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Energy consumption, human well-being and economic development in central and eastern European nations: A cautionary tale of sustainability



Andrew K. Jorgenson^{a,*}, Alina Alekseyko^a, Vincentas Giedraitis^b

^a Department of Sociology, University of Utah, 380 South 1530 East, Room 301, Salt Lake City, UT 84112, USA

^b Faculty of Economics, Vilnius University, Sauletekio al. 9, (II building), Room 411, 10222 Vilnius, Lithuania

HIGHLIGHTS

- We analyze the energy intensity of well-being in Central and Eastern European nations.
- The effect of economic development is time-dynamic.
- Other factors influence the energy intensity of well-being.
- The results highlight possibilities for enhanced sustainability policies.

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ABSTRACT

Sustainability is fundamentally a challenge of tradeoffs. In order to improve human well-being through economic development we consume nonrenewable energy and other natural resources, relying on a broad range of ecosystem services. Enhancing sustainability requires reducing the “energy intensity of human well-being (EIWB)”: the amount of energy used per unit of human well-being. In this study we employ longitudinal analysis techniques to assess the temporally dynamic relationship between EIWB and economic development for a sample of 12 Central and Eastern European (CEE) nations for the 1992 to 2010 period. These are nations that have recently transitioned, which is still an ongoing process, from socialist command economies to market demand economies. During this ongoing transition, many of them have experienced declines in energy intensity, coupled with increased energy efficiency, while human well-being has improved considerably. The results of the analysis indicate that the relationship between EIWB and economic growth in CEE nations is complex and has changed dramatically through time. Of particular importance, the later years of the study exhibit an increasingly sustainable relationship between EIWB and economic development. The findings point to future possibilities for relatively more harmonious relationships between development, human well-being, and the natural environment.

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1. Introduction

Pathways to sustainability pose challenges for how to balance ecological and environmental concerns with human well-being and economic development. It is generally assumed that development enhances human well-being (Brady et al., 2007; Gilpin, 2001), while ecosystems provide valuable services to humanity (Liu et al., 2007; Ringold et al., 2012), which themselves enhance quality of life in various ways (Prescott-Allen, 2001; Reid et al., 2005). However, for decades many sustainability scholars have questioned the extent to which heightened resource use further

enhances quality of life once societies have reached certain thresholds of collective well-being (Mazur, 2011; Mazur and Rosa, 1974; Steinberger and Roberts, 2010). At the same time, lively debates across the environmental social sciences continue regarding the complex relationships between environmental conditions and economic development (Jorgenson and Clark, 2012; Rosa et al., 2010; York, 2012).

Each of these smaller pieces of the overall sustainability challenge demands continued theoretical consideration and empirical investigation. For example, Mazur (2011), in a longitudinal analysis of energy consumption and multiple human well-being indicators for a sample of high income nations, finds that from 1980 to 2006, life expectancy rose in all nations in his sample irrespective of whether they increased or decreased their per capita energy consumption levels. However, Mazur's study does not consider the broader causal mechanisms that explain this

* Corresponding author. Tel.: +1 801 554 7393.

E-mail addresses: andrew.jorgenson@soc.utah.edu (A.K. Jorgenson), alina.alekseyko@utah.edu (A. Alekseyko), vincas.giedraitis@ef.vu.lt (V. Giedraitis).

variation, and perhaps the longitudinal relationship between energy consumption and human well-being might differ for lower income nations relative to high income nations. Turning to human well-being and economic development, much past research suggests that development increases life expectancy and reduces infant mortality in nations throughout the world (e.g., Firebaugh and Beck, 1994), but the effect of development on different well-being outcomes has slightly decreased though time in less-developed nations (Brady et al., 2007), and other studies suggest that many factors besides economic development also influence changes in the well-being of human populations (e.g., Preston, 1975). Even with the need for further analyses in each of these specific areas, we contend that sustainability research needs to advance integrative approaches that simultaneously focus on the interconnections of human well-being and environmental conditions, and how economic development affects them.

One of the more promising integrative approaches to sustainability studies is the emerging body of research on the environmental (or energy) intensity of well-being (EIWB), which refers to pressure placed on the environment per unit of human well-being (Dietz et al., 2009, 2012; Knight and Rosa, 2011). Scholars commonly operationalize EIWB as the ratio of a measure of stress on the environment, such as the ecological footprint, to a measure of human well-being, typically life expectancy at birth. A central question in this body of work is what role economic development plays in shaping the EIWB of societies. Some prevalent theoretical traditions in both environmental sociology and environmental economics suggest that the effect of development on the environment may change across levels of development, with some theories predicting increased stress while others suggest the opposite (e.g., Grossman and Krueger, 1995; Jorgenson and Clark, 2012; Mol, 2001). These perspectives can also apply to the broader relationships between EIWB and development (Dietz et al., 2012; Knight and Rosa, 2011).

However, the implications of research on EIWB and development stretch well beyond academic boundaries and theoretical considerations, and have potential policy implications. Since economic growth is a common objective of governments and international organizations, understanding the relationship between economic development and EIWB is critical. Some assume that development leads to reductions in the environmental (or energy) intensity of well-being. If that is so, then the pursuit of economic growth will have the beneficial side effect of enhancing sustainability. However, if economic growth has no effect on EIWB, then the environment will be protected if and only if policies that supplement growth promotion are enacted. If economic growth increases EIWB, then development policies are deleterious to sustainability, and must be reconsidered or balanced with new approaches to counter the unintended environmental harms of development (Banuri and Hallstrom, 2012).

Past research on EIWB and economic development includes large samples of nations from most regions of the world (Dietz et al., 2012; Knight and Rosa, 2011), a practice common in other areas of sustainability research (Jorgenson and Clark, 2011; Roberts and Parks, 2007; Rosa et al., 2004). While such an approach has many strengths and advantages, a limitation common in cross-national comparative research is the exclusion of nations from particular regions of the world, most notably the nations of Central and Eastern Europe (CEE). These are nations that have recently transitioned from socialist command economies to market demand economies and the attending changes are ongoing. With their independence, CEE countries inherited an energy-intensive industrial sector, coupled with high dependence on raw materials and primary energy sources (Boeri, 2000). Further, energy inefficiency was common in early years of independence for a number reasons dating back to the Soviet era, including older equipment and outdated technologies, low thermal performance of

households and public buildings, the prevalence of older automobiles, and inadequate metering and control of energy consumption (Miskinis et al., 2006). Since the collapse of the Soviet Union, however, many CEE nations have experienced decreases in energy intensity, coupled with relative increases in energy efficiency (Alekseyko and Giedraitis, 2013). Turning to well-being, many CEE nations' welfare has improved considerably relative to the pre-independence period, partly due to infrastructural improvements and economic development (Giedraitis et al., 2009).

Given the noteworthy changes taking place in these nations in recent decades, rigorous assessments of the environmental and human well-being impacts of their patterns and structures of economic development would offer valuable insights for their future sustainability efforts as well as having implications for other world regions. The changes that these nations have made in recent decades are unique in the period for which we have data and thus are of considerable interest for understanding how transitions in political and economic institutions influence the environment and human well-being. Some scholars have conducted longitudinal analyses of the relationships between carbon emissions or energy consumption and economic development in CEE nations (Alekseyko and Giedraitis, 2013; Jorgenson, 2011; Jorgenson et al., 2012; York, 2008), while other sustainability-oriented studies have focused on the predictors of environmental concern for individuals within CEE nations relative to other regions of the world (Marquart-Pyatt, 2012). Public health research on the economic factors influencing human well-being in these nations has also blossomed in recent decades (Beaglehole and Bonita, 2009; Bobak et al., 2000; Hyns, 2005).

What is missing is research on CEE nations that focuses on the connections between human well-being, the environment, and economic development in general, and the effects of development on EIWB in particular. The current study is an initial attempt to fill this void. Drawing from past work, we calculate an annual measure of EIWB for a sample of CEE nations from 1992 to 2010, using the ratio of per capita energy consumption to average life expectancy at birth (i.e., the energy intensity of well-being). We analyze these data on EIWB as well as measures of economic development and interactions between development and time to assess their temporarily dynamic relationships. To assess the relationships between EIWB and development we employ two-way fixed effects panel modeling techniques. The estimated model includes a number of additional controls commonly employed in past research on related outcomes, including measures of domestic income inequality, democratization, public health expenditures, manufacturing, and world-economic integration. The results highlight the temporally dynamic relationship between EIWB and development, and point to future possibilities for enhanced sustainability in CEE nations.

2. Materials and methods

2.1. The sample

We analyze a perfectly balanced dataset that consists of annual observations from 1992 to 2010 for a sample of 12 CEE nations. This results in a sample of 228 total observations. Data availability precludes us from including time points before 1992 or after 2010. The 12 nations in the dataset include Armenia, Azerbaijan, Belarus, Estonia, Georgia, Kazakhstan, Kyrgyz Republic, Latvia, Lithuania, Russia, Tajikistan, and Ukraine. These are the same nations included in other recent sustainability-oriented studies of Central and Eastern Europe (Jorgenson, 2011; Jorgenson et al., 2012), although data availability has limited some other studies to a smaller numbers of nations in the region (York, 2008).

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