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The Private Provision of Public Goods: What Factors Help Predict the Private Supply of Neighborhood Watch Programs?

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# The Private Provision of Public Goods

### What Factors Help Predict the Private Supply of Neighborhood Watch Programs?

#### Abstract

The private provision of public goods represents an important issue within discussions of economic decisions. Historically, economists believed that private agents could not succeed in privately supplying public goods at an efficient level due to incentives for free-riding. New theories and economic experiments developed within the last thirty years, however, have brought that conclusion into question. Now, economists recognize that under certain conditions, private agents have the potential to supply public goods without government intervention. This paper uses an empirical investigation of Neighborhood Watch participation in the city of Chicago to analyze what demographic factor, if any, influence the private supply of public goods. This paper finds surprising evidence that population characteristics like group heterogeneity do not play a measurable role in determining Neighborhood Watch involvement. Instead, this paper finds evidence that variables measuring the duration of interaction between residents and the costs and benefits of Neighborhood Watch program better explain variations in participation.

## I. Introduction

In 1954, Paul Samuelson wrote *The Pure Theory of Public Expenditure* and with it helped introduce economists to a formal treatment of public goods. In his paper, Samuelson proclaims that it is impossible for economic agents to efficiently supply public goods without government intervention (Samuelson, 1954, 388). Fifty years later that claim no longer seems true. Instead, economists continue to produce theories and situations where private agents cooperate to efficiently produce non-rival, non-excludable goods and services (Bagnoli and McKee 1991). Many of these theories identify experimental mechanisms that allow citizens to reach an efficient level of supply under their own volition (Gradstein, 1994), (Smith, 1980), (Chander, 1993). In order to accurately evaluate the potency of these mechanisms, however, economists must know more about the influences that affect an agent's decision to help supply a public good.

This paper proposes to investigate the private provision of public goods by examining the demographic effects associated with successful Neighborhood Watch programs. In 1972, after its inception, the Neighborhood Watch program served as a means for local officials to disseminate crime statistics and instructions for securing private residences against burglaries. From those beginnings, the Neighborhood Watch grew into a program focused predominantly on encouraging citizens to monitor their neighbors' property in case of theft and report any suspicious activity. Today, thousands of citizens in the U.S. maintain community watch programs dedicated toward reducing crime and fostering neighborhood cooperation.

At a fundamental level, community policing programs qualify as public goods. Every neighbor within a reasonably small area can enjoy the protection offered by community vigilance without limiting anyone else's consumption. Consequently, community monitoring is non-rival for all individuals within the same neighborhood. Furthermore, at the most basic level, citizens cannot exclude one another from the protection offered by a successful Neighborhood Watch. Even if a group of neighbors wanted to exclude a specific home from their protection, it would be unusual for a prospective criminal to have enough information to be able to exploit that sort of

selective protection. Instead, it seems reasonable to treat community watch programs as non-excludable goods as well.

The non-rival and non-excludable attributes of the Neighborhood Watch, coupled with its community-oriented supply make it an ideal focus for discussions of the private supply of public goods. Although community watch programs often receive government support, the burden of provision lies almost entirely on the shoulders of private citizens. In general, citizens elect community members to serve as program coordinators and block captains (Neighborhood Watch, 2004). These individuals organize meetings, distribute information and direct their neighbors in crime prevention steps. Some government assistance comes in the form of information and guidance on how to establish community watch programs. Local police bureaus may even assign officers to visit Neighborhood Watch meetings. These instances of government involvement are minimal, however. The police officers who attend meeting come at the invitation of private citizens and the community members perform the specific duties of organizing meetings and self-policing their neighborhoods. Consequently, it seems reasonable to consider Neighborhood Watch programs as privately supplied public goods.

The fact that citizens must privately supply Neighborhood Watch programs suggests that an investigation of the influences associated with this public good may help resolve questions about why people decide to cooperate. Section II introduces the background literature regarding cooperation and the private supply of public goods. It begins by discussing the classical theory expounded by Samuelson (1954) and Olson (1968) before moving into game theory discussions by Sen (1967), Runge (1984), and Sugden (1984). It concludes with an examination of the empirical frameworks

implemented by Vigdor (2004), and Ferrara (2002). Section III begins by describing the data set I use in my investigation and then specifies the parameters of my group logit model. In this section, I also describe the independent variables in my regression and their expected signs. Section IV provides a summary of my econometric results. I find statistically significant coefficients that suggest the duration of interaction between group members has a measurable influence on Neighborhood Watch participation. I also find that the relative costs and returns to the Neighborhood Watch, as measured by misdemeanor crime levels, police effectiveness and average number of children per household, influence community watch involvement. These results imply that the private supply of public goods will be influenced by the costs and returns of the public good and on the basis of group interactions. Section V critiques my model and provides suggestions for areas of future research. Section VI summarizes the findings of this paper, highlighting the implications of my research and suggests new areas for future research on Neighborhood Watch provision of public goods.

## II. Background and Context for the Private Provision of Public Goods

As mentioned above, the economic discussion of public goods began in earnest with Samuelson's seminal article in 1954. In *The Pure Theory of Public Expenditure*, Samuelson expresses the notion of a public good in concrete terms and gives a mathematical justification for why private citizens will undersupply public goods without government intervention. At the conceptual heart of Samuelson's theory for undersupply is the notion of 'free riding'. Samuelson claims that although most agents benefit from public goods "it is in the selfish interest of each person to give *false* signals, to pretend to

have less interest in a given collective consumption activity than he really has" (1954, 388-389). By falsely signaling, an individual can pay less than the marginal benefit he would receive from the public good and thus "hope to snatch some selfish benefit in a way not possible under the self-policing competitive pricing of private goods" (1954, 389). It follows that every rational economic agent will face this same temptation. Consequently, economists like Brubacker (1975) use Samuelson's theory to conclude that, under ideal conditions, no group member will contribute to the provision of a public good. Instead, Brubacker's theory, known as the 'strong free rider hypothesis' predicts that, when left to their own devices, economic agents will choose to give false signals and be unable to supply public goods in a group setting.

For over ten years, Samuelson's theories about free riders and the clarity he bestowed on the issue served as canon for how economists approached the provision of public goods.<sup>1</sup> In the 1960's and1970's, however, economists began introducing new theories and experiments that questioned Samuelson's claims (Smith, 1980). At the forefront of the effort to reevaluate the nature of public goods was Amartya Sen. Sen (1967) used game theory to develop a powerful, alternate description of the incentives that private agents face when they decide whether to produce a public good. In his analysis, Sen first identifies why economists like Samuelson and Olson believe free riding will always prevail over cooperation. Sen then identifies the mistaken assumptions in their analyses and provides an alternate description of the private provision of public goods.

Sen's theories rest on his belief that rational people, given the opportunity to negotiate among themselves, may succeed in supplying public goods efficiently. In order

<sup>&</sup>lt;sup>1</sup> For other notable contributions during this period refer to Olson (1968) and Hardin (1962)

to frame his discussion and address Samuelson's theories, Sen begins with an N-person prisoner's dilemma game. The N-person game is a natural extension of a simpler and more tractable 2-person game. In the 2-person version of the prisoner's dilemma, two people must decide whether or not to cooperate with each other (Axelrod, 1984). Figure 1 expresses one possible set of values for this game. Each cell in the figure represents an available combination of choices for person 1 and person 2. Person 1's payoff for each outcome is in the bottom left of each cell and person 2's payoffs are in the top right. Thus, if person 1 and person 2 both choose to cooperate, they will receive the pay-off (3, 3) in the top, left cell.





Sen begins his discussion of cooperation with this model because it establishes conditions under which Samuelson's theories hold true. In the prisoner's dilemma, the participants may not communicate with one another, they only play the game once and they make their decisions simultaneously. Sen draws the important conclusion from this game that it will always pay for both participants to not cooperate. To see this, examine the pay-off matrix from person 1's perspective. If person 2 cooperates, then person 1 will benefit most by not cooperating. If person 2 does not cooperate, then once again person 1 will benefit most by not cooperating. Thus for person 1, not cooperating is the dominant strategy and as a rational agent she will choose to do so every time. The matrix is symmetric so person 2 faces the same incentives.

Within the context of public goods, the decision to "cooperate" represents a commitment to help provide a public good and "don't cooperate" represents the decision to free ride. Even though the exact numbers in Figure 1 have little practical significance, it seems reasonable to believe that their relative values have grounding in the real world. Both people are better off with the allotment (3, 3) than (1, 1). This represents the benefit people receive from the existence of a public park or a town watchtower. Each person, however, has an incentive to not assist with the construction of a new park as long as her partner picks up the cost of providing it. These incentives are captured in payoffs (5, 0) and (0, 5). Furthermore, in a game played once, each person knows that her partner has a dominant strategy to not pay and consequently can expect her to do so. Thus, if the two people cannot communicate with one another, this model predicts that they will both maximize their expected wellbeing by not cooperating.

Sen does not accept the limited nature of the prisoner's dilemma, however, and he alters this model to encompass a different set of assumptions. Sen first expands the 2-person model to an N-person game. Now, N people must choose between cooperation and free riding. Furthermore, Sen claims that agents will cooperate (and improve their wellbeing) as long as he slightly modifies the conditions of their behavior. Specifically,

he requires that "in the special case where everyone else [cooperates], the individual now prefers to [cooperate] himself" (114). Figure 2 captures the payoffs for person 1 and person 2 under this new condition. If person 2 contributes, person 1 no longer benefits from not cooperating. Similarly, person 2 now prefers to cooperate whenever person 1 cooperates as well.

FIGURE 2



Person 2

Under these new conditions, each person no longer faces a dominant strategy to not cooperate. Consequently, free riding is no longer guaranteed. Instead, the outcome will depend on each player's expectations about his partner (114). Notably, if an individual believes that the other player will cooperate then he will maximize his wellbeing by cooperating as well. Under free communication, the agents will cooperate whenever they can successfully assure one another, before the game, that they are committed to cooperation. Sen recognizes, however, that it may be difficult for one agent to assure another that he will cooperate. Sen calls this difficulty the "Assurance Problem."

Runge (1984) builds on the game theory groundwork laid by Sen and argues that the Assurance Problem not only accurately describes human behavior accurately, but that economists should expect private agents to resolve it regularly as well. For Runge, countless institutions and organizations, both formal and informal, exist that promote cooperation. As Runge puts it, "there may be significant incentives internal to any group to develop institutions which promote voluntary contributions to public goods" (171). Runge claims that in most communities people are able to bring social networks and customs to bear on their fellow members. These potential channels of persuasion can allow group members to assure themselves that other members will contribute to public goods. The question of whether economic agents will privately provide a public good now becomes a question of whether a group will be able to establish and maintain the networks necessary for enforcing cooperation.

Ames and Marwell (1979) demonstrate empirically, however, that people may cooperate even when they lack assurance networks and cannot communicate with each other. In an economic experiment, Ames and Marwell divide 256 high school students into small groups and ask them to participate in a version of the prisoner's dilemma. In the experiment the students choose to allocate resources between a public good and a private good. Ames and Marwell construct the public good in such a way that it has a minimum provision level and an optimum provision level. Prior to the experiment, the authors anticipated that the students would fail to supply the minimum provision level and instead, "this experiment [would] demonstrate the tremendous power of the free rider

problem to destroy investment in collective goods (1979, 1359)." Surprisingly, the authors find that the typical investment in the second exchange is well above the mean value of zero predicted by the strong free rider hypothesis. This suggests that the incentive to free ride may not be as compelling as economists once thought. Nevertheless, these results do not discredit Samuelson's theories entirely. The students did not approach the optimum provision level in their investments and, as a consequence, the authors revise their hypothesis and conclude that "free riding probably does occur but only in the behavior of some subjects, and usually only to a mild, rather than strong, extent" (1979, 1350). The surprising implication of these results is that people may not need to communicate in order to choose cooperation.

Akerlof (1983) uses his theory of loyalty filters to explain why people might solve the Assurance Problem without communication networks. For Akerlof, a loyalty filter is any experience that causes an individual's values or loyalties to change (54). He draws upon psychological studies of parenting and descriptions of human behavior to argue that people encounter value-changing events throughout the course of their lives. For example, he classifies acts of parenting as loyalty filters. Thus, when a parent teaches her child to share with his sister or hold hands crossing the street the parent is imposing a loyalty filter on the child. The principle consequence of loyalty filters is that economists should no longer consider values as immutably fixed. Instead, economists can expect rational agents to adjust their values, and hence their behavior, as they encounter loyalty filters. Within the context of public goods, the presence of loyalty filters implies that group mores and social networks have the potential to alter a group member's values in such a way as to encourage solutions to the Assurance Problem. Consequently, the

participants in Ames and Marwell's experiment may have chosen to allocate tokens in the second exchange because they had previously encountered loyalty filter which encouraged cooperation.

Sugden (1984) suggests a synthesis of all these ideas and describes a model where issues of the Assurance Problem, group networks and learned behavior allow economic agents to successfully cooperate. Sugden's theory, 'the principle of reciprocity', stipulates that each member of a group will not free ride while other members cooperate. Sugden does not claim that his reciprocity model explains every form of group behavior. Instead, given the theories of Sen and Akerlof, it provides one plausible description of social behavior that will always lead to cooperation. In the reciprocity model, let there be some group G where every individual except i contributes at least a level of effort  $\alpha$  to a public good. Then let *i* choose the level of effort she would most prefer that every member of G should make. If this most preferred level is above  $\alpha$  then *i* is obliged to supply at least  $\alpha$  as well. Using this reciprocity model, Sugden shows that there will always be an equilibrium distribution of contributions from the group members (778). Whether that equilibrium corresponds to an efficient level of the public good depends, however, on the preferences of the members. Thus, the reciprocity model has the potential to describe the experimental results of Ames and Marwell. In that experiment, the participants all valued the second exchange and hence were obliged to help contribute, but the group preferences were such that the equilibrium level of contributions fell below optimality.

At the heart of public good analysis is the question of whether groups will succeed in creating social networks similar to the one described in the reciprocity model.

Economists have tried to create allocation mechanisms and models which will encourage the private supply of public goods (Gradstein, 1994), (Smith, 1980), (Chander, 1993). The incentives and models that they create must exist, however, within the context of a given group's demographics. In fact, economic theory predicts that the formation of social networks and solutions for the Assurance Problem will depend heavily on group characteristics.

Specifically, the relevant literature indicates that population size plays a critical role in determining whether a community decides to provide a public good (Isaac et. al., 1994), (Latané, and Nida, 1981). Economists disagree, however, regarding the influence of population size. Some economists argue that as population size increases, economic agents lose the ability to relate to one another and it becomes more difficult to informally resolve the assurance problem (Dijk and Widen, 1997). Other economists argue that as more agents become available to supply the public good, the likelihood that there will be agents willing to supply the good increases (Xiaopeng, 2001). A third argument claims that as the population size increases, the ability of a community to informally discourage free riding decreases and thus the probability that any individual agent will choose to supply a public good decreases (Xiaopeng, 2001).

Fortunately, population heterogeneity does not occupy an area of contention for most economists. Instead, economists seem to agree that dissimilarities among group members impede cooperation (Dijk and Widen, 1997). Alesina and Ferrara (2000) show that "empirical results on U.S. localities suggest that income inequality and racial and ethnic heterogeneity reduce the propensity to participate in a variety of social activities including recreational, religious, civic and educational groups" (Alesina and Ferrara,

2000, 850). In a paper summarizing the state of research on collective action, Ledyard (1995) concludes that age, similarity between people, group size, sex, and geography all influence the likelihood that people will cooperate. Notably, however, economists have found that religious differences between people in the U.S. do not inhibit trust (Alesina and Ferrara, 2002). The general links between population heterogeneity and cooperation suggest that the private supply of public goods will depend heavily on the demographic characteristics of a given group.

Despite the relative accord regarding population heterogeneity, economists disagree on how income inequality affects the private supply of public goods. Some argue that income inequality is merely another example of population heterogeneity (Dijk and Widen, 1997). Other economists maintain that public goods may be privately supplied when one community member is not credit constrained and values the good at the same level (or greater) than the minimal cost of its provision (Ames and Marwell, 1979). Under this assumption, the more community members with very high relative incomes the greater the likelihood one of them will choose to supply the public good. In the context of the neighborhood watch this second theory may have currency. In general, the block leader assumes the bulk of responsibility for organizing and directing the neighborhood watch. Without at least one person willing to provide the high level of effort associated with being a block leader it would be impossible to maintain a community watch program. Consequently, depending on the relationship between wealth and available time there may be a mixed relationship between income and the existence of a Neighborhood Watch.

Finally, economic game theory predicts that the amount of time agents spend interacting together will have a significant affect on their ability to solve the Assurance Problem. As Sen argues, the Assurance Problem can be modeled as an N-person prisoner's dilemma where participating agents decide whether to cooperate or free ride. Axelrod (1984) uses theory and empirical evidence regarding the prisoner's dilemma to show that if an agent decides not to cooperate in period t, then other group members will almost always take the opportunity to punish her (as far as they are able) in period t + 1. Thus, for an agent who knows that she will be playing a game with the same group, as the expected duration of the game increases the consequences of not cooperating will also increase. If, however, the agent knows that a game is finite and knows when it will end, then she will face stronger incentives to free ride. Consequently, the threat of punishment will be greatest if the players cannot predict when the game will end. Under this condition, the players will act as if the game's duration were infinite (Axelrod, 1984, 42).

All of these demographic considerations: population size, heterogeneity, income, and interaction time, may play a role in the supply of Neighborhood Watch programs. The current literature, however, often addresses the significance of these issues within the broad context of cooperation and bargaining. When economists test these theories empirically, they generally do so through experiments (Andreoni, 1988), (Bagnoli and McKee, 1991), (Cadsby and Maynes, 1999). Experiments allow economists to isolate relevant issues, control for external forces and measure the efficient level of provision. Despite these advantages, experiments represent an abstraction from reality and it seems reasonable to wonder how the theories perform under econometric analyses of real world public goods.

Vigdor (2004) presents an econometric analysis of how community composition influences that private supply of public goods by analyzing return rates for the 2000 U.S. Census. Vigdor claims that "because population counts based on the Census affect the distribution of federal grants to local areas, an uncounted individual costs his or her community roughly \$5,000 in present value over a ten year period" (303). As a consequence, Vigdor argues that people who submitted a mail response for the U.S. Census helped supply a public good to their local communities. In order to analyze what factors promote the completion of a mail response for the Census Vigdor constructs a logit model where the probability that an individual, *i*, belonging to social group, *j*, and residing in community, *k*, chooses to return her Census is a linear function of her individual characteristics, her community characteristics, and group *j*'s share of the population (305). Within this model, Vigdor includes demographic measures of race, education level, income, age, native language, family type, and homeownership.

In his analysis, Vigdor finds evidence that ethnic and social fragmentation influence cooperation with the Census. Specifically, he finds that an individual's propensity to respond to the Census increases by one percent when her racial group's share of the local population increases by 10 percentage points (307). Even more significantly, Vigdor uses educational attainment as a proxy for socioeconomic status and finds that response rates increase by 5.6 percentage points when an individual's group gains an additional 10-percentage point of the total share (309-310). These results provide suggestive empirical evidence that group heterogeneity influences response rates to the U.S. Census.

Ferrara (2002) presents an empirical investigation similar to Vigdor (2004) when she analyzes how demographic differences affect group membership in rural Tanzania. In order to analyze group participation, Ferrara constructs a probit model with a dichotomous variable for the regressand. The regressand takes on value 1 if person i belongs to any group within her village and 0 otherwise. Ferrara attempts to describe the incentives and conditions that individuals face when they decide to form groups. Group membership does not qualify as a public good, however, and on a theoretical level Ferrara's approach differs from the analysis presented by Vigdor (2004). Nevertheless, group participation and the private supply of public goods both require cooperation. As a consequence, it seems reasonable to expect that many of the variables that influence group participation will also influence the private supply of public goods. Consequently, on the right-hand side of her model, Ferrara includes variables like duration of residency, population size, tribal fractionalization, and demographic heterogeneity. As expected, her results agree with economic theory and Vigdor (2004). Ferrara finds that people who live in villages with higher inequality are less likely to be members of groups (267).

#### III. The Model

In order to analyze how demographic characteristics influence Neighborhood Watch participation I implement a model specification that agrees with the work of Vigdor (2004) and Ferrara (2002). Specifically, my model includes measures of population heterogeneity, population size, income, persistence of residency, and community cohesion. In addition, I include control variables that capture the crime

preventing nature of community watch programs. In particular, I use control variables measuring perceptions of crime and opinions about the local police force.

To perform an econometric analysis of Neighborhood Watch involvement, I need to quantify what it means for a household to have a member who participates in the program. A natural way to do this is to code each household in a community as a 1 if a member of the household participates in the Neighborhood Watch and 0 otherwise. The dichotomous nature of these responses, however, means that I cannot assume that the responses for this variable, Neighborhood Watch participation, follow the normal distribution. Consequently, I need to assume a new statistical distribution in order to structure my analysis. Furthermore, my dependent variable, Neighborhood Watch participation, does not range below zero or above one, so it seems reasonable to choose a distribution that also adheres to this zero-one constraint. As a consequence of these considerations, much like Vigdor (2004), I implement a generalized logit model to frame my analysis. In particular, I use a group logit model – a model which econometricians regularly use to describe the proportion of respondents from a group that share a given quality. If P<sub>i</sub> represents the proportion of people in community *i* who participate in a Neighborhood Watch program then I can describe my model algebraically as follows.

(4) 
$$\ln\left(\frac{P_{i}}{1-p_{i}}\right) = \beta_{0} + \beta_{1}YEARS + \beta_{2}OWN.RENT + \beta_{3}DENSITY + \beta_{4}CHILDREN + \beta_{6}AGE.MEAN + \beta_{7}INCOME + \beta_{9}NBHD.PART + \beta_{8}DENSITY * INCOME + \beta_{9}NBHD.PART + \beta_{10}POLICE.TREATMENT + \beta_{11}POLICE.EFECTIVE + \beta_{12}FELONY + \beta_{13}MISDEMEANOR + \beta_{14}RACE.HHI + \beta_{14}INCOME.HHI + \beta_{14}AGE.HHI$$

The first three variables, YEARS, OWN.RENT, and DENSITY capture the demographic characteristics that game theory predicts will be important in resolving the Assurance Problem. The variable YEARS represents the average number of years that respondents have lived at their current address. Game theory predicts that longer interaction times will encourage resolution of the Assurance Problem (Axelrod, 1984) so I anticipate a positive coefficient on this variable. OWN.RENT is the proportion of respondents who own their homes as opposed to rent. Home ownership represents a large fixed investment and it seems reasonable that, on average, home owners intend to remain in their neighborhoods longer than people who rent. Consequently, I use the proportion of home owners as a way to proxy how much longer, on average, residents expect to interact with one another. Game theory predicts that as the expected time span of future interactions increases, resolution of the Assurance Problem will become more likely so the coefficient on this variable should be positive as well.

The final game theory-based variable, DENSITY, captures population density and I calculate it by taking the ratio of residential parcels in a beat over total land-use parcels.

Due to the interconnected nature of police beats, I use this measure of population density in lieu of population size. As mentioned earlier, economic theory predicts that population size may encourage or inhibit resolution of the Assurance Problem (Dijk and Widen 1997), (Xiaopeng 2001). In rural Tanzania, it made sense for Ferrara (2002) to control for village population because the population of one village is disjoint from all others. The city of Chicago, on the other hand, represents a much more interconnected distribution of people. Furthermore, police beats do not cover uniform areas of land and instead contain roughly equal population sizes of 10,000 residents (The Greenhouse project). As a consequence, a measurement of population density should approximate the frequency of interaction between members of a community better than a measure of population size. A negative sign on this coefficient would indicate that greater concentrations of people impede the supply of community watch programs. Such a coefficient would support Dijk and Widen (1997) who claim that economic agents lose the ability to relate to one another as population size increases. Alternatively, greater population density may lead to a greater number of interactions between community members. If this is the case then, holding all else constant, population density may increase the likelihood that a group resolves the Assurance Problem.

The next four demographic variables, CHILDREN, AGE.MEAN, INCOME and DENSITY\*INCOME represent demographic control variables. CHILDREN measures the average number of children per respondent in a given police beat. This variable captures the incentives that parents and families may have to protect their children from crime and thus I anticipate its coefficient being positive. AGE.MEAN represents the average age of respondents from a beat and controls for any age-based variations in

Neighborhood Watch participation. I include this variable because the theories summarized by Ledyard (1995) conclude that the age of participants plays a role in facilitating cooperation. I anticipate this coefficient being positive as well because, on average, adults change their residence less frequently as they grow older and may choose to invest more effort in the maintenance of their neighborhood.

INCOME is the average income level in a beat in thousands of dollars. If the Neighborhood Watch were a normal good then its provision level should rise as incomes rises. Neighborhood Watch provision requires allocations of time, not money, however, and consequently, as a person's income rises the opportunity cost of devoting time to the Neighborhood Watch should increase as well. Thus, the coefficient on INCOME may actually be negative.

Finally, there also may be an additional affect generated by the interaction between rising income and rising population density. High density neighborhoods with high incomes are qualitatively different from high density, low income neighborhoods. Residences in high-density, high-income neighborhoods often require considerable income expenditure, whereas high density, low income neighborhoods represent some of the most violent areas of the United States. As a consequence, the last demographic variable in my model is an interaction term DENSITY\*INCOME. Due to the potentially conflicting influences of INCOME and DENSITY I find it difficult to anticipate the sign of its coefficient.

The next conceptual aspect of my model is neighborhood cohesion. In order to measure neighborhood cohesion, respondents were asked to describe whether they "feel a part of their neighborhood" or consider it "just a place to live". The two available

responses received integer values between one and zero respectively. I then averaged those scores within each beat in order to create a measure of the average number of respondents who feel a part of their neighborhood. I call this variable NBHD.PART and I anticipate a positive sign on its coefficient.

In order to control for the crime-fighting nature of the neighborhood watch, I also include variables that capture the affects of the Chicago Police Department. I obtain my data from a survey that included fourteen questions about perceptions of the Chicago police ranging from "how well do police prevent crime?" to "are police polite when dealing with the neighborhood?" Including every single measure of perception about the police in my model would probably contribute little, however. One would anticipate high colinearity between the responses and a tendency toward over specification. Consequently, I choose to aggregate these responses and create two proxy measures for satisfaction with the police. The first measure, POLICE.TREATMENT, is an aggregation of questions addressing how the police treat members of the neighborhood. The survey questions used to construct this variable cover topics like police politeness, helpfulness and fairness. The other measure for the police, POLICE.EFFECTIVE, captures respondent's opinions about the effectiveness of the police. It includes questions like "how well do police keep order?" and "how well do police help victims of crime?" It seems as though POLICE.TREATMENT should have a positive coefficient. When people feel pleased with demeanor of local police they should be more willing to assist in crime prevention measures. The effectiveness of police, on the other hand, may serve as a substitute for the Neighborhood Watch. Thus, I anticipate a negative coefficient on POLICE.EFFECTIVE.

It also seems clear that crime should play a role in determining the provision of a community watch. The data set I use, Skogan (2004), does not include direct measures of beat-level crime, however, and instead has survey responses about perceptions of crime. In a strict theoretical sense, the true crime level in a community should influence neighborhood watch participation. Nevertheless, residents' perceptions of crime ought to serve as a proxy measure for the actual crime level. Furthermore, it seems reasonable to expect residents to base their behavior on their perceptions of the crime level. Consequently, I use opinions about neighborhood crime to control for the influences of crime on Neighborhood Watch participation.

In order to measure perceptions of beat-level crime, I create two variables: FELONY and MISDEMEANOR. FELONY represents aggregate fears about felonies like gang violence and murders in the neighborhood and MISDEMEANOR captures fears about less severe crimes like vandalism. As crime rises, the potential returns to the Neighborhood Watch should increase. As a consequence, I anticipate the coefficients on both of these crime variables being positive. I do not expect the magnitudes of the two coefficients to be equivalent, however. Neighborhood Watch programs may succeed in deterring crime, but community policing programs do not have the same power to combat crime as an official criminal justice system. It seems unlikely that a Neighborhood Watch would be as effective at stopping felonies as it would be at preventing misdemeanors. Accordingly, I anticipate a larger coefficient on MISDEMEANOR than on FELONY.

The final variables in my regression seek to capture different aspects of population heterogeneity. RACE.HHI is the Herfindahl-Hirschman Index<sup>2</sup> (HHI) for race in each police beat. Similarly, INCOME.HHI and AGE.HHI represent HHI's for age and income. The races I use are African-American/Black, Hispanic/Latino, Caucasian, Alaskan Native, American Indian, Asian, Pacific Islander, Indian/Asian Subcontinent, Middle Eastern and Self-ID mixed race. Many police beats are predominantly Black, Hispanic or White, but no beat has more than 31% of its population belonging to all the other races combined. The income brackets I use are household annual incomes of less than \$10,000, incomes between \$10,000 and \$20,000, between \$20,000 and \$40,000, between \$40,000 and \$60,000, between \$60,000 and \$100,00 and over\$100,000. In order to measure the HHI for age I create adult age categories that range over ten years. Specifically, I consider people younger than 20, ages 20 to 29, ages 30 to 39, ages 40 to 49, etc. Economic theories, and the results obtained by Vigdor (2004) and Ferrara (2002), predict that population heterogeneity will hinder resolution of the Assurance Problem and thus I anticipate the coefficients on all these variables being negative. Table 1 summarizes the variables in my model and their expected signs.

<sup>&</sup>lt;sup>2</sup> The HHI is defined as the sum of the squared shares of a community held by different group. Thus, if there are *i* groups in a community and the share of the community held by each group is  $S_i$  then the HHI is equal to  $\sum S_i^2$ . The HHI can range from a maximum of 10,000 to a minimum of almost 0, where higher HHI's indicate less hetereogeneity.

# TABLE 1

Variable	Expected Sign	
YEARS	Positive	
OWN.RENT	Positive	
CHILDREN	Positive	
AGE.MEAN	Positive	
INCOME	Negative	
DENSITY	Negative	
INCOME*DENSITY		
NBHD.PART	Positive	
POLICE.TREATMENT	Positive	
POLICE.EFFECTIVE	Negative	
FELONY	Negative	
MISDEMEANOR	Positive	
RACE.HHI	Negative	
INCOME.HHI	Negative	
AGE.HHI	Negative	

## IV. Data

I obtained measures for all of the variables I use in my analysis from a data set gathered by Skogan (2004). The data were collected in order to generate information regarding the long-term effects of the Chicago Alternative Policing Strategy (CAPS). The CAPS program uses community meetings and on-foot patrol officers to encourage community involvement in crime fighting. In order to measure the success of this program, Skogan (2004) compiled data from 1993 to 2001 describing not only CAPS participation but community characteristics, perceptions of crime and perceptions of the Chicago police force. In the years 1998, 1999 and 2001, one of the many questions on the survey was whether anyone in the respondent's household participates in a Neighborhood Watch program. In this paper, I aggregate the survey responses from those three years to obtain measures of community characteristics and average Neighborhood Watch participation for each beat.

The CAPS program operates within the framework of the Chicago city police beats. Each police beat has community meetings devoted to preventing crime and a beat officer who patrols on foot. There are 25 police districts in Chicago containing 279 police beats. Pictured below in Figure 3 is a sample police district in Chicago and the beats within it. Each beat has roughly 10,000 residents with slight variation from one beat to the next. Skogan (2004) includes individual responses about demographic information, perceptions of crime and opinions about local police. For some beats the data set has very few observations – even after aggregating all three years worth of data. In order to avoid small sample size bias I only analyze police beats with at least ten observations. This limitation gives me a working sample size of 230 beats.

All the demographic information in this data set was obtained through telephone surveys. Each household was reached by random-digit dialing in order to avoid a sampling bias. In the survey, random-digit dialing was especially important for representative data because over one-third of sampled households had unlisted numbers. Within each household, one adult, eighteen years of age or older, was interviewed. The interviewee selected from each house was chosen randomly according to whichever adult in the house most recently had a birthday. In such a way, the data collection guaranteed random sampling within each household as well.



# **IV. Results**

Table 2 expresses the results from this regression. It should be noted that the  $R^2$  value at the bottom of the table is a McFadden  $R^2$ . Consequently, care should be taken to not treat it like an  $R^2$  from an OLS regression. As rule, the different  $R^2$  measures cannot be meaningfully compared. Due to the nature of the group logit model, each coefficient

Variable	Coefficient	Odds Ratio	Std. Error	Z-Score
INTERCEPT	-3.635799	-3.635799	1.140098	-3.189
YEARS	0345056***	1.035108	0.0170496	2.095
OWN.RENT	0.3963354	1.486368	0.500681	1.177
CHILDREN	0.2426904*	1.274674	0.1771558	1.746
AGE	0.0189369	1.019117	0.0139512	1.383
INCOME	-0.0225964*	0.977657	0.0128441	-1.720
DENSITY	-1.009018	0.3645769	0.3167639	-1.161
INCOME*DENSITY	0.0252259	1.025547	0.0174483	1.483
NBHD.PART	0.492893	1.637045	0.558526	1.445
POLICE.TREATMENT	0.0952599	1.099945	0.0714306	1.467
POLICE.EFFECTIVE	-0.4151334***	0.6602522	0.0905742	-3.026
FELONY	-0.1504619*	0.8603105	0.0748304	-1.730
MISDEMEANOR	0.3457058***	1.412987	0.1387988	3.519
RACE.HHI	-0.0000027	0.9999973	0.0000242	-0.111
INCOME.HHI	-0.000025	0.999975	0.0001029	-0.242
AGE.HHI	0.0000908	1.000091	0.0001018	0.891

TABLE 2 **First Regression Analysis** 

Pseudo  $R^2 = 0.0430$ 

Chi Square Value = 211.37 Prob( $\chi^2 > 211.37$ ) = 0.0000

\* indicates significance at the 90%
\*\* indicates significance at the 95%
\*\*\* indicates significance at the 99%

represents the natural log of the odds ratio corresponding to the given independent variable. The odds ratio is the ratio  $\frac{P_i}{(1-P_i)}$  where  $P_i$  is the probability that the  $i^{\text{th}}$ 

household participates in the Neighborhood Watch. Consequently, each coefficient represents how the log of the odds ratio of Neighborhood Watch participation changes as the relevant independent variable changes, holding all else constant. These coefficients facilitate a quick analysis of whether the coefficients have the expected sign but the log of an odds ratio has little intuitive appeal. Thus, I also present the odds ratios corresponding to each independent variable. The odds ratio for each coefficient represents the change in the weighted odds that a household will help supply the Neighborhood Watch due to a change in the relevant independent variable, holding all else constant. An odds ratio greater than one indicates that the variable in question raises the probability that a randomly selected household will support the Neighborhood Watch. An odds ratio less than one indicates that the given variable lowers the probability that a household supports the Neighborhood Watch. It follows from the properties of the natural logarithm that positive coefficients correspond to odds ratios less than one and negative coefficients correspond to odds ratios greater than one.

As an empirical aside, there is some concern that heteroskedasticity exists in my regression. The survey conducted by Skogan (2004) was based on random phone sampling throughout the city of Chicago. As a consequence, there is an inconsistent number of observations across police beats. It seems likely that this may lead to heteroskedasticity. Unfortunately, testing for heteroskedasticity in a logit model is not a trivial task. Testing for heteroskedasticity would require specific knowledge about the estimation algorithm used by my statistical package and in-depth manipulation of

computer code. As a consequence, I do not present a test for heteroskedasticy in this analysis. In order to address the potential problem, however, I use the statistical package STATA 5 to weight each observation according to the number of observations per police beat. I also use STATA to present White's robust standard errors for each variable. These steps should address heteroskedsiticity if it is present. Even if heteroskedasticity is not present, the use of White's robust standard errors will not bias my parameter estimates, and instead should improve the power of my estimation.

Each of the eight demographic variables in my model has the correct expected sign; although only three of them have statistically significant coefficients at the 90% level and only one is statistically significant at the 95% confidence level. Interestingly, of the two variables intended to capture duration of interaction (YEARS and OWN.RENT) only YEARS is statistically significant. This suggests that the amount of time people have spent interacting together has a measurable influence on their ability to cooperate. It is worth noting, however, that people who have lived in one place for a long time may be more inclined to maintain their current place of residence. Consequently, the positive sign in front of YEARS may capture a commitment by community members to continue interacting in the future. Furthermore the correlation between YEARS and OWN.RENT is high; the correlation coefficient is .538 and significant at the .01 level. This suggests that the insignificance of OWN.RENT may be due, in part, to the competing influence of YEARS.

Table 3 below expresses the results from a sequential Chi Square test for each coefficient in the model. This test analyzes whether each independent variable improves the fit of my model conditional on all the previous variables. For example, the p-value

0.0083298 corresponding to CHILDREN indicates that CHILDREN has a significant contribution to the model at the 0.008 confidence level given that YEARS and OWN.RENT are already in the model. Due to the sequential nature of this analysis, the order in which I test the variables may influence their significance levels. When YEARS comes first in my specification, OWN.RENT does not contribute to the model at the 0.05 significance level. When I reverse the order of YEARS and OWN.RENT and perform the Chi Square test again, however, I find that both OWN.RENT and YEARS have a statistically significant influence on the fit of the model. Thus, conclusions should not be drawn about the relative importance of "past interaction time" verses "expected future interaction time." Instead, it seems sufficient to conclude that interactions, both past and expected, increase the voluntary supply of Neighborhood Watch programs.

TABLE 3

**Iterated Chi-Square Test** 

Coefficients	df	Sum of Squares	$\chi^2$ value	$Pr(\chi^2)$
YEARS	1	15.36057	123.4356	0.000
OWN.RENT	1	0.08826	0.7092	0.4006370
DENSITY	1	0.01372	0.1102	0.7402045
CHILDREN	1	1.24906	10.0373	0.0017583
AGE.MEAN	1	0.30373	2.4408	0.1196961
INCOME.LEVEL	1	0.01795	0.1443	0.7044413
NBHD.PART	1	0.10451	0.8398	0.3604864
POLICE.TREATMENT	1	0.88259	7.0924	0.0083298
POLICE.EFFECTIVE	1	1.81093	14.5524	0.0001784
FELONY	1	0.27244	2.1893	0.1404441
MISDEMEANOR	1	1.28040	10.2892	0.0015434
RACE.HHI	1	0.00382	0.0307	0.8611354
INCOME.HHI	1	0.16135	1.2966	0.2561034
AGE.HHI	1	0.16710	1.3428	0.2478280
INCOME.DENSITY	1	0.04408	0.3542	0.5523488
Residuals	214	26.63057	0.12444	

The variable CHILDREN has a statistically significant coefficient at the 90% confidence level with the expected positive sign. This suggests that on average, holding all else constant, adults with children are more likely to participate in a Neighborhood Watch program. As speculated above, this may indicate the desire of parents to protect their children from crime. The coefficient in front of INCOME is also significant at the 90% confidence level. Furthermore, the coefficient is negative, which seems to indicate that as incomes rise, Neighborhood Watch participation falls. This result makes sense, assuming that time is the principle expenditure for a Neighborhood Watch program. As a person's income rises, the opportunity cost of her time will rise, thus raising the costs associated with supporting a community watch.

The last three demographic variables, DENSITY, AGE, and INCOME\*DENSITY all have statistically insignificant variables. It seems worth noting, however, that DENSITY, the variable I use to proxy for the frequency of interactions between residents, has a negative sign. DENSITY is statistically insignificant, but in a purely speculative sense, its negative sign may indicate support for the theories of Dijk and Widen (1997). As mentioned earlier, Dijk and Widen claim that as populations increase the ability of group members to interrelate will fall.

Of the variables I use to control for police involvement and crime, one is statistically significant at the 90% confidence level and two are significant above the 99% confidence level. Furthermore, the iterated Chi Square test (Table 3) indicates that both the police variables (POLICE.EFFECTIVE and POLICE.TREATMENT) and MISDEMEANOR have statistically significant influences on the fit of my model. Given the placement of these variables toward the end of the specification, the results from the

Chi Square test suggest that these variables play an important role in determining Neighborhood Watch Participation.

Although, both POLICE.TREATMENT and POLICE.EFFECTIVE are significant in the sequential Chi Square test, only POLICE.EFFECTIVE has a significant z-score. In fact, POLICE.EFFECTIVE is statistically significant above the 99% confidence level and it has the negative sign that I expected. This seems to signify that residents face a disincentive to provide community policing when they are satisfied with the effectiveness of the police. Considering the complementary nature of community watch programs and the police this makes sense. If the police are more effective at preventing crime then the marginal benefit from additional time spent monitoring the neighborhood or attending watch meetings should fall.

As I expected, my model also provides evidence that crime influences Neighborhood Watch participation. The coefficient on MISDEMEANOR is also very statistically significant and positive. This implies that as petty crimes like vandalism and public drinking increase community residents are more prone to involve themselves in a Neighborhood Watch. This supports the notion that increases in petty crimes will encourage community members to adopt neighborhood policing strategies. Interestingly, the coefficient on FELONY is negative. Even though it is only significant at the 0.089 confidence level, its negative sign indicates that severe crimes like murder actually serve as a disincentive for participation in a community watch. Although this result contradicts my original intuition about the relationship between felonies and the Neighborhood Watch, it does not seem entirely unreasonable. Neighborhood Watch participants do not have government and legal support in the same manner as traditional police.

Consequently, Neighborhood Watch participants have less protection from criminal retaliation. The violent nature of felonies may actually represent a threat to the health and wellbeing of residents willing to confront crimes through the Neighborhood Watch. As a consequence, increases in felonies and the subsequent threat of violence may deter people from participating in a community watch program.

The coefficients on RACE.HHI, AGE.HHI and INCOME.HHI are all insignificant, yet economic theory predicts that resolution of the Assurance Problem would depend on the group members' ability to establish informal networks with one another. It seems plausible that differences in race, income and age would influence community member's ability to interrelate and hence their propensity to participate in the provision of a public good. Thus, at first, it seems problematic that the coefficients on all three variables would be insignificant. Furthermore, the coefficients on RACE.HHI and INCOME.HHI, although insignificant, are negative. A high HHI for race indicates racial homogeneity in a police beat. Consequently, a negative coefficient on RACE.HHI would mean that Neighborhood Watch participation actually rises as a community becomes more heterogeneous. In an analogous manner, a negative coefficient on INCOME.HHI would indicate that income heterogeneity increases Neighborhood Watch participation. These results support that I should apply further tests to ensure that population heterogeneity does not influence Neighborhood Watch participation.

In order to continue testing for the importance of population heterogeneity I analyze three alternate specifications for my model. The justification behind these alternate models is that there may be an interactive influence caused by race and income. Income distributions often correspond to different racial categories, and racial tensions

may be more intense in the presence of income inequality. Consequently, the influence of racial inequality on the supply of the Neighborhood Watch may change dramatically as incomes fluctuate. In order to address this issue, I present three more specifications. Each specification measures a different way that income and race may interact.

One way that income and race may interact is if different income levels or different levels of income heterogeneity cause racial heterogeneity to have a different effect on Neighborhood Watch participation. In order to test for this possibility, I present a specification in Table 4 that includes the interaction between income and the HHI for race (INCOME\*RACE.HHI) and the interaction between income HHI and race HHI (INC.HHI\*RACE.HHI). If it is true that income levels interact with racial heterogeneity to determine the supply of a Neighborhood Watch then these interaction terms should be statistically significant and their inclusion should improve the fit of my model.

Another way that income and race may interact is if income heterogeneity influences Neighborhood Watch participation differently depending on which racial group is most prevalent in a given community. In order to address this possibility, I present a specification in Table 4 that includes dummy variables representing different racial groups. This regression tests whether there are different baseline Neighborhood Watch participation rates depending on a police beat's dominant racial group. DB is a dummy variable that represents police beats with populations that are at least fifty percent Black or African American. Similarly, DH represents beats which have populations that are at least fifty percent Hispanic or Latino. Finally, DW measures beats that have populations of at least 50% Whites or more. The excluded category in this system of dummy variables is every beats which does not have a population is at least fifty percent

one race. As mentioned earlier, the only races that are more than fifty percent of the population in any given police beat are Whites, Hispanics/Latinos and Blacks/African-Americans. If different racial groups support the Neighborhood Watch differently then the coefficients on these variables should be statistically significant, and their inclusion should improve the fit and the general results of my previous model.

I conclude my analysis of potential interaction terms by testing whether the interactions between the racial dummy variables and RACE.HHI matter in my model. In this regression, DB.HHI is the dummy variable for Blacks/African-Americans interacted with RACE.HHI. DH.HHI is the interaction between RACE.HHI and the dummy for Hispanics/Latinos. Finally, DW.HHI represents the interaction term corresponding to Whites. If these interaction terms are statistically significant then it would follow that different racial groups cause income heterogeneity to influence Neighborhood Watch participation in qualitatively different ways. I present the results from this specification in Table 4 along with the two other tests I use to check for the existence of an affect caused by the interaction between income and race.

A few practical and statistical observations follow from the first specification (2) in Table 4, which analyzes whether different income levels and HHI's for income change the affect that RACE.HHI has on Neighborhood Watch participation. First, a Chi-Square test comparing this specification to my first model produces a test statistics of 0.6629, and a corresponding p-value of 0.2821. This large p-value indicates that the inclusion of INCOME\*RACE.HHI and INCOME.HHI\*RACE.HHI does not significantly improve the fit of my model. From a statistical standpoint, the results of this test suggest that this specification (2) may not be the proper model. From a practical standpoint, the new

coefficients I obtain in this regression agree more closely with economic theory. In particular, the odds ratios corresponding to RACE.HHI and INCOME.HHI, although still insignificant, are now greater than one as predicted by theory. Furthermore, the odds ratios in front of INCOME\*RACE.HHI and INCOME.HHI\*RACE.HHI are both less than one so it seems likely that including them in the model removes a downward bias from RACE.HHI and from INCOME.HHI.

As an aside, there are theoretical reasons to expect the interaction between race and income to have a qualitatively unique influence on Neighborhood Watch participation. An odds ratio less than one corresponding to INCOME\*RACE.HHI, if significant, would indicate that as incomes rise and racial homogeneity rise simultaneously community members become less likely to support a Neighborhood Watch. This result makes sense if there is a systematic association between different races and mean income levels. If there is a systematic association between race and income then communities with high measurements of INCOME\*RACE.HHI may be communities that have members from the same privileged racial and socioeconomic group (In Chicago this group would be upper class, native-born Caucasians). Members of privileged groups often have very high opportunity costs associated with their time and may be less inclined to devote energy toward neighborhood policing. If members of the privileged racial and social group generally live in homogeneous communities then it follows that the interaction between INCOME.HHI and RACE.HHI would capture a similar affect as INCOME\*REAC.HHI. As a consequence, even though the coefficients are insignificant, it does not seem unreasonable to expect INCOME\*RACE.HHI and

INC.HHI\*RACE.HHI to have downward influences on Neighborhood Watch participation.

It is also worth noting that every control variable that was statistically significant in my first model remains significant now and has a similar odds ratio as before. This robustness in results suggests that there is an underlying consistency between the two specifications. Nevertheless, this specification (2) does not indicate that population heterogeneity has a measurable influence on Neighborhood Watch participation. Instead, the coefficients on INCOME.HHI and RACE.HHI remain statistically insignificant. These results support the evidence from my first regression, which indicated that population heterogeneity does not influence community watch involvement.

The next specification (3) in Table 4 measures whether there are different baseline participation rates in respect to the Neighborhood Watch depending on a police beat's dominant racial group. A Chi-Square test comparing this new regression (3) to my first model produces a test statistic of 0.00003345, and a corresponding p-value of 0.000001627. This indicates that the inclusion of these dummy variables significantly improves the fit of my model. Nevertheless, all the variables that were significant in my first regression are now statistically insignificant. Economic theory clearly predicts that variables like POLICE.EFFECTIVE and MISDEMEANOR should influence Neighborhood Watch participation. Thus, the insignificant coefficients in this specification (3) seriously undermine this model's credibility and suggest that there may not be much consistency between this regression and my first model.

It seems worth noting, however, that the odds ratio for DB is greater than one and statistically significant in this regression. This introduces the possibility that

communities with a population of at least 50% Black/African Americans may have a greater propensity to help supply a Neighborhood Watch program. Although I will not speculate too deeply about why black communities may be more prone to participate in community policing it seems relevant to note that the main source of support for Neighborhood Watch participation in recent years has come from CAPS. Proponents of CAPS have intentionally targeted community involvement initiatives at minority neighborhoods and inner-city areas (CAPS at 5). The programs have had notable success in black neighborhoods and consequently, CAPS may help create a high Neighborhood Watch participation rate in black communities.

The odds ratio for RACE.HHI in specification (3) is also significant above the 95% confidence level. It is less than one, however, and, as discussed above, an odds ratio on RACE.HHI indicates that Neighborhood Watch participation actually rises as a community becomes more racially heterogeneous. The emergence of this paradoxical result when coupled with the insignificance of almost every other coefficient in this model suggests that this regression (3) does not represent a correct specification.

The final specification (4) in Table 4 tests whether interaction terms between the race dummy variables and RACE.HHI improves my model and changes the statistical significance of the measures I use for population heterogeneity. A Chi Square test comparing this regression to my original model produces a test statistic of 0.07543 and a corresponding p-value of 0.000008691. This indicates that this specification (4) does improve the fit of my model in a statistical sense. Nevertheless, almost all of the coefficients in this model are statistically insignificant. The only statistically significant coefficient are OWN.RENT and NBHD.PART. The significance of OWN.RENT may

indicate that Neighborhood Watch participation is influence by the duration of time which residents expect to interact with one another. NBHD.PART is also statistically significant at the 90% confidence level, but this variable was never significant in any of the other regressions that I ran. Consequently, it seems more likely that this result is an aberration as opposed to a product of some underlying truth in the data. In general the low significance of all the variables in specification (4) suggest that it is reasonable to conclude that the interaction terms between the race dummy variables and RACE.HHI do not improve my model.

The results described in Table 4 support evidence from my first regression indicating that population heterogeneity does not influence Neighborhood Watch participation. My regression results suggest, instead, that Neighborhood Watch participation is influenced most significantly by variables that measure the costs and benefits of community policing. In particular, in my first regression, YEARS, POLICE.EFFECTIVE and MISDEMEANOR are significant at the 99% confidence level, and CHILDREN, INCOME and FELONY are significant at the 90% confidence level. With the exception of YEARS, each of these variables can be considered a measurement of a cost or benefit associated with the Neighborhood Watch.

POLICE.EFFECTIVE, for example, is a reflection of how the benefits from a Neighborhood Watch change as police effectiveness changes. As described earlier, a more effective police force will lower the marginal benefit of a Neighborhood Watch program, which describes why the odds ratio on this variable is less than one. The odds ratio for MISDEMEANOR captures the potential benefits that a Neighborhood Watch offers to residents as a result of preventing misdemeanor crimes. The benefit of

protecting one's children is captured in the variable CHILDREN and the opportunity cost of a person's time is represented by the odds ratio less than one on INCOME. FELONY also represents a potential cost associated with participating in a Neighborhood Watch program. In this case, as discussed earlier, the cost may be potential violence directed at members of the Neighborhood Watch.

An interesting distinction between my results and Vigdor (2004) hinges on the costs and benefits associated with Neighborhood Watch programs as opposed to mail-in Census forms. Although, Vigdor argues that an un-submitted Census form costs a person's wider community \$5,000 in present value over a ten year period, very little of that benefit accrues to the person who decides to fill out the Census. Furthermore, the cost of completing a Census form is a one-time cost that only requires an investment of time. It seems plausible, that when faced with such minimal costs and benefits, a person might be more likely to allow perceptions of group heterogeneity to influence her decision (either implicitly or explicitly).

A Neighborhood Watch program, on the other hand, has much greater potential to change the costs and benefits that a person faces. In addition to requiring a much more substantial investment of time, a Neighborhood Watch program may also impose safety costs on the people who help supply it. Likewise, although a completed Census form only guarantees a small measure of government funding to the participating individual, a successful Neighborhood Watch program may promise much greater returns to a participant in the form of lower community crime. As a consequence, it does not seem unreasonable that the magnitude of the costs and benefits of the Neighborhood Watch

would play a greater role determining its provision level than in determining the return rates of the U.S. Census.

Furthermore, there are reasons to believe that my results may not contradict the conclusions reached by Ferrara (2002) either. Ferrara (2002) examines group participation not the supply of public goods. Groups can exclude members whereas public goods (including the Neighborhood Watch) are non-excludable. The excludable nature of groups implies that people with prejudices may be able to selectively allocate membership in accordance with their demographic preferences. As a consequence, group members may not face much incentive to cooperate with dissimilar people. In regard to a Neighborhood Watch, however, community residents should have an incentive to encourage as much participation as possible. In general, a greater level of resident participation should lead to more community vigilance and a greater deterrent for crime. It seems likely that there will be some finite, efficient participation rate for the Neighborhood Watch in any community. In a heterogeneous community, efforts to reach that efficient participation point may require residents to work around demographic differences. If the benefits of a Neighborhood Watch outweigh the costs of cooperation between dissimilar residents then it may be reasonable that coefficients measuring population heterogeneity do not demonstrate a statistically significant role in my regression analysis.

In general, the results from my model question economic theories and previous empirical results about the relationship between population heterogeneity and the supply of the Neighborhood Watch. Instead of finding evidence that population heterogeneity influences Neighborhood Watch participation, my results indicate that the duration of

interaction between community members and the costs and benefits associated with a neighborhood Watch play a much greater role in determining Neighborhood Watch participation. These results, if reinforced by future tests, have significant implications for how economists consider the private supply of public goods. As a consequence, more testing of these results seem in order.

### V. Critique of the Model and Possibilities for Further Research

Although my econometric analysis provides suggestive evidence about the influence that demographic variables have on the private supply of public goods, there is room to refine my approach. A clear source of improvement would be a similar analysis of Neighborhood Watch participation based upon a more comprehensive data source. In particular, a natural extension of my results would be to analyze Neighborhood Watch participation on a closer level. In my paper I use a data set that has demographic information specific to Chicago police beats. Unfortunately, each police beat contains about 10,000 people. Thus, although police beat demographics may reflect neighborhood characteristics on average, there is still the potential for substantial variation across neighborhoods within a police beat. A data set with information on the neighborhood level would help relieve this problem and facilitate a more accurate appraisal of Neighborhood Watch participation.

Another data-based way to improve my approach would be to implement a time series when examining Neighborhood Watch participation. For the purposes of this paper, and within the constraints of the data, I assume that all the variables remain

constant from 1998 until 2001. It may be worthwhile to investigate whether my results continue to hold once the variables are allowed to change over time.

It would also be interesting to examine 'bleed-over' effects between neighboring communities. The degree to which individuals in one community succeed in solving the Assurance Problem and supplying a public good may influence the presence of privately supplied public goods in neighboring communities. Serrano and Cabrer (2004) analyze productivity growth across regions in Spain and argue that there is a strong association between information and knowledge levels across adjacent regions. Their results and the geographic nature of Neighborhood Watch programs suggest that it may be possible to synthesize the two theories.

In particular, the creation of informal networks for assurance is one of the principle difficulties associated with resolving the Assurance Problem. If adjacent communities can learn about successful social arrangements from their neighbors then it seems plausible that community *i*'s ability to create those informal networks would be positively associated with the existence of similar networks in neighboring communities. Consequently, it may be the case that the existence of privately supplied public goods in neighboring communities promotes community *i*'s ability to resolve the Assurance Problem.

Another source of improvement for the specification in my model would be a measurement of respondents' satisfaction with the Neighborhood Watch program. In order to identify the costs and benefits associated with Neighborhood Watch participation I examine income levels, average number of children, perceptions of crime and opinions about the police. Variables measuring these influences help control for the effect that

Neighborhood Watch participation may have on crime or a participant's time. Neighborhood Watch programs, however, are not a universally accepted form of crime prevention. Community policing in Chicago has come a long way since the police department first initiated the CAPS program in 1993 and it continues to gain support (CAPS at 5). Nevertheless, many people remain skeptical about the positive benefits associated with community watch programs. A variable measuring respondents' perceptions of the effectiveness of the Neighborhood Watch (or at least participant satisfaction) would help control for variations in opinions about the Neighborhood Watch across people with similar demographic backgrounds.

Finally, my model would benefit substantially from an assessment of endogeneity. As I have specified the model now, perceptions about crime influence participation in the Neighborhood Watch. If, however, community policing programs successfully deter criminal behavior then I should expect the existence of a Neighborhood Watch to help determine the crime level as well. Consequently there is a very real danger that endogeneity exists between perceptions of crime and neighborhood Watch participation. An appropriate correction for this misspecification would be two stage least squares and the introduction of an instrument variable. Without a correction for endogeneity, the parameter estimates will be biased and inconsistent. Consequently, the results from my specification should be interpreted with some care.

All these critiques of my model demonstrate that there is plenty of potential to improve my econometric approach. In general corrections addressing issues ranging from model specification to quality of data could improve the significance of my results. Nevertheless, my results have demonstrated robustness in respect to different

specification approaches. As a consequence, it seems plausible that the results from my empirical analysis genuinely reflect the relevant importance that group characteristics play in determining the private supply of public goods. Consequently, it may be efficacious to treat my results as a starting point – a jumping off point, if you will, for a more rigorous investigation of how population demographics and the benefits associated with a public good determine whether private agents will succeed in privately supplying it.

### **VI.** Conclusion

The specification I use in my econometric analysis of Neighborhood Watch participation focuses on population demographics, community cohesion, crime levels, police influence and measures of group heterogeneity. Using a data set collected by Skogan (2004) I construct a group logit model in order to determine how the proportion of residents who participate in a Neighborhood Watch program changes in Chicago police beats as variables measuring group characteristics and the benefits of a community watch change. Using robust standard errors I obtain some statistically significant coefficients, which seem to indicate that duration of interaction between group members and the costs and benefits associated with a community watch program have measurable influences on Neighborhood Watch participation.

In particular, my regression results indicate that five of the variables I use to measure the costs and benefits of a Neighborhood Watch program are statistically significant at the 90% confidence level or higher. The significant odds ratio less than one on POLICE.EFFECTIVE provides evidence that community watch programs serve, in

part, as substitutes for police protection. As the police become more effective at stopping crime, holding all else equal, residents will be less likely to participate in a community policing program. The significant odds ratio greater than one in front of MISDEMEANOR suggests that as petty crimes increase in a community, residents will be more prone to help supply a Neighborhood Watch. The statistically significant odds ratio greater than one corresponding to CHILDREN indicates that neighborhoods with more children tend to have a higher Neighborhood Watch participation rate. This may be a product of parent's desires to protect their children from crime. The opportunity cost of a person's time associated with participating in a Neighborhood Watch is represented by the odds ratio on INCOME. The odds ratio in front of FELONY also captures a potential cost associated with participating in a Neighborhood Watch program. In this case, the fact that the odds ratio is less than one may indicate the potential threat of violence faced by members of the Neighborhood Watch.

The significant odds ratio in front of YEARS provides support for theories about the importance of group member interaction in determining whether private agents will succeed in supplying public goods. The odds ratio is greater than one, which indicates that the time people spend together has a positive influence on their ability to resolve the Assurance Problem and voluntarily supply public goods. This odds ratio indicates that any attempt to encourage the private supply of public goods would be amiss to focus entirely on the material costs and benefits associated with the public good. Instead, group interactions also play a prominent role in determining whether a public good can be supplied by private agents.

These econometric results disagree with the results obtained by Vigdor (2004). It seems plausible, however, that this discrepancy in results may reflect the magnitude of costs and potential benefits associated with Neighborhood Watch programs. The investigation conducted by Vigdor (2004) analyzes mail-in Census returns – an activity that does not represent a substantial cost or benefit to the participant. Under normal conditions, considerations of group demographics may play a minimal role in determining whether a person will engage in a collective goods action. Thus, when the costs and benefits of the public good are negligible, the relative importance of group composition should increase. Consequently, Vigdor (2004) may have found evidence that population heterogeneity has a measurable influence on Census returns simply because the costs and benefits associated with completing a mail-in Census are so low.

If this is true, then my results have important implications for how economists treat the private supply of public goods. From a theoretical perspective, the Assurance Problem, the Reciprocity Principle, and many other game theory applications all have relevancy in the supply of the Neighborhood Watch. By learning more about how external factors relate to community watch programs, economists can gain insight into why certain groups manage to cooperate and others do not. In particular, knowledge about how the costs and benefits of a public good and group interaction time affect cooperation will contribute to discussions regarding whether people always obey their self-interest, or instead make decisions based, in part, on social norms and prejudices. The results from my analysis indicate that people place a greater emphasis on self-interest than on group heterogeneity.

The relationship between demographic variables and the private supply of public goods also has profound implications for human welfare. In many instances, the ability to cooperate can have a substantial affect on a group's wellbeing. Whether a group cooperates or not can mean the difference between obtaining a Pareto optimal outcome or becoming mired in an unpleasant, low-paying Nash equilibrium. When people fail to cooperate through informal mechanisms they often resort to government intervention, as described by classical economists like Samuelson. Unfortunately, it can be very costly for governments to provide public goods. Consequently, knowledge about the role that cost and benefit incentives play in determining the private supply of public goods may allow policy makers to facilitate private supply without require direct government provision of public goods.

Consequently, although the results from this paper cannot predict what the efficient provision-level of a Neighborhood Watch program would be for any community, I believe that this paper can contribute to the wider academic discussion of efficiency. In particular, this paper attempts to clarify how duration of interaction and the costs and benefits of a public good influence private supply. By analyzing community factors that determine Neighborhood Watch participation, I hope that my paper offers greater insight into why certain groups choose to cooperate. Ideally this information will further academic discussions about how to break down barriers to the private supply of public goods.

## Data Appendix

The data I use, Skogan (2004) cam from ICPSR as a restricted data set. The original data set includes extremely detailed information on Chicago residents. In fact, the information on each person is so detailed that it would be possible to identify individuals in Chicago with the information it contains. As a consequence, ICPSR would not release the data without first obtaining a formal agreement that only my data advisor, Paula Lackie, and I would have access to the data. Furthermore, ICPSR rules restrict me from making individual, identifiable information available after analysis.

The sensitivity of the individual level data was not a significant concern for my analysis, however. Instead, the purpose of my investigation was to analyze Neighborhood Watch participation on the beat level. As a consequence, I aggregated all the individual level information that was relevant to my specification into measures of police beat characteristics. The process of aggregating all my relevant measures was one of the most important aspects of my initial data manipulation.

The variables YEARS, CHILDRENand AGE.MEAN are continuous. Thus, in order to produce beat level measurements I found the mean value of the variables for each police beat. As a consequence, YEARS literally represents the average number of years that each survey respondent has lived at his or her current address. In an analogous manner, CHILDREN represents the average number of children in households occupied by survey respondents. AGE.MEAN also represents the average age of every survey respondent per police beat but the data set included respondents' birth years not ages. As a consequence, I first subtracted each person's year of birth from the survey year in order to obtain a measurement of age.

For many of my variables, it did not make sense to simply take the mean of the individual values. Instead, the variables OWN.RENT and NBHD.PART were zero – one dummy variables. In order to create a measure for home ownership in a beat verses home renting I calculated the proportion of respondents from each police beat who own their homes over total respondents. Thus, this variable represents the percentage of respondents from each beat who own their homes. I calculated my measure for NBHD.PART in a similar manner. In this case, I used the individual level dummy variables to calculate the proportion of respondents in each beat who felt a part of their community relative to all respondents. Thus, this variable, NBHD.PART, represents the average number of respondents per beat who feel as though they are a part of their neighborhood and it is not just a place to live.

The income data in Skogan (2004) is not continuous and instead is captured according to six income groups. These groups are households with annual incomes below \$10,000, annual incomes between \$10,000 and \$20,000, between \$20,000 and \$40,000, between \$40,000 and \$60,000, between \$60,000 and \$100,000 and annual incomes greater than \$100,000. In order to measure average income per police beat, I first multiplied the number of respondents in each income group by the average income within that range. For example, the number of respondents for each police beat who claimed an income between \$10,000 and \$20,000 was multiplied by \$15,000. Furthermore, I multiplied the bottom group by \$5,000 and based on average incomes for people earning more than \$100,000, I multiplied the upper most group by \$150,000. I

In order to calculate DENSITY I simply used the land use data from Skogan (2004). In particular I took the measurement for total residential parcels in each beat and divided that by the total number of parcels in each beat. This measurement offers a proxy for residential density in each beat.

POLICE.EFFECTIVE and POLICE.TREATMENT were a little bit more difficult to calculate. I began categorical variables that measured how much each respondent agreed with a given statement. For example, one question was "Do the police do a good job dealing with neighborhood concerns." Potential responses include "Very Good Job," "Good Job," "Fair Job," and "Poor Job." For each variable I ranked the most favorable response as a four, with the next best response a three, then a two and finally a one for the least favorable opinion. I found the mean for each of these variables across police beats. This gave me a measure, on average, of how favorably respondents thought of the police. In order to construct POLICE.EFFECTIVE, I summed together all the responses that addressed the effectiveness of the police force. Similarly, I constructed POLICE.TREATMENT by summing together all the responses that addressed the treatment offered by police.

I constructed my measurements for crime in a similar manner. Each question regarding crime had categorical responses which measured how concerned respondents felt about the given type of crime. I ranked the categorical response in such a way that higher values corresponded to greater concern. I averaged the concerns about crime for each police beat and then combined questions addressing felonies together just like with my measures of opinions about the police. Similarly, I summed together crime questions

addressing misdemeanors in order to get a proxy measure for concerns about misdemeanors in each beat.

The final variables that I constructed are the ones that measure population heterogeneity. The Herfindahl-Hirschman Index is defined as the sum of the squared shares of a community held by different groups. Thus, if there are *i* groups in a community and the share of the community held by each group is S<sub>i</sub> then the HHI is equal to  $\sum S_i^2$ . The HHI can range from a maximum of 10,000 to a minimum of almost 0, where higher HHI's indicate less hetereogeneity. In order to calculate RACE.HHI, I simply summed together the number of people in each beat who belonged to each racial category. I then found the proportion of each race by dividing the number of respondents in each racial category over the total number of respondents per beat. I then squared all those shares and summed them together to obtain RACE.HHI. In a completely analogous manner I found the share of respondents from each beat who belong to the income categories in Skogan (2004). I then squared each of those shares and summed them together to get INCOME.HHI. For AGE.HHI, I first created age categories for people between 20 and 29, between 30 and 39, etc. I then calculated the share of people from each age category per beat. Once I had those shares I squared each one of them and took their sum in order to create. AGE.HHI

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