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## **Determinants of Individual Social Capital Investment**

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### **Abstract**

It has been claimed that social capital has a significant effect on various socio-economic phenomena. Recent articles criticize the social capital literature for emphasizing the implications of social capital without understanding how social capital is formed. This paper presents a model of individual social capital investment that synthesizes ideas from several economic disciplines so as to capture the important features of social capital: investment requires time to be allocated to social capital production, it is place-specific, the investment decision depends upon individual and social stocks, and its effects generate externalities. Comparative statics derived from the theoretical model will be estimated using data from a survey of homeowners in Franklin County, Ohio. The empirical results show that the predictions of the model reflect actual social capital investment behavior.

Social capital has become a prominent topic of analysis in the social sciences. Grootaert (1997), along with Barkley (1998), Castle (1998), and Rainey, et al (2003), has credited it as the “missing link” in the development process that separates economically developing communities from economically stagnant or declining communities. Others have demonstrated the productivity of social capital in technology adoption (Isham, 2002; Murphy, 2002), commodity trade (Fafchamps and Minten, 2001), and epidemiology. There are also claims that it is a critical determinant of individual characteristics such as educational achievement, household income, and employment (Narayan and Pritchett, 1999).

Despite the breadth of application and apparent significance of social capital as a concept, it remains elusive and difficult to identify. Definitions of social capital are all over the board – some emphasizing the type of social interactions that yield social capital, others emphasizing the functionality of social capital (e.g., trust, social norms, or overcoming free-riding), and yet others that attempt to recognize the substance of social capital. Because of this cacophony of ideas, Durlauf and Fafchamps (2003) suggest that the term “social capital” should be viewed as a concept to “federate disparate but interrelated research interests and to facilitate the cross-fertilization of ideas across disciplinary boundaries” (2). This lack of consensus is indicative of the lack of a theoretical foundation to determine how social capital is formed or how its stock is affected by public policy and structural changes in the community, etc.

Given this lack of theory, it is not surprising that the empirical results from social capital studies are considered questionable and thought to suffer from many econometric problems. Durlauf (2002) and Durlauf and Fafchamps (2003) provide the most succinct criticisms of the empirical literature using the concept of exchangeability violations. Applying this concept to social capital, they focus specifically on problems of identifying parameters from the given data,

heterogeneity caused by non-social capital group effects, and a group endogeneity problem first introduced by Manski (2000). In addition, these authors, like Paldam (2000), criticize the ad hoc proxies and model specifications used to analyze the relationship between social capital and other socio-economic phenomena.

To address these criticisms, I present a theoretical model for individual social capital investment that integrates social capital-specific characteristics into a neoclassical model of capital investment, following in the footsteps of Becker and Murphy (2000) and Glaeser, Laibson and Sacerdote (2002). The characteristics of particular concern are: externalities that arise from group social capital stocks, inseparability of time-intensive activities, and the spatial reality of social capital. Comparative statics derived from the theoretical model are tested using data from a survey of homeowners in Franklin County, Ohio. The data tends to support all of the stylized facts and hypotheses analyzed. Opportunities for policy to affect social capital investment behavior that arise from this analysis are briefly discussed in the conclusion.

### ***The Theoretical Model***

Collier (1998) defines social capital as a process that creates externalities from social interactions, where either the interaction or the externality is persistent. This definition acknowledges that social capital is unobservable. But rather than focus on the observable interactions (as do Putnam, 1993 and Woolcock, 1998) or the observable benefits derived from interaction (Coleman, 1988), Collier's definition describes the nexus of the structure of social interaction and the externality it generates to fully identify the presence of social capital in a context. Collier describes three types of externalities that characterize social capital: knowledge of other agents' behavior, knowledge of non-behavioral phenomena (e.g., prices), and collective action that overcomes free-riding. Given the structure of interaction, Collier presents a

correspondence between the type of interaction and the potential effect of the externality generated. For example, repeated transactions between a merchant and a consumer (the social interaction) allows for opportunistic knowledge (stock of social capital) to be acquired by both individuals, potentially generating trust (benefit of social capital) between them. This trust then facilitates the reduction of transaction costs of doing business between these individuals (further benefit of social capital).

Collier's conceptualization provides guidance in constructing a theoretical model of social capital investment by delineating the substance of social capital (persistent externalities) from its source, social interaction, and its effect or consequence (e.g., trust, norms and reputations; Woolcock, 1998). It also points to economic models useful for analyzing social capital investment behavior, such as common resource allocation models that capture externality effects across members of a group (as used by Becker and Murphy, 2000) and the neoclassical capital investment model (which Glaeser, Laibson and Sacerdote modify to address individual social capital investment).

Glaeser, Laibson and Sacerdote (2002; GLS) modify the neoclassical capital investment model to address individual social capital investment. In their model, an agent seeks to maximize his discounted lifetime net benefit from social capital, where social capital has both individual and public components. Examples of individual social capital are charisma, social skills, and the number of contacts held by the individual. Public social capital is then some function of all the individual social capital stocks held within the community. GLS model and also include a mobility parameter that reflects the reality that an individual's social capital declines upon relocation. In this way, the mobility parameter emphasizes that social capital is place-specific.

While social capital fits nicely into the standard capital investment model, GLS' application of the model has a major weakness: their model implicitly assumes that individual utility is weakly separable in social capital and all other consumption. That is to say, they assume that social capital formation does not affect one's consumption of other commodities and services. Since social capital formation requires time (relationships are developed by spending time with other individuals), this assumption is clearly too strong since how much time is allocated to social capital investment directly impacts the amount of time available for other activities. In addition, the amount of income available for consumption is closely related to the amount of time spent working, so that time directly affects the level of consumption for all commodities (even if time is not required to consume them).

To overcome this limitation of the GLS model, an inseparable utility function is used in this analysis. Therefore, an individual's utility is determined by three factors,  $x_t^i$  (individual i's consumption in period t),  $s_t^i$  (individual i's social capital stock in period t, as determined by his/her investment decision in the previous periods), and  $R_t^i$  (aggregate social capital as perceived by i in period t):  $U_t^i = U(x_t^i; s_t^i, R_t^i)$ . The utility function is assumed to be quasi-concave, so that its first derivatives with respect to x, s, and R are positive, and its second derivatives are non-positive. That is to say, utility increases as consumption increases, as the individual's social capital stock increases, and as the community's social capital stock increases. However, each of these factors is subject to diminishing returns, so that utility increases at a decreasing rate as consumption and social capital stocks increase.

Individual utility is limited by the budget constraint, given by  $p_t x_t^i \leq m_t^i = t_t^{w,i} w_t + \omega_t^i$ .

The term  $p_t x_t^i$  represents expenditures, where  $p_t$  is a vector of current period prices and  $x_t^i$  is a

vector of the quantities of goods consumed. The variable  $m_t^i$  is income, which has two components:  $t_t^{w,i} w_t$  is time spent working by individual  $i$  in the current period multiplied by the current period wage rate, and  $\omega_t^i$  is the individual's current period endowment. Since there is no money savings (i.e., future consumption from current income) in this model, the individual will consume until his or her money income is completely exhausted. So, the inequality will always hold with equality. This implies that the optimal consumption bundle is determined by the individual's money income, which is a function of the number of hours he or she works and his or her endowment (a monetary stochastic, exogenous shock revealed at the beginning of each period with an expected value of 0); all other factors in the budget constraint are exogenous ( $p_t$  and  $w_t$ ).

Social capital is generated each period when an individual allocates time and existing social capital to produce additional social capital; modeling social capital investment in this manner follows the human capital investment model presented by Ben-Porath (1967). I assume that an individual uses time to either work or create social capital (i.e., interacting with other people), so the individual chooses  $t_t^{s,i}$  (the amount of time allocated to social capital production) and the remainder is used for work:  $t_t^{w,i} + t_t^{s,i} = 1$ . In addition, the investment in social capital (i.e., the additional social capital generated in a period) requires an allocation of existing social capital,  $\mu_t^i$ . A technology constraint,  $I_t^i = g(t_t^{s,i}, \mu_t^i)$ , governs the productivity of the inputs in generating social capital.  $I_t^i$  increases with allocations of time and social capital to the production of additional social capital. Intuitively, I can accumulate more friends by spending time building new relationships, or I can leverage my existing network to meet my friends' friends assuming an initial stock of friends. The total social capital stock in a given period, then,



is  $s_{t+1}^i = I_t^i + \delta s_t^i$ , where  $(1-\delta)$  is the depreciation parameter. As the initial stock in the period increases, *ceteris paribus*, more social capital can be generated. For example, the more friends I have initially, the more friends I can make for a given amount of time and social capital invested.

$R_t^i = f(s_t^1, \dots, s_t^j, \dots, s_t^n, \Psi)$  for all  $j \neq i$ . This captures the externality effect of others' social capital stocks (i.e., their behavior) on individual  $i$ 's social capital investment decision.  $\Psi$  is a vector of community characteristics that is constant for all individuals within the same community; examples of elements within  $\Psi$  might be per capita income, unemployment rate, average educational attainment, crime rate, and age composition. Individual  $i$  does not take into account the effect of his social capital stock on others<sup>1</sup>. Since I am only focusing on the individual's investment decision, it is sufficient to take  $R_t^i$  as given exogenously to the individual at the beginning of each period. I leave further specification of  $R_t^i$  (e.g., how are individuals' stocks weighted? is community social capital generated through linear or nonlinear aggregation of individual stocks?) for future research.

Lastly, social capital has a place-specific dimension as pointed out by GLS. I will use their convention to introduce this spatial attribute into the model. In their model, an individual may relocate to another community with known probability  $\theta$ . The effect of relocating is a severing of ties to localized networks (e.g., membership in organizations) and increased distance from friends and family. An individual's social capital falls to  $\lambda$  of their previous social capital stock when he or she moves. GLS refer to  $(1-\lambda)$  as depreciation from relocation.<sup>2</sup>

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<sup>1</sup> By the law of large numbers, the effect of individual  $i$  on the overall community stock will be insignificant. Thus, there is no loss of generality by making this assumption.

<sup>2</sup> The social capital stock does not generally go to zero following a move. For example, the social capital stock in one location can still be useful in another location as old friends may refer someone to friends in the new location or provide emotional support at a distance during the individual's transition, or memberships in regional or national organizations may be easy to transfer so as to augment the individual's social capital rebuilding in the new community.

As is assumed in other capital investment problems, I assume that individuals seek to maximize their lifetime utility subject to the constraints mentioned above. If  $\pi$  represents the discount factor<sup>3</sup>, the solution to this problem can be characterized using Bellman's equation, a common technique that enables a researcher to examine the tradeoffs that occur between two consecutive periods in time. The temporal reward function is given by the utility function in period  $t$ , whose choice variables are  $x_t^i, t_t^{s,i}$ , and  $\mu_t^i$ . The state variable is  $s_t^i$ , and its transition rule is given by  $s_{t+1}^i = I_t^i + \delta s_t^i$ . The individual is assumed to maximize the sum of his current utility and the present expected value of next period's value function. Setting the problem up this way, and given a terminal condition that specifies the value function in the last period, one can use backward iteration to solve for the optimal values of the choice variables and the optimized value of the value function in each period. The formal problem can be written as:

$$\begin{aligned} V_t(s_t^i) &= \max_{\{x_t^i, t_t^{s,i}, \mu_t^i\}} U(x_t^i, s_t^i - \mu_t^i; R_i) + \pi[(1 - \theta)V_{t+1}(s_{t+1}^i) + \theta V_{t+1}(\lambda s_{t+1}^i)] \\ \text{s.t. } s_{t+1}^i &= I_t^i + \delta s_t^i, I_t^i = g(t_t^{s,i}, \mu_t^i), x_t^i = h(t_t^{w,i}; p, w, \omega_t), t_t^{s,i} + t_t^{w,i} = 1 \end{aligned} \quad (1)$$

Using the constraints, the problem reduces to:

$$\begin{aligned} V_t(s_t^i) &= \max_{\{t_t^{s,i}, \mu_t^i\}} U(h(1 - t_t^{s,i}; p, w, \omega_t), s_t^i - \mu_t^i; R_i) + \pi[(1 - \theta)V_{t+1}(s_{t+1}^i) + \theta V_{t+1}(\lambda s_{t+1}^i)] \\ \text{s.t. } s_{t+1}^i &= g(t_t^{s,i}, \mu_t^i) + \delta s_t^i \end{aligned} \quad (1')$$

To simplify the analysis and highlight the key implications from this model, I will make the assumption that all individuals within the community are the same. This allows me to drop

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<sup>3</sup> The discount factor will be defined as  $(\frac{1}{1 + \text{discount rate}})^m$ , where a high discount rate implies that an individual places little value on the welfare in future periods and  $m$  represents the number of periods that are being discounted.

the individual superscript and set  $R_t^i = \bar{R} = f(n-1, s_t, \Psi)$ ,<sup>4</sup> where  $n$  is the population of the local community.

The condition that characterizes the optimal value of  $t_t^s$  is:

$$\frac{\partial V_t}{\partial t_t^s} \Rightarrow \frac{\partial U_t}{\partial x_t} \frac{\partial x_t}{\partial t_t^s} = \pi \left[ (1-\theta) \frac{\partial V_t}{\partial s_{t+1}} + \theta \lambda \frac{\partial V_t}{\partial s_{t+1}} \right] \frac{\partial g}{\partial t_t^s} \quad (2)$$

The left hand side of (2) represents the additional utility derived from an additional unit of time worked. It is a wealth effect, since increasing the time worked decreases the time invested in social capital but increases income and, hence, consumption. The right hand side of (2) represents the present expected value of additional social capital in the next period resulting from an additional unit of time invested in this period. The term in brackets represents the expected value of an additional unit of social capital, while the last term represents the increase in social capital from an additional unit of time invested.

The condition that characterizes the optimal value of  $\mu_t$  is:

$$\frac{\partial V_t}{\partial \mu_t} \Rightarrow \frac{\partial U_t}{\partial \mu_t} = \pi \left[ (1-\theta) \frac{\partial V_t}{\partial s_{t+1}} + \theta \lambda \frac{\partial V_t}{\partial s_{t+1}} \right] \frac{\partial g}{\partial \mu_t} \quad (3)$$

A similar interpretation can be given to (3) as was given of (2). The left hand side represents the marginal current utility foregone of an additional unit of social capital used to produce more social capital; the right hand side represents the present expected value of the social capital produced by that additional unit used for producing social capital.

The envelope condition, that describes the value of an additional unit of social capital stock, is given by

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<sup>4</sup> The assumption that all individuals are the same certainly minimizes the complexity of the problem. One can argue, as Tiebout (1956) does, that households choose their location based upon the bundle of goods and services provided within that community. The implication of this hypothesis is that communities consist of roughly homogenous residents with similar preferences.

$$\frac{\partial V_t}{\partial s_t} \Rightarrow \frac{\partial U_t}{\partial s_t} + \pi \left[ (1 - \theta) \frac{\partial V_t}{\partial s_{t+1}} + \theta \lambda \frac{\partial V_t}{\partial s_{t+1}} \right] \left( \delta + \frac{\partial g}{\partial s_t} \right) \quad (4)$$

(since I set  $R = \bar{R}$ , a constant). This condition implies that an additional unit of social capital stock in period  $t$  has a marginal value equal to its current marginal utility and the present expected value of the higher social capital stock in the next period.

If one assumes that  $V$ ,  $U$  and  $g$  do not change in their functional form over time, then one can generalize the maximization conditions given above to any period  $t$ , where  $t$  is prior to  $T$  (the last period of life). I have assumed  $V_{T+1} = 0$  is the terminal condition. Equations 5 and 6 are useful in examining how the parameters of the model affect the optimal choices of the individual.

$$\frac{\partial V}{\partial t_t^s} = \frac{\partial U}{\partial x_t} \frac{\partial x_t}{\partial t_t^s} = \left[ \pi(1 - \theta) \frac{\partial U(s_t)}{\partial s_t} + \pi\theta\lambda \frac{\partial U(\lambda s_t)}{\partial s_t} \right] (1 + \pi(1 - \theta) + \pi\theta\lambda\delta)^{T-t-1} \frac{\partial g}{\partial t_s} \quad (5)$$

$$\frac{\partial V}{\partial \mu_t} = \frac{\partial U}{\partial \mu_t} = \left[ \pi(1 - \theta) \frac{\partial U(s_t)}{\partial s_t} + \pi\theta\lambda \frac{\partial U(\lambda s_t)}{\partial s_t} \right] (1 + \pi(1 - \theta) + \pi\theta\lambda\delta)^{T-t-1} \frac{\partial g}{\partial \mu_t} \quad (6)$$

Since the optimal choices are characterized by similar conditions, I present the comparative statics for  $t_t^s$  only, with the understanding that the relationships also hold for  $\mu_t$  (except for the relationships from the budget constraint, namely prices, wages and endowment). I will use the phrase “social capital investment” to collectively refer to time and social capital allocations. The social capital investment will increase when the discount factor increases. Increasing the discount factor suggests that the relative importance of future utility has increased, so that an individual will want to investment in social capital as a means of transferring current utility to next period. Social capital investment will increase if the probability of relocation decreases, since the present expected value of the produced social capital is higher and requires additional investment to increase the current marginal utility of social capital. Likewise, social capital investment should increase if the proportion of social capital remaining after relocation

increases, because the present expected value of future social capital is higher and additional investment is needed to increase current marginal utility of social capital. If wages increase, which in turn increases income and consumption, social capital investment will also increase so that the decrease in marginal utility from the additional consumption induced by the higher wage in the current period is offset by the decreased present expected marginal utility of increased social capital stocks in the next period. In the same way, if the endowment increases, current consumption will increase driving down the current marginal utility; this is matched in the next period by an increase in the social capital stock. Investment in social capital will decrease with an increase in prices, since higher prices will decrease consumption and raise current marginal utility. This increase in current marginal utility is matched by an increase in present expected value of marginal utility from lower social capital stocks in the next period. The investment in social capital will decrease as the terminal period approaches because the longevity of the stock created from the investment is decreasing, so the benefit derived from the stock is also decreasing which leads to a reduction in utility.

The relationship between the stock of social capital and the amount of investment is undetermined a priori. On one hand, one might think that a high stock of social capital would reduce the incentive to invest, since more social capital may be of little benefit to the individual and it may even reduce the individual's utility because of the extraordinary amount of time it would require to maintain contact with numerous friends. However, a high social capital stock might be self-reinforcing in the sense that an individual might be induced to invest in more social capital to maintain the high stock he/she possesses. One example of this might be membership in an exclusive social organization, where members are expected to sponsor new members to

perpetuate the perceived status and membership of the club. The direction of this relationship will have to be determined from future empirical analysis.

### ***Empirical Analysis of the Model's Predictions***

While all of the comparative statics follow from the standard capital investment model, it is nevertheless helpful to test empirically the predicted relationships within the model as a way of legitimizing the model. That is to say, if the data demonstrates the relationships predicted, there would be some evidence that the theoretical model is useful in simulating individual social capital investment behavior. This section features analysis that will test several of the comparative statics described above using responses from a mail survey of Franklin County, Ohio homeowners.

A few words about the data are appropriate. The survey was mailed to a random sample of homeowners in Franklin County, Ohio (the location of Columbus, the state's capital, and the Ohio State University). 823 surveys were returned, which yielded a 34% response rate; however roughly 200 observations had to be deleted due to missing values. The survey captured data on factors that might affect one's neighborhood satisfaction such as the quality and availability of amenities, individuals' attitudes regarding taxes and public services, and the amount and type of interaction one has with neighbors. The survey also gathered demographic data about the respondents and their families. The demographic data of particular relevance to this study includes: age, educational attainment (measured in last year of school completed), gender, ethnicity and marital status of the respondent; household income (categorical variables in \$20,000 increments between 0 and \$200,000); and the presence of children in the home (a dummy variable denoting if one or more children reside within the home at least 50% of the time).

To construct a proxy for social capital investment, an index of social interaction was created based upon three questions in the survey. These questions asked the respondent to indicate how often they talk to their neighbors, do a favor for their neighbors, or participate in organized neighborhood activities. The respondent is to choose one of five responses: never, a few times a year, once a week, more than once a week, or everyday. The responses are coded as 0, 1, 2, 3, or 4, where 0 represents a never response and 4 represents an everyday response. The responses to the three questions are summed and normalized by 12 to create a social interaction index that ranges from 0 to 1. An individual who more regularly interacts with his/her neighbors, does favors for them, or participates in neighborhood activities will have a social interaction value close to 1, so that his/her social capital investment is relatively high. This variable is the dependent variable used in the regressions discussed below.

Similarly, a neighborhood social capital stock proxy is constructed. Two questions in the survey elicit the respondent's attitude of neighborhood cohesiveness (i.e., "My neighborhood sticks together.") and neighborliness (e.g., "I have good relations with my neighbors."). The respondent chooses the degree to which he/she agrees or disagrees with the statement using a Likert scale bounded between 1 (strongly disagree) and 7 (strongly agree). The value of the response of these two questions is summed and normalized by 14 to yield the neighborhood social capital stock proxy that is between 0 and 1. If the respondent is agreeable to both of these statements, then the perceived neighborhood social capital of his/her neighborhood is close to 1.

Lastly, the survey asked about the respondents' desire to relocate. One question asked, "Please circle the number that indicates how likely it is that you will move within the next five years," and the respondent chose a value between 1 and 7, 1 indicating "very unlikely" and 7 indicating "very likely". The other question asked, "Please indicate the probable time period

within which you might move,” and the respondent had to select one of the following options: do not know, within 1 year, 1-2 years, 3-5 years, 6-10 years, over 10 years, and do not plan to move. These options were coded between 7 for “do not know” and 1 for “do not plan to move”, in the order presented above. A time-weighted probability of relocation parameter was constructed by multiplying the likelihood of moving in the next 5 years by the time frame of a move and normalizing by 49.

Neighborhood dummy variables, defined as the zip code of the respondent, were used to control for all spatial characteristics (e.g., points of access to modes of transportation and shopping), non-social capital group interactions, and other neighborhood-based factors that might affect social interactions (such as crime and school district quality). Observations from seven zip codes were deleted from the dataset as outliers, since each of these zip codes received less than 20 responses leading to identification issues, and one zip code was outside of the study area. The zip code for New Albany, Ohio, a bedroom community of Columbus, was used as the control variable because it possessed the highest median household and per capita income levels. This convention allows us to interpret the coefficients of the other neighborhood dummy variables relative to New Albany. Inclusion of these regional variables increased the explanatory power of the models three-fold, reinforcing the idea that social capital is a place-specific phenomenon. For this reason, the neighborhood dummy variables were included in each of the four regression models discussed below.

The analysis presented below follows that of GLS in that similar models are estimated to test the comparative statics of the model. There are two major differences, however. The analyses below depend upon the neighborhood satisfaction survey dataset described above, whereas GLS utilized the General Social Survey. A second difference is that the analyses below



acknowledge Durlauf's criticism that heteroskedasticity arising from non-social capital group effects plagues the empirical social capital literature. Given the variables described above, the neighborhood dummy variables serve as the best proxy in the dataset to explain the structural form of heteroskedasticity. Breusch-Pagan tests for heteroskedasticity were conducted for each of the four regression models below, assuming the error term variance correlated with the zip code dummies. The null hypothesis of homoskedasticity was rejected in three of the four models at the 5% confidence level, while the null hypothesis was rejected at the 7.5% level for the fourth. Table 1 presents the results of these tests for heteroskedasticity. Weighted least squares was used to estimate the parameters of all four models to correct for this form of heteroskedasticity.

The first hypothesis that was tested concerns the relationship between social interactions and the time horizon of investment. The theoretical model predicts a negative relationship between social capital investment and the nearness of the terminal period. That is, social capital investment monotonically decreases over time. Using respondent's age as a proxy for time, I test this hypothesis by regressing the social interaction index on age and age squared. The estimated coefficients are presented in Table 2. The coefficients of age and age squared are positive and negative, respectively. However, neither is statistically different from zero. While the hypothesis is rejected, the signs of these parameters do reflect the stylized fact that social capital stock has a negative, parabolic relationship with time. In the absence of an instrumental variable for social capital stock, it is impossible to know for what the social interaction variable is a proxy. Fortunately, this distinction between stock and investment only matters for the time relationship; the comparative statics are identical between stock and investment for all other parameters.

The model predicts a negative relationship between social capital investment and probability of relocation: as the probability of relocation rises, social capital investment decreases. The parameter estimates, presented in Table 3, affirm this hypothesis since the coefficient on theta is both negative and statistically significant at the 5% confidence level. The squared and tertiary terms were included because GLS found a cubic relationship between these variables; this data suggests the relationship is only linear.

Next, the theoretical model predicts that higher wages will lead to higher social capital investment. Household income served as a proxy for wages. The results in Table 4 show that the data supports this hypothesis. That is to say, the positive and statistically significant parameter estimate for income suggests that higher income leads to higher levels of social interaction. Interestingly, the income-squared term is negative, suggesting that social capital investment would occur at decreasing rates as income rose. However, this term is statistically equal to zero. Another interesting observation is that the sign of some of the significant neighborhood dummy variables is positive. Since the control group for these dummy variables is the zip code with the highest per capita income, these results suggest that less wealthy communities have higher social interaction levels. This reinforces the notion that social capital is multidimensional and not simply a function of income.

The last model examines the relationship between social capital investment and demographic variables. Table 5 presents the estimated coefficients for this model. Among the demographic variables included in this model, only three are statistically significant at the 5% confidence level. The presence of a child in the home at least 50% of the time is positive, suggesting that households with children are more likely to interact with their neighbors than those that do not have children. This is intuitive because neighborhood children often attend

school and play together, providing opportunities for the parents to interact that otherwise would not exist. Females are less likely than males to interact with their neighbors. While one might find this odd since females are stereotypically friendlier than males, this result may reflect safety or other considerations that would induce women to not interact with their neighbors. The perception of high neighborhood social capital induces individuals to interact more with their neighbors. Two explanations of this relationship are plausible. First, in a community with high social capital, one might feel obligated to be neighborly within the community; in this sense, neighborhood level social capital operates like a social norm. A second explanation could be that high levels of neighborhood social capital imply extensive networks exist among individuals within the community, so that individual social capital investments are rather costless (e.g., I can easily invest in social capital simply by meeting my friends' friends).

The empirical results affirm several of the hypotheses suggested by the comparative statics of the model, and thereby they justify the model's use in predicting social capital investment behavior. Specifically, the data provides evidence that social capital investment decreases with higher probabilities of relocation, increases with income, and is place-specific. Further, the analysis shows that households with children present invest more in social capital, females invest less in social capital than males, and that perceived levels of neighborhood social capital positively affects social capital investment.

### ***Conclusions***

The theoretical model presented brings rigor to the analysis of social capital and accordingly responds in part to the criticisms raised about the empirical social capital literature. Capitalizing on Collier's less ambiguous definition of social capital, the model presented here not only delineates social capital from its source and its effect, but it also describes the process

by which social capital is formed. This clarification addresses Durlauf's criticisms regarding endogeneity. The empirical results also validate the theoretical model as useful in predicting individuals' social capital investment behavior.

Despite the optimistic conclusions above, they are predicated on less than perfect data. First, the survey was sent to homeowners in an urban county; the implication is that the sample is not likely to be representative of all residents in the county. Of particular concern is the emphasis that development economists have placed on social capital as a means of poverty alleviation; our sample is clearly biased against low-income households because the sample is drawn from homeowners. In addition, the generality of the results are questionable, and additional studies conducted in different environments are needed to determine the central tendencies for these relationships. Second, this was the third administration of this survey in an attempt to create a quasi-panel dataset to examine neighborhood satisfaction over time. As such, there was little opportunity to add or modify questions in order to maintain the comparability of responses across time. So, attempts to capture negative social capital investment through attitudinal questions, for example, were not available, though the theoretical model itself is not so limited. Third, the neighborhood dummy variable needs to be refined so that the spatial dimension to social capital can be better understood. For example, school districts could be introduced in addition to the zip code dummies, as they would better approximate neighborhood boundaries since they are generally smaller geo-political units than zip codes. Also, if one assumes the Tiebout hypothesis is valid, using school districts would better capture the homogeneity of residents within communities and address Durlauf's concern over group wise heteroskedasticity. I am currently working to develop these school district variables.

The comparative statics described above allude to opportunities for policy interventions to affect individual social capital investment decisions. One opportunity would be to reduce the relocation parameter by making the community a desirable place to live through the provision of amenities (e.g., high quality schools, low crime rate) and ensuring economic opportunities exist for the constituency to deter relocation for economic reasons. Another policy prescription would be to implement policies that encouraged higher wages for employees in the community or reduced prices of consumption goods.

An obvious extension to this research is to empirically estimate the parameters of the theoretical model and calculate the welfare benefits that accrue from social capital investment. If social capital investment does significantly increase individual welfare, justification for further analysis of social capital may exist. In addition, valuable information will exist to guide the creation of policies directed at building social capital. I am currently administering a survey to collect data for this purpose. Then, using numerical techniques to approximate equations 3 and 4, I will generate welfare estimates for individuals with different characteristics and varying social capital investment levels to understand how personal characteristics and investment levels affect the individual stock of social capital over time.

Additional extensions are to generalize the model by relaxing assumptions on the uses of time, and by clarifying the aggregate social capital multiplier function,  $R_t^i$ . Such generalizations would make this model more applicable to other contexts such as developing countries. Furthermore, one could build upon this analysis to investigate how individual investments are aggregated and derive the socially optimal level of social capital. Ultimately, this could allow for  $R_t^i$  to be endogenous in the model, so the socially optimal level of individual investment in social capital could be derived.

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Table 1: Results of White and Breusch-Pagan Tests of Heteroskedasticity<sup>\*</sup>

Model	B-P Test Statistic	Degrees of Freedom	P-value
Age	51.07	35	0.04
Probability of Relocation	47.61	35	0.08
Income	56.48	35	0.01
Demographics	52.84	35	0.03

<sup>\*</sup> The test statistic was computed using the 34 regional dummy variables included in the models and a constant term.



Table 2: WLS Estimated Coefficients for the Social Interactions-Age Model

Variables*	Estimated Coefficient (Standard Error)
Age	0.003 (0.002)
Age <sup>2</sup>	-0.00003 (0.00002)
43065	0.34 (0.054)
43110	-0.32 (0.13)
43119	-0.28 (0.11)
43201	-0.33 (0.14)
43202	0.15 (0.05)
43204	0.26 (0.05)
43206	-0.43 (0.19)
43207	-0.30 (0.11)
43211	-0.34 (0.13)
43223	-0.22 (0.09)
43224	-0.21 (0.10)
43228	-0.20 (0.10)
43231	0.15 (0.05)
43235	0.11 (0.05)
R <sup>2</sup>	0.70
F-value	45.30

\* Only those regional dummy variables that are statistically significant at the 5% level are reported. Estimated coefficients in shaded boxes are significant at a 5% confidence level.

Table 3: WLS Estimated Coefficients for the Social Interactions-Probability of Relocation Model

Variables *	Estimated Coefficient (Standard Error)
Theta (Probability of Relocation)	-0.49 (0.14)
Theta <sup>2</sup>	1.11 (0.40)
Theta <sup>3</sup>	-0.80 (0.30)
43004	0.18 (0.04)
43016	0.11 (0.05)
43026	0.11 (0.05)
43065	0.41 (0.04)
43068	0.17 (0.04)
43085	0.13 (0.06)
43125	0.13 (0.04)
43201	-0.32 (0.15)
43202	0.27 (0.04)
43204	0.38 (0.02)
43207	-0.25 (0.11)
43209	0.17 (0.05)
43211	-0.33 (0.16)
43212	0.24 (0.06)
43214	0.15 (0.05)
43231	0.30 (0.01)
43235	0.21 (0.04)
R <sup>2</sup>	0.78
F-value	62.46

\* Only those regional dummy variables that are statistically significant at the 5% level are reported. Estimated coefficients in shaded boxes are significant at a 5% confidence level.

Table 4: WLS Estimated Coefficients for the Social Interactions-Income Model

Variables*	Estimated Coefficient (Standard Error)
Income	0.02 (0.01)
Income <sup>2</sup>	-0.001 (0.0007)
43004	0.09 (0.03)
43065	0.33 (0.04)
43110	-0.28 (0.11)
43201	-0.35 (0.13)
43202	0.18 (0.03)
43204	0.25 (0.03)
43206	-0.55 (0.20)
43207	-0.26 (0.10)
43209	0.10 (0.04)
43211	-0.26 (0.12)
43212	0.16 (0.06)
43223	-0.21 (0.09)
43224	-0.25 (0.11)
43228	-0.24 (0.10)
43231	0.16 (0.02)
43235	0.08 (0.04)
R <sup>2</sup>	0.69
F-value	42.20

\* Only those regional dummy variables that are statistically significant at the 5% level are reported. Estimated coefficients in shaded boxes are significant at a 5% confidence level.

Table 5: WLS Estimated Coefficients for the Social Interactions-Demographics Model

Variables <sup>*</sup>	Estimated Coefficient (Standard Error)
Age	-0.00007 (0.0005)
Educational Attainment	-0.0003 (0.002)
Presence of Children	0.04 (0.01)
Number of Years Living in Current House	0.0009 (0.0006)
Gender of Respondent	-0.03 (0.01)
Female, Child Present Interaction	0.02 (0.02)
Ethnicity	-0.01 (0.008)
Income	0.003 (0.002)
Marital Status	0.009 (0.005)
Neighborhood Social Capital Proxy	0.32 (0.02)
43065	0.20 (0.04)
43202	0.08 (0.04)
43204	0.15 (0.04)
43205	0.08 (0.03)
43231	0.08 (0.03)
R <sup>2</sup>	0.91
F-value	125.16

<sup>\*</sup> Only those regional dummy variables that are statistically significant at the 5% level are reported. Estimated coefficients in shaded boxes are significant at a 5% confidence level.