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SUMMARY

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A VALUATION OF SPECIFIC CRIME RATES

By

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## SUMMARY

Evaluating the explicit costs of crime to society is a difficult task, as seen in the few number of researchers that have attempted to solve this problem. However two main approaches have emerged in these endeavors. The most tried technique has used hedonic models, dating back to Richard Thaler's "A Note on the Value of Crime Control: Evidence from the Property Market" in the *Journal of Urban Economics* (1978). Using this type of model, researchers have strived to isolate the value individuals place on specific amenities or disamenities, such as weather, air pollution and crime rates, as seen in the wages they require and the prices they pay for housing.

The other technique evaluates these costs by combining the actual out-of-pocket expenses associated with crime with the imputed costs from the pain, suffering and fear endured by crime victims. Mark Cohen computes these values for specific crimes for the first time in "Pain, Suffering, and Jury Awards: A Study of the Cost of Crime to Victims" in *Law and Society Review* (1988). Both methods have their limitations. The hedonic approach has allowed researchers to derive a value for an index measure of crime, but not for specific crimes. Cohen's technique allows him to examine estimates for individual crimes, but not without sacrificing the market-based analysis of the hedonic models which estimates the costs of crime based on individuals' voluntary decisions.

I combine these two methods to obtain a market-based estimate for specific crimes. Incorporating a data set Cohen and I use for "The Effect of Concealed Weapons Laws: An Extreme Bound Analysis" in *Economic Inquiry* (1998), I obtain detailed nationwide information on specific crimes committed at the county level. Expanding other researchers' use of the US

Census Bureau's *Population and Housing Surveys* with hedonic models, I use multiple decades of information obtained from counties across the United States to create a panel data set.

Specifically I start with the type of analysis completed by Hoehn, Berger and Blomquist in "A Hedonic Model of Interregional Wages, Rents, and Amenity Values" in the *Journal of Regional Science* (1987). They study urban areas across the United States to examine specific amenities and disamenities that contribute to a quality-of-life index they examine.

Clark and Nieves focus this type of hedonic analysis on a more specific issue in "An Interregional Hedonic Analysis of Noxious Facility Impacts on Local Wages and Property Values" in the *Journal of Environmental Economics and Management* (1994). They expand the list of amenities and disamenities to examine within different metropolitan areas to include multiple noxious facilities to derive the negative impact of these disamenities relative to each other. In this way, they can attempt to show which type of facility has the greatest impact on living areas. With the data I collect for 1980 and 1990, including the crime rates of murder, rape, robbery, aggravated assault, burglary, larceny and automobile theft for multiple metropolitan areas, I isolate the effects that individual crimes have on housing prices and wage rates, as seen by individuals' and households' preferences changing over time. I then place a dollar value on the benefit of specific crime reduction, as perceived by their willingness to pay.

Hoehn et al. (1987) use a system of equations to find the comparative static results of changes in amenities on wages and housing prices. The pertinent partial derivation of this system yields  $f_r = k_r dq_r / ds - dw / ds$ , an equation for the marginal value of amenities at any given point  $r$  within the area, where  $k_r$  is the quantity of housing purchased and  $q_r$  is the product price of the local good (including transportation costs) at that distance. The first term is the effect on housing expenditures from the change in amenities, and the second term is the differential arising

in total earnings. They hypothesize that higher housing prices and/or lower wages would be accepted for greater levels of an amenity. Thus the implicit price of amenities could be computed from coefficients from housing and wage hedonic equations.

They utilize other information they acquire on proxies for amenities in the individuals' area of habitation. These include weather variables from the National Climatic Data Center, environmental concerns from the Environmental Protection Agency and urban variables they construct. With this information, they run regressions for separate wage and housing models using a limited Box-Cox format. Each model uses independent variables gleaned from the census information, accompanied with the variables for amenities or disamenities they have compiled. Their housing hedonic equation uses the dependent variable of monthly housing expenditures for 1980, and the wage hedonic equation uses a computed hourly wage rate in 1980 for the working individuals in the household.

For both the housing and wage equations to be estimated, I explore several different models, such as the semi-log and log-linear models. Clark and Nieves (1994) use the latter due to the certainty of the restrictions it places on the implicit price function, as opposed to the semi-log or limited Box-Cox models. For both model formats, the dependent variable for the housing price differential equation is the log of the gross monthly rental price paid for housing, including utility costs. The dependent variable for the wage differential equation is the log of the computed hourly wage rate derived from the individual's combined wage, salary and self-employment income. For either 1980 or 1990, I have information available for ninety-two urban areas for the wage equation and seventy-seven areas for the housing equation. The use of these metropolitan areas provides base rent and wage equation samples of 21,872 and 73,245 observations, respectively.

Correlations between the seven individual crime rates experienced within a metropolitan area may worry some researchers about collinearity affecting my results. Throughout the regressions I examine, some coefficients of the crime variables do not have the correct theoretical sign, and many are not significant, due perhaps to large standard errors that could be caused by multicollinearity. These concerns are warranted, and I try several different methods to test for the influence of collinearity on my results. Evaluating these regressions with these changes illustrates a potential problem with collinearity, but I believe that all crime rates should still be included. Any changes I find in the coefficients and significance levels of the crime variables, when testing multicollinearity, also occur throughout the analysis when I examine the use of other alternative models and variables. I do not assume a theory that espouses the effect of one crime on wages or housing prices, but purports that another has no effect. Thus I believe that all crime rates should be examined.

I also study the effect of these crime rates on specific groups of people differentiated on the basis of income. In terms of housing costs, I do find a stronger effect of crimes, except for burglary, on the relatively poor, commiserate with the hypotheses of Steven Levitt in "The Changing Relationship between Income and Crime Victimization" in the *Federal Reserve Bank of New York Economic Policy Review* (1999). This finding may reflect the fact that I am using data for renters only. This subset of the rich may be less able to engage in preventative measures, as opposed to homeowners, so a crime such as burglary may affect the rich more in my sample. When examining separate income groups in the wage equation, only the top quartile has any significant results for the crime variables, and it is for burglary, which is signed incorrectly. We may expect to find the stronger results from the rent regressions that I do due to self-selection within the sample. The crime rates being used are measured at the level of the

metropolitan area, but individuals may be segregated and living in different sectors within that area based upon their income levels. If so, different income categories may be experiencing different crime rates, which may affect their valuations of their housing costs, and not necessarily of their wages. Levitt (1999) notes this trend of segregation as a probable reason for the higher victimization of the poor.

For the purpose of policy analysis, it is beneficial to have these types of estimates of the specific costs involved. For example, Ridker and Henning study the effects of differences in air quality on property values in "The Determinants of Residential Property Values with Special Reference to Air Pollution" in *the Review of Economics and Statistics* (1967). After much research into this area, the Environmental Protection Agency now uses these estimates for cost-benefit analyses, and many states have enacted environmental costing for utility companies based on such research findings. Cohen, Miller and Rossman discuss how the application of criminal policy analysis could also benefit from specific cost estimates in "The Costs and Consequences of Violent Behavior in the United States" in *Understanding and Preventing Violence, Volume 4: Consequences and Control* (1994). To this point, the research used to evaluate the costs of specific crimes has focused on the actual costs incurred by the victim or society for the crimes committed.

The approach of evaluating the importance of (dis)amenities on a nationwide scale allows us to objectively view the individual's preferences over locations due to these (dis)amenities. Hoehn et al. (1987) construct a dollar value for the disamenity of crime, as measured by the average household. This value is determined in a market system by individuals being compensated through their wages and housing prices for the chance of becoming a victim of crime, and suffering the subsequent losses that Cohen (1988) describes. If the trade-off is too

great, the individuals can change their location and so consumption of housing and other amenities.

The hedonic approach seems to be the most direct route to estimating the cost of crime to individuals, as measured by their own choices. I expand this technique to estimate the value of reducing specific crimes. This last step is important for specific policy analyses. For example a larger police force may reduce overall crime, but other techniques such as tougher sentencing for specific offenses affect crime in a different way. All crime prevention techniques have price tags, but government agencies and individual communities may be able to use such value estimates of specific crimes to determine which programs pass a cost-benefit test.

The results are not as conclusive as I would have liked since the effects of the crimes vary between regressions. According to the formula for the evaluation of the marginal amenity price, the crime variables, as disamenities, should have a negative total effect. By the hedonic theory, the effect of these crimes would be negative on the housing component and positive on the wage component. My results show that the effect on the two components, and on the total effect, depends upon the functional form and the particular variables used in the regression.

What may be considered less convincing for this research is the number of changes that occur between the housing and wage components when the functional form is changed or when the variables are measured differently. The results must also be considered in the light that many of the coefficients of the housing and wage regressions are significantly labeled incorrectly. One may expect this result. We do not know the true functional form of the wage and housing price equations. My intent is to estimate various specifications, as many other researchers have done in the past, to test for a robustness of findings to form a reasonable estimate of individual crime effects on households and individuals across the United States. Unfortunately I find that several



of the individual crime variables are still incorrectly classified as amenities, even with these changes in the models and in the variables I examine.

In this paper, I first examine the regression equations including index crime variables for violent and property crimes, and not the individual crime rates. Unfortunately the results do not perform exceptionally well. The property crime index consistently has a positive total amenity value. Hoehn et al. (1987) and Clark and Nieves (1994) only use an index measure for violent crimes, so I do not know if they would find the same result as I did with the property crime index variable. This variable's inclusion may be proxying for a supply effect of crime. The dependent variables are measuring housing values and income in the rent and wage equations, respectively. As these measures rise, perhaps property crime is following the same trend. This explanation would probably not work as well for violent crimes, which may explain its better performance in the research. The violent crime index is classified as a disamenity in three of the four models when the index measures are used. Of these correct measurements, I calculate cost estimates for a ten-percent increase in violent crime ranging from \$17-66 per household annually in 1980-90 dollars. Hoehn et al. (1987) find an estimate of \$67 for a ten-percent change in this variable, and Clark and Nieves (1994) find a value of \$83, with both measured in 1980 dollars. So my estimates would seem to fall near an acceptable range based upon previous research.

When studying the effects of the seven individual crime rates, the results for the wage equation dominate the combined results for practically all outcomes, both within the log-linear and semi-log models. In both model formats, rape, robbery and larceny are the only crime variables that are consistently classified as disamenities with positive annual costs to households. Perhaps these three crimes are the only ones which residents consider in their wage and housing decisions. Or again an argument for collinearity affecting my results could be made here. I do

find some strong correlation coefficients between these three crime variables and the remaining four, which are labeled as amenities in my analysis. In particular, robbery is highly correlated with murder, aggravated assault and auto theft in both the rent and wage samples. Burglary is correlated with both rape and larceny. Collinearity may be difficult to prove or disprove, but its impact should be considered in this context.

If these three crime variables do have an impact on households, the cost estimates I have calculated to decrease the crime rates for the marginal household from their means by ten percent annually range from \$4-42 for rape, \$51-93 for robbery and \$29-296 for larceny. However all effects are determined by the relative size of the rent and wage effects, as the two are of the opposite sign in all cases, except for murder in the log-linear model. This phenomenon seems to justify the use of both equations, as explained by other researchers, in determining the effect of (dis)amenities. If I use only the rent equation, my findings will be reversed. These ranges of dollar estimates also show the importance of the particular functional form and variables chosen for the estimation.

Using these cost estimates, I can calculate a cost per individual crime. Using the mean rate for rape of 46.5 crimes per 100,000 capita committed annually between my housing and wage samples, I calculate that the "average" rape costs a household \$6875 - \$72,192 in 1980-90 dollars, based upon each household in the "typical" metropolitan area in my sample being willing to pay \$4-42 annually to reduce rapes by ten percent. Similarly I can use the other cost figures above to find that a robbery costs \$2239 - \$4094 at a mean rate of 291 crimes per 100,000 committed annually and that a larceny costs \$8-89 if the mean crime rate is 3520 per 100,000 capita, as in my sample. These figures compare to a cost per individual of \$51,058 for rape, \$12,594 for robbery and \$181 for larceny, in 1985 prices, that Mark Cohen finds in "A

Note on the Cost of Crime to Victims” in *Urban Studies* (1990). Considering an average of 2.69 people per household, my range of cost estimates will be somewhat smaller than what he found for these crimes, but not out of the range for comparison.

Hopefully policy analysts can expand the research on these crime cost figures. Perhaps in the future, more detailed information may become available to better study the effects of individual crimes on a nationwide scale. I believe that significant hurdles may exist at this time in terms of obtaining data for such a task that does not involve problems with collinearity or specification. One possible later extension for other researchers or myself would be to use these kinds of estimates to study migration into and out of specific urban areas. My current study assumes migrants have no real effect on the equilibrium housing and wage prices found. Berger and Blomquist use this hedonic approach to study this topic in “Mobility and Destination in Migration Decisions: The Roles of Earnings, Quality of Life, and Housing Prices” in the *Journal of Housing Economics* (1992), incorporating changes in location-specific amenities with previously used disequilibrium wage gains. It may be interesting to study migration with a discrete choice model used by other researchers after measuring drastic changes in crimes within metropolitan areas, coupled with the type of cost figures I have derived.

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