Energy Inequality and Instrumental Violence: An Empirical Test of a Deductive Hypothesis

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Abstract
Economic research has firmly established that energy consumption is closely linked to economic growth patterns. The subtext of such research is that disruptions to stable supplies of affordable energy could adversely affect quality of life and interrupt patterns of social cohesiveness. This article investigates a hypothesized link between patterns of energy consumption and instrumental violence across 868 U.S. counties. Tobit regression results confirm an inverse association between a global indicator of energy consumption and robbery rates, after statistically holding constant numerous theorized correlates of crime. Results support calls for increased contingency planning in anticipation of energy-related social control challenges and continued efforts to research and develop alternate and affordable energy.

Keywords
social control, energy consumption, resource depletion, sustainability, crime theory

Introduction
Among economists, there is a tendency to assume that a confluence of economic growth and urbanization contribute to increases in localized energy use and individual consumption patterns (Lutzenhiser, 1993; Mazur, 1994; Stern, 1986). Aggregate-level variables are occasionally used to predict energy use fluctuations (Oh & Lee, 2004; Soytas & Sari, 2003; Suri & Chapman, 1998; York, 2007). Environmental studies are explicitly concerned with the link between energy usage and harmful environmental outcomes (Bennett & Newborough, 2000; Bin & Dowlatabadi, 2005; Clement & Schultz, 2011). In social science, economic expansion and population growth are often utilized as predictive variables driving energy use patterns. This article asks whether the inverse of energy consumption (energy depletion) is associated with threatening disruptions to social order.

The focus on energy withdrawal reflects long-standing criminological concerns regarding inequality and community decay. Although energy use has been overlooked as a predictive variable in macro-level criminology, recent research (primarily in the fields of economics and geophysics) suggests that there is substantial inequality across spatial units in access to (and utilization of) affordable energy resources (Buzar, 2007; Rosas-Flores, Gálvez, & Zayas, 2010; Spreng, 2005). Considering the emphasis traditional criminology places on inequality in predicting aggregate patterns of criminal activity, it is surprising that criminologists have not yet evaluated such a relationship.

Work in the field of environmental sociology and geophysics both underscore the robust association between energy supplies and social life and suggest energy use should be closely correlated with quality of life indicators.¹ Geophysicists who focus on energy depletion have already suggested economic degeneration associated with energy shortages may present challenges to socioeconomic functioning and social order (Friedrichs, 2010; Hirsch, Bezdek, & Wendling, 2005; Höök, Hirsch, & Aleklett, 2009).

If energy use relates to human quality of life (Meadows, Meadows, & Randers, 1992), consideration should be given to potential effects of a withdrawal of affordable energy on various quality of life indicators, including aggregate-level crime rates. In this article, we present a rudimentary hypothesis linking aggregate energy consumption patterns with instrumental crime rates across U.S. counties. Diverse strands of research correspond in emphasizing the relationship of energy consumption to human social life and stress that economic expansion is impossible without expansion of energy resources (Deffeyes, 2005; Heinberg, 2005; Korowicz, 2010; Ruppert, 2004, 2005, 2009). Interdependencies that arise in the production of goods and services in today’s society are built upon a fossil fuels energy foundation (Friedrichs, 2010) and appear vulnerable to

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breakdown in the presence of even relatively small disruptions to stable supplies.

The term energy depletion, often utilized by peak oil theorists, relates to the idea that sustainability of economic growth is limited by constraints on the ability to consume energy (Bentley, 2002; Cleveland, 2005; Murphy & Hall, 2011). If energy depletion scenarios become reality, several new challenges for national and local criminal justice agencies tasked with providing formal social control can be expected. This is true especially in geographic areas that experience the negative aspects of general inequalities and already manifest heightened rates of violent crime. The literature on violence and inequality is extensive and provides grist for thinking about links between natural resource disparities and social control.

Literature Review

There are two areas of literature taken into consideration in what follows. One aspect of review draws attention to articles in peer-review journals and agency technical reports that focus on energy consumption and depletion effects. The implications of this area of literature suggest that energy use and quality of life indicators are likely empirically knotted (Cook, 1971; Heinberg, 2005; Pachauri & Spreng, 2004; van Griethuysen, 2010). If access to affordable energy resources becomes problematic, one plausible hypothesis is that quality-of-life for people in the most energy dependent areas will suffer.

The second body of work considered is fused from two distinct areas of sociology: environmental sociology (that addresses energy use) and criminology (that addresses diverse structural determinants of aggregate-level crime rates). Research from environmental sociology suggests energy use is associated with varying economic conditions (Clement & Schultz, 2011; Costanza, Farber, & Maxwell, 1989; Guy & Shove, 2000). Criminological studies have focused intensively on documenting empirical links between conditions of inequality and diverse indicators of crime (Costanza & Helms, 2012; Elgar & Aitken, 2011; Kovandzic, Vieraitis, & Yeisley, 1998; Peterson & Bailey, 1991; Sampson & Wilson, 1995). Research efforts in these two respective fields have rarely informed one another. This article seeks to place them in near enough proximity to begin the process of empirically evaluating the merits of this hypothesized link.

Literature on Oil Depletion

The first researcher to posit that the world’s petroleum supply was a finite resource was Hubbert (1956) who estimated a mathematical model predicting a 1970 peak in continental U.S. oil production. Although many of his contemporaries ignored Hubbert’s research, when conventional oil did peak in 1972 (see Figure 1), economists and geologists revisited his research, and subsequently expanded and refined the model. Höök et al. (2009) recently developed updated estimates for world oil production and their results point to a disquieting depletion scenario (also see Campbell, 2002).

A major concern in energy literature today regards energy inputs required to facilitate stable expansion of the economy (Howland, Murrow, Petraglia, & Comings, 2009; Korowicz, 2010; Martenson, 2011; Meadows, Meadows, & Randers, 1992). A growing body of research articulates a straightforward insight that energy is essential to practical life in a very concrete way, affecting the production of pharmaceuticals, availability of transportation, development of all phases of agricultural production, transportation, storage, and preparation, as well as virtually all aspects and phases of industrial production, the production of media, and delivery of education.

According to Korowicz (2010), a single barrel of crude oil contains the equivalent in energy of a person working 40 hours a week 52 weeks a year for 12 years. The world
consumes approximately 85 million barrels of oil each day, other energy sources notwithstanding. Drawing on standard physics, energy use represents the ability to get work done. The loss of even a small amount of this premium source of energy would present substantial challenges, likely resulting in a severe reduction in society’s capacity for completing critical work. Any such energy withdrawal would appear to necessitate a shrinking of productive capacity.2

Heinberg (2005) emphasizes that extraction shortages in the U.S. have been offset by an increased reliance on imported oil and, to a lesser extent, conversion of some areas to nuclear power. The most recent journalistic reports, available on the Internet, of the evolving nuclear disaster at Fukushima highlights the complexity and substantial risks associated with relying on nuclear technology to power the global economy of the future. Absent an obvious replacement for the foundational energy platform of oil, energy supply deficits are likely to undermine social stability and impose new requirements on social control agencies3 (Heinberg, 2005).

Deffeyes (2008) explains that geophysicists and economists have worked over the past 30 years to develop a defensible model for estimating the rate of oil and natural gas depletion (Hirsch, 2005, 2008; Ruppert, 2005). Hirsch (2005) authored a highly regarded report strongly supporting the modeling efforts of peak oil theorists, which, in sum, has sought to document using a variety of methodological approaches decline rates by well, field, region, and the world collectively. Similarly, Simmons (2005) drew on 225 technical reports and publicly available research papers from Saudi energy experts to develop his thesis that the Saudi oil fields, which represent approximately 20% of the total proven reserves worldwide, were on the cusp of experiencing an irreversible decline.

**Literature on Sustainability and Natural Resource Extraction**

Heinberg (2005) emphasizes that the critical determination relating to sustainable production of energy resources involves what is referred to as energy return on energy invested (EROEI). If it takes more energy than is contained in a barrel of oil to explore and discover, extract, process, refine, store, and transport that barrel of oil to market, then that barrel will not be extracted. He argues that this relationship between the energy return on energy investments affects production processes at the level of individual wells, fields, producing countries, regions, and for the world collectively. Concurrent literature (King & Fritsch, 2008) suggests that pricing for oil products influences the rate of investment to discover new sources of oil, but new discoveries have remained flat for many years while physical depletion of existing resources has expanded annually. Greenham (2012), drawing from an investment model of causation, asserts that slowing the decline in the availability of oil will require a doubling of the price of oil in the next decade. Greenham refers to the phenomenon of “economic peak oil,” which he defines as “the point at which the cost of incremental supply exceeds the price economies can pay without significantly disrupting economic activity at a given point in time.” He continues, saying that “Beyond this ‘pain barrier,’ the level of oil prices will have a dramatic effect on a nation’s people and its economy, threatening stagnation and hardship.” We concur with this conceptualization, noting that geological physicists with their emphasis on underground forces, energy researchers with their focus on EROEI, and those emphasizing economic peak oil all point to a similarly distressing future characterized by a diminishing supply of easily accessible and affordable liquid fuels based energy, the driving force in any modern economy.

Worldwide estimates for liquid fuels show a peak in availability at or about 2006 to 2007. Demand for energy sources has been increasing at a spectacular pace.4 All of the previously cited energy researchers seem to concur that the 21st century will herald the opening of a gap between expanding world demand for new energy and a moderately declining available supply. A variety of monographs and peer reviewed articles in the field of geophysics point to anticipated difficulties for population groups and their respective governments under this scenario (Deffeyes, 2005; Heinberg, 2005; Korowicz, 2010; McBay, 2006).

**Limitations in Environmental Sociology**

Environmental sociologists have noted the link between energy consumption patterns and global inequalities (Clement, 2010) drawing attention to ecological dimensions of inequality. The following quote from a recent article sums up the way that sociologists have viewed energy consumption: “The point needs to be made that urbanization drives energy use not just because it amplifies economic activity but also because human activity, in general, is heightened in urbanized areas” (Clement & Schultz, 2011, p. 587). We agree, but note that the social science literature never directly empirically evaluates conceptual links between energy resources and shifting requirements for effective social control.

In sociological literature, energy use is usually explained as a function of population growth (Meadows et al., 1992), economic growth (Paul & Bhattacharya, 2004) and often as a logical cause of environmental pollutants (Alam, Bala, Huq, & Matin, 1991). Environmental sociology squarely focuses on economic growth relative to energy usage (Cheng, 1995; Chontanawat, Hunt, & Pierse, 2008; Hondroyiannis, Lolos, & Papapetrou, 2002; Lee & Chang, 2008). What is missed by environmental sociology are the ancillary concerns of criminology; the functioning of communities and the consequences of a negative rate of growth. There is some consideration to the issue of global inequality relative to accessing energy (Bunker, 1985; Parks & Roberts, 2010), but
Infinite growth cannot continue unabated in a finite world and when conditions supporting such expansion hit their peak and thereafter become less available at affordable prices, there will undoubtedly be environmental and criminological consequences that follow. Standard macro-level criminological literature has provided myriad predictive variables in the attempt to account for variation in rates of crime. Much of the aggregate crime research emphasizes concepts such as poverty, cultural capital, and various dimensions of social inequality. Despite this focus, inequality of access to affordable energy has never been studied directly as a predictor of aggregate crime. This is surprising, as energy use patterns have been linked so closely to economic growth and quality of life in environmental sociological research. We note, parenthetically, that the introduction of new variables into criminology has been rare over the last 40 years.

Taking as a point of departure insights from the inequality-criminal research, this article evaluates a hypothesized inverse association between aggregate energy use and violence rates. The potential effects of structured inequality on aggregate crime rates has been tenaciously debated (Greenberg, Kessler, & Loftin, 1985; Patterson, 1991; Sampson, Morenoff, & Raudenbush, 2005). Aggregate income inequality (Hipp, 2007; Hooghe, Vanhoutte, Hardyns, & Bircan, 2011), unemployment (Cantor & Land, 1985; Chiricos, 1987), housing (Greenberg, 1985; Sampson et al., 2005), and education (Lochner & Moretti, 2004; Meghir, Palme, & Schnabel, 2012), among other predictors have all been conceptualized and operationalized as sources of crime variation. Structural research has also focused on race, economic inequality, and other social disadvantage indicators but the empirical results have often been characterized by mixed or contradictory findings (McCall, Land, & Parker, 2010; Pridemore & Trent, 2010). Perhaps the most consistent finding is in the race-crime area of research, with most studies reporting a positive race effect (Kovandzic, Vieraitis, & Yeisley, 1998; Liska, Sanchirico, & Reed, 1998; Messner, 1983; Parker & Pruitt, 2000).

Economic inequality has been the focus of violence research (J. R. Blau & Blau, 1982; Jacobs & Richardson, 2008), but findings have been mixed (Messner, 1982, 1983; Messner & Tardiff, 1985). Poverty is also seen as an important crime correlate (Bailey, 1984; Messner, 1983; Messner, Raffalovich, & Sutton, 2010; Williams, 1984). Unemployment has been theorized as a key source of “economic-induced strain” (Parker & McCall, 1999, p. 464), and may contribute to patterned violence, but the evidence, as in other areas of crime research, has been inconsistent. Kapuscinski, Braithwaite, and Chapman (1998) report that unemployment is not associated with homicide rates. Cantor and Land (1985) report mixed results, whereas Parker and McCall (1999) and Kovandzic et al. (1998) report significant unemployment effects on violence rates. City size has also been statistically held constant in most instrumental violence research (Parker & McCall, 1999; Shihadeh & Ousey, 1998; Williams, 1984) with similarly mixed results.

Social Disorganization and Theoretical Links

A review of social disorganization literature provides foundation for many of the theoretical links that are advanced in this article. Prior studies have documented a link between energy use and the economy; we suspect that energy consumption is an important correlate with social cohesiveness and collective efficacy in neighborhoods. In communities that have experienced decay, economic deprivation is often thought to significantly influence variation in violence patterns and social control responses (Costanza & Helms, 2012; Costanza, Kilburn, & Miles, 2013; Helms & Costanza, 2009, 2010; Jones-Webb & Wall, 2010; McCall, Parker, & MacDonald, 2008; Skogan, 1990; Stark, 1987). Disorganized neighborhoods are often substantially disenfranchised, having limited control over the actions of neighborhood residents and limited ability to influence the decisions of politicians and actions of police (Kaylen & Pridemore, 2013). Poverty, family disruption, restricted labor markets, social and economic marginalization, and political disenfranchisement have all been linked to violence rates in urban jurisdictions in the United States (Jacobs & Richardson, 2008; Jorgenson, Rice, & Clark, 2010).

Social disorganization studies do not characterize the diverse array of deprivations as having a natural and immutable source, but rather these are seen as politically and socially determined. In the following sections, we seek to develop a research approach that emphasizes this critical energy-crime connection. We do not ignore previous research concerns, but rather, we seek to develop a more complete
account by conceptualizing and then assessing correlational evidence regarding energy inequality effects on patterns of instrumental crime in U.S. counties.

**Theory and Hypotheses**

Across communities, patterns of energy consumption vary substantially. Structural inequality studies (with their focus on skewing of advantages and concentration of community-level violence) are suggestive for the purposes of research developed here. We propose that the skewed ability to consume energy represents a facet of social inequality. We hypothesize criminal consequences associated with this disparate consumption of energy resources.

The research presented below advances a social ecological explanation of crime to explain variance in street robbery rates across counties. Concepts addressed in this article extend beyond traditionally used indicators of disorganization, as we seek to address the broader issue of energy consumption and how it relates to crime. When discussing energy consumption, we address the fundamental link between areas and resources and note that certain geographic regions are energy rich while others are energy poor (Jorgenson et al., 2010). We focus first on the energy-community violence hypothesis and then proceed with other widely utilized controls from the extant literature on communities and crime.

**Energy Consumption and Instrumental Violence**

Geological physicists have for many years provided monthly updates to the world energy picture, based on rigorous modeling efforts. The ASPO (Association for the Study of Peak Oil & Gas—Irish Chapter, n.d.), in an extensive collection of 100 published newsletters, has demonstrated that oil and related liquid fuels are becoming increasingly scarce and more difficult to process at a reasonable investment cost. Advanced industrial societies can anticipate reductions in living standards resulting from the peak energy scarcity situation (Friedrichs, 2010).

Such reasoning finds anecdotal corroboration with the journalistic linkage between sudden resource shortfalls and violence, and draws from observations surrounding natural disasters (Van Heerden & Bryan, 2006). Research documents how populations respond to abrupt and protracted disruptions in flows of energy and other related critical resources (Brinkley, 2006; Van Heerden & Bryan, 2006). The peak oil thesis implies an evolving structural set of problems with substantial social control implications, a set of problems that amount to what one author has referred to as a “long emergency” (Kunstler, 2007, p. 123).

Any substantial disruption to a stable supply of energy (regardless of the source of that disruption) would be a deeply influential determinant in the overall crime patterns of any American community. Critical to this notion is the understanding that this model does not depend on the truth of the geological resource scarcity model to predict deleterious effects for any area faced with reduced access to energy. Given the link between energy consumption and community economic well-being in the United States, any disruption to stable and affordable energy due to either above ground (political) or below ground (geological) causes would (in due course) necessitate a community reset to a reduced living standard.

With the foregoing considerations in mind, one plausible hypothesis stemming from this thesis is as follows: the inability of areas to access and consume energy resources at reasonable cost can be expected to produce aggregated risks of instrumental forms of social expression, including patterns of heightened disorder and crime. Energy consumption patterns across units should be inversely associated with respective rates of instrumental crimes.

**Additional Conceptual Controls**

Many variables have been assessed for their empirical association with instrumental violence in previous research. Along with the skewed ability to consume energy, several factors are likely to be predictive of aggregate crime patterns, and so it is appropriate to statistically control for these in the presence of the energy consumption indicator. The logic for these statistical controls follows.

**Concentrated Disadvantage**

Concentrated disadvantage has been a widely utilized concept and predictor variable in violence research. Literature on violence highlights several conceptually distinct (but empirically overlapping) structural factors that should be statistically held constant to increase the precision of estimated effects. Land, McCall, and Cohen (1990) emphasized overlapping features of social structure that have been linked with community disorganization and crime. The basic insight is that overlapping features of social inequality are constitutive of a condition that increases the propensity for violence across neighborhoods and communities. Conditions including race, poverty, and income inequality have been shown to exhibit overlapping effects on violence rates in previous studies (Hagan, 1997; Morenoff, Sampson, & Raudenbush, 2001; Ousey & Lee, 2002; Wilson, 1987). We follow the practice of previous structural research in constructing a combined indicator of concentrated disadvantage. We expect the following: In counties where an indicator of concentrated disadvantage is heightened, the rate of instrumental violence should be expanded.

**Unemployment**

Unemployment has been the focus of a great deal of research relating to punishment (Chiricos & Delone, 1992). The
relationship extended to instrumental violence (robbery) is straightforward. Where unemployment is heightened, there is more pressure to resolve economic strain through redistributive violence. Jacobs and Helms (1997) draw on insights from Blau (1964), arguing that “redistributive violence is one method the dependent can be expected to use to overcome their disadvantaged position in unbalanced exchange relationships” (p. 1365). Parker and McCall (1999) argue as well that a high unemployment rate contributes to reduced legitimate opportunities and may result in “economic-induced strain” (p. 464). If this argument has merit, we expect the following: Heightened unemployment should be a positive correlate with instrumental crime. But where the unemployment rate is reduced, crime should be curtailed.

**Black/White Median Household Incomes**

Two alternative models have been prevalent in studying the relationship between racial income ratios and violence. A conflict hypothesis sees greater inequality resulting in the heightening of criminal patterns of economic redistribution, here operationalized as robberies. In this model, greater disparity in incomes, representing minority disempowerment in relationship to Whites, would be a factor shaping robbery patterns. And so we expect to observe a negative sign on the coefficient. Alternatively, a racial competition model conceptualizes that as Blacks approach parity with Whites, a range of social difficulties tends to take shape. This would likely be a consequence of greater direct competition for economic resources and shifts in status differentials across racial groups, as well as the separation of middle-class Blacks from an increasingly concentrated class of minorities who have been economically marginalized. A consequence of rising expectations is the tendency for violence as expectations are not fully (and equally) gratified. In this competition model, the relative equalizing of group social power should heighten competition over the distribution of limited resources and may trigger diffuse mechanisms that contribute to and result in heightened rates of robbery. In other words, we would expect to observe a positive coefficient if the competition model is supported.

**Household Instability**

Informal controls are plausibly weakened by rapid turnover in any community. Early social ecology literature recognized the degrading influences associated with population turnover as local communities attempted to establish governing norms (Sampson, Raudenbush, & Earls, 1997; Shaw & McKay, 1942). To address these concerns, we include a statistical control that seeks to isolate influences for a widely recognized dimension of neighborhood stability, household moves in the last 5 years. Areas with high turnover should on average be less able to informally govern public spaces and control economically marginalized members. One expected result of this weakening of informal social control is that in areas with higher rates of household moves, we should see heightened rates of robbery. But in areas characterized by greater household stability, the robbery rates should be reduced.

**Population Size**

Larger populations produce more interpersonal exchanges and provide greater opportunities for crime as more potential targets are available for victimization. Highly populated areas also allow individuals to remain anonymous and so may be related to lower societal control on criminal activities and situations that may result in violence (Felson, 1995). All of these factors suggest that population size should be related to the level of violence, and so we include population as a statistical control. Larger populations should be associated with heightened rates of crime, while less populated counties should experience reduced crime.

**The Strength of Police Forces**

Finally, policing has been theorized as providing a deterrent effect but research has to date failed to provide unambiguous evidence in support of the deterrence hypothesis (Walker & Katz, 2011; Wiley & Esbensen, 2013). More plausibly, police are most concentrated in areas with heightened social control contingencies (Helms, 2007, 2008). We note that communities most affected by social and economic marginalization are generally areas that most strongly utilize police services. Moreover, these same areas may have strong political interests in maintaining reserve capacity to address socially threatening disruptions with enhanced police-administered violence. With this in mind, we posit a positive empirical link between area police resources and crime. As police are hired to provide routine service while also providing reserve capacity to manage social threats, it would not be surprising to find that personnel are most concentrated in the most crime-prone areas. Formally, we expect that the strength of police forces will be closely correlated with the crime rate. In other words, we expect to observe a positive association between police (whose presence affords reserve capacity to handle serious disruptions to social stability while also remaining responsive to ordinary demands for service in high demand areas) and patterns of instrumental crime.

**Regional Dummies**

We control for regional effects with a series of dummies. In the various models, we include dummy indicators for the Northeast, Midwest, and South, with the Western region serving as the omitted (reference) category. A dummy approach is useful because regions may differ substantially in terms of their respective cultures and economic requirements even as jurisdictions within any region remain
relatively similar to each other. Moreover, a dummy approach can assist in reducing spatial autocorrelation (for an additional statement to this effect, see Helms, 2009). Finally, the inclusion of regional dummies can be expected to capture systematic influences on the robbery rates indicator that are otherwise unmeasured and untheorized. For all of these reasons, we include regional dummy indicators in the analyses below.

**Method**

**Research Design, Sample, Dependent Variable, and Method**

This study uses a cross-sectional research design and sample data on 868 U.S. counties to assess diverse correlates of instrumental crime. The dependent variable in this study is the per capita rate of robbery. Information used to construct the robbery rate indicator was taken from the Uniform Crime Report, published by the Federal Bureau of Investigation, for the year 2001. As the per capita rate exhibits positive skew, we logged the indicator. As some counties reported 0s, we added a 1 prior to logging. Therefore, the indicator used in the analysis below is the natural log of the rate of robberies (+1). We note here that robbery is an instrumental crime centered on the acquisition of resources, and it is also a crime involving either force or the threat of force and so it is an event that involves substantial risks as well as the potential for economic rewards. Robbery is a particularly relevant focus for this research because the primary thesis focuses on the role of inequality in energy consumption in the production of crime.

The robbery indicator, we note, has characteristics of left censoring. When an outcome variable is characterized by the presence of 0s, this may result in estimation difficulties that cannot be easily remedied using standard ordinary least squares (OLS). In such a data analytic situation, one alternative is to explicitly model the presence of left censoring with a Tobit model (StataCorp, 2008). In the analysis that follows, we assess statistical results produced using a Tobit estimation procedure.

**Independent Indicators**

Independent variables used in this analysis were taken from the U.S. 2000 Census and were merged with other data sources. The energy use indicator is an aggregate estimate of total energy consumption from all sources measured in trillions of British Thermal Units. Data used to construct this indicator were taken from the U.S. Energy Information Administration. We standardized the indicator, dividing by total population and multiplying by a constant. To correct for positive skew, the indicator is logged.

Social disorganization indicators were constructed by combining U.S. 2000 census data and U.S. Bureau of Economic Analysis data. Structural researchers have increasingly focused on a confluence of variables that together have been linked with socially disadvantaged conditions (Helms & Costanza, 2010; Land et al., 1990; Sampson & Wilson, 1995; Wilson, 1987). We follow convention and use a constructed indicator of concentrated disadvantage based on the results of an un-rotated principal components analysis.

Strong factor loadings on indicators for poverty, percent Black population, and the Gini coefficient computed on family incomes indicated substantial overlap in the regression space; therefore, these indicators were used to construct the combined index of concentrated disadvantage. In addition, unemployment is operationalized as the percent unemployed as reported by the Bureau of Economic Analysis. The population indicator exhibited skew and so it is logged. Neighborhood instability is measured as the percentage of households that experienced a move in the past 5 years. Racial economic inequality is operationalized with a ratio indicator of Black to White median household incomes.

**Police and Regional Variation Indicators**

Police capacity was operationalized with an indicator of the number of badged deputies per 10,000 county population. We rescaled the indicator by applying a natural log to address positive skew. Regional variation is addressed with a series of dummies. We follow convention and develop dummy indicators for the four major regions (South, Northeast, Midwest, and West). The West is treated as the reference or omitted category in the analyses.

The basic model should result in positive coefficients on indicators of concentrated disadvantage, unemployment, household instability, and population size. Also, for reasons noted above, the police rate should exhibit a positive and significant effect on the robbery rate. We are agnostic regarding the sign of the coefficient on the Black–White median income indicator; the energy consumption indicator should exhibit an inverse relationship with the dependent variable. State dummies are not explicitly theorized and may take either a positive or negative sign in the analyses.

**Analyses**

**Preliminary Analysis of Data**

Table 1 presents descriptive statistics for all of the indicators used in the analyses. Table 2 includes zero-order correlations. We note that correlations among the respective independent variables are all modest. Table 3 includes estimates for three alternative specifications of the robbery rates model. The first model focuses on the energy consumption-instrumental violence hypothesis. Model 2 retains the energy indicator but includes diverse indicators from the social disorganization literature and also the police rate. In the final model, all of the foregoing indicators are retained and regional dummies are introduced.
Results: County-Level Influences on Instrumental Violence Rates

The first model presented in Table 3 provides initial evidence of a significant inverse association between the energy consumption indicator and the dependent variable (−3.90**). This result offers confirmation that areas experiencing a high level of per capita energy consumption are linked with reduced rates of localized instrumental violence. This important result, however, must be treated tentatively because the model does not contain any of the plausible social disorganization controls theorized above. We note that the overall model is significant ($\chi^2 = 15.14^{**}$), but the pseudo $R^2$ for the model is rather small (.005), implying that only the barest amount of variance appears to have been accounted for with this specification. Having said this, we note that the significant likelihood ratio chi-square tells us that our model as a whole fits significantly better than an empty model (i.e., a model with no predictors).

Model 2 introduces an array of theoretically plausible controls into the instrumental crime model. After having expanded the model, we note the persistence of the energy-consumption rates empirical link. The tabled results in Model 2 again prove consistent with the energy withdrawal-instrumental violence hypothesis. Across the sample, counties with the highest levels of energy consumption experienced the lowest rates of robbery (−3.38**). After introducing the series of social disorganization and police rate indicators, we find that the overall model is much improved ($\chi^2 = 752.18^{**}$; pseudo $R^2 = .275$). Model 2 shows support for a variety of additional hypotheses. The sworn police rate exhibits a significant positive effect (1.91*) suggesting that augmented law enforcement services are closely correlated with heightened crime. The combined indicator of concentrated disadvantage exhibits a close positive association with violent crime in many empirical studies and this result is reproduced here as the indicator is highly significant with a positive sign (15.17**). Population size (17.37**) and Neighborhood Instability (7.97**) also are each shown to exhibit a positive and highly significant association with the dependent variable. The coefficient for the Black/White income ratio is significant and exhibits an inverse association with the robbery rate (−5.50**). According to our conceptualization of this indicator, the result is most consistent with a conflict hypothesis. Where inequality is greatest economic stress and related social tensions likely contribute to expanded criminal redistribution of scarce and valued resources. One surprise in the analysis is associated with the unemployment indicator. Rather than exhibiting the expected positive association, implying that the presence of larger unemployed populations would be a predictor of increased instrumental crime, we observed the opposite effect. The percentage of the labor force currently experiencing unemployment is a negative predictor of the robbery rate (−3.29**). One possible explanation for this result is linked to unemployment benefits as a factor reducing immediate economic stresses for recently unemployed individuals. In addition, those recently unemployed are most likely strongly tied to labor market processes (in other words, informal controls on behavior) and may be unlikely candidates for street robbery in the absence of quite strong catalyzing circumstances. On the other side of the equation is the effect of unemployment on the circulation of people with economic resources. Heightened unemployment may be a factor that actually reduces the circulation of lucrative targets (individuals with cash and other material possessions) in opportunistic social environments such as downtown bars, sporting events, and other inviting settings for crime. But the effect extends to others who may feel economic anxiety, and therefore curtail their own social activities. The net result of these processes might be a reduction in criminal opportunities and thus a reduced rate of instrumental crimes. The empirical results of this study appear consistent with such alternative theorizing concerning the unemployment-crime link.

Model 3 retains all of the previously discussed indicators and introduces regional dummies into the Tobit model in the attempt to further assess the effects of energy inequality on instrumental crime rates. The overall model appears slightly enhanced with the introduction of the regional dummy variables ($\chi^2 = 797.76^{**}$; pseudo $R^2 = .292$). The energy consumption indicator remains a strong negative predictor of area robbery rates (−3.00**). All of the previously discussed indicators remain significant with consistent signs on the coefficients. The respective dummy indicators represent relative mean differences when compared with the omitted category (West region). All of the dummy indicators are significant, implying that these areas of the country experience significantly heightened rates of robbery relative to the Western region, holding constant a diverse array of structural indicators.

With regard to our focal hypothesis, the inclusion of contextual controls in Model 2 and then regional dummies in Model 3 resulted in only modest changes in the estimated
coefficient. This result is reassuring because it suggests that diverse specifications of the robbery model produce stable estimates on the key hypothesized relationship. The only notable differences in results across Models 2 and 3 are a slight reduction in the unemployment coefficient and corresponding significance level (dropping from .01 to .05) and an enhanced coefficient and significance level on the police rate indicator.

What makes for a most interesting discussion is that other indicators drawn from the research on crime proved significant in the various models but did not eliminate the relationship between patterns of energy consumption and instrumental violence. The estimated coefficient for an index of concentrated disadvantage proved positive and statistically significant in this model. Counties characterized by substantial social hardship and economic disadvantage apparently experienced heightened rates of instrumental crime. Both the population indicator and indicator of household instability exhibited positive and significant associations with the robbery rates as anticipated in the theory section. More heavily populated counties and counties with a greater percentage of households experiencing recent moves were both associated with heightened instrumental crimes. Areas characterized by larger populations and greater population movements apparently are welcoming environments for robbery because these conditions foster anonymity that favors criminal actors in selecting targets, timing attacks, and facilitating escape from the scene of the confrontation.

The Black/White income ratio in this model is significant and exhibits a negative sign on the coefficient, yet does not undermine the effects of the energy consumption indicator. We note that this result is evident after isolating important theorized structural controls that have been extensively conceptualized and evaluated in the crime research. Although regional dummies are all significant predictors of instrumental violence in the third model, they do not obscure the significant relationship between energy consumption and instrumental violence patterns. This provides for interesting speculation, as certain areas of the country are thought to be more dependent on gas, oil, coal, or hydroelectric resources.

Ostensibly, the relationship between energy consumption and violence should have been nullified while controlling for the effects of regions, as it is known that there is tremendous variability in access to respective sources of energy across areas, and particularly regions. In fact, after controlling for regional variation and a diverse set of structural controls and

Table 2. Zero-Order Correlations (868 Observations).

|   | 1   | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   | 11   |
|---|-----|------|------|------|------|------|------|------|------|------|------|
| 1. Ln robbery | 1.000 | | | | | | | | | | |
| 2. Ln energy | -0.143 | 1.000 | | | | | | | | | |
| 3. Ln police | -0.066 | 0.176 | 1.000 | | | | | | | | |
| 4. % unemployment | -0.037 | 0.092 | 0.135 | 1.000 | | | | | | | |
| 5. Concentrated disadvantage | 0.433 | 0.206 | 0.121 | 0.438 | 1.000 | | | | | | |
| 6. Ln population | 0.653 | -0.254 | -0.266 | -0.154 | 0.108 | 1.000 | | | | | |
| 7. Household instability | 0.450 | -0.154 | -0.028 | -0.234 | 0.011 | 0.439 | 1.000 | | | | |
| 8. Black/White ratio | -0.087 | -0.076 | -0.054 | 0.017 | -0.131 | -0.002 | 0.086 | 1.000 | | | |
| 9. D. Midwest | -0.323 | -0.002 | -0.173 | -0.249 | -0.449 | -0.143 | -0.214 | 0.035 | 1.000 | | |
| 10. D. Northeast | 0.114 | -0.317 | -0.3678 | -0.021 | -0.092 | 0.214 | -0.151 | 0.022 | -0.197 | 1.000 | |
| 11. D. South | 0.225 | 0.310 | 0.2649 | 0.120 | 0.471 | -0.083 | 0.077 | -0.101 | -0.625 | -0.271 | 1.000 |

Note. D = dummy.

Table 3. Tobit Analyses of County Robbery Rates.

| Independent variables | Model 1 | Model 2 | Model 3 |
|-----------------------|---------|---------|---------|
| Ln energy consumption | -3.90** | -3.38** | -3.00** |
| Ln rate sworn police | -0.621 | -0.355 | -0.327 |
| Unemployment | -3.29** | -1.91** | -0.044 |
| Disorganization (inequality, race, poverty) | 15.17** | 12.82** | |
| Ln population | 17.37** | 17.25** | 0.002 |
| Household instability (%) household moves between 1995 and 2000) | 7.97** | 9.44** | 0.002 |
| Black/White median income ratio | -5.50** | -4.59** | -0.473 |
| D. Midwest | -2.78** | 0.304 |
| D. Northeast | 5.84** | 0.837 |
| D. South | 4.84** | 0.482 |

LR $\chi^2$ 15.14** 752.18** 797.76**
Probability > $\chi^2$ .000 .000 .000
Pseudo $R^2$ .005 .275 .292
Observations 868 868 868

Note. D = dummy; LR = likelihood ratio.
*Significant at .05 level with one-tailed test.
**Significant at .01 level with one-tailed test.
a measure of police availability for service, a global measure of energy consumption is shown to be a strong correlate of instrumental violence. Areas with greater utilization of energy resources (our global indicator captures all sources including personal and household use, transportation, public, and industrial uses among other uses within any area) are associated with reduced instrumental violence but areas less able to effectively utilize energy resources to address social demand for goods and services were associated with heightened rates of instrumental violence.

Limitations of the Data

Before proceeding to conclusions, it is necessary to discuss various limitations inherent in this analysis. The data include observations from a single year and may not accurately capture the volatile dynamics of energy or crime. Using cross-sectional data, we must infer causal connections that are inherently time dependent by observing variation across units at a single point in time. We acknowledge this limitation and strongly encourage other researchers to develop multi-year data to advance this hypothesized link between energy inequality and community violence. We also acknowledge limitations in the generality of our findings both with regard to the United States as a whole and to areas beyond the United States. The data used in this research represents a sample of the large number of counties in the United States and these were originated by their sources for diverse purposes, not the least of which included the study of police administration (i.e., Law Enforcement Management and Administrative Statistics [LEMAS] data from the Federal Government). The questions animating original data collection efforts and sampling methodologies across data collection projects may have produced biases that we are unaware of as consumers of secondary data.

Regarding comparisons with processes in areas beyond the United States, we note that Muntaner, Lynch, and Smith (2001) have pointed out that neighborhood dynamics vary from country to country. In some countries, the state is the prime arbiter of economic redistribution, while in other nations there may be common enemies that force social cohesion. Zureik (1988), for example, pointed out that in areas such as Palestine where value systems differ traditional theories of deviance may not apply. We note as well that social welfare and health and retirement systems vary substantially across countries. All of these considerations may mediate the effects of energy consumption patterns on rates of instrumental crime.

This only serves to highlight the fact that the present research pursues insight concerning a tentative hypothesis and provides analysis of this conceptualized relationship for one advanced society. It would be presumptuous to assert generality beyond the units under study. Indeed, we hope that this inquiry will stimulate additional assessment of the thesis using alternative methods and perhaps cross-national data to assess the generality of these findings.

Finally, we note that the time period under study offers a conservative test of the thesis because the pricing of oil was relatively inexpensive at the time of the study’s data generation and citizens in the United States had not yet encountered the full discourse on terror and associated resource wars that ensued over the following decade. We strongly encourage further research into this thesis because these questions, in our view, are of critical importance to society; we are on the cusp of a period of uncertainty because resources are expected to become increasingly scarce and the struggle over access to and control of resources is expected to escalate.

Conclusion

Economists tend to view efficiency gains related to energy consumption favorably. Utilization of fossil fuels facilitates economic expansion. Economic expansion is thought to be a factor in the stabilization of communities. Stable communities experience lower crime rates. Although it may be a bitter pill to swallow, social scientists (especially criminologists) must eventually come to terms with the importance of natural resource extraction on community safety and well-being. There are some very practical examples of this link in action that we see in everyday life. Energy is essential to all facets of modern urban life, including maintaining police forces and implementing various initiatives that seek to stabilize communities. Central to this analysis is the realization that stable economic expansion under current conditions of extreme complexity and economic interdependence requires perpetual expansion of energy inputs. We note as well the critical role energy plays in the growth of the economy as represented in the system of money and the issuing of debt (for a full review of this aspect, see Martenson, 2011).

The widening gap between available energy at a low cost and demand for energy under conditions of economic expansion may one day result in a failure of supply to meet demand. The practical result of this realization is that for economically marginalized areas the ability to deliver goods and services must reflect that shortage. For communities on the economic margins, this means that some goods and services will become less available for consumption if there is a failure to continue to supply local economic processes.

The situation proposed is somewhat similar to the withdrawal of industry from any given area. For communities, the worst-case scenario may be the increasing presence of poverty for ever larger percentages of the local population, and, for those who cannot gain access to the most basic level of resources, starvation or freezing to death from lack of electrical, steam, or gas heating. Another possibility is that individuals will innovate and turn to criminal behavior to ensure basic needs are met. If such a scenario plays itself out, one would expect an uncertain social environment and perceived need to incorporate defensive strategies to mitigate criminal risks. That said, we note that even though we cannot predict on a given day (or on a given street corner) what person will engage in a robbery, we can certainly develop
insights concerning aggregate patterns of robbery. The empirical results of the foregoing study provide preliminary evidence consistent with the hypothesized energy withdrawal-instrumental violence association.

Although these alternative futures may appear distant and unlikely to the educated and socially mobile reader, the proven depletion of oil energy reserves may already have asserted itself into community. The American landscape is replete with bust-towns that once relied on natural resource extraction to drive the local economy. However, when considering the fate of such places, it should be pointed out that oil-depletion would eventually reach into all communities, not just those that are currently or have been in the past subject to economic and social dislocation. In this context, we strongly encourage readers to access and review the excellent summary by Korowicz (2010) on the relationship between an exponentially growing demand for energy and the stable functioning of the complex and highly interdependent just-in-time delivery systems that support the functioning economy.

Although political venues are continually in flux, the socioeconomic impact of inequality that correlates with violent crime appears stable. Energy distribution as it is viewed here represents a distinct dimension of inequality, a general concern that has been firmly established in the literature on crime. The foregoing analysis provides evidence of an empirical link between a global indicator of resource inequality and patterns of increased violent crime. In future research, we may seek to find what aspects of energy distribution are specifically linked to community development and enhanced quality of life. But for now, it would behoove civic leaders to seek changes in policy that would address future inequalities in the distribution of energy. The price of oil has risen to more than US$100 a barrel and current political machinations such as the “war on terror” have substantially factored into the resource supply equation. This is readily observable in the U.S. government’s sustained expansion of a worldwide-militarized presence, with a notable focus on energy resource-rich areas. But we also observe political decisions favorable to private investments in fracking technologies, development of ethanol, deep water drilling, and exploration of the far reaches of the North Pole in the milieu of melting ice sheets, among other energy development supports.

In consideration of the heightening strain on the globalized energy system (associated with both geological and political forces), we note escalating security developments at home and abroad and speculate that law enforcement and correctional agencies are very likely to experience a tightening of resources that will hamper administration and planning for emergent social control challenges. One plausible approach is to prepare for anticipated crises in the criminal justice system and wider communities by articulating policies that focus on the impact of energy distribution within communities. The reality is that the federal government appears preoccupied with other matters. The overextension of the United States in world military conflicts has been matched with domestic developments sustained over many years in the form of a buildup of militarized police forces (Kraska, 1999, 2007; Kraska & Cubellis, 1997). The recent lockdown of Boston, Massachusetts (in response to the recent bombing at the annual Boston Marathon), and the international crisis stemming from Edward Snowden’s whistle-blowing regarding National Security Agency (NSA) monitoring of electronic transactions and communications are indicators that the U.S. government is currently highly sensitized to state security. But there has been a marked failure to address the nation’s overwhelming reliance on fossil fuels or to take obvious steps in redirecting government resources to develop meaningful alternatives.

There are several recommendations for contingency planning in the presence of predictable social developments associated with energy scarcity in the near term. We have highlighted that reduced energy consumption is linked with reductions in the scale of economic functioning. We have also noted that according to several experts, the primary catalyst for economic growth (oil) is being depleted. Radical policy addressing alternatives to oil and fossil fuels are a gambit that the U.S. federal government does not appear willing to risk. However, results presented in this article clearly would seem to support development of solar, wind, and hydroelectric power if America is to counter rising energy costs and also, incidentally, may be a factor in mitigating the risk of rising violent crime rates.

It seems pertinent to focus intensively on developing federal policies that address more than just the symptoms of the problem. If global oil shortages are a phenomenon that will play out over the life of the current or next generation, surely this development will manifest in concrete difficult realities. Such realities we can expect might include reductions in economic security, diminished employment opportunities, and a decline in the effectiveness of public sector services such as schooling and other assistance programs.

During the 1930s, several policies were developed to begin to address social welfare needs and thereby allay fears and create hope among the generation suffering through the Great Depression. Backers of these policies were accused of being “communists.” The emergence of an extensive social welfare safety net was delayed by the emergent affluence of the postwar era. In anticipation of evolving structural problems due in part to energy depletion, the state could take advantage of its ability to marshal resources and target such policies with an eye toward extracting the meritorious features of previously attempted social welfare assistance. We note in this context that the federal government has an ability to extract usable resources and target their uses in ways that are unmatched by local governments and private interests (Peterson, 1981).

Finally, we point out the need to develop police and community response options to prepare for and confront the human and social consequences of energy scarcity. Recent
1. Various reports (e.g., Hirsch, Bezdek, & Wendling, 2005, authorship of this article. The author(s) received no financial support for the research and/or publication of this article.

Funding

To the research, authorship, and/or publication of this article. Declaration of Conflicting Interests

Unfolding and highly uncertain future.

To greater effectiveness of response in the face of a rapidly changing environment. We strongly encourage research by academics and attention to these issues in both federal and local policy arenas. With empirically grounded insight, we can hope to counter the worst possible outcomes and contribute to greater effectiveness of response in the face of a rapidly unfolding and highly uncertain future.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research and/or authorship of this article.

Notes

1. Various reports (e.g., Hirsch, Bezdek, & Wendling, 2005, 2010) have already done the difficult work of marshaling compelling evidence that the peaking and subsequent decline of liquid fuels will result in unrivaled difficulties throughout the world.

2. Ruppert (2009) refers to energy and economic systems as Siamese twins. They expand and contract in concert. This is inexorably the case because new energy is required to expand the economy and any reduction in the available supply of energy necessarily will result in a corresponding reduction in productive capacity and destruction of market demand.

3. The webpage for Association for the Study of Peak Oil & Gas–Irish Chapter (n.d., ASPO-USA) documents these statements with the following: Historical proof of Peak Oil is demonstrated by the work of M. King Hubbert, who, in 1956, correctly predicted that U.S. oil production would peak between 1965 and 1970. A growing number of industry participants and analysts believe that we are now at or near the top of the curve of global oil production (for the US case, see Figure 1). Peak Oil is not about “running out” of oil, but the curve does illustrate the quantity and pace at which humanity has extracted and used oil. With a rising world population and large developing countries like China and India experiencing rapid growth, between 2005 and July of 2008 demand was gradually outstripping supply.

During the second half of 2008, high oil prices plus financial turmoil and the economic slump actually reduced demand for oil, thus prices crashed. But the reprieve will only be temporary because more oil is being consumed than found; despite the latest technology, few major oil fields have been discovered since the mid-1970s. The most valuable and widely used source of energy on earth is gradually becoming.

And widely used source of energy on earth is gradually becoming.

4. We note a related concern associated with anticipated worldwide declines in energy. Here, the ability of exporting nations to continue to supply oil and energy exports will very likely be affected negatively due to growing domestic demand in source countries for this declining resource. This scenario implies that as resources worldwide become increasingly scarce, the quantity of exports will contract at a rate higher than the decline rate for the world as a whole. For the most energy dependent nations, such as the United States, substantial reliance on imported fuels presents a critical strategic challenge that has been the focus of intensive and often secretive efforts to develop and deploy the means to secure a stable future supply of energy. Central to these policy developments is an acute awareness that access to and consumption of critical energy resources underwrites continuing expansion of the economy.

5. Sampson and Wilson (1995) note the “unproductive mix of controversy and silence” surrounding discussions of race and crime as criminologists are loath to openly discuss issues that might be misconstrued as racist.

6. Original construction of the data focused on research surrounding police administration and related police outcomes and used Law Enforcement Management and Administrative Statistics (LEMAS) data. LEMAS data collection is based on a sampling procedure that insured all urban agencies were included as well as a stratified random sample of smaller jurisdictions.
Consequently, data used in this analysis cannot assess energy consumption patterns for all U.S. counties but is limited to a large representative sample.

7. Robberies are on the upper end of an inclusive range of instrumental criminal activities recorded by police, many of which lie below the threshold for inclusion in the robbery category. For example, larceny, burglary, and auto theft are each instrumental crimes but are considered lesser crimes. Indeed, these are the core categories of property crimes in the Uniform Crime Report, while robbery is included as one of the four violent crimes. In addressing robberies, we consider the fact that these events involve force or the threat of force while taking possession of property and so it is a serious instrumental crime posing substantial risk for both victims and offenders, if caught and prosecuted. The robbery indicator exhibits some zeros across the sample of counties but this should not imply that these are free of all instrumental crimes. Indeed, we might expect to still observe many lesser categories of instrumental criminal activity even if there are no recorded robberies for the year. But as our recording instrument does not include these categories, the data record is censored at zero. Under such circumstances, an alternative to ordinary least squares (OLS) may provide a more consistent estimate of effects. Tobit is a method that seeks to explicitly estimate effects under conditions involving censoring on the outcome indicator. For this reason, we present the results based on a Tobit model.

8. Community resilience is not something that can be expected to arise suddenly and successfully. It must be fostered and developed, and this is something that requires thoughtful efforts, planning, and resources in its own right. This extends well beyond a focus on reducing the risk of crime; the implications for food security, social mobility, and a wide range of neighborhood and community systems for delivery of essential social services (schools, sewage and water treatment facilities, power generation, parks, emergency services and social control, among others) are susceptible to disruption and should be given full consideration in any contingency planning surrounding future energy security.

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