NBER WORKING PAPER SERIES

DOMESTIC VIOLENCE: A NON-RANDOM AFFAIR

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Working Paper No. 1665

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
July 1985

The research presented in this paper was supported by a grant from the National Institute of Mental Health (NIMH). We gratefully acknowledge this support; however, NIMH's support for this work should in no way indicate the organization's aggreement with our approach or conclusions. We would also like to thank Richard Berk for his valuable comments on an earlier draft, David Ruppert for providing us with a bounded influence regression program, and Margaret Hazen and Mary Kokoski for programming assistance. The research reported here is part of the NBER's research program in Labor Studies. Any opinions expressed are those of the authors and not those of the National Bureau of Economic Research.

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ABSTRACT

In this paper, we develop and estimate a model of violence between romantically linked men and women. Physical violence is viewed as both a source of direct gratification and as an instrument for controlling the victim's behavior. Our model is a Stackleberg type model in which the assailant maximizes expected utility subject to the stochastic reaction function of the victim. Our model is estimated by a bounded-influence regression technique because the process generating violence appears to lead to a heavy-tailed error distribution.

Our empirical results suggest that increases in the assailant's (i.e. the male's) income serve to increase violence, while increases in the proportion of the year that he is employed serve to decrease violence. Further, the employment effect is larger than the income effect. By way of contrast, our results suggest that the effect of a change in the female's employment or income depends heavily on her economic status relative to the male's. Finally,we find that improvements in the female's opportunites outside the relationship significantly reduce the level of violence.

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I. Introduction

In the last two decades economists have widened their areas of interest to such non-market activities as marriage, divorce, and crime.[1] Following in this tradition, we have applied work on the economics of the family and the economics of crime to an issue which is currently receiving widespread national attention, namely, the issue of domestic violence.[2,3]

There is rather extensive evidence that violence within the family is neither new nor uncommon. The most comprehensive and nationally representative data available indicate that 16 percent of U.S. households (married or cohabitating couples) experienced physical violence in the 12 months prior to the survey and 28 percent experience violence at some time during their relationship (Strauss, Gelles and Steinmetz, 1980). In recognition of the breadth and scope of the problem the Attorney General's Task Force on Family Violence advises that "we must admit that family violence is found at every level of our social structure" (William L. Hart, et al., 1984, iv).

In this paper we develop and estimate a model of violence between romantically-linked men and women. Physical violence is viewed as both a source of direct gratification (e.g., direct enjoyment of the pain of another person or release of frustration) and as an instrument for controlling the victim's behavior. Our model is a Stackelberg type model in which the assailant maximizes expected utility subject to the stochastic reaction function of the victim. Randomness is an essential feature of a model in which

violence occurs for instrumental purposes. In a deterministic model, the dominant decision maker can easily exploit the other person's reaction function, and credible threats of violence can be sufficient to control behavior. Our theoretical model differs from dictatorial bargaining models of family decision making and from classical principal-agent models in that the dominant partner does not assure the other individual some minimum level of well-being. In contrast to these models, the dominant partner in our model accepts some probability that his or her decisions will result in the other person (agent) leaving the relationship.

Our model is estimated by a bounded-influence regression technique which limits the influence of small subsets of data on the estimated parameters. We choose such a technique because the nature of violence and early regression results both suggest a heavy-tailed error distribution.

To briefly summarize our empirical results, we find that increases in the assailant's (in our sample the male's) income serve to increase violence, while increases in the proportion of the year that he is employed serve to decrease the level of violence. Further, the employment effect is larger than the income effect. If the median male in our sample were to work one additional month and earn his average monthly salary, the number of violent incidents would fall significantly. By way of contrast, our results suggest that the effect of a change in the female's employment or income depends heavily on her economic status relative to the male's. For example, if the male's income is low and the female's high, then

further increases in the female's income serve to increase violence significantly. Finally, we find that improvements in the female's opportunities outside the relationship significantly reduce the level of violence. This finding is quite interesting theoretically since it supports the contention that opportunities outside the family affect the distribution of resources within the family. If external opportunities matter, bargaining models, such as the one developed in this paper, are more relevant than more traditional neo-classical models of family decision-making such as those developed by Becker.

The outline of the paper is as follows. In the next section, we briefly survey the relevant theoretical and empirical literatures, and in Section III we develop our model of domestic violence. We next, in Section IV, describe our data and present our empirical model. Section V contains our empirical results and the final section our conclusions.

II. The Literature

The existing literature on domestic violence is primarily descriptive with few attempts to model family situations that lead to violence[4]. In their summary of the National Conference for Family Violence Research, Finkelhor, et al. indicate a need to link "the study of forms of family violence and abuse to more well-established research literatures" and the need for "systematic theory building and testing" (Finklehor, et al., 1983, p. 12). The work undertaken in this paper is in part a response to these suggestions.

When developing our model we draw heavily on the economic literatures that model criminal activity and family decision making. Both of these literatures have been heavily influenced by Becker's pioneering work (Becker, 1968, 1973, 1974). In his 1968 article on crime Becker posits that an individual "commits an offense if the expected utility to him exceeds the utility he could get by using his time and other resources in other activities" (Becker, 1968, p. 176). Since 1968, Becker's model of crime has been extended and tested empirically. However, economic models of crime have by and large remained models of purely individual behavior.[5] Only for crimes against persons, such as murder, is the interaction between individuals considered. Even in these cases, the model is often structured as an individual optimization problem. For example, in Ehrlich's model of murder the interaction between the murderer and the victim is handled by having the victim's well-being enter the murderer's utility function (Ehrlich, 1975). The problem then reduces to one with a single individual, the murderer, as the decision maker.

By way of contrast, the family decision making literature has as its focus relationships between individuals. Models of family decision making are of two basic types: (1) models such as those developed by Samuelson (1956) and Becker (1973, 1974) that posit a single utility function for the family, and (2) bargaining models which use game theoretic approaches.[6]

Bargaining models of family decision making have been developed quite recently (see Manser and Brown, 1980 and McElroy and Horney, 1981). In these models the best opportunity for each individual outside the relationship establishes a minimum acceptable position within the relationship. Unlike models such as Becker's that posit one family utility function, the bargaining models assume that the family members have conflicting preferences and postulate an explicit bargaining structure to resolve conflicts. In bargaining models that treat the individuals in the relationship symmetrically, the outcome of the process is generally a Nash or a Kalai-Smorodinsky equilibrium. The alternative dictatorial bargaining models identify one individual as the dominant partner and impose a Stackelberg equilibrium; the dominant partner maximizes his or her utility subject to a constraint that the more submissive partner receives the minimally acceptable utility level for which the person will remain in the relationship.

The usual dictatorial bargaining model is in some respects appropriate for representing the behavior in violent relationships. As a bargaining model, it allows the male and female to have differing objectives as would seem likely in such relationships. The nonsymmetric treatment of family members in the dictatorial model is consistent with empirical evidence indicating that the male tends to be the dominant partner and the aggressor when violence occurs.[7,8]

Our reading of the family violence and sociology literatures suggests, however, that even the usual dictatorial bargaining model

does not adequately capture all the essential aspects of violent relationships. Violent relationships, even more than other relationships, tend to be unstable.[9] In terms of a dictatorial bargaining model, this means that the dominant person does not necessarily assure the other person the minimum utility level required for the individual to stay.

An additional complication in considering family violence and in relating it to other models of criminal activity is that the crime may not be an end in and of itself. The violence may also be a means of exercising control over the victim's behavior. In terms of the general literature on violence, the violence is both expressive and instrumental. Expressive violence provides an assailant with direct gratification; the gratification may result simply from pleasure in inflicting harm, or it may be the result of some indirect psychic improvement such as would occur if an individual relieved pent-up frustrations by striking out. By way of contrast, instrumental violence is used as a method of obtaining some other desired end, for example, forcing the victim to behave as desired by the assailant. The existing literature strongly indicates that domestic violence occurs for both instrumental and expressive reasons, and we seek to incorporate both motivations in our model.

III. The Theoretical Model

Consistent with the existing evidence, we assume that the male, the dominant partner and assailant in the relationship, has

expressive and instrumental motives for inflicting violence. To incorporate expressive violence we allow the level of violence to enter the male's utility function directly. Incorporating instrumental violence in the model is more difficult. We see the male as attempting to impose certain types of behavior on his partner. He does this by setting rules of behavior for his partner and credibly threatening violence if these rules are not obeyed. These rules might cover a number of aspects of behavior including the use of financial funds, contact with friends and other family members, and the provision of services within the home or directly to the male.

The male makes his choices in order to maximize his expected utility. To focus on violent aspects of the relationship we assume that his utility, if the relationship remains intact, depends only upon the level of services provided by his partner (z), the level of violence he inflicts on his partner (v), and the level of sanctions against him as a result of his violent behavior (c^m). His utility is an increasing function of the level of services and a decreasing function of the sanctions. His utility may be an increasing or a decreasing (eventually) function of the violence. The male determines rules of behavior for his partner and the violence level that will result if his rules are disobeyed. In its simplest form, the rules may be expressed as a minimum level of the services that he requires, $\bar{z}$, and the violence he will inflict if she disobeys, v^d, and if she obeys, v^o. The rule-setting is affected by his expectations concerning his partner's and external agents' reactions to his decisions and the resulting violence.

Modeling the male's expectations concerning his partner's reactions to his rules and the violence requires some care and leads to an interesting discovery. In models where the male knows the female's reaction with certainty [i.e., knows for any rule (z, v^d, v^o) whether the female will obey, disobey, or leave], no instrumental violence will be observed. In such models, the male sets the rules in such a way that it is never optimal for the female to disobey. She will either stay in the relationship and obey the rules or she will leave.[10] See Tauchen, Long and Witte (1983).

In order to allow for instrumental violence, we assume that the male's expectation of the female's utility has a random component. The random element may result from the inability of any one individual to know the preferences and alternatives of another, or from truly random elements in the female's behavior. We assume that the male has a perceived joint probability density function, g, for a random variable in the female's utility function if she remains in the relationship (ε) and for her utility in the best alternative outside the relationship ($\bar{U}^f$). The male does not know the realized values of the random variables when he makes the rules; the female knows the value when she chooses whether to obey, disobey, or leave.

It is somewhat simpler to model the uncertainty arising from intervention by external agents as a result of the male's violence. Existing evidence indicates that external intervention often takes non-monetary forms such as the disapproval of friends. To reflect this, we see the costs of external intervention as entering the

male's and the female's utility functions directly. Although the male is the culprit, external intervention may impose costs on the female as a result of exposing the violent nature of the family or as a result of direct court cost and legal fees paid from family income. Both the expected probability of external intervention (π) and the costs to the male (c^m) and to the female (c^f) are increasing functions of the level of violence.

In the remainder of this section we describe: (1) the female's choice problem in order to show how the probabilities of disobedience, obedience, and leaving are affected by his rules; (2) the male's choice problem in terms of setting the rules; and (3) the properties of the resulting Stackelberg equilibrium. The female's utility if she remains in the relationship is:

$$U^f(z, v, c^f, \varepsilon)$$

where U^f denotes the female's utility function and ε is the value of the random variable in her preferences (at least as perceived by the male). Her utility is an eventually decreasing function of the level of services and a decreasing function of violence and the random variable ε. To simplify our work we assume that the marginal utility of violence is a decreasing function of the random variable ε.

Given her partner's rules, the female's choices are to disobey, obey, or leave. If she disobeys, the female incurs violence, v^d, and chooses the level of services to maximize her expected utility, where her uncertainty results fom the possibility of external intervention. Her expected utility if she disobeys, is:

$$EU^{f,d}(z^d, v^d, \epsilon) = \pi(v^d)U^f(z^d, v^d, c^f(v^d), \epsilon) + (1-\pi(v^d))U^f(z^d, v^d, 0, \epsilon) \quad (1)$$

where z^d denotes the optimal level of services if she disobeys.

The female's second possible choice is to obey. The level of services must be at least $\bar{z}$, and in the interesting case the required level of the services acts as a binding constraint on her behavior. Her expected utility if she obeys is defined analogously to (1) above.

The female's third potential choice is to leave, in which case the woman's best alternative yields her utility level $\bar{U}^f$. For any realized values of the random variables, ϵ and $\bar{U}^f$, the woman compares the maximum utility levels if she obeys, disobeys, or leaves and makes the choice that gives her the highest expected utility.

As noted earlier, the male, like the female, seeks to maximize expected utility. However, the male's problem is more complicated than the female's as he has to estimate the probability that the female will make each of her potential choices. He estimates these probabilities from his perceived joint probability density function on the random variables, g. Formally, the male seeks to:

$$\underset{\bar{z},\, v^d,\, v^o}{\text{Max}} \quad EU^m \equiv p^d EU^{m,d} + p^o EU^{m,o} + p^l \bar{U}^m$$

where $EU^{m,d}$ and $EU^{m,o}$ denote the male's expected utility if the female disobeys and obeys, $\bar{U}^m$ is the male's level of utility in his best alternative to the relationship, and p^d, p^o, and p^l denote the male's expectation concerning the probability that the female disobeys, obeys and leaves the relationship, respectively.

The male's expected utilities are defined analogous to the female's. The male's expectation that the female will disobey is:

$$p^d = \int_{-\infty}^{\bar{\bar{\varepsilon}}(\bar{z}, v^d, v^o)} EU^{f,d}(z^d, v^d, \varepsilon) \int_{-\infty} g(\varepsilon, \bar{U}^f) d\varepsilon \, d\bar{U}^f$$

where $\bar{\bar{\varepsilon}}$ is the value of ε for which the female is indifferent between disobeying and obeying given the required level of services and the threatened violence levels. His expectations of p^o and p^1 are defined analogously.

Given the above model, we can determine the first order conditions for an optimum. (See Tauchen, Long, and Witte, 1983, for this derivation.) Even with rather strong assumptions on the form of the utility functions (e.g., additive separability) and on the probability density function, the signs for the comparative static results are ambiguous. For example, consider the effects of an improvement in the woman's opportunities outside the relationship (e.g., greater support from public or private agencies). Such an improvement has two distinct and opposing effects on the threatened level of violence, even in the simplest case where violence is used only for instrumental purposes. First, when the woman has better opportunities, violence becomes a less effective means of obtaining obedience. Threatening violence is less likely to induce her to obey rather than disobey, and the optimal level of threatened violence falls. Second, with an improvement in her opportunities, the probability that she stays, ceteris paribus, is lower. Thus the probability that the relationship remains intact and that the male inflicts violence and bears the costs associated with violence are

less. With a lower probability of bearing the cost, the optimal level of threatened violence rises. The relative magnitude of these two effects is ambiguous, and thus the effect of an improvement in her opportunities on the level of violence is an empirical question.

IV. The Empirical Model and Data

The theoretical model presented in the previous section has two important implications for empirical work. First, the model suggests three jointly determined, reduced form equations: one each for the level of rule setting, disobedience, and violence. There is no identified structural system in which any of these endogenous variables appear as right hand side variables. Second, the model implies that all exogenous factors in the model enter all equations.[11] The exogenous variables in the model are of four basic types: (1) variables reflecting the characteristics of the relationship (e.g., number of children, family income); (2) variables reflecting the male's and female's situation if the relationship were dissolved (e.g., whether the couple is married, number of young children); (3) variables reflecting the tastes and preferences of the male and female (e.g., racial/ethnic group, age); and (4) variables affecting the probability and cost of external intervention as a result of the violence.

The data used in the empirical analysis are from interviews with 125 women who had been physically abused by their male, romantic partners. The interviews were conducted in 1982 and 1983 with women recruited in Santa Barbara County, California. Most of

the women (60 percent) were identified by personnel of local shelters for battered women or a special victim/witness assistance program in the county district attorney's office. The remainder were recruited through personal contacts of interviewers, counselors, lawyers, Catholic service agencies, classes, or using snowball sampling techniques. Care was taken to achieve accurate results by conducting the interviews face-to-face soon after the women were identified and by paying a nominal amount ($25).

While this data set is not idea for studying domestic violence, it represents one of the most extensive and complete data sets currently available for studying this sensitive and important topic. We believe that results we obtain using these data provide interesting insights concerning our model, but generalizations must await more representative data sets.

Table 1 contains a list of the endogenous and exogenous variables used in our empirical work and descriptive statistics for the variables. The measure of violence is the number of violent incidents that the women reported to have occurred in the 6 months prior to the interview. The measure of male rule setting is the number of areas in which the female reported that the male set rules with which she disagrees.[12] The measure of disobedience is the number of areas in which the male sets rules and the female both disagrees and disobeys.

The exogenous variables are divided into an economic and a noneconomic category in Table 1. The economic category includes the male's and female's income and employment. AFDC payments are not

attributed either to the male or female. Under California's AFDC-U program the male may receive payment while the family is intact; however, the female is more likely to receive the payments if the family were to dissolve.

Careful consideration of our measure of male employment led us to delete 14 aged and disabled men from our data set. We did this to allow unambiguous interpretation of a value of zero for the male employment variable as indicating unemloyment of an able-bodied male.

The noneconomic category include sociodemographic variables (e.g., age and race), variables which measure the characteristics of the relationship and costs of ending it (e.g., the number of children, marital status), and variables reflecting the opportunities available to the male and female if the relationship were ended (e.g., the number of children less than six and the availability of alternative living arrangements for the female).

The coefficients on the racial/ethnic variables must be interpreted with care as they may well incorporate indirect as well as direct effects on violence. The indirect effects result from the potential relationship between the male's and female's racial/ethnic group and the probability of arrest for an incident of domestic violence in Santa Barbara County. We discovered this indirect effect while working with a Santa Barbara data set collected in 1978. This data set had information on whether or not an arrest occurred as a result of an incident of domestic violence. Using these data, we estimated a model for the probability of arrest.[13] Most variables significantly related to the probability of arrest

related to the nature of the violent incident. These variables are endogenous to our model of violence and, thus, should not enter the reduced form equations that we estimate. However, our results also indicated that black males and males with minority female partners are significantly more likely to be arrested than are other males. Racial/ethnic variables are clearly exogenous to the model and, thus, should enter the reduced forms not only because different racial/ethnic groups may have different proclivities for violence (the direct effect), but also because it appears that they face different probabilities of arrest (an indirect effect).

V. Empirical Results

We began by examining OLS and Tobit results for the violence equation with all the variables listed in the second part of Table 1 appearing in linear form. The Tobit technique was considered because the endogenous variable, the number of violent incidents during the six month period, is censored at zero. In our sample, the number of violent incidents ranges from zero (14 percent of the sample) to 180 (daily beatings for 2 percent of the sample). The correct specification of a model with a censored dependent variable depends on the extent of censoring and the conditional distribution of the non-censored observations. Recent Monte Carlo results suggest that when it is reasonable to assume a truncated normal distribution for non-censored observations, OLS and Tobit analyses produce virtually identical results when the concentration at the censoring point does not exceed 20 to 25 percent of the sample.[14]

Comparing the estimated OLS and Tobit parameters for our model confirms this result. To our concern, however, both techniques yield a number of abnormally large Studentized residuals. There are several possible explanations: (1) data errors, (2) misspecification of the model due to omitted variables or incorrect functional form, and (3) incorrect distributional assumptions.

We checked for data errors using techniques developed by Belsley, Kuh and Welsch (1980). Given the extensive hand and computer cleaning of the data, it was surprising to us to find six observations where answers to questions were inconsistent. We were able to correct two of these errors by going back to the coding forms and were forced to delete four other inconsistent observations from our sample.

To examine the specification of the model we checked various plots of the residuals but found no patterns suggestive of omitted variables. Nor did careful consideration of the characteristics of the outlying observations suggest any additional independent variables. We did note, however, that for most of the outlying data points the frequency of violence was high (> 20 incidents in a six month period). As a final check for omitted variables we altered the measures of some independent variables and added other variables to our specification. The coefficients on the new variables were either insignificant or less significant than the alternative measure in our previous specification.[15]

To explore the possibility that we had used an incorrect functional form, we added quadratic and interaction terms for all economic variables. The new specification for the economic variables can, of course, be considered a second order approximation to any non-linear form. Given our sample size it was not possible to consider second order approximations for the non-economic variables.

In all specifications considered, normal probability plots of the Studentized residuals reveal an upper tail that is thicker than can be accounted for by a normal distribution. We believe that the process generating the large residuals is the potentially uncontrollable nature of violence once it has reached a high level.

We estimate our model using a bounded influence regression technique (BIR) developed by Krasker and Welsch (1982). This technique limits the bias in results due to departure from normality, or other misspecification, while minimizing the asymptotic variance of the normal model subject to a bound on the asymptotic gross error sensitivity. An advantage of the BIR method is that it can be used when, as in our case, the gross error distribution may be assymetric. We selected this robust estimation method after considering a number of other possibilities. See Tauchen, Witte and Long (1984) for a discussion.

Table 2 contains both OLS and BIR results. The large differences between the least squares and BIR results are immediately evident. For some variables the coefficient estimates differ by a factor of ten. The message is clear: OLS, and by

extension, Tobit parameter estimates contain substantial bias and, thus, these techniques are inappropriate for our model. Further, use of the BIR technique rather than OLS markedly improves the "fit" of our model. An improvement in fit is to be expected when anomalous observations are downweighted as they are in BIR, but even so the increase in the F-statistic and R^2 is rather striking.

Since the economic variables enter our model in a non-linear form, it was necessary to use Wald tests to determine the significance of these variables. We find that all of the economic variables except the proportion of the time that the female is employed are significantly related to the number of violent incidents at the .001 level; the female's employment is significantly related to the number of violent incidents at the .01 level. With many of the second order terms in the economic variables being significant, the effects of changes in the economic variables depend on the level of income and employment and cannot easily be described by examining only the indivdual coefficients. Accordingly, we computed the elasticities for effects of changes in the economic variables for values of income and employment representative of our sample.

Our results suggest that the frequency of violence depends on both income level and source. At median values for all independent variables, an increase in the male's weekly income is associated with a significant increase in the violence, ceteris paribus ("t-ratio" = 3.52). The elasticity of the number of violent incidents with respect to the male's income is 1.12 at the

median. Thus for individuals representative of our sample, increased income may actually serve to increase violence. Indeed, for couples in which the male's income is at or below the median, we find that an increase in his income is associated with a positive or zero effect on violence regardless of the victim's income and either partner's employment. Further, for non-working men, increases in income (i.e., increases in unearned and non-AFDC income) always serve to increase violence. Only for high income males are increases in income ever associated with less violence.

We find that the level of violence decreases significantly as the fraction of time the male is employed increases at median and most other values representative of our sample. Indeed, when significant, the effect of increased employment for the male is always negative, and is stronger the higher is the couple's income. Further, increases in male employment have far stronger effects on violence than do increases in male income (an elasticity of -3.74 and 1.12, respectively). If a male representative of our sample works one additional month and earns his average monthly salary, the number of violent incidents falls significantly. The negative employment effect on violence more than offsets the positive income effect.

This strong employment effect contrasts sharply with the vast majority of work on the relationship between crime and employment.[16] Our work in this study suggests that the weak results in the literature may stem from: (1) inadequate measures of income, (2) use of a 1/0 (employed vs. unemployed) measure rather

than a continuous measure for employment, or (3) use of too simple a functional form.

The effects of changes in the female's income and employment do not parallel the effects of such changes for the male. For values of the independent variables at the median for our sample, neither changes in the female's employment nor changes in her income have a significant effect on violence. Changes in the female's income significantly affect violence only when the income level of the male and female differ markedly. For example, if the male's income is low (at or below the median), then further increases in the female's income serve to increase violence significantly. In contrast, if the male's income is high and the female's low, then increases in her income may serve to lower significantly the frequency of violence.

Changes in the female's employment significantly affect violence for only two types of families: (1) high income families and (2) low income working families. In very high income families, an increase in the time the woman spends working is associated with a significant increase in the frequency of violence. In low income working families, an increase in employment (and accompanying changes in her income) serve to lower violence. One possible interpretation of our finding is that increases in female employment may only have beneficial effects if the need for income is pressing.

A comparison of the effects of changes in employment for the male and female provides some insights concerning the reason for the strong employment effect for males. Increases in employment have a number of potential effects on violence: (1) income effects,

(2) psychological effects, (3) physical effects, and (4) time effects. As we are controlling for income, we know that the effect of employment we observe is not an income effect. Our quite different results for the effects of employment for the male and female also suggest that the major cause of the strong effect of male employment does not arise mainly from the reduced time together for employed couples (i.e., the "time at risk" factor). We are left with the conclusion that increases in male employment serve to decrease violence primarily because of beneficial psychological effects (e.g., increased self-esteem) or because of physical effects (e.g., increased fatigue).

Approximately 30 percent of the families in our sample receive AFDC payments. For these families increases in AFDC payments, or in the victim's income from any other sources, serve to lower the number of violent incidents. Other results described previously for non-AFDC families tend to be even stronger for AFDC families. The one difference in results involves the victim's employment. For AFDC families, increases in the female's employment are more likely to be associated with higher violence.

Since the noneconomic variables enter the model linearly our results for these variables are more easily summarized. In terms of the male's and female's ages (AGEM and AGEF), we find that older men beat more frequently, holding other variables including the woman's age constant, and that younger women are beaten more often. Like men who earn less than their partners, men who are older than their partner tend to inflict more violence. Note also that the coefficient on MARRIED is insignificant. Our results provide no

support for the claim that "the marriage license is a hitting license."

As mentioned previously, the level of violence is less (3.3 incidents less per six months) if the woman has family. friends, or an affordable motel where she can stay (STAY) when she feels threatened by her partner. This finding is consistent with our theoretical model and our choice of empirical technique. In terms of the theoretical model, it does appear that the male offers the female a better domestic situation when she has an immediately available housing alternative. Also, with a means of escape from the potentially violent situation, the woman is able to avoid the threatened outbursts against her. The immediately available escape seems to provide more real protection for the female involved in a violent romantic relationship than the longer term security and independence that a higher income level might seem to offer. The policy implication would seem to be that providing short-term shelters for victims of domestic assaults may be more effective in lowering the frequency of the violence than general income assistance payments.

Our results for the children variables clearly show a relationship between family characteristics and violence. Specifically, our results suggest that the relationship will, ceteris paribus, be more violent if the couple has parented more children together. At first glance this result might be interpreted as supporting the common hypothesis that a "trapped" victim with other responsibilities is more ready to tolerate violence. Note, however, the coefficient on the variable for the number of her and

their young children (CHILD>6). With more young children in the family setting, there is less violence. Generally, this result together with the finding that higher income women may suffer more rather than less violence, contradicts the common notion that violence is more prevalent when the woman has fewer financial resources of her own and more financial responsibilities. Not unsurprisingly, the presence of children from other relationships (STEPCHLD) is associated with more violence.

As shown by the coefficients on the racial/ethnic variables, we find no difference in the frequency of violence across racial/ethnic groups. Whatever differences there may be in the characteristics of the groups in regard to domestic violence may be exactly balanced by differences in the perceived probability of criminal justice system actions across the groups. Recall from the previous section that black males and males married to minority females are more likely to be arrested for domestic violence, other things equal. Thus, it may be that the insignificant coefficients on the racial binaries are a result of offsetting direct effects (e.g., differences in behaviors and attitudes) and indirect effects (i.e., differences in the perceived probability of arrest).

We also estimate models of rule-setting and disobedience. We use a maximum likelihood ordered logit procedure since the dependent variable consists of a series of ordered categories. Having discovered anomalous residuals for our violence equation we checked for but found no similar pattern in the rule setting and disobedience equations. This lends considerable support to the

contention that the anomalous residuals in the violence equation are due to the non-normality of the distribution of the endogenous variable since other specification and response errors should appear in our rule setting and disobedience equations as well as our violence equation.

The rule-setting and disobedience models explain much less of the variance in the data than does the violence model. Specifically, the likelihood ratio statistic for our model of rule-setting is only significant at the .40 level; the comparable statistic for our model of disobedience is .14.

In the rule-setting equation the only economic variable that is significantly related to the extent of the male's rule-setting at the .05 level or better is the portion of time the male works. An increase in the fraction of time the male is employed tends to decrease the extent of his rule-setting, other things equal. This result seems to support our finding for the violence equation where the male was also found to be less physically abusive as the proportion of time spent working increases. The number of the couple's own children is the only other variable that is significant at the .05 level or better. The male tends to set more rules if the couple has parented more children together.

Non-economic rather than employment and income variables are significantly related to the female's disobedience. A woman is more likely to disobey her partner's rules if the couple has had more children, particularly if the children are still young. Further, Hispanic and younger men are less likely to be disobeyed, other things equal. Note that Hispanic men are not perceived to set

significantly more or less rules, but the rules they do set are less likely to be disobeyed.

VI. Conclusions

We believe that our theoretical and empirical work offer interesting and valuable insights. For example, since opportunities outside the relationship significantly affect the level of violence, it appears that a bargaining model, such as ours, more closely represents decision making for violent couples than do traditional neoclassical models. Also, our findings suggest that violence may be a resource that the male uses to maintain control when disadvantaged or challenged in other ways (e.g., relatively lower in economic status or older than the female). There is a literature which views individuals as using physical as well as other resources to maintain control in relationships (e.g., Scanzoni, 1979); however, we know of no work incorporating this effect for violent relationships.

From a purely theoretical perspective, we believe that our model provides an interesting extension of principal-agent and other bargaining models of relationships. In contrast to existing dictatorial bargaining models and principal-agent models, we do not, in our model, impose the assumption that the dominant partner provides the other individual with the minimum utility level necessary to perpetuate the relationship. Rather, we see one partner as uncertain as to the other's behavior and opportunities. This partner, in making his or her decisions, accepts some

probability that the relationship will be terminated. We believe that this approach provides an interesting alternative to current models that allow relationships to be terminated (e.g., models of divorce).

FOOTNOTES

[1]Becker has been a dominant force in economic analyses in many non-market areas. For examples see Becker and Landes (1974) and Becker (1981). Although work in non-market areas has been dominated by Becker and the Chicago school, it has not been limited to Chicago. For examples of work by individuals not directly associated with the Chicago school see Heineke (1978), Manser and Brown (1980), McElroy and Horney (1981) Pollak (1983), and Schmidt and Witte (1984). Even work outside the Chicago school has, however, been greatly influenced by the Chicago approach.

[2]As far as we are aware there has only been one previous attempt by economists to analyze domestic violence -- Long, Witte and Karr (1983).

[3]National concern about domestic violence has been apparent in the popular press. However, it was not until 1983 when Attorney General William French Smith established a Task Force on Family Violence charged with "identifying the scope of the problem of family violence in America and of making suitable recommendations" (William L. Hart, et al., 1984, vi-vii) that the issue received the concentrated attention of the federal government.

[4]For historical and legal perspectives on domestic violence, see Davidson (1978), Dobash and Dobash (1979), and Martin (1976). For surveys of the family violence literature see Gelles (1980, 1982) and Straus, Gelles and Steinmetz (1980).

[5]For surveys of the theoretical literature see Heineke (1978) or Schmidt and Witte (1984). For surveys of the empirical literature see Blumstein, Cohen and Nagin (1978) or Cook (1980).

[6]See Pollak (1984) for a survey of models of family decision making.

[7]See Straus, Gelles and Steinmetz (1980) and Yllo (1983) for evidence concerning dominance in violent relationships.

[8]See Berk and Sherman (1983), Novack and Galaway (1982), and U.S. Department of Justice (1980) for evidence that suggests that the male is the assailant in 93 to 95 percent of the incidents of domestic violence.

[9]See Levinger (1966) and Pagelow (1981) for evidence.

[10]This property of the nonstochastic model is analogous to the well-know property of principal-agent models when the agent's effort can be observed accurately. In the case of the principal-agent model, the fee is structured so that the agent receives a very low reward unless the optimal effort is

forthcoming. In the nonstochastic family violence model, the male threatens a high level of violence and low utility for the female, if she disobeys. As in the principal-agent models, the constraint upon the male's rule-setting is that the female (agent) may leave the relationship if the rules are too strict. The optimal structure for the rules is such that purely instrumental violence for disobedience of the rules is never observed.

[11]This may seem odd at first glance, but it is the nature of bargaining models that the characteristics of each participant may affect all decisions.

[12]We felt that male rules with which the female agrees were non-binding and, thus, irrelevant for the purpose of testing our model.

[13]See Tauchen, Witte and Long (1984) for details of the analysis of the probability of arrest.

[14]These Monte Carlo experiments were conducted by Donald Waldman of the University of Colorado and David Guilkey of the University of North Carolina. Details can be obtained from Donald Waldman.

[15]In particular, variables measuring the length of the relationship and reporting stresses had coefficients that were insignificantly different from zero.

[16]See Long and Witte (1981) or Freeman (1983) for surveys.

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Table 1

Symbols, Definition, Mean Values and Standard Deviations of Empirical Variables

Symbol	Definition	Mean (N=125)	Standard Deviation
Endogenous Variables:			
VIOL	The number of violent incidents in the six months prior to incident that led to the interview	10.56	28.67
RULES	The number of ares[a] in which the male has strong ideas on a particular topic and the female disagrees	4.70[b]	2.74[b]
DISOBED	The number of areas[a] in which the male has strong ideas and the female both disagrees and disobeys	1.19[b]	1.27[b]
Exogenous Variables:			
Economic:			
INCM	Male's weekly income from all sources except AFDC	$231.81	$211.20
INCF	Female's weekly income from all sources except AFDC	$127.14	$128.27
WORKM	The fraction of the year that the male was employed	0.69	0.38
WORKF	The fraction of the year that the female was employed	0.56	0.42
AFDC[c]	Family's weekly receipt of AFDC payments	$ 27.78	$ 49.67

Table 1
(continued)

Symbol	Definition	Mean (N=125)	Standard Deviation
Non-Economic:			
AGEM	The male's age in years	30.61	7.02
AGEF	The female's age in years	27.68	6.71
CHILDTG	The number of children from the relationship	0.92	1.06
CHILD<6	The number of her and their children who are less than six years old	0.78	0.85
STEPCHILD	The number of his or her children living with her	0.38	0.79
HISPANM	A binary variable equal to one if the male is Hispanic and zero otherwise	0.33	0.47
BLACKM	A binary variable equal to one if the male is black or other non-Hispanic minority[d] and zero otherwise	0.14	0.35
MNRTYF	A binary variable equal to one if the female is minority[e] and zero otherwise	0.26	0.45
MARRIED	A binary variable equal to one if the male and female have ever been married and zero otherwise	0.72	0.45
STAY	A binary variable equal to one if the victim had a place to stay if she left the relationship and zero otherwise	0.73	0.45

Notes to Table 1

[a]There are twelve areas in which we discerned the male's rule-setting behavior and the female's reaction to the rules set. The areas are: working outside the home, having a bank account, having credit cards, handling household finances, giving her money to the male, taking responsibility for household work and child care, seeing her women friends, seeing her relatives, talking on the phone, calling or seeing the male during the day, and sexual relations.

[b]The sample size used when calculating these numbers was 99, not 125, due to missing values in these variables.

[c]We did not attribute AFDC payments to either the male or female since California has an AFDC-U program and, thus, payment often went to the family unit. There was very little income other than AFDC that was received jointly by the victim and assailant.

[d]The racial/ethnic group denoted BLACKM includes black, Indian, Asian, and other males.

[e]The racial/ethnic group denoted MNRTYF includes Hispanic, black, Indian, Asian, and other females. There were too few minority females to allow us to create two binaries as we did for the males.

Table 2

Results of the Analyses of the Number of Violent Incidents
("t-ratios" in parentheses)
(N=125)

Exogenous Variables	OLS	Bounded Influence Regression
Economic Variables		
INCM	0.2904*	0.0715***
	(1.94)	(2.76)
$(INCM)^2$	0.36×10^{-4}	-0.36×10^{-4}**
	(0.27)	(-2.52)
INCF	-0.0996	0.0012
	(-0.77)	(0.05)
$(INCF)^2$	0.27×10^{-4}	0.32×10^{-4}
	(0.09)	(1.12)
(INCM)*(INCF)	-0.64×10^{-4}	-0.23×10^{-4}
	(-0.22)	(-1.16)
AFDC	-0.2668	0.1164***
	(-0.82)	(2.68)
$(AFDC)^2$	-0.13×10^{-2}	-0.15×10^{-2}***
	(-0.37)	(-2.81)
(AFDC)*(INCM)	0.13×10^{-3}	0.22×10^{-3}***
	(0.16)	(2.70)
(AFDC)*(INCF)	0.39×10^{-3}	-0.25×10^{-3}
	(0.28)	(-1.29)
WORKM	-129.165**	4.5418
	(-2.50)	(0.48)
$(WORKM)^2$	195.313*	5.5197
	(1.73)	(0.24)
(WORKM)*(INCM)	-0.3377*	-0.0733**
	(-1.88)	(-2.26)
(WORKM)*(INCF)	0.0091	-0.0254
	(0.06)	(-1.31)
(WORKM)*(AFDC)	0.1729	-0.1199***
	(0.56)	(-3.16)
WORKF	-15.5875	11.3832
	(-0.37)	(1.48)
$(WORKF)^2$	-15.9357	-20.7678*
	(-0.21)	(-1.65)
(WORKF)*(WORKM)	21.859	-10.8166
	(0.50)	(-1.43)
(WORKF)*(INCF)	0.0904	0.0260
	(0.63)	(1.13)
(WORKF)*(INCM)	0.0349	0.0288**
	(0.45)	(2.55)
(WORKF)*(AFDC)	0.3007	0.0420
	(1.00)	(1.08)

Table 2
(continued)

Exogenous Variables	OLS	Bounded Influence Regression
Non-Economic Variables:		
AGEM	0.7256	0.2899***
	(1.21)	(2.68)
AGEF	-1.4799***	-0.5848***
	(-2.23)	(-4.79)
CHILDTG	2.9830	1.9600***
	(0.80)	(3.51)
CHILD<6	1.2618	-2.4086***
	(0.27)	(-2.79)
STEPCHLD	5.4283	3.2112***
	(1.33)	(3.86)
HISPANM	-2.1330	1.4748
	(-0.28)	(1.19)
BLACKM	4.4899	1.1317
	(0.54)	(0.73)
MNRTYF	9.3299	1.0943
	(1.27)	(1.10)
MARRIED	-7.9140	-0.7438
	(-1.17)	(-0.67)
STAY	-13.9232**	-3.2880***
	(-2.23)	(-2.98)
CONSTANT	74.6947***	7.7493***
	(3.36)	(2.58)
Test for significance of model (significance level)	1.48 (>.078)	14.73[a] (>.001)
R^2	0.32	0.82[b]

*Indicates that the coefficient is significantly different from zero at the .10 level, two tailed test.

**Indicates that the coefficient is significantly different from zero at the .05 level, two tailed test.

***Indicates that the coefficient is significantly different from zero at the .01 level, two tailed test.

[a]This statistic is based on the Wald test and is distributed $F_{30,94}$ under the null hypothesis that the coefficients on all independent variables are jointly equal to zero.

Table 2
(continued)

[b] This "R^2" figure was calculated by noting that in OLS the likelihood ratio test statistic used to test the joint significance of the explanatory variables is:

$$F_{p-1,N-p} = (N-p/p-1)\ (R^2/1-R^2)$$

where p is the number of parameters estimated and N is sample size. The F-statistic that we obtain for our bounded influence regression would imply an R^2 of .82.