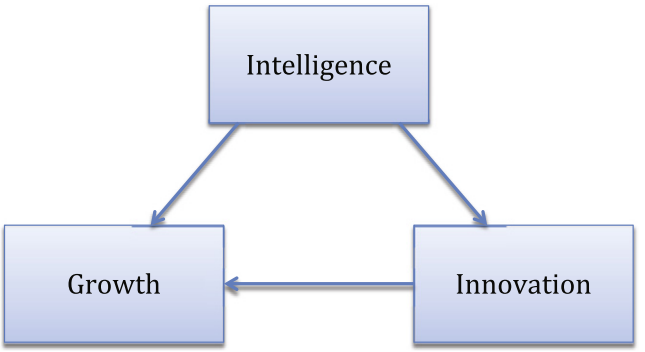

Fig. 1. The transmission of intelligence to growth via innovation.

endogenous growth (Romer, 1986, 1990). Although the transmission mechanism from innovation to economic growth varies depending upon the framework, the evidence consistently predict that more innovation leads to greater economic growth (Guellec & van Pottelsberghe de la Potterie, 2001; Lederman & Maloney, 2003). Innovation boosts productivity, improves an economy's competitiveness and contributes to building knowledge-based economies and societies. Intelligence is a key aspect of human capital in any society and human capital plays an important role in the theory of economic growth. For instance, Mankiw, Romer, and Weil (1992) include a human capital variable in their empirical test of the Solow (1957) model where human capital is measured by secondary school enrollments. Other human capital measures include primary school enrollments (Sala-i-Martin, 1997) and average years of schooling (Barro & Lee, 1993). More recently, Jones and Schneider (2006) use IQ as the human capital measure in their empirical test of the human capital-economic growth hypothesis. Similar to Weede and Kämpf (2002) they find that intelligence, measured by IQ, has a direct, positive effect on economic growth.

Given that intelligence is an important element of human capital, we propose that there is more innovation in societies that have high-IQ populations for three reasons. First, more intelligent people have longer time horizons, a consistent finding in psychology and economics (Potrafke, 2012; Shamosh & Gray, 2008) which enables them to better appreciate the increasing returns from innovation, entrepreneurship and risk-taking behavior. Second, in high-IQ population groups, knowledge spillovers from 'social technologies' (Nelson & Sampat, 2001) are likely to be greater.[2] Third, since a key part of innovation involves scientific and engineering discovery and applications that are embodied in intellectual property via patents, we propose that more intelligent people are more able to undertake the considerable intellectual challenges associated with knowledge creation and innovation. Indeed, there is compelling evidence that intelligence has a direct effect on job performance when a job is inherently less trainable; such as jobs that require creative problem solving, independent decision making and innovative adaptation (Gottfredson, 2004). These are the very skills needed for productive work in an innovation system. The transmission mechanism from intelligence to economic growth, illustrating support for the proposition that innovation has a direct, positive effect on economic growth, is represented in Fig. 1.

Building on scholarly work in the psychology and economics literature, the original contribution of this paper is to provide the first test of the intelligence–innovation hypothesis. This assessment would contribute to the current intelligence–creativity debate in the psychology literature and to the innovation–growth debate in the economics literature. To this end, the paper is organized as follows: Section 2 discusses creativity and innovation. Section 3 describes our empirical strategy. Section 4 summarizes the results. Section 5 summarizes robustness estimations. Section 6 discusses the results and concludes.

2. Creativity and innovation

Intelligence, creativity and innovation may be well understood in general terms but attract considerable controversy when attempts are made to define, measure and assess their inter-relationships. Consider the following basic definitions of intelligence and creativity. According to the Merriam-Webster dictionary, intelligence is "the ability to learn or understand things or to deal with new or difficult situations." By comparison, Mayer (1999) provides the following definition of creativity: "creation of new and useful products including ideas as well as concrete objects." Such definitions place the area of overlap between the constructs as quite small. This is consistent with the early findings of Wallach and Kogan (1965) noted above. By contrast, Silvia et al. (2008) undertake a latent variable reanalysis of Wallach and Kogan's findings and find a correlation of $r = 0.20$. Silvia (2008) continues this theme and argues that past work has tended to underestimate the relationship between intelligence and creativity. Silvia favors latent variable models which allow researchers "to estimate higher-order latent factors, such as a latent g composed of lower-order latent factors" (p. 1013). According to Silvia, testing the relationship between intelligence and creativity requires modeling intelligence as a higher-order, general factor composed of lower order cognitive skills. More recently, Nusbaum and Silvia (2011) use the latent variable approach to test the relationship between fluid intelligence and creativity and conclude that intelligence and creativity are more closely related than more popular research contends.

[2] Social technologies or social capital include the norms and social relations embedded in social networks and include the sum of the resources that accrue to an individual or group when individuals work and interact together.