

Slaughterhouses and Increased Crime Rates

An Empirical Analysis of the Spillover From “The Jungle” Into the Surrounding Community

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More than 100 years after Upton Sinclair denounced the massive slaughterhouse complex in Chicago as a “jungle,” qualitative case study research has documented numerous negative effects of slaughterhouses on workers and communities. Of the social problems observed in these communities, the increases in crime have been particularly dramatic. These increases have been theorized as being linked to the demographic characteristics of the workers, social disorganization in the communities, and increased unemployment rates. But these explanations have not been empirically tested, and no research has addressed the possibility of a link between the increased crime rates and the violent work that takes place in the meatpacking industry. This study uses panel analysis of 1994–2002 data on nonmetropolitan counties in states with “right-to-work” laws (a total of 581 counties) to analyze the effect of slaughterhouses on the surrounding communities using both ordinary least squares and negative binomial regression. The findings indicate that slaughterhouse employment increases total arrest rates, arrests for violent crimes, arrests for rape, and arrests for other sex offenses in comparison with other industries. This suggests the existence of a “Sinclair effect” unique to the violent workplace of the slaughterhouse, a factor that has not previously been examined in the sociology of violence.

Keywords: *meatpacking industry; slaughterhouses; crime; employment; rural communities*

At the turn of the 20th century, Upton Sinclair exposed the devastating work conditions and living environments of those who toiled in Chicago’s stockyard slaughterhouses. In *The Jungle* he made a connection between the numerous after-work fights instigated by slaughterhouse workers and the killing and dismembering of animals all day at work:

He [the police officer] has to be prompt—for these two-o’clock-in-the-morning fights, if they once get out of hand, are like a forest fire, and may mean the whole reserves at the station. The thing to do is to crack every fighting head that you can see, before there are so many fighting heads that you cannot crack any of them. There is but scant account kept of cracked heads in back of the [stock] yards, *for men who have to crack the heads of animals all day seem to get into the habit, and to practice on their friends, and even on their families, between times* (Sinclair, 1905/1946, pp. 18–19 emphasis added).

Although the “Sinclair hypothesis”—the propensity for violent crime is increased by work that involves the routine slaughter of other animals—has not been given much attention, geographers, sociologists, and anthropologists have begun to examine the community effects of the migration of slaughterhouses from urban areas to rural communities. As we will detail below, the framing of that work is solidly grounded in community sociology, where work on “boomtowns” resulting from a new industry coming to town has been a topic of research for at least three decades (see Berry, Krannich, & Greider, 1990; Camasso & Wilkinson, 1990; Freudenberg, 1981, 1984, 1986; Freudenberg & Jones, 1991; Hunter, Krannich, & Smith, 2002; Krannich, Berry, & Greider, 1989; Smith, Krannich, & Hunter, 2001; Wilkinson, Reynolds, Thompson, & Ostresh, 1984; Wilkinson, Thompson, Reynolds, & Ostresh, 1982). The application of the “boomtown” hypothesis and related theories to meatpacking communities undertheorizes the slaughterhouse in that it treats the work of killing animals as more or less the same as other assembly line work. We will demonstrate that a “sociology of the slaughterhouse,” (York, 2004) which attends to the unique characteristics of this form of work, is needed.

A number of recent sociological studies have suggested that many social problems and phenomena cannot be adequately understood unless we examine the social role of nonhuman animals. For example, Arluke and Sanders (1996) and Irvine (2004) suggest that companion animals can play the role of the Median “other” in interactions. Fitzgerald (2005, 2007) and Flynn (2000a, 2000b) demonstrate the importance of companion animals in the dynamics of intimate partner violence. Jerolmack (2007) examines the importance of animals in constructing ethnicity and how some species become constructed as social problems (Jerolmack, 2008). Nibert (2002) and Winders and Nibert (2004) articulate the myriad ways the oppression of animals and humans are linked within the system of industrialized animal agriculture. Kalof (2007) documents the critical role animals have played in Western society for thousands of years. These and many other recent studies make the case that human interactions with nonhuman animals must be adequately theorized to understand a number of key social phenomena. Further, social organizations are frequently at the center of our most complex (and harmful) relations with animals (Gaines & Jermier, 2000). In particular, Rémy (2003) and Smith (2002) have demonstrated that the slaughterhouse occupies a contradictory position within society. Formal rules about requiring humane slaughter acknowledge that sentient creatures are being killed.¹ Yet those who are engaged in the work of the slaughterhouse also develop constructions that allow them to carry out this work. This contradiction does not occur when the subject of the industrial process is not an animal.

In this article, we test the argument—the Sinclair hypothesis—that suggests that the work of industrial animal slaughter with its inherent contradiction has a different effect on local communities than other forms of industrial work. We examine the relationship between slaughterhouse employment levels and crime rates, controlling for the variables commonly proposed in the literature as associated with crime in communities, and we compare the effects of the slaughterhouse industry with other manufacturing industries that are similar in labor force composition, injury and illness rates, but different in that the materials of production are inanimate objects, rather than animals. Our immediate goal is to examine the causes of crime in slaughterhouse communities, including the Sinclair hypothesis, and thereby contribute to the discussion of whether or not this social problem can be understood without taking account of “the animal Other” in human society.

The Community Effects of the Contemporary Slaughterhouse Industry

The production and slaughter of animals for human consumption has increased dramatically since the time of Sinclair's writing, facilitated by the "free" market and state policies (Winders & Nibert, 2004). This increase has been accompanied by drastic changes in the slaughterhouse or meatpacking industry—most notable in the past few decades—including corporate consolidation, the relocation of slaughterhouses to rural areas, a depression in wages, and the increased recruitment of immigrant workers (Stull & Broadway, 2004; Winders & Nibert, 2004). These changes have attracted the attention of scholars who have carefully documented three areas of impact: (a) influence on the physical environment and human health in communities where slaughterhouses have been sited, (b) physical impacts on the workers, and (c) social impacts in the communities. Our focus is on the latter category.

Ethnographic studies of communities where large slaughterhouses have been sited (such as Finney County, Kansas; Lexington, Nebraska; Perry and Storm Lake, Iowa; Guymon, Oklahoma; and Brooks, Alberta) have documented housing shortages (due to the influx of workers into the community), increased demand for social assistance (due to a number of factors, including the low wages paid by the industry, high injury and illness rates, and the high employee turnover rate), and an increase in crime (Broadway, 2000; Stull & Broadway, 2004). Of these social problems, increased crime rates have been the least readily explainable.

The slaughterhouse community studies have documented dramatic increases in crime that have outpaced increases in the population. Increases have been documented for violent crimes (Broadway, 2000; Grey, 1998b; Stull & Broadway, 2004), property crimes (Grey, 1995), and drug offenses (Horowitz & Miller, 1999). Most of the increases in violent crime rates have been attributed to increases in domestic violence and child abuse (Broadway, 1990, 2000, p. 40; Stull & Broadway, 2004, p. 103).

Crime Increases in Slaughterhouse Communities: Theory

The explanations proposed for the increase in crime rates in slaughterhouse communities have coalesced into three categories grounded in the sociology of community crime: explanations based on the demographic characteristics of the workforce, explanations based on population booms and social disorganization, and explanations that point to unemployment. These categories are certainly not mutually exclusive; rather, they represent three strains of thought that have developed rather distinctly in the literature on slaughterhouse communities and in slaughterhouse communities themselves.

Crime as a result of the demographic characteristics of the workforce. Much attention has been directed to the demographic profile of slaughterhouse employees. Whereas the general public, media, and even government officials have focused on the immigration status of slaughterhouse employees in relation to crime (discussed below), the academic literature has focused on the age, gender, and marital status of the workers as posing an increased criminogenic risk, with young single males most likely to seek employment in the meatpacking industry (Broadway, 1990, 1994, 2000, 2001; Broadway & Stull, 2006; Stull & Broadway, 2004).

It is, however, not clear that the bulk of those who move to slaughterhouse communities are single males. Immigration for work purposes generally involves the following process:

solo men are recruited or come to an area for work; later their families follow; and subsequently other immigrants might follow, using social networks with individuals already settled in the area to find employment (Dalla, Ellis, & Cramer, 2005; Martin, Taylor, & Fix, 1996). Although this pattern is characteristic of migrant farmer communities, the immigrants moving to slaughterhouse communities for work are usually not migrant farm workers, although this is not meant to imply that there is never crossover between these groups. The salient point here is that there are fewer solo males and more families in meatpacking towns than in migrant farm worker towns because unlike migrant farm work, slaughterhouse jobs offer year-round employment and enough money to make supporting a family more feasible (Martin et al., 1996).

The influx of immigrants into slaughterhouse communities has also been blamed for the increase in crime. The transition to the use of immigrant labor has been a profound and highly contested development in the meatpacking industry (Grey, 1998a). Immigrants who relocate to communities to work in slaughterhouses are often scapegoated by the general public, the media, government officials, and the meatpacking industry itself, in an attempt to explain away the resultant social disruption in communities where slaughterhouses have been sited. After a recent influx of slaughterhouses in Nebraska, a group of police officers and government officials contacted the Immigration and Naturalization Service (INS) Commissioner in Washington with concerns over the increased crime rates, which they attributed to the increase in immigrants in their communities (Bacon, 1999). In Buena Vista County, Iowa, an assumed link between immigration and crime became the central issue of the 1994 election for the county attorney position. The challenger to the 16-year incumbent made the slaughterhouse industry's hiring practices a central theme of his campaign and accused a slaughterhouse company of "social pollution" (Grey, 1998b). The challenger won the primary. Racial violence has erupted in some locations. For example, there have been reports of cross burnings and physical confrontations in meatpacking towns in Iowa, Nebraska, and Kansas (Dalla et al., 2005). This notion that immigration leads to increases in crime is consistent with the assumption of social disorganization theory that population heterogeneity and population influxes result in the weakening of social institutions and crime increases.

Crime as the result of population booms and social disorganization. It has been hypothesized that the sheer increase in population in some communities could foster social disorganization, bringing about an increase in crime. Popular in studies of boomtowns,² this hypothesis has also been proposed in studies of slaughterhouse communities (Broadway, 2000, 2007; Broadway & Stull, 2006; Markus, 2005; Stull & Broadway, 2004), and assumes that preboom communities are stable and characterized by social cohesiveness, where social control is made possible by a "high density of acquaintanceship" (Freudenberg, 1986). In areas that experience a population influx, newcomers bring new values that conflict with those of current residents and may disrupt established networks and support systems (Broadway, 1990), perhaps resulting in a reduction of informal social control and increases in personal disorganization and social isolation, exacerbating the frequency of mental breakdowns, suicide, deviance, and social isolation (Broadway, 2000, p. 40).

Increased crime as a result of unemployment. It has also been proposed that slaughterhouse communities experience increased crime rates because the recruitment of workers

from outside the community, coupled with high turnover rates in the meatpacking industry, might result in increased unemployment in the community (Eisnitz, 1997; Schlosser, 2005). Eisnitz (1997) explicitly argues that former slaughterhouse workers may turn to crime due to their unemployment. The empirical research on the relationship between crime and unemployment rates in general (e.g., Cantor & Land, 1985), however, has found that the relationship varies by type of crime and is not as straightforward as many assume.

In summary, the demographic characteristics of the workforce, the effects of population influxes on social disorganization, and increased levels of unemployment have all been invoked to explain increased crime rates in communities where slaughterhouses have opened. However, none of these theories have been tested empirically. Additionally, the slaughterhouse community literature has not explicitly mentioned the possibility of a link between the violent work undertaken in slaughterhouses and the social disruption in the surrounding communities. One exception is Broadway (1990), who suggests that work-related stress might contribute to the increases in crime and occurrences of other depression, divorce, and alcoholism. The source of this “work-related stress,” however, has not been interrogated. Although the possibility that the killing and dismembering of thousands of animals a day might contribute to work-related stress and crime has not been addressed in the literature on slaughterhouse communities, the link has been raised by green criminology scholars.

Green Criminology and the Slaughtering of Animals

“Green Criminology” (Lynch, 1990) examines “the study of those harms against humanity, against the environment (including space) and against non-human animals committed by both powerful institutions (e.g. governments, transnational corporations, military apparatuses) and also by ordinary people” (Beirne & South, 2007, p. xiii). Within green criminology explicit attention is paid to animals with the aim of developing a “nonspeciesist criminology” (Beirne, 1999; Cazaux, 1999) concerned with taking harm to animals seriously. Thus far, however, attention has focused exclusively on individual actions against companion animals, such as drawing a link between abuse perpetrated within the family and animal abuse (e.g., Fitzgerald, 2005; Flynn, 2000a, 2000b). Several scholars have argued that attention should also be given to institutionalized practices that result in harm to animals but are considered socially acceptable (Beirne, 2002, 2004, 2007; Beirne & South, 2007; Cazaux, 1999; South & Beirne, 2006). In particular, the potential effects of institutionalized harm to animals on those engaged in such activities needs consideration. This leads us to the Sinclair hypothesis—the work of killing animals in an industrial process may have social and psychological consequences for the workers over and above other characteristics of the work.

For example, Piers Beirne (2004) considers slaughterhouses the ideal site for investigating the institutionalized harm to animals and how violence perpetrated against animals might affect the perpetrators, even though the violence is socially sanctioned. He argues that “Whenever human-animal relationships are marked by authority and power, and thus by institutionalized social distance, there is an aggravated possibility of extra-institutional violence” (2004, p. 54). This proposition parallels studies of other types of work wherein the institutionalized distance and aggression between people can spillover³ into other social contexts, such as studies documenting extra-institutional violence among military personnel (e.g., Allen, 2000; Marshall, Panuzio, & Taft, 2005; Marshall & McShane, 2000; Mercier, 2000;

Rosen, Kaminski, Parmley, Knudson, & Fancher, 2003) and prison guards (Black, 1982; Kauffman, 1988; Stack & Tsoudis, 1997). It also parallels claims made under the “brutalization hypothesis.” According to this hypothesis, instead of having a deterrent effect on homicides, the use of the death penalty (a clear example of state-sanctioned violence) increases homicides due to the legitimization of the use of lethal violence. Research testing the hypothesis, however, has had mixed results depending on the inclusion of a lagged effect (King, 1978), whether the measure of homicides is disaggregated to take the relationship between the offender and victim into consideration (Cochran & Chamlin, 2000; Cochran, Chamlin, & Seth, 1994), and whether the studies are longitudinal or cross-sectional (Yang & Lester, 2008).

More specific to the work in slaughterhouses, ethnographic accounts by Eisnitz (1997), Fink (1998), and Rémy (2003) have emphasized the contradiction faced by slaughterhouse workers between the rules that regulate the slaughter and the necessity of carrying out the killing in an efficient and routinized way. This contradiction is dramatized by the all-too-frequent abuse of animals during the slaughtering process (see Grandin, 1988). Their studies, along with Beirne’s proposition and Sinclair’s 100-year-old hypothesis, draw our attention to the possibility that negative effects of employment in arenas where institutionalized support for violence exists and employees have total power over others (although circumscribed in some regards; see Sykes, 1980) can result even when the “Others” being subjugated are animals. This study provides an initial test of the propositions of Beirne and Sinclair. In particular, we consider whether or not a relationship exists between slaughterhouse employment levels and community crime rates net of what is explained by the typical correlates of crime and that is unique when compared with other similar industries.

Study Objectives and Research Hypotheses

The general objectives of this study are (a) to test the three theories proposed in the literature to explain increases in crime that are applicable to slaughterhouse communities but afford no special theoretical status to slaughterhouse work and (b) to compare the effects of slaughterhouse employment levels on crime rates with the effects of other industries categorized mainly as manufacturing and similarly characterized by high immigrant worker concentrations, low pay, routinized labor, and dangerous conditions but that do not entail killing and dismembering animals, to see if the effects of slaughterhouses are unique or are congruent with those of enterprises with similar characteristics. Finding unique effects of slaughterhouse employment compared to similar forms of industrial work would point to the type of work undertaken in slaughterhouses as a contributor to the crime increases observed in the communities. Therefore, the general hypothesis tested in this study is as follows:

Hypothesis: Controlling for the variables commonly proposed to explain crime, slaughterhouse presence and employment will be associated with increased crime rates. These increases will be greater than those observed from industries that use the same type of labor force, have high injury and illness rates, and entail routinized labor, but do not involve killing and dismembering animals. In particular, rape and family violence will be influenced by slaughterhouse work, net of other factors.

Testing the hypothesis requires ascertaining whether or not the increase in crime in slaughterhouse communities can be explained by the variables proposed in the literature, and if the effects are unique to slaughterhouses or if employment rates in similar industries would result in similar increases in crime. The focus on rape and family violence is suggested by scholars such as Adams (1991), Nibert (2002), Patterson (2002), and Spiegel (1996) who posit a connection between the victimization of animals and the victimization of less powerful human groups, such as children and women. It also reflects the claims made by some of the scholars who have studied slaughterhouse communities that the observed crime increases have been propelled by increases in domestic violence and child abuse. Several issues were taken into consideration in designing a study to test this hypothesis, and we describe these next.

Research Design and Methods

The unit of analysis for this study is the U.S. county. Only nonmetropolitan counties not adjacent to metropolitan areas were analyzed to remove the potentially confounding effects of urbanization and spillover from metropolitan areas to rural counties documented in previous research (e.g., Lee & Ousey, 2001). Furthermore, rural counties in states with right-to-work laws,⁴ where most slaughterhouse facilities have been relocated to (Stull and Broadway, 2004), are examined here. The result of these criteria is that 581 counties are analyzed in this study (a complete list is available from the authors). The data were compiled from six secondary sources, for the period from 1994 to 2002.⁵ Pooled time-series cross-section (TSCS) techniques were used in analyzing the data, therefore the number of data points is 5,229 (581 counties \times 9 years of data).

The independent variables are the number of "Animal (except Poultry) Slaughtering" employees in each county for each year and the number of employees in five comparison industries for which bridgeable SIC-NAICS⁶ data are available. These data were accessed through the U.S. Census Bureau's County Business Patterns. The number of slaughterhouse employees is used instead of the number of slaughterhouse establishments because it has greater variance (see Table 1) and provides us with more complete information about the magnitude of employment than the number of slaughterhouses, which provides no information about their size. The same is true of the comparison industries used (see Table 2). These include iron and steel forging, truck trailer manufacturing, motor vehicle metal stamping, sign manufacturing, and industrial laundering. These industries were selected because they are similar to the slaughterhouse industry: They are categorized as manufacturing (with the exception of one industry, which was included due to a high rate of immigrant concentration), the industries are characterized by high immigrant worker concentrations, low pay, routinized labor, and dangerous conditions (Bureau of Labor Statistics, 2004a, 2004b; Cortes, 2005; U.S. Census Bureau, 2006). Unfortunately, comparisons could not be made with agricultural production industries, as the Census Bureau's County Business Patterns does not record that information.

There are 22 dependent variables in the analyses, including 14 arrest variables and 8 crime report variables drawn from the Uniform Crime Report.⁷ Some of these variables are of particular theoretical interest because they are violent offenses which are implicated by the hypothesis that violence from the slaughterhouses would spillover into the larger community. The other variables (i.e., property crimes) were identified by factor analysis as

Table 1
Trends in Slaughterhouse Establishment and Employment Variables, 1994-2002

	Slaughterhouse Establishments			Slaughterhouse Employment		
	Mean	Minimum	Maximum	Mean	Minimum	Maximum
1994	0.28	0	6	57.14	0	3,750
1995	0.28	0	4	60.08	0	3,750
1996	0.29	0	4	67.02	0	3,750
1997	0.28	0	4	63.33	0	3,750
1998	0.47	0	5	64.86	0	3,750
1999	0.44	0	5	73.94	0	7,500
2000	0.44	0	5	71.89	0	7,500
2001	0.44	0	5	62.55	0	3,750
2002	0.38	0	4	57.49	0	3,750

Table 2
Slaughterhouse and Comparison Industries Characteristics

NAICS	Name	No. of employees	Immigrant Concentration	Injury/Illness
311611	Animal (except Poultry) Slaughtering	142,374	Part of Food Manufacturing, which is #7 in immigrant concentration	#15 for injury and illness
332111	Iron and Steel Forging	26,432	Part of Fabricated Metal Products, which is #18 in immigrant concentration	#8 for injury / #7 for injury and illness
336212	Truck Trailer Manufacturing	30,678	Part of Motor Vehicles and Equipment manufacturing, which is #35 in immigrant concentration	#12 in injury and #12 in injury and illness
336370	Motor Vehicle Metal Stamping	126,905	Part of Motor Vehicles and Equipment manufacturing, which is #35 in immigrant concentration	#19 in injury and illness
339950	Sign Manufacturing	82,956	Part of Miscellaneous Manufacturing, which is #4 in immigrant concentration	Not among the highest rates
812332	Industrial Launderers	81,908	Part of Personal and Laundry Services, which is #5 in immigrant concentration	Not among the highest rates

Source: Information on the industry classification and number of employees obtained from County Business Patterns Web site (U.S. Census Bureau, 2006). Information on immigrant concentration obtained from Cortes (2005). Information on illness and injury rates obtained from Bureau of Labor Statistics, U.S. Department of Labor (2004a, 2004b).

grouping together with the variables of most theoretical interest. Additionally, it seemed prudent to include property offences in the analyses as the slaughterhouse community studies documented important shifts in these variables. Consistent with the theorized causes of crime increases the following control variables are used: the number of males in the county aged 15 to 34 years, population density, the total number of males, the number of people in poverty, international migration, internal migration, total non-White and/or Hispanic population, and the unemployment rate (the county population is accounted for in the analyses through its use to create rates in the ordinary least squares (OLS) regression models and as the exposure variable in the negative binomial regression models). (Please see the appendix for the descriptive statistics and zero order correlations among the variables used in the analyses).

The statistical approach used in this study was motivated by two factors: (a) the availability of longitudinal data and (b) the count nature of the dependent variables. In response to the first factor, pooled fixed effects TSCS techniques are used. There are many advantages to the use of this approach. Notably, it makes it possible to control for all time-invariant county-specific variables (such as history and geographic location) not included in the model but which could potentially result in a spurious relationship between the observed independent variables and the dependent variables (Halaby, 2004; Wooldridge, 2002). Because the dependent variables are counts (often with very small numbers) some of the assumptions of OLS regression cannot adequately be met; specifically the assumptions of homogeneity of error variance and normal error distributions are frequently violated with units of analysis containing small population (such as rural counties; Osgood, 2000). Recent criminological studies examining aggregate crime with expected small counts have instead used regression models based on the Poisson distribution (Krivov & Peterson, 2004; Lee, Martinez, & Rosenfield, 2001; Lee & Ousey, 2001; Osgood, 2000; Rosen et al., 2003). However, the basic Poisson regression model assumes that the variance equals the mean. This assumption is often violated in analyses of crime data. Violating this assumption produces underestimates of the standard errors and misleading significance tests. In instances of overdispersion (where variance exceeds the mean), negative binomial regression (using the Poisson distribution) is preferred, as it allows for overdispersion (Long, 1997; Osgood, 2000). Therefore, negative binomial regression, which is a more conservative approach, is used in the analyses conducted here with individual crime variables as the dependent variable.

For some analyses, crime rate variables were created and factor analyzed to create two scales (arrest rate and report rate scales). Using the scales as dependent variables mitigates the violations of OLS regression assumptions by creating a more normal distribution of scores than obtained with the counts or rates for particular crimes. To create the scales the counts were first converted into rates. Then principal components analysis was used to determine the factor structure, followed by iterative principal factors to obtain the factor loadings. The resulting Arrest Rate Scale is made up of the following variables: rape, robbery, burglary, other assaults, forgery, possessing stolen property, vandalism, offences against the family, and disorderly conduct.⁸ The same process was followed to create the Report Rate Scale.⁹ The Report Rate Scale is made up of the following variables: reports of rape, robbery, assault, burglary, motor vehicle theft, and arson. Three pooled TSCS models were run with each of the scales in turn as the dependent variable (each with fixed effects): (a) with the number of slaughterhouse workers as the sole independent variable, (b) with the control variables added, and (3) with the comparison industries added.¹⁰

Table 3
Multiple Regression With Arrest Scale as the Dependent Variable (N = 4,646)

Independent Variables	Coefficient (Standard Error)		
	Model 1	Model 2	Model 3
Slaughterhouse employment	0.019 (0.004)***	0.013 (0.004)**	0.013 (0.004)**
Unemployment		1.17 (0.346)**	1.164 (0.346)**
Number in poverty		0.0003 (0.0007)	0.0003 (0.0007)
Immigration		0.072 (0.028)*	0.069 (0.028)*
Migration		0.004 (0.003)	0.003 (0.003)
Number of non-Whites and/or Hispanics		0.008 (0.001)***	0.008 (0.001)***
Young males		-0.003 (0.002)	-0.003 (0.002)
Total number of males		-0.009 (0.002)***	-0.009 (0.002)***
Population density		-0.563 (0.257)*	-0.556 (0.257)*
Iron and steel forging			-0.204 (0.126)
Truck trailer manufacturing			-0.016 (0.020)
Motor vehicle metal stamping			-0.035 (0.061)
Sign manufacturing			-0.011 (0.013)
Industrial launderers			0.086 (0.062)
Model <i>F</i> value	21.36***	19.83***	19.72***
<i>R</i> ²	.004	.040	.030

* $p < .05$. ** $p < .01$. *** $p < .001$.

Results

The results of the OLS regression models with the Arrest and Report Rate Scales in turn as the dependent variables are described first. Then we describe the results of the negative binomial regression models with individual crime variables as the dependent variables.

OLS Regression Analyses

As shown in Tables 3 and 4, the Number of Slaughterhouse Employees variable is a significant predictor in all six models. With the Arrest Rate Scale as the dependent variable (Table 3), the Slaughterhouse variable coefficient decreases from 0.019 to 0.013 with the addition of the control variables, but it remains significant. This means that controlling for all of the variables in the model, when the number of slaughterhouse workers increases by 1 the arrest rate scale increases by 0.013 arrests ($p < .01$).

The results are more substantial with the Report Rate Scale as the dependent variable (Table 4). Controlling for all of the variables, the coefficient for slaughterhouse employment is 0.027 ($p < .01$). It is worth noting that none of the comparison industries have significant effects on the Arrest Rate Scale or Report Rate Scale.

By fixing the control variables at their means and adjusting only the number of slaughterhouse employees in a county it is possible to see how different levels of slaughterhouse employment would affect the scales (see Table 5). An average-sized slaughterhouse, which employs 175 people, would be expected to increase the arrest scale by 2.24 arrests and the

Table 4
Multiple Regression With Report Scale as the Dependent Variable ($N = 4,646$)

Independent Variables	Coefficient (Standard Error)		
	Model 1	Model 2	Model 3
Slaughterhouse employment	0.039 (0.008)***	0.027 (0.008)**	0.027 (0.008)**
Unemployment		2.035 (0.662)**	2.027 (0.662)**
Number in poverty		0.006 (0.001)***	0.006 (0.001)***
Immigration		0.264 (0.053)***	0.263 (0.054)***
Migration		0.014 (0.005)**	0.014 (0.005)**
Number of non-Whites and/or Hispanics		0.012 (0.002)***	0.012 (0.002)***
Young males		-0.003 (0.003)	-0.003 (0.003)
Total number of males		-0.019 (0.003)***	-0.019 (0.003)***
Population density		0.308 (0.492)	0.312 (0.492)
Iron and Steel Forging			-0.363 (.240)
Truck Trailer Manufacturing			0.060 (0.038)
Motor Vehicle Metal Stamping			-0.113 (0.117)
Sign Manufacturing			-0.018 (0.024)
Industrial Launderers			0.016 (0.118)
Model <i>F</i> value	21.51***	15.46***	10.39***
R^2	.003	.068	.068

** $p < .01$. *** $p < .001$.

Table 5
Results of TSCS OLS Equation at Varying Levels of Slaughterhouse Employment, Keeping Control Variables Constant ($N = 4,646$)

Slaughterhouse Employment	Arrest Scale	Report Scale
0 employees	69.32	115.40
10 employees	69.44	115.67
60 employees	70.09	117.01
175 employees	71.56	120.09
375 employees	74.13	125.45
750 employees	78.94	135.50
1,750 employees	91.78	162.30
3,750 employees	117.45	215.90
7,500 employees	165.59	316.39

Note: TSCS = time-series cross-section; OLS = ordinary least squares.

report scale by 4.69 reports. Particularly telling is the fact that the expected arrest and report values in counties with 7,500 slaughterhouse employees are more than double the values where there are no slaughterhouse employees.

These results demonstrate that the effect of slaughterhouse employment on these scales cannot be explained away by the control variables and that the comparison industries do not have similar significant effects. Also, because the analyses employ fixed effects they also therefore control for time-invariant variables in these counties that might affect the crime rates, such as geographic location. These findings, however, cannot provide insight

into how slaughterhouses, the comparison industries, and the control variables affect individual crime variables. To provide this insight, we used negative binomial regression.

Negative Binomial Regression Analyses

Pooled TSCS negative binomial regression was performed on 11 individual dependent variables (7 arrest variables and 4 report variables).¹¹ These analyses were modeled with county population set as the exposure variable¹² and county fixed effects. The same three models were run for each of the dependent variables as was done with the OLS regression analyses.

The regressions were performed on the data for two time periods: the entire time period under study (1994-2002) and the period before custom slaughter facilities were added to the slaughterhouse industry category (1994-1997). A few words here regarding this change in classification are warranted. In 1998, custom slaughtering facilities were added to the Animal (except poultry) Slaughtering category (personal communication with Census Bureau representative, May 2, 2006). Custom slaughter includes (a) slaughter or processing of uninspected food animals for the sole consumption of the owner; (b) slaughtering/processing animals as a custom service for an individual who owns the animal, and uses the meat for his or her own consumption. These tend to be very small establishments. This change in classification resulted in an increase in the smaller slaughterhouse facilities from 1997 to 1998 (an increase of 514 facilities employing 1 to 4 people). A potential consequence of this change in classification is that the effects of slaughterhouses on crime in these years could be diluted in the aggregate data by the increase in these small slaughter facilities, an issue that we discuss in more detail below.

The values reported in Tables 6 and 7 are the incidence-rate ratio (IRR)¹³ values for the most complete models (Model 3). Analysis of the precustom slaughterhouse period (1994-1997), while controlling for all the control variables, indicates that slaughterhouse employment has a significant positive effect on the total number of arrests and arrests for violent crimes (see Table 6). The IRR value for total number of arrests (1.000454) means that each additional slaughterhouse employee would be expected to increase the total arrest rate by a factor of 1.000454 or approximately 0.05%. Again, although on face value this may not appear impressive, it is important to note that some of the large facilities employ thousands of people, so that the actual effect could be much more substantial. For example, 4,000 slaughterhouse employees would increase the total number of arrests by approximately 2%.

The IRR value for the Arrests for Violent Crimes variable is interpreted to mean that each additional slaughterhouse employee increases the expected number of violent arrests by a factor of 1.000221 or by 0.0221%. Accordingly, 4,000 slaughterhouse employees would be expected to increase the number of arrests for violent offenses by nearly 1%. Note that only one of the comparison industries (motor vehicle metal stamping) has a significant positive effect on any of the crime variables (rape reports) and there are several instances where the comparison industries have significant negative effects.

When the entire time period is examined (Table 7), the effect of slaughterhouse employment on total arrests and arrests for violent crimes is no longer significant in the expected direction. This is likely due to the inclusion of the custom slaughter facilities. However, in the analysis of the entire time period, the slaughterhouse employment variable has a significant positive effect on arrests for rape and for other sex offenses (the effects are in the same direction in the previous analysis, but it is possible that they are significant here because of the increase in data points). Additionally, these effects are not found in the comparison industries.

Table 6
Effects of the Independent and Control Variables (Net of the Other Variables)
on the Crime Variables of Interest, 1994-1997 (N = 1,743)

Independent Variables	Total Arrests	Violent Arrests	Murder Arrests	Rape Arrests	Family Arrests	Sex Arrests	Assault Arrests	Index Reports	Murder Reports	Rape Reports	Assault Reports
Slaughterhouse employment	1.000454**	1.000221*	1.000089	1.000059	1.000222	1.000083	1.000196	.9997331	1.001345	1.000008	0.9999967
Unemployment	0.9267538***	0.9981239	1.040852	1.024633	0.9700561	1.031244	1.004418	0.9448218***	0.9880815	0.9971552	0.9490392**
Number in poverty	1.000018*	0.9999896	0.9999166*	0.9999978	0.9999625	0.9998982***	0.9999922	1.000016	1.000019	1.000032	1.000039*
Immigration	0.9990475	0.9968228*	0.9953541	0.9979653	1.003668**	1.000434	0.9965581*	1.002738***	1.000711	1.000913	1.000715
Migration	1.000243***	0.9999918	1.000304	0.9999951	0.9998443	0.9999715	0.9999702	0.9999195**	1.000048	0.9997468**	0.999887*
Non-White/Hispanic	1.000464***	1.000038*	1.000049	1.00001	1.000015	1.000006	1.000036	0.9999082***	1.00006	1.000065	0.9999471**
Young of young males	0.9994193***	1.000081	0.9996847	1.00012	1.000025	0.9998274	1.000141	1.000807***	0.9997969	1.000182	1.00056***
Total number of males	0.9993236***	0.9998762**	1.000111	0.9998887	0.9998898*	0.9999842	0.9998497***	0.9997796***	1.000049	0.9999179	0.9997982***
Population density	1.073137	0.9988433	0.9972847	1.036529	1.002707	1.00699	1.000122	0.9891606**	0.9937794	0.9966124	1.000516
Iron and Steel Forging	0.9968899	0.989946	1.031706	0.9604903*	1.024801	1.001263	0.9894973	1.005325	1.037114	0.9883354	0.9877602
Truck Trailer Manufacturing	0.9979979***	0.9980742**	0.9979514	0.9997399	0.9983923	1.000406	0.997983**	1.000048	0.9995342	0.9996249	0.9987897
Motor Vehicle	0.9992525	0.9946924*	0.9985286	0.9992979	0.9985946	0.9997529	0.9953782	0.9941526**	1.000061	1.072275*	1.00843
Metal Stamping											
Sign	1.003135	1.000377	1.004712	1.002019	0.9996684	1.003013	0.999614	0.9896203***	0.9935767	0.9949149**	0.9920695***
Manufacturing											
Industrial Laundreters	1.006312	1.00489	.9862215	0.9974364	1.011544	1.009035	1.00595	1.005605	0.993868	1.005044	1.004502

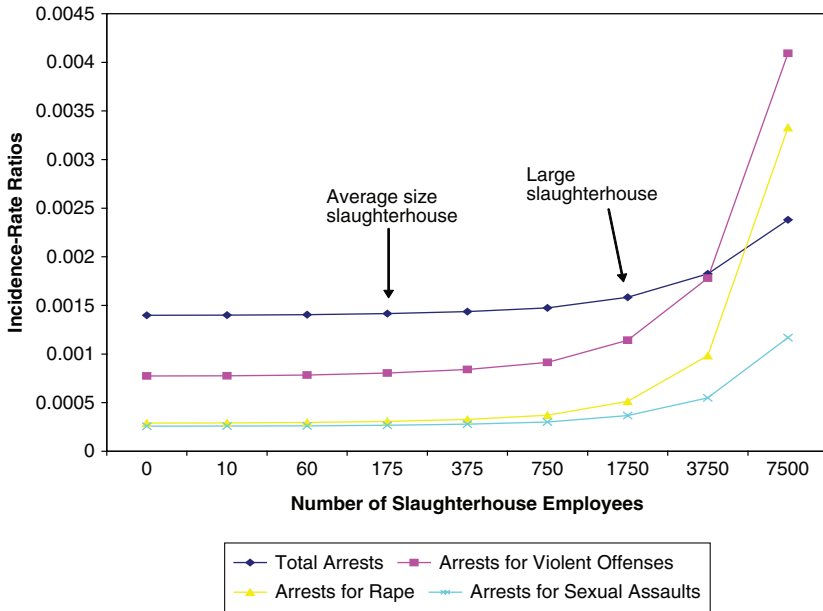
* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 7
Effects of the Independent and Control Variables (Net of the Other Variables)
on the Crime Variables of Interest, 1994-2002 (N = 4,646)

Independent Variables	Total Arrests	Violent Arrests	Murder Arrests	Rape Arrests	Family Arrests	Sex Arrests	Assault Arrests	Index Reports	Murder Reports	Rape Reports	Assault Reports
Slaughterhouse employment	0.9993113***	0.9993811***	1.000044	1.000327**	0.9996448***	1.000202*	0.9994051***	0.999141***	1.000081	0.9993045***	0.9992509***
Unemployment	1.024472***	1.01407*	1.017718	1.049572***	0.9748383**	1.008044	1.013346*	0.9803073**	1.001645	1.001668	0.9848345*
Number in poverty	1.000004	1.000008	0.9999858	1.000019	0.9999584*	0.9999497**	1.00001	1.00003**	1.000037*	1.000008	1.000034**
Immigration	0.9998359	1.000491	1.000039	1.000373	1.001244*	1.001403*	1.000503	1.002717***	0.9999194	1.001314**	1.002496***
Migration	1.000391***	1.000358***	1.000429***	1.000305***	1.000048	1.000068	1.000332***	1.000353***	1.000269***	1.000144**	1.000348***
Non-White/Hispanic	1.000103***	1.000055***	1.000065***	1.000068***	1.00004***	0.9999926	1.000047***	1.000063***	1.000084***	1.000036**	1.000027***
Number of young males of males	0.9999787*	0.999984	1.000046	0.999983	0.9999822	0.999893**	0.9999805	0.9999704*	0.9999701	0.9999002***	0.9999574*
Total number of males	0.9998677***	0.9998769***	0.9999138***	0.9999041***	0.9998871***	0.9999781	0.9998815***	0.9999053***	0.9999452*	0.999974	0.9999168***
Population Density	1.00558***	1.002586	1.003975	1.000542	1.003551*	1.002014	1.003026*	0.9985326	1.003147	1.000152	0.9996134
Iron and Steel Forging	0.9921377***	0.9918974***	0.9957149	0.9926863*	0.9944603**	0.9924746	0.9924163***	0.9959642**	1.005719	0.9969287	0.9926321***
Truck Trailer Manufacturing	0.9992624*	1.000008	0.9994264	1.000295	1.0002	1.000339	1.000083	1.000966**	0.9998746	1.000313	1.000424
Motor Vehicle	1.000723	0.9993025	1.000228	1.000279	0.9997799	1.001256	0.9995619	0.9993088	1.000025	0.9989647	0.998472
Metal Stamping	1.000269	1.000019	1.000082	0.9997824	0.9999199	0.9999348	1.000124	0.9972855***	0.9998537	0.9992095	0.9980522**
Sign Manufacturing	1.002269*	1.000014	1.000547	0.999034	1.001069	1.000004	0.9998854	1.004173***	1.002587	1.000645	1.001481
Industrial Launderers											

p* < .05. *p* < .01. ****p* < .001.

Figure 1
Log Scale Prediction Equation Values for Total Arrests,
Arrests for Violent Offenses, Rape, and Sexual Assaults



With these data we can estimate the effects of varying levels of slaughterhouse employment on the four variables that slaughterhouse employment significantly predicts. Figure 1 demonstrates how the effects of slaughterhouse employment on these variables become particularly pronounced with higher levels of employment in the industry.

Discussion and Conclusions

We anticipated that controlling for key variables (the number of young men in the county, population density, the total number of males, the number of people in poverty, international migration, internal migration, total non-White and/or Hispanic population, unemployment rate, and the total county population), slaughterhouse employment levels would be associated with increased crime rates in counties, and that the effects would be greater than the effects of employment in the comparison industries. Two techniques were employed to test this hypothesis. The first technique is OLS regression using the arrest and report scales in turn as the dependent variable. The results using this technique are consistent with our hypothesis: Slaughterhouse employment is a significant predictor of both the arrest and report rate scales with all the control variables included in the model. The comparison industries do not have parallel effects: none of the comparison industries have significant positive effects on the Arrest and Report Scales.

Positive effects of slaughterhouses employment levels on crime rates were also found using pooled TSCS negative binomial regression to regress individual arrest and report

variables. In the results derived from the entire time period, and controlling for the extraneous variables, slaughterhouse employment has significant effects on arrests for rape and arrests for sex offenses. Of the comparison industries, only iron and steel forging demonstrates a significant effect on arrests for rape, but it is a negative one. Thus, controlling for the other variables, an increase in employment in iron and steel forging is associated with a *decrease* in arrests for rape.

The effects of slaughterhouse employment on the arrests for rape and other sex offenses are not significant in the analysis of the data prior to the inclusion of custom slaughter facilities (1994-1997). This is not surprising given that the analysis of the entire time period includes more than double the number of observations than the period before the inclusion of custom slaughter facilities. For the analyses of the entire time period (1994-2002), 4,646 observations are analyzed (581 counties \times 8 years [8 years of observations instead of 9 are included in the analyses as the result of the one year lag] - 2 missing cases = 4,646). For the analyses of the time period before custom slaughter facilities were added to the slaughterhouse categorization (1994-1997), 1,743 observations are analyzed (581 counties - 3 years = 1,743). Slaughterhouse employment is a significant predictor of two variables for the period before custom slaughter facilities were added to the slaughterhouse categorization: total arrests and violent arrests. Only one of the comparison industries (Truck Trailer Manufacturing) has a significant effect on the total arrests variable, but it is a negative effect and therefore an increase in the number of truck trailer employees in these counties would be expected to *decrease* the number of total arrests.

The IRR value for the slaughterhouse employment variable in predicting violent arrests is 1.0002 (rounded), controlling for the other variables. Two of the comparison industries (Truck Trailer Manufacturing and Motor Vehicle Metal Stamping) have significant effects on violent arrests, but both are negative. Again, we would therefore expect that an increase in the number of employees in these industries would be associated with a decrease in the number of arrests for violent offenses. Thus, the results of the pooled TSCS OLS regression and pooled TSCS negative binomial regression both demonstrate that slaughterhouse employment does have significant positive and unique effects on the Arrest and Report Rate Scales, as well as on rates of total arrests, arrests for violent crimes, arrests for rape, and arrests for other sex offenses, controlling for the number of young men in the county, population density, the total number of males, the number of people in poverty, international migration, internal migration, total non-White and/or Hispanic population, the unemployment rate, and the total county population.

The effect of slaughterhouse employment on offenses against the family was significant and negative for the analysis of the entire time period, and positive but not significant for the analysis of the 1994-1997 data. The negative effect found in the 1994-2002 analysis may be the result of including the custom slaughter facilities. It is also worth noting that the Offenses Against the Family variable consists of unlawful *nonviolent* acts by family members against each other (U.S. Department of Justice and Federal Bureau of Investigation, 2004). Therefore, there is not a clear measure of family violence in the Uniform Crime Reports that includes violence against family members. Perhaps the inclusion of violent forms of offenses against the family in this variable would have made the effects of slaughterhouse employment clearer. Additionally, we cannot assess the effect of slaughterhouse employment on reports of offenses against the family, because, as previously mentioned, only data on reports for Part I or Index offenses are collected (including murder, rape, robbery, aggravated assault, burglary, larceny, motor vehicle theft, and arson).

Increases in slaughterhouse employment had a significant positive effect on rape arrests across the entire time period under study. However, this effect was not significant when fewer observations were analyzed for the period before custom slaughter facilities were added (1994-1997). Similarly, slaughterhouse employment did not have a significant effect on reports of rape for the years 1994 to 1997. Slaughterhouse employment did have a significant negative effect on the rape reports variable for the analysis of the entire time period. It is possible that this result was impacted by the inclusion of the custom slaughter facilities.¹⁴

The significant positive effect of slaughterhouse employment on sex offenses is also noteworthy. Although this variable excludes forcible rape and prostitution, it does include sexual attacks on males, incest, indecent exposure, statutory rape, and "crimes against nature" (U.S. Department of Justice and Federal Bureau of Investigation, 2004). Many of these offenses are perpetrated against those with less power, and we interpret this as evidence that the work done within slaughterhouses might spillover to violence against other less powerful groups, such as women and children. Further, the positive effects of slaughterhouse employment on rape and other sexual assaults were not observed in the comparison industry analyses.¹⁵

The results presented here therefore demonstrate significant and unique effects of slaughterhouse employment on several crime variables. These effects are not found in the comparison industries, and they cannot be explained by unemployment, social disorganization, and demographic variables. Additionally, the differences in the results before and after custom slaughter facilities were added to the slaughterhouse category also suggests that the industrialization of slaughter has the strongest adverse effects, whereas the addition of the smaller, custom slaughter facilities likely adds "noise" to the analyses and may even be adding the effects of social capital (related to small businesses and small-scale agriculture). Given the highly stochastic nature of the arrest and report variables in rural counties, the findings presented here are quite suggestive.

A few words on the performance of the control variables are in order. Recall that the control variables have gathered into three groupings in the literature: demographic, social disorganization, and unemployment. The control variables with the most explanatory power in predicting the crime variables in this study include the unemployment variable and some of the social disorganization variables (specifically migration and immigration). The effects of the demographic variables were largely contradictory and close to zero. The arguments that have been used to explain the slaughterhouse effect overall find limited substantiation here, again supporting the claim that there is something unique about slaughterhouse work.

The major limitation of our study is the reliance on Uniform Crime Report (UCR) data. Although many studies of crime rely on the UCR for their data (such as Kawachi, Kennedy, & Wilkinson, 1999; Krivo & Peterson, 2004; Lee & Ousey, 2001; Wilkinson, Reynolds, et al., 1984), shortcomings of the data have been identified. For instance, official statistics obviously exclude those crimes that law enforcement officials are not aware of. However, for some offenses, such as motor vehicle theft and homicide (Kawachi et al., 1999), and serious crimes more generally (Sampson, 1987), the undercount is trivial. There are also problems related to the ability of victims and witnesses to recall and report accurate information, limitations of police resources for making arrests, and inconsistencies in the deployment of resources and enforcement of laws across geographic areas (Krivo & Peterson, 2004; Sampson & Groves, 1989). The validity of official statistics has been questioned particularly in areas undergoing rapid growth. It is possible that increases in official crime rates in growing areas are the result of increases in police staff, additions which are common in boomtowns. It is also possible that

increases in crime rates in boomtowns might be partly due to increased reports by law enforcement officials in an attempt to justify increasing their resources (Gold, 1982). On the other hand, residents in stable areas have been known to assert that the police record even minor incidents because their time is not occupied with serious offenses (Freudenberg & Jones, 1991), thus potentially increasing crime rates at the less severe end of the spectrum. Some have suggested that victimization data be used instead of arrest and report data; however, victimization data are more limited and few differences have been found between the arrest rates of the UCR and offending rates estimated from the national victimization survey (Sampson, 1987). Despite the critiques of official arrest and report data, these data are the best sources of systematic and timely offense information at the county level (Miles-Doan, 1998).

Our results cannot be generalized to counties in states without right-to-work laws and to counties in or adjacent to metropolitan areas. Subsequent research expanding these delimitations might provide interesting information about the effects of labor unions and urbanization on social disruption in communities surrounding slaughterhouses.

Finally, the aggregated level of the data poses three limitations: (a) There may be inconsistencies in reporting across counties and the small number of certain types of crime (such as homicide) may make reliable estimates difficult (Pridemore, 2005). However, given the scope of this study and the need for comparable crime data at a fairly low level of aggregation, there are no viable alternatives to using official crime data at the county level. (b) Because of spatial aggregation, the effects of slaughterhouses might be muted and thus make the analysis rather conservative. (c) These data provide a broad picture, but do not enable gaining a clear understanding of the dynamics in these communities, such as who is actually committing the crimes, or if some jobs in slaughterhouses are more problematic than others. Thus, although this study does not permit one to draw conclusions about the individuals who work in slaughterhouses, it nonetheless is a first step in better understanding what is occurring in slaughterhouse communities. It is therefore an important complement to micro-level survey or ethnographic research that would permit a more nuanced analysis of what is occurring in the work and life experiences of those involved in the slaughterhouse industry but would not allow the detection of overall patterns and control for alternative theoretical explanations.

In conclusion, despite some limitations, our research makes valuable theoretical and empirical contributions to a developing sociology of the slaughterhouse. This study is the first to test the theories proposed to explain increased crime in slaughterhouse communities,¹⁶ providing evidence that elaborates on the case study research that initially documented increased crime in communities where large slaughterhouses were sited. The inclusion of comparison industries as well as standard predictors of crime rates in our analyses supports the claim that slaughterhouses have a unique and insidious effect on the surrounding communities. Although studies have found that employment in the manufacturing sector in general has suppressant effects on crime (e.g., Lee & Ousey, 2001), this is clearly not the case for the slaughterhouse subsector of manufacturing. Meaningful theoretical and empirical distinctions can and ought to be drawn between slaughterhouse employment and other types of manufacturing employment. In particular, our results lend support to the argument, first articulated by Sinclair, and since elaborated by Beirne, that the industrial slaughterhouse is different in its effects from other industrial facilities. We believe that this is another of a growing list of social problems and phenomena that are undertheorized unless explicit attention is paid to the social role of nonhuman animals.

Appendix Descriptive Statistics and Zero Order Correlations

Descriptive Statistics and Zero Order Correlations, Independent Variables, Control Variables, and Summary Arrest Variables

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
1. Slaughterhouse employment	1											
2. Slaughterhouse establishments	.338	1										
3. Total arrests	.021	.015	1									
4. Violent crime	-.013	-.05	.545	1								
5. Number in poverty	.08	.133	.398	.361	1							
6. Unemployment rate	-.062	-.12	.322	.381	.344	1						
7. Immigration	.513	.188	.095	.052	.366	.163	1					
8. Migration	-.176	-.080	-.035	.023	-.139	-.071	-.198	1				
9. Non-White or Hispanic residents	.113	.058	.362	.354	.822	.426	.477	-.231	1			
10. Population density	.080	.054	.358	.3122	.548	.171	.169	.007	.425	1		
11. Number of males	.168	.213	.344	.294	.880	.173	.439	-.119	.700	.597	1	
12. Males aged 15 to 34 years	.187	.195	.304	.257	.849	.187	.510	-.176	.727	.552	.959	1
Mean	64.26	0.37	3348.05	99.07	2239.99	5.02	15.95	-33.84	3077.25	22.2	6816.09	1988.33
Median	0	0	3002.79	67.97	1281.50	4.20	3	-25	764.5	12.54	4529	1184
Standard deviation	402.36	0.65	2605.23	111.06	2548.04	3.06	47.48	260.96	5449.53	32.09	6908.21	2394.04
Minimum	0	0	0	0	8.25	1	-6	-4,083	1	0.1	34	3
Maximum	7,500	6	27,044	1,288	21,450	38.4	777	3,281	47,049	519	66,194	22,118

Note: Correlations and descriptive statistics for dependent variables are shown as crime rates per 100,000 population.

Descriptive Statistics and Zero Order Correlations, Independent Variables, Control Variables, and Individual Arrest Variables

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.
1. Slaughterhouse employment establishments	1																	
2. Slaughterhouse establishments	.338	1																
3. Murder	-.011	-.026	1															
4. Rape	.036	.022	.116	1														
5. Robbery	-.008	-.025	.229	.249	1													
6. Aggravated assault	-.016	-.052	.216	.297	.500	1												
7. Other assaults	.076	.026	.194	.286	.495	.482	1											
8. Sex offenses	.029	.016	.092	.147	.182	.218	.325	1										
9. Offenses against the family	-.004	-.017	.129	.168	.330	.269	.352	.193	1									
10. Disorderly conduct	.029	-.015	.161	.188	.384	.345	.522	.185	.312	1								
11. Number in poverty	.080	.133	.145	.206	.436	.311	.445	.122	.216	.311	1							
12. Unemployment rate	-.062	-.120	.178	.151	.331	.349	.319	.102	.235	.284	.344	1						
13. Immigration	.513	.188	-.009	.038	.068	.048	.144	.050	.011	.023	.366	.163	1					
14. Migration	-.176	-.080	-.001	-.006	-.031	.032	-.089	.019	-.017	-.092	-.139	-.071	-.198	1				
15. Non-White or Hispanic residents	.113	.058	.168	.197	.469	.294	.466	.120	.253	.322	.822	.426	.477	-.231	1			
16. Population density	.080	.054	.095	.145	.310	.287	.360	.098	.166	.182	.548	.171	.169	.007	.425	1		
17. Number of males aged 15 to 34 years	.168	.213	.086	.160	.335	.261	.398	.126	.147	.226	.880	.173	.439	-.119	.700	.597	1	
18. Males aged 15 to 34 years	.187	.195	.075	.145	.307	.226	.355	.108	.127	.203	.849	.187	.510	-.176	.727	.552	.959	1
Mean	0.37	3.56	6.44	8.3	80.21	289.45	14.74	48.87	134.18	2239.9	5.02	15.95	-33.84	3077.3	22.2	6816.1	1988.3	
Median	0	0	0	0	0	53.51	218.76	7.67	15.81	70.72	1281.5	4.20	3	-25	764.5	12.54	4,529	1,184
Standard deviation	402.4	0.65	11.64	11.76	15.95	94.96	283.35	23.63	92.21	193.69	2548	3.06	47.48	260.96	5449.5	32.09	6908.2	2,394
Minimum	0	0	0	0	0	0	0	0	0	0	8.25	1	-6	-4.083	1	0.1	34	3
Maximum	7,500	6	366.1	245.1	174.98	1143.4	2108.6	530.51	1680.2	2098.6	21450	38.4	777	3,281	47,049	519	66,194	22,118

Note: Correlations and descriptive statistics for dependent variables are shown as crime rates per 100,000 population.

Descriptive Statistics and Zero Order Correlations, Independent Variables, Control Variables, and Crime Report Variables

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.
1. Slaughterhouse employment																		
2. Slaughterhouse establishments	.338	1																
3. Index reports	.095	.132	1															
4. Murder	-.004	-.022	.197	1														
5. Rape	.086	.082	.544	.135	1													
6. Robbery	.031	.028	.595	.219	.350	1												
7. Assault	.010	.017	.679	.220	.406	.511	1											
8. Burglary	.032	.059	.847	.226	.467	.590	.601	1										
9. Motor vehicle theft	.076	.117	.780	.180	.438	.494	.532	.672	1									
10. Arson	.009	.029	.378	.111	.264	.186	.293	.355	.344	1								
11. Number in poverty	.080	.133	.526	.144	.326	.580	.385	.498	.455	.169	1							
12. Unemployment rate	-.062	-.120	.133	.136	.067	.240	.248	.210	.103	.044	.344	1						
13. Immigration	.513	.188	.283	.026	.180	.173	.150	.204	.261	.071	.366	.163	1					
14. Migration	-.176	-.080	-.074	-.006	-.101	-.116	-.016	-.039	-.031	-.038	-.139	-.071	-.198	1				
15. Non-White or Hispanic residents	.113	.058	.443	.162	.2737	.618	.350	.443	.371	.114	.822	.426	.477	-.231	1			
16. Population density	.080	.054	.416	.082	.258	.401	.294	.318	.355	.1443	.548	.171	.169	.007	.425	1		
17. Number of males aged 15 to 34 years	.168	.213	.562	.081	.346	.492	.341	.455	.475	.171	.880	.173	.439	-.119	.700	.597	1	
18. Males aged 15 to 34 years	.187	.195	.517	.073	.320	.457	.316	.4138	.425	.147	.849	.187	.510	-.176	.727	.552	.959	1
Mean	64.26	0.37	1827.9	3.25	14	15.743	142.1	429.53	87.83	11.83	2239.99	5.02	15.95	-33.84	3077.25	22.2	6816.09	1988.33
Median	0	0	1523.5	0	0	0	83.20	367.60	70.19	0	1281.50	4.20	3	-2.5	764.5	12.54	4529	1,184
Standard deviation	402.36	0.65	1611.9	8.82	20.88	31.55	181.13	390.19	88.16	22.51	2548.04	3.06	47.48	260.96	5449.53	32.09	6908.21	2394.04
Minimum	0	0	0	0	0	0	0	0	0	0	8.25	1	-6	-4.083	1	0.1	34	3
Maximum	7,500	6	9630.4	173.71	245.1	405.34	2808.7	3076.9	697.67	528.17	21,450	38.4	777	3,281	47,049	519	66,194	22,118

Note: Correlations and descriptive statistics for dependent variables are shown as crime rates per 100,000 population.

Notes

1. Similar contradictions have been noted in examinations of vivisection (see Adams, 2000; Balcombe, 2000; Dunayer, 2000; Fox, 2000). Animals are used in experiments precisely because they share many characteristics and qualities with humans, and all the while linguistic devices are employed to distance the experimenters from their subjects.

2. Boomtown communities are characterized by the following features: They experience unprecedented population growth within a short amount of time; relatedly, they experience expanded employment opportunities; and they also experience heavy demands on social services (Camasso & Wilkinson 1990).

3. The use of the term *spillover* here derives from the cultural spillover of violence theory developed by Larry Baron and Murray Straus (1987, 1988; Baron, Straus, & Jaffe 1988). The central tenet of this theory is that

The more a society tends to endorse the use of physical force to attain socially approved ends—such as order in the schools, crime control, and military dominance--the greater the likelihood that this legitimization of force will be generalized to other spheres in life, such as the family and relations between the sexes, where force is less approved socially. (Baron et al., 1988, p. 80)

Although the authors did not specifically discuss the slaughter of animals as part of this process, we argue here that it is a possibility.

4. In these states, employees cannot be required to join or pay dues to a union and may resign from the union at any time, but still enjoy the benefits of the collective agreement. The following are the right-to-work states included in the analyses in this study: Alabama, Arizona, Arkansas, Georgia, Idaho, Iowa, Kansas, Louisiana, Mississippi, Nebraska, Nevada, North Carolina, North Dakota, Oklahoma, South Carolina, South Dakota, Tennessee, Texas, Utah, Virginia, and Wyoming.

5. This time period is used because due to reporting changes in the Uniform Crime Report data, data prior to 1994 are not comparable with data from later years, and at the time of the study some of the demographic variables were not yet available at the county level for 2003 and later.

6. In 1998, the classification of industries changed from the Standard Industrial Classification (SIC) system to the North American Industry Classification System (NAICS), and only some industries remain comparable across the time period.

7. The arrest variables used include the following: Total arrests, Violent offenses, Murder, Rape, Offenses against the family, Sex offenses, Assault, Robbery, Burglary, Forgery, Possessing stolen property, Vandalism, Other assaults, and Disorderly conduct. The report variables used include: Index offenses, Murder, Rape, Assault, Robbery, Burglary, Motor vehicle theft, and Arson.

8. The factor loadings are all above the commonly accepted minimum values of 0.3 to 0.4 and the Chronbach's alpha for the scale is .6728.

9. Again, all of the loadings for these variables were above the acceptable range and Chronbach's alpha was .6062.

10. As is commonly done in panel studies, in the analyses here the Slaughterhouse Employment variable and the comparison industry variables were lagged 1 year because their impact on crime would likely not be felt in the same year in these counties. More likely, the impact would be felt the following year (especially in cases where the industry opened or expanded late in the year).

11. The variables analyzed include the following: Total number of arrests, Arrests for violent crimes, Arrests for murder, Arrests for rape, Arrests for offenses against the family, Arrests for sex offenses (excluding rape), Arrests for aggravated assault, Total reports for index offenses, Reports of murder, Reports of rape, and Reports of assault.

12. Negative binomial regression requires that an exposure variable be identified to differentiate across cases differences in the possibility of being "exposed" to the effect. Long and Freese (2006) use the example of time as an exposure variable. In this study, however, it is not time that differentiates the likelihood of crime in the counties but the differences across counties in population (a larger number of people makes the possibility of offending or being victimized greater). Therefore, we set county population as the exposure variable. Including the exposure variable adds the natural log of the size of the population at risk to the model. Thus, in essence, the model analyzes per capita rates of crime instead of merely counts of crime even though the dependent variable is

a count, not a rate. This is standard practice in the quantitative criminology literature (Osgood, 2000). Using the population as the exposure variable also permits an acknowledgement in the model that rates based on larger populations have greater precision, which addresses the issue of heterogeneity of variance, which is problematic in the use of OLS regression on count variables (Krivo & Peterson, 2004; Osgood, 2000)

13. The IRR values can be interpreted as the multiplicative factor by which a one unit change in the independent variable affects the dependent variable, controlling for the other variables. Therefore, an IRR value below one indicates that the predictor variable (controlling for the other variables) decreases the incidence-rate, which demonstrates a negative effect. Accordingly, an IRR value above one indicates an increase in the incidence-rate, or a positive effect.

14. The change in classification to include small custom slaughterhouses in the slaughterhouse category may affect these analyses in two ways. If the years after the reclassification are included, due to the way the County Business Patterns categorizes the employee data (e.g., 1-19, 20-99) instead of reporting the exact number of employees, the inclusion of small custom slaughter facilities could artificially increase the number of slaughterhouse workers in counties since the midpoint of the ranges are used in the analyses, therefore diluting the possible effect of slaughterhouse employment. In addition, work at a custom slaughterhouse may be episodic, involving the slaughter of a relatively small number of animals in any given time period rather than the routinized slaughter of the larger facilities. This means that workers may be less exposed to slaughter. If the years after the reclassification are excluded, then these problems are avoided but the sample size is reduced from 4,646 to 1,743, reducing the power of the analysis. Although this seems like a large sample, given the highly stochastic nature of crime in rural communities, substantial power is required to see significant effects. Unfortunately, there is no way to disaggregate the slaughterhouse data and exclude these facilities from the analysis.

15. It is also possible that if violent offenses committed by family members were included in the offenses against the family category that the effect of slaughterhouse employment on offenses against the family would have been positive and significant (instead of *positive* but *not significant* for the period prior to the inclusion of custom slaughter facilities).

16. This study should not, however, be considered the definitive testing of these theories, or predictive models of crime in general. Different operationalizations of the theories might have resulted in slightly different findings. Further, The R^2 values of the models are low; however, the purpose of this research was to control for the variables implicated in the theorized causes in the literature to assess the effects of slaughterhouse employment. It is also worth noting that there is some degree of multicollinearity among the variables. Specifically, the total number of males, number of young males, and the number of people in poverty have variance inflation factor (VIF) values greater than 4 (the values are 19.25, 15.64, and 8.01, respectively). Because this collinearity is entirely among control variables, it has no important effect on the estimates of the effects of slaughterhouse employment (the VIF value of the lagged slaughterhouse employment variable is 1.47).

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