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Are greenhouse gas emissions and cognitive skills related? Cross-country evidence

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ABSTRACT

Are greenhouse gas emissions (GHG) and cognitive skills (CS) related? We attempt to answer this question by exploring this relationship, using cross-country data for 150 countries, for the period 1997–2012. After controlling for the level of economic development, quality of political regimes, population size and a number of other controls, we document that CS robustly predict GHG. In particular, when CS at a national level increase by one standard deviation, the average annual rate of air pollution changes by nearly 1.7% (slightly less than one half of a standard deviation). This significance holds for a number of robustness checks.

1. Introduction

The last several years have witnessed rising interest in the consequences of cross-national differences in cognitive skill (CS). Although scholars debate on how they specify cognitive abilities (or intelligence), there is general consensus that cognitive capital represents the capacity to reason, solve problems, think abstractly, and acquire knowledge (Snyderman and Rothman, 1988, p. 56). Moreover, Gottfredson (1997, p. 13) suggests that '[cognitive capital] reflects a broader and deeper capability for comprehending our surroundings – "catching on", "making sense" of things, or "figuring out" what to do. Indeed, while cognitive skills is a multidimensional concept which may encompass social intelligence, emotional intelligence and general intelligence (Freeman et al., 2016), in this paper we focus on one aspect of this concept, namely general intelligence.[1] At a macro-societal level CS is measured by different psychometric tests such as Raven's Standard Progressive Matrices (SPM) and its derivatives.

Research on this subject can generally be broken down into three major streams. The first thoroughly explores the economic correlates of CS in cross-national literature. The key findings of this research positively associate CS with economic growth (Jones and Schneider, 2006), per capita wealth (Whetzel and McDaniel, 2006), financial development (Salahodjaev, 2015a, 2015b, 2015c) and welfare (Hafer, 2017).

The second line of study investigates the link between CS and quality of life. In most of these studies, CS is shown to predict life expectancy (Lv and Xu, 2016), tolerance (Souza and Cribari-Neto, 2015), life satisfaction (Veenhoven, 1996) and happiness inequality (Nikolaev and Salahodjaev, 2016).

The third research stream studies the consequences CS has on environmental quality. There is evidence that CS at a national level predicts the quality of environmental institutions, such as the ratification of environmental agreements (Obydenkova and Salahodjaev, 2016) and the stringency of climate change policies (Obydenkova and Salahodjaev, 2017). However, the evidence regarding the 'hard measures' of environmental sustainability is still mixed and debated. For example, Squalli (2014), using US-state level data, failed to establish that CS significantly affects greenhouse gas emissions. While CS seemed to be positively related to N2O emissions in that study, CS had no significant link with CH4 and CO2. The study concluded by stating that future 'scholarly work should consider assessing the intelligence–environment relationship using alternative measures of intelligence'. Salahodjaev (2016), meanwhile, using data from 186 nations from 1990 to 2010, found new evidence indicating that human psychology, proxied by CS, inversely relates to forest cover loss. In a different study, Salahodjaev (2016) further provides evidence that environmental sustainability, measured by the Environmental Performance Index is significantly predicted by CS at a national level.

While extant studies focus on such aspects of environment as deforestation, climate change policies or sustainability, it is crucially important to accumulate new evidence about the relationship between CS and greenhouse gas emissions using cross-country data for a number of reasons. First, the World Health Organisation (WHO) reports that approximately 7 million people died in 2012—one-eighth of the total number of global deaths that year—as a result of air pollution exposure.

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[1] In this study we use intelligence and cognitive skills interchangeably.

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This more than doubles previous estimates and confirms air pollution as the world's largest single environmental health risk today.[2] In addition, worldwide ambient air pollution contributes to 5.4% of all deaths each year. What's more, related studies have revealed that air pollution significantly relates to life satisfaction (Ferreira et al., 2013), suicide rates (Lin et al., 2016) and intention to migrate (Qin and Zhu, 2015).

Overall, the current literature offers ambiguous predictions regarding the link between CS and greenhouse gas emissions. On the one hand, considering that CS positively affects economic development and gross domestic product (GDP) growth, it can be detrimental for the environment. On the other hand, while some studies seem to find that air pollution and deforestation increases with economic development, growing evidence suggests that the trend between GDP per capita and environmental degradation reverses once nations reach a certain threshold level (Van Alstine and Neumayer, 2010).[3] Moreover, in their influential study, Grossman and Krueger (1995, p. 370) found 'no evidence that economic growth [causes greater pollution]. Instead [they] find that while increases in GDP may be associated with worsening environmental conditions in very poor countries, air and water quality appear to benefit from economic growth once some critical level of income has been reached'.

On top of this, a possible mechanism by which CS can affect air pollution is delay discounting—a '"commitment-choice" procedure typically present[ing] choices between larger delayed and smaller but more immediate reinforcers' (Reynolds and Schiffbauer, 2005). Research in the field of intelligence suggests that high-IQ individuals tend to reject the smaller-sooner rewards despite its close temporal proximity in favour of delayed environmental benefits (Squalli, 2014). In this vein, Shamosh and Gray (2008, p. 296) argue that 'more intelligent people demonstrate less of a preference for smaller, immediate rewards versus larger, delayed rewards'. Moreover, at the national levels, scholars have found that citizens in more intelligent societies tend to have longer time horizons (Potrafke, 2012), build more efficient institutions (Kanyama, 2014) and avoid informal activities (Salahodjaev, 2015a, 2015b, 2015c), which in turn have been linked to environmental degradation.

Another important aspect is that even if cognitive capital fosters economic development, it does so by affecting the economy's structure. For example, cognitive abilities positively relate to innovation (Azam, 2017) and economic diversification (Kodila-Tedika and Asongu, 2016). For example, Burhan et al. (2015, p. 152) argues that 'it is possible to increase per capita national income by raising the impact of IQ on productivity through the O-ring effect of skill complementarities. Accordingly, with diverse levels of IQ distributed within a country, when individual laborers with equivalent levels of cognitive skills work in groups, they are inclined to cooperate through positive assortative matching, resulting in magnified per capita productivity'. In fact, these factors have also been linked with environmental improvements, meaning that CS could indirectly decrease air pollution by firms adopting more efficient technologies.

Moreover, Obydenkova and Salahodjaev (2017, p. 183) argue that 'socio-intellectual capital is paramount for environmental policies at both a micro- and macro-social level. Cognitive abilities are necessary for institutionalised environmental commitment, protecting the environmental resource base, environmental stringency and government effectiveness'. Indeed, cognitive capital is instrumental to competence of policymakers in overseeing the quality of environmental resources. In a similar vein, intelligence is associated with greater liberties and freedom such as minority equality, freedom of media and speech. As a result, societies with liberal and free media are described their of external influences in terms of democracy promotion and cross-border diffusion of values like the bureaucrats' accountability to society (Lankina et al., 2016; Libman and Obydenkova, 2014a; Obydenkova and Libman, 2012; Obydenkova, 2012).

This study explores the relationship between CS at a national level and easily quantifiable indicators of environmental degradation: greenhouse gas emissions. We investigate this conjectured link between CS and air pollution through a sample of 150 nations for the years 1997–2012. This study is the first to explore whether CS are important predictors of greenhouse gas emissions in the era of Kyoto protocol, which was adopted in Kyoto, Japan on 11 December 1997. The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change, which commits its Parties by setting internationally binding emission reduction targets. The main aim of the Kyoto Protocol is to contain emissions of the main greenhouse gases in ways that can reflect underlying national differences in emissions, wealth, and capacity, following the main principles agreed in the 1992 United Nations Framework Convention on Climate Change (Grubb, 2004, p. 15).

Our results suggest a negative relationship between cognitive skills and air pollution. More specifically, when CS skills at a national level increase by one standard deviation, we found the average annual rate of air pollution to change by nearly 1.7% (slightly less than one half of a standard deviation). The results remain robust when we control for the level of economic development, democratisation rate, population size and a number of other control variables.

2. Method and data

2.1. Method

For our empirical exercise, we used an ordinary least squares (OLS) estimator in Stata 11.2 with a dependent variable of the average annual greenhouse gas emission change from 1997 to 2012. We included a variety of control variables measured in 1997. We also conducted a number of robustness tests in order to confirm that our estimates are not driven sample size of the choice of main estimation method.

2.2. Sample

Our sample contains all countries grouped as low-, middle- and high-income according to the World Bank. After discarding missing observations, our sample comprises 150 countries.

2.3. Dependent variable

The dependent variable in our study is the average annual percentage change in greenhouse gas emissions from 1997 to 2012. Greenhouse gas emissions are measured by total greenhouse gas emissions in kt of CO2 equivalent. This variable is composed of CO2 totals, excluding short-cycle biomass burning (such as agricultural waste burning and Savannah burning) but including other biomass burning (such as forest fires, post-burn decay, peat fires and decay of drained peat lands), all of which are anthropogenic CH4 sources, N2O sources and F-gases (HFCs, PFCs and SF6). In our sample, the average annual percentage change in greenhouse gas emissions ranges from − 17.1% in Papua New Guinea to 16.8% in Mozambique. The data came from the World Bank.

2.4. Independent variables

2.4.1. Cognitive skills

We rely on national IQs compiled by Lynn and Vanhanen (2012) as our proxy for CS. In their pioneering work, Lynn and Vanhanen (2002) reviewed studies in which cognitive abilities tests where administered. The authors were able to collect reliable data for 81 countries. For each of these countries they have calculated average national cognitive skill (national IQ) level by setting the IQ in Britain at 100 (standard

[2] www.who.int/mediacentre/news/releases/2014/air-pollution/en/.

[3] These findings hold even for sub-national data (Roca et al., 2001; Shaw et al., 2010).