LIFECYCLE OF SOCIAL NETWORKS: A DYNAMIC ANALYSIS OF SOCIAL CAPITAL ACCUMULATION

DISSERTATION

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By

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ABSTRACT

This study investigates the lifecycle of social capital formation at the individual level. A dynamic model is developed that analyzes individuals’ decision making about social capital accumulation that incorporates characteristics specific to social capital. The structural parameters of the model are estimated that address a variety of social capital issues.

Theoretical Model

The notion that people build up a network of friends (stock of social capital) by spending time in interacting with others (investment in social capital) is conducive to a neoclassical treatment. The model proposes a two-part return specification where, as distinct from the usual lagged return from stocks, social capital has an instantaneous return in the form of a direct utility accrued from the investment activity itself. Because of lifecycle variation in labor supply, opportunity cost of time is likely to be nonstationary and, similarly, because of high mobility rates in the first half of the individual’s life, the
depreciation rate is also likely to be time varying. The model allows for both the opportunity cost of time and depreciation rates to vary over the lifecycle. The model generates a variety of time paths of interest, including those of stocks, flows and individual benefit and cost components. Comparative dynamic exercises are carried out to study lifecycle impacts by perturbing parameter values.

Econometric Model

The structural parameters of the model are estimated using the method of simulated moments where matching is done using a GMM-type minimum distance estimation procedure. The data set used is from the General Social Survey (1972-2002). Chi-square statistics are calculated to test various restrictions to determine whether the parameter estimates are different among different groups.

Results and Findings

Contrary to some of the claims in the literature, this study finds that social capital does depreciate and this depreciation rate varies over the lifecycle. The stylized fact of existing research that the time path of the stock of social capital has an inverted U-shape is not supported by my estimation results. In comparing various groups it turns out net benefits are higher for people with more
education and, therefore, although their opportunity costs of investment are higher, they invest more in social capital. This resolves a paradox that previous research could not explain. When comparative investigation is done for groups of different city sizes – city, suburb, and small rural areas – the observed differences can be traced back to different components of costs and benefits. Most of these differences remain when schooling differences are controlled.
Dedicated to
Abdul Matin and Masuda Khatun,
my parents and my favorite teachers.
This dissertation, like any other undertaking of this nature, had its share of long hours, sleepless nights, frustrations, and anxieties. But I feel that the payoff has far exceeded the costs as it has given me an opportunity to form some personal and professional ties that I will always remember and cherish.

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CHAPTER 1

INTRODUCTION

Social Capital has been an active field of research in the social sciences for quite some time now. Among sociologists there is a greater awareness of the fact that in social sciences our focus is overwhelmingly on, what Granovetter [1985] called, an undersocialized man. Economists have been somewhat sluggish in appreciating the social aspects of the economic man. Recently, however, there has been a surge in the so called social economics to address social issues, and among them, social capital has been one of the most talked about pair of words.

Social capital – at the individual level which refers to a system of interpersonal networks [Dasgupta 2002] – enhances cooperation, collaboration, and coordination. Several studies have found social capital to have real impacts on job search, entrepreneurship, and creation of economic opportunities. People rely on social networks as informal insurance and derive satisfaction from socializing [Lin et al. 2001, Dasgupta 2002, Durlauf and Fafchamps 2004]. This
study investigates the decision process of the individual regarding social capital formation.

The early research on social capital is somewhat marred by the lack of a precise definition consistent with the mainstream theoretical traditions. Recent development in the network literature has paved way for definitions of social capital conducive to rigorous theoretical treatment. Chapter 2 of this study is devoted to a detailed discussion of the concept of social capital that is well-defined and consistent with economic theories.

One of the reasons why social capital has generated widespread interest is that researchers have been consistently documenting the importance of social capital. From the individual level to the aggregate economy, social capital matters in all walks of our lives. Chapter 3 reviews some of these findings. This study, however, is focused on social capital at the individual level. Apart from discussing the individual outcome of social capital, chapter 3 also discusses the importance of studying social capital at the individual level.

Chapter 4 discusses a dynamic framework to analyze social capital accumulation of the individual. Modeling of the individual’s investment behavior builds on the work of Glaeser et al. [2002]. Their stylized model has been augmented to develop a more general model that incorporates the following additional features that are specific to social capital: direct utility from investment, time varying cost of investment and time varying
depreciation rates. These augmentations constitute an important contribution in social capital research.

In a traditional neoclassical model, return comes only from stocks. But, in case of social capital, because socializing is a pleasurable activity, people derive utility not only from the stock but from the investment activity as well. Most researchers of social capital acknowledge this feature but this is the first study that incorporates it formally.

Time varying cost of investment and time varying depreciation rates are features that are particularly important in a lifecycle context, and have not been incorporated before. Because labor supply decisions and family compositions vary over the lifecycle, it is unlikely that cost of investment remains constant throughout the life of an individual. Similarly, because mobility rates also vary with age, the rate at which social networks depreciate also is likely to vary over the lifecycle.

Measurability of social capital is a contentious issue in the social capital literature. The tentativeness of the early research in clearly defining social capital certainly contributed to this. However, network definition of social capital, which is the definition used in this study, provides adequate guidance for empirical measures of social capital. The General Social Survey (GSS), 1972-2002, is a unique survey that provides information about interpersonal networks and socializing behaviors of the respondents. This information is used
to create network measures of social capital. Chapter 5 discusses the data in the GSS and these social capital measures.

Chapter 5 also carries out some descriptive analysis to study the demographic variation in social capital investment. A specific focus of this chapter is the effect of income on social capital. Findings of chapter 5 show that once the endogeneity of income is accounted for, it does not seem to have an independent effect on social capital investment.

Accumulation of any capital is an intertemporal phenomenon. It applies as well to accumulation of social capital. Surprisingly, there is a lack of research that studies the evolution of social capital over an individual’s lifecycle. Chapter 6 addresses a number of lifecycle issues using the dynamic framework proposed in chapter 4. The first issue addressed is the evolution process of the stock of social capital. Both Putnam [2000] and Glaeser et al. [2002], using membership measure of social capital, find that the life path of the stock of social capital has an inverted U-shape peaking during the middle ages. In contrast, this paper uses the so called ‘Network’ measures of social capital and

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1 ‘Membership in voluntary organizations’ is the so called Putnam’s Instrument, which is assumed to represent the existence and the levels of social capital.  
2 Social ties and contacts are the network measures of social capital. Most researchers who use Putnam’s instrument define social capital as ‘societal trust’, thus differing from the network view used in this paper. For detailed discussion of Putnam’s instrument and its various criticisms see Paldam [2000], Sobel [2002], and Fukuyama [2000]. A discussion of the network definition is in chapter 2. Measures of social capital that follow from the network definition are discussed in the data section (chapter 5).
finds that the inverted U-shape hypothesis of the life-path of stock is not supported.

The second question that this paper addresses is: Is the investment in social capital positively related to the level of schooling? Glaeser et al. [2002], using a neoclassical investment model, find that this relationship is more complex than what the previous research had predicted. Their theoretical model predicts that people with higher opportunity cost of time will invest less in social capital. Since people with more education also have a higher opportunity cost of time [Murphy and Welch, 1992], this implies that more schooling reduces social capital investment. However, in their empirical exploration, Glaeser et al. [2002] find that education has a strong positive effect on social capital. These findings are reconciled in this study. More schooling affects social capital formation in a variety of ways that may work in opposite directions. Because people with more education have a higher opportunity cost of time their cost of investment in social capital is higher. However, at the same time, they may benefit more from social capital. The net effect of additional education on social capital formation thus may go either way.

Third, what can explain the differences in social capital across cities, suburbs, and small rural areas? Are people in big cities socially more connected than people in the rural areas, and if so, why?
In order to answer these questions, the dynamic model of chapter 4 is parameterized in chapter 6 to analyze lifetime decision making about social capital accumulation. It also presents estimates of the structural parameters of the model. This is an important contribution to the literature. This is the first study that estimates the structural parameters of a model of social capital accumulation. The method of simulated moments is used to estimate these structural parameters. The matching is done using a GMM-type minimum distance estimation procedure.

Once the model’s structural parameters are estimated, they are used to simulate the lifecycle paths of stocks and flows of social capital. We can study the lifecycle patterns, we can also compare various groups such as the college graduates and those who did not go to college, or compare people living in big cities with those living suburbs or small rural areas.

This study makes a number of contributions to the social capital literature. It presents a dynamic model of individual’s social capital investment that is flexible enough to incorporate features that are unique to social capital. It uses measures of social capital that are precise and exploits the information in the GSS that has not been used in the context of measuring individual level social capital. A reduced form analysis using these social capital measures is

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3 Costa and Kahn [2001] used the same measures of social capital. However, they used it at the aggregate level and not to study the individual’s decision mechanism.
also presented that sheds light on the demographic variation of individual level social capital.

This study also presents the first structural parameter estimates of the decision model of social capital accumulation. The structural estimates and the simulation exercises shed lights on a variety of social capital issues. The study contradicts the popular lifecycle hypothesis that the life-path of stock has an inverted U-shape. It also suggests an explanation for the apparent puzzle in the literature regarding the relationship between human capital and social capital. And finally it addresses the issue of variation in social capital across geographical locations.
CHAPTER 2

SOCIAL CAPITAL DEFINED

2.1. Early Definitions: An Embarrassment of Riches

As Fukuyama [2000] aptly puts it about social capital, “there are multiple alternative understandings of this intellectually fashionable but elusive concept.” Glenn Loury [1977] has been one of the first to use the term social capital. In Loury’s conceptualization, social capital represents the consequences of social position in facilitating acquisition of the standard human capital characteristics. It is much in the same spirit that George Borjas [1992] uses the concept, although he calls it Ethnic Capital. His basic idea is that skills of the next generation depend on the quality of the ‘ethnic environment’. What this concept appeals to is some kind of an unobservable that is ‘social’ in nature; it is something in the community or group or, perhaps, among people that is different from the other forms of capital and that it has nontrivial real effects.
 Needless to say, this kind of a definition is much less precise than what is needed to make the concept operational.

Sociologists and political scientists have been much more enterprising in defining this unobservable from many different angles. Some of the widely used definitions are presented below.

“... social capital refers to connections among individuals – social networks and the norms of reciprocity and trustworthiness that arise from them....”

Robert Putnam (2000)

“Social capital can be defined simply as an instantiated set of informal values or norms shared among members of a group that permits them to cooperate with one another. If members of the group come to expect that others will behave reliably and honestly, then they will come to trust one another. Trust acts like a lubricant that makes any group or organization run more efficiently.”

Francis Fukuyama (1999)

“...a variety of different entities, with two elements in common: they all consist of some aspect of social structure, and they facilitate certain actions of actors—whether personal or corporate actors—within the structure.”

James Coleman (1988)

“Social capital is an attribute of an individual in a social context. One can acquire social capital through purposeful actions and can transform social capital into conventional economic gains. The ability to do so, however,
depends on the nature of the social obligations, connections, and networks available to you.”

Pierre Bourdieu (1986)

Fukuyama’s definition represents view that used to be the popular view of social capital where social capital is characterized as the level of trust within the group which promotes cooperation. Nan Lin is generally opposed to identifying social capital with trust. James Coleman [1999], like Lin [2001a, 2001b] and Burt [2000], uses concepts of social ties and social networks but mostly to emphasize the importance of the micro aspects of social capital; Coleman’s notion of social capital, however, is fundamentally different from that of Lin and Burt. Putnam generally mixed both the concepts of trust and network without being very precise or concrete about either. It is Bourdieu’s definition that is closest in spirit to an individual based neoclassical treatment.

This lack of a coherent set of definitions in the early years may have given rise to the tendency among empirical researchers to label everything social as ‘social capital.’ To quote Serageldin and Grootaert [1999], “Examples of

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4 There is opposition to using the ‘Trust’ definition among economists as well. Durlauf [2000] expresses concern about the intermixing of concepts such as ‘norms or reciprocity’ and ‘trustworthiness’.

5 Lin and Burt’s views will be discussed in the next section.

6 In fact, Fukuyama [2000] criticizes Putnam’s thesis showing that Putnam’s results are driven by societal trust component and not the societal network component.

7 Bourdieu’s conceptualization of social capital, however, is more in line with his theory of ‘cultural capital’ that has not been a popular view in the social capital literature.
social capital are easier to provide than one specific definition.” This apparently paradoxical statement actually highlights a lack of guidelines as to what constitutes social capital. A general criticism by many of the researchers comes in the forms of a point of contention to some of Coleman’s remarks: “Social capital is defined by its function.” “It is not a single identity, but a variety of different entities having two characteristics: they all consist of some aspect of a social structure, and they facilitate certain actions of individuals who are within the structure.”

This notion of social capital creates confusion because the cause is defined by the effect. Coleman’s examples of social capital would include trustworthiness in the closed Jewish community of wholesale diamond sellers that decreases need for elaborate insurance, bringing customers to each other as a gesture of goodwill in Cairo’s money exchange market, organizational power in diffusion of information and mobilization through social circles among radical South Korean students, attitudes of responsibility towards each other’s children in Jerusalem, etc. Lin [2001a, 2001b] and Durlauf [2000] criticize it being a ‘functional’ characterization. Trustworthiness may be considered a form of social capital but then bringing customers to each other as a gesture of goodwill in Cairo’s money exchange market is a ‘norm of reciprocity’. Trustworthiness and norms of reciprocity are distinct concepts and may or may
not be lumped together under a common heading. In fact, some of the norms of reciprocities may be viewed as effects of trust or social capital in general.

Coleman’s notion of social capital, therefore, might run the risk of allowing almost everything ‘social’ to be identified as social capital. Coleman [1999] argues, “The social capital of the family is the relations between children and parents (and, when families include other members, relationships with them as well).” There is also a view that suggests that social capital includes the social and political environment that enables norms to develop and shapes social structure. This view accommodates formalized institutional relationships and structures such as governments, political regimes, the rule of law, court systems, and civil and political liberties. If one looks at the list of examples of social capital in the literature it becomes clear how all encompassing social capital is thought to have been. It is, therefore, important to use a narrower and more precise definition of the concept. Such definitions are indeed available in the recent literature as will be discussed in the following sections.

The first issue discussed in this study is the conceptualization of social capital where it is more narrowly and sharply defined. Secondly, since one wants to study social capital using the neoclassical investment model, this definition needs to be conducive to a reasonable micro-foundation. Having said

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8 The impact of this more broadly defined concept of social capital on macroeconomic outcomes has been investigated by North [1990] and Olson [1982].
that, the more pressing reason why a micro-foundation is desirable, in fact, is because we need an explanation – and possibly an understanding of the mechanism – for endogenous formation of social capital. This will allow us to formulate explicit models of individual behaviors (micro decision making) and examine how they translate into the aggregate level (the macro variables). In this study, however, we will concentrate exclusively on the individual and not address the aggregation issues.

An ‘individual’ is the focus of analysis here. One group of researchers is generally opposed to characterizing social capital at the individual level. Fukuyama [2000], for instance, asserts that, “. . . social capital is a relational phenomenon that can be the property of groups, local communities, and nations, but not individuals. We can be rich or poor in social capital, I can’t”. Unfortunately, little theoretical basis has ever been cited to support such claims. Studying social capital at the individual level not only facilitates an optimization framework,⁹ but also makes social capital analysis comparable to the economic idea of capital. As we will see in the following sections, social capital defined in terms of social networks opens up opportunities to discuss social capital at the individual level.

⁹ Needless to say, optimization at the individual level is the most common practice. In fact, it so ubiquitous that Glaeser et al. [2002] argues, optimization and individual based analysis are sometimes treated as synonymous. Glaeser et al. [2002] discusses studying social capital at the individual and at the group level in some detail.
In general, definitions of social capital can be divided into two groups: the trust/cooperation view and the Network view. It is the latter view that has been adopted here. A discussion of the trust/cooperation view and a comparison between the two views are in Appendices A1 and A2.

2.2. The Network Definition of Social Capital

Because the focus here is essentially on the individual we concentrate on the individual level definition. The essence of the so-called Network view of social capital is that people who are better connected do better. Therefore, to identify social capital of an individual, we look at a person’s social relationships.

Definition 2.2.1: Network\textsuperscript{10}

At any point in time \( t \), an individual is variably connected to other individuals as a function of prior contact, exchange, and attendant emotions. An individual’s network consists of all these connections.

\textsuperscript{10} This definition is constructed in light of Burt [2001].
Definition 2.2.2: Usefulness of Network

Information: Social ties and contacts (network) help obtain access to useful information.

Influence: Networks can be used to exert influence on other individuals. Suppose A has a tie with B and B with C. A may be able to exert influence not only on B but, perhaps, on C as well.

Insurance: Social ties and contacts can work as insurance policies during bad times.

Non-economic aspects: Social ties and contacts have associated with them returns of a non-economic nature such as prestige, respect, recognition of entitlement of resources and other attributes, etc.

Direct utility: The activities of network building have intrinsic values in the sense that they may directly enter into individual’s utility function.

All forms of exchange are inherently embedded in social relationships. This concept is similar to the concept of closure in Burt [2001]. The closure argument is that social capital is created by a network of strongly interconnected people. The remaining three definitions are taken from Woolcock [1998].

11 Woolcock [1998] has a detailed discussion of the concept of social capital and how it can be addressed within the framework of mainstream economic research. Although the definitions are developed in the context of development issues, they are generalized enough to be used as a generic definition.
Definition 2.2.3: Embeddedness\textsuperscript{12}

For the individual, embeddedness refers to intra-community ties.

One clarification is in order here. First and foremost, what do we mean by a community (or group) and what are the criteria for group formations? We can think of a Metropolitan Statistical Area (MSA) or a neighborhood as the operational concept of a community. In that case geographical location is the criteria for group formation. One could also argue that one’s economic activity should be the criteria for group formation and a firm or a business organization should be considered a group.\textsuperscript{13} Groups can be distinguished on many criteria. Burt [2001] uses network criteria that define information redundancy to distinguish groups. We can also set up our own criteria and define groups or communities. As it turns out, due to data limitations, we will not have to worry about the criteria for group formation. We will remain agnostic about the idea of a community (or a group) and simply assume that there exist well-defined criteria that label each individual into various groups.

\textsuperscript{12} Mark Granovetter’s notion of embeddedness has been adopted here [Granovetter, 1985]. His embeddedness hypothesis is a rather general one that claims that desired social and economic outcomes are achieved through interaction between social, economic, physical and environmental conditions. In Granovetter’s words, “Actors do not behave or decide as atoms outside a social context, nor do they adhere slavishly to a script written for them by the particular intersection of social categories that they happen to occupy. Their attempts at purposive action are instead embedded in concrete, ongoing systems of social relations.” [Granovetter 1985, page 487]. The crucial element of the concept of embeddedness is its contextualization. This definition describes the specific context in which Woolcock [1998] uses the concept.

\textsuperscript{13} Burt (2001) presents evidence of social capital within business organizations.
Now, intra-community ties are not the only variety of social ties that an individual has. As in Burt [2001] there is also the argument of *structural holes*. This argument is that social capital could also be created by a network in which people can broker connections between otherwise disconnected segments. We, therefore, also look for *autonomous* relations that the individual has.

**Definition 2.2.4: Autonomy**

For the individual the autonomous relationships refer to extra-community ties or linkages.

![Figure 1: Networks of Individuals A, B and C](image)

Figure 1 shows networks of individual A, B and C. The thickness of the lines shows the strength of ties while the positions of the agents in the boxes
represent positions in the economy. In the above case A does not have extra community ties while B and C do. Networks within the community have the usual network benefits, but extra community ties open up possibilities of different dimensions. B and C have some additional dimensions to their network that A does not have. Take B, for instance. First of all, his connection with community 2 gives him an advantage with respect to information access; not only can he obtain a higher volume of information because of his diverse contacts, the accuracy of his information is also likely to be greater. Secondly, B is in a position to bring together otherwise disconnected contacts, which might give him a disproportionate say. And last but not the least, the fact that having an extra community network yields such benefits makes B a valuable contact in the networks of other individuals (such as A or C).

**Definition 2.2.5: Social Capital**

Social capital at the individual (micro) level consists of all the social ties – intra and extra community – that the individual possesses at a point in time.

Although the focus in this study is entirely on the individual – for the sake of completeness – the definition of social capital at the macro level is presented in Appendix B.
2.3. Characterization of Social Capital

To translate the above definition into the framework of neoclassical economics we need to take a closer look at the concept of capital and verify whether and how the concept of social capital can be addressed using the neoclassical capital theory.

2.3.1. Fitting into the Neoclassical Investment Framework

One of the reasons why many social characteristics and traits are often considered forms of social capital is that they fit the following general characteristics of capital.

Definition 2.3.1: Characteristics (C)

(C1) Stock-flow concept: Social capital is a stock generated by a flow. This emphasizes a feature of accumulation or decumulation, or, in other words, an evolution over time. In the long run it is endogenous, but almost exogenous (predetermined) in the short run.

(C2) It is useful, and

(C3) It can be destroyed or reduced abruptly.14

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14 Capital should have the property that it can be destroyed or reduced abruptly with a shock (or shocks).
These characteristics allow for a large number of social attributes to be labeled social capital. For instance, some researchers have argued that cultural aspects such as ‘nationalism’ or individual characteristics such as ‘status’ are examples of social capital. The argument for nationalism brings up the issue of the so-called ‘East Asian miracle’ where nationalism has arguably been a contributor in the production function. It can certainly be destroyed or reduced abruptly, and perhaps, it may even be viewed as a stock-flow concept. Similar arguments are applicable for status to establish that it also satisfies (C1)-(C3). However, if we want to use a neoclassical capital theory, it would be necessary to impose the following general structure on top of the above-mentioned characteristics.

**Definition 2.3.2: Structure (S)**

(S1) The individual is the smallest denomination in the analysis.

(S2) The individual takes purposeful actions (investments) to maximize her rewards.

(S3) At each point in time these actions (which are flows) cause accumulation of ‘stock’ (of social capital).

(S4) There is a return on social capital stocks (and flow) which constitutes an incentive mechanism for the individual’s decision making.
Needless to say, neither nationalism nor status would fit into *Structure* \((S)\). Nationalism would not satisfy \((S2)\); it is difficult to think of nationalism arising from a typical individual’s optimum decision making. Nationalism may also not satisfy \((S1)\) in the sense that it may just be a cultural phenomena or a background variable. Status, on the other hand, may be considered a ‘return on social capital’ and not a form of social capital itself.

The remainder of this section discusses the implications of Definitions 2.2.1-2.2.5, \((C1)-(C3)\) and \((S1)-(S4)\). Before that, however, a qualification must be made. By imposing *Characteristics* \((C)\) and *Structure* \((S)\), it is not being argued that there are no significant differences between social capital and other forms of capital, namely, physical and human capital. In fact, social capital is different from the other forms of capital in substantive ways. These differences are discussed in section 2.3.2.

Arrow [1999] argues that *social capital does not require material sacrifice*. This is true under the notion where inherent social qualities of individuals such as charisma are viewed as forms of social capital. In fact, charisma is an *innate ability* that is comparable to *cultural capital*, a concept promoted by Pierre Bourdieu. Cultural capital includes language, accent, manner, familiarity with religious rituals etc. There are other references of these attributes that are often cited in the literature (Loury [1977] or Borjas [1992], for instance). Bourdieu himself includes in the category of social capital attributes such as titles. Now,
all these attributes are not always subject to choice and are often obtained without sacrificing an alternative. And this does not meet the qualifications of a ‘purposeful action’. The definition used in this paper, therefore, is more precise. It is important to restrict ourselves to attributes that individuals acquire with purposeful actions. Charisma, title, or one’s ethnic heredity may influence these actions and their results. But they should be viewed as innate ability of the individual and not their stock of social capital. What needs to be underscored is that when we emphasize purposeful actions that individuals take to make social relationships, there arise the question of making real sacrifices of resources such as time and money.

The question of identifying returns from the form of capital, in fact, brings up an important issue, namely, that of the ‘functional’ characterization of social capital. In many studies the distinctions among flows of investment, stocks and returns are not explicitly made. In the definitions above the idea is to restrict purposive actions only to the actions that are taken to create and maintain social ties and contacts. The objective behind this is to avoid the problem of a ‘functional’ characterization where the distinction between cause and effect is often blurred. As a result, according to this definition, status – an attribute Glaeser et al. [2002] view as a form of social capital – would, in fact, be treated as a ‘return’ to investments in social capital and not a form of social capital itself.
(C1)-(C3) and (S1)-(S4) sharpens the concept of social capital. In many studies the distinctions among flow, stock, and returns are not explicitly made. In the definitions above there is an emphasis to restrict the actions to only those that are taken purposefully and the objective behind these actions is to create and maintain social ties and contacts. To see why this is crucial, we can focus on an argument put forward in Glaeser et al. [2002]. They define individual social capital as a person’s social characteristics including social skills, charisma, and the size of the Rolodex. Their underlying assumption, therefore, is that social capital incorporates purely intrinsic ability such as charisma, attributes obtained by purposeful actions such as the Rolodex, and social skills which could easily be considered a form of human capital obtained, at least in part, from schooling. They lump all these together because they argue that these attributes are practically indistinguishable. One of the reasons behind this confusion is a lack of careful and formal definition of social capital. Under definitions 2.2.1-2.2.5, (C1)-(C3), and (S1)-(S4), the emphasis is on identifying clearly what is a stock, what is a flow, and what is a return. This view would consider a large Rolodex to be a large (stock) of social capital and rule out charisma, popularity, and various social skills. Charisma – it has been argued - is primarily an innate ability and social skills could easily be considered a form of human capital obtained, at least in part, from schooling. An attribute such as popularity could be viewed as a return on investment in social capital. In fact,
popularity is probably a result of a combination of charisma, social skills, and investment in social capital.\textsuperscript{15}

Definitions 2.2.1-2.2.5, (C1)-(C3), and (S1)-(S4) help avoid the problem of a ‘functional’ characterization where the distinction between cause and effect is blurred. Social capital should not be defined by what it does. Many norms of reciprocity are often considered social capital. Social norms are results of a complex mix of history and social interaction. Some social norms could be influential in governing social capital investments while in some other cases social capital can affect shaping of some of these norms. Thus, by the definitions used here, norms of reciprocity are not social capital themselves.

2.3.2. Social Capital is Different from Other Forms of Capital

Social capital may not be fungible. Arrow [1999] asserts, one cannot transfer his social capital to someone else (nontransferable).\textsuperscript{16} Usual notion of borrowing and lending may not apply to social capital. The contribution of social capital to production may not be as direct as the other forms of capital. Another crucial difference is that social capital may also have some intrinsic or direct consumption value, in which case social capital becomes a consumption

\textsuperscript{15} A person can have a lot of charisma and a high level of social skills, but if he does not take the initiative to mingle with others and take the purposive action of connecting with people, it is obviously impossible to acquire popularity.

\textsuperscript{16} The same, however, also apply to most forms of human capital. Furthermore, some social capital may in fact be transferred. For example, father’s business network may be readily available to the son for assuming father’s business.
good and an investment good at the same time. This makes individuals motivation for investment in social capital far more complex.

Solow [1999] points out that physical capital has a rate of return and can be readily measured by summing past investments net of depreciation, which is not necessarily true of social capital. In fact, Ostrom [1999] points out that social capital need not even depreciate with use the way physical capital does. In important instances, making use of social capital increases the stock of social capital available for future use. Models of incomplete information help explain how bonds strengthen with use and thus, receiving a favor can strengthen a bond. The notion that owing someone a favor may be advantageous is not counterintuitive in strategic models where receiving a favor signals the availability of a compatible trading partner. Using social capital also has positive third party effects. Expanding your network indirectly increases social capital of your associates by giving them access to a larger network.

How does social capital differ from human capital? In fact, some researchers have called social capital the ‘social part of human capital’. The fundamental differences come from what constitutes social capital. The conceptualization of both forms of capital may be close, but what constitutes stocks, flows and returns are quite different. However, the philosophical debate as to whether social capital should be considered a separate form of capital or just another dimension of human capital is not terribly relevant for this study.
Whatever the nomenclature may be, the fact remains that people make social ties and contacts and we want to study the systematic patterns of this behavior.

Social capital doesn’t have to be benign. To quote Durlauf [2000], “To the extent that social capital constitutes a set of mechanisms which describe how intra-group relationships reinforce certain types of behaviors, one cannot conclude that any presumption exists as to whether this enforcement is or is not desirable.”

Social capital among the members of organized crime is, arguably, rather high, which could be quite detrimental to people outside this organization. Social capital could also be viewed as one of the reasons for racial isolation to perpetuate, at least during segregation. While a white individual who violated segregation norms could be subject to sanctions, by upholding racist ideology the same person can acquire and maintain a large amount of social capital. Thus, each individual in the white groups may have high levels of social capital but at the aggregate level one of the embodiments of these high levels of social ties is a social ill.
CHAPTER 3

WHY IS SOCIAL CAPITAL IMPORTANT?

Studies demonstrated that social capital can explain a broad range of social and economic phenomena. It has been treated as the missing link in a variety of social science research. Unfortunately, there has also been a tendency to overuse the concept of social capital; it has been called upon to explain just about anything. The range of circumstances in which social capital is brought up as an explanation is truly remarkable. In what follows a brief literature review illustrates some of the conjectures and findings about the effects of social capital. It shows that social capital is such an essential and integral part of the social and economic mechanisms that it can, by no means, be bypassed. But, at the same time, it also demonstrates widespread abuse of the concept. It will be argued later in this chapter that the source of this abuse is primarily an absence of a satisfactory micro-foundation.
3.1. Social Capital and the Economy


Putnam has been the most influential in social capital research with his books *Making Democracies Work* (1993), *Turning In Turning Out* (1995), and, the most widely quoted *Bowling Alone* (2000). Three core claims that Putnam made created, on the one hand, widespread interest about social capital, but, on the other hand, extensive criticism from various corners. First – and it has been argued by many others as well – that social capital matters for societal cooperation, coordination, and collaboration. For instance, the labor market for the poor may be characterized by the absence of social capital (labor market connections) or the event of church-going may be an explanation for success of some of the inner-city youths. The second claim is that social capital may have significant political consequences. Social capital, defined as social network and cultural norms, is believed to facilitate political participation and good governance. And finally, the third, and the most contentious claim is that, social capital has declined in post-war America. The decrease in social capital is a reason behind the increased crime rate, decreased voters participation rate, and long period of decreased philanthropy in the U.S. Helliwell and Putnam [1995] measure ‘civic community’ by a composite index of newspaper readership, the density of sports and cultural associations, turnout in referenda, and the
incidence of performance voting. They show that, holding initial income constant, regions of Italy with a more developed civic community had higher growth rates over the 1950-1990 period. Putnam [2000] presents a variety of summary statistics and anecdotal evidence to describe social capital incidences and trends in the U.S.

Fukuyama [1995, 2000]
Fukuyama claims that the differences between countries in their social capital (in this case, trust) can explain the differences in their ability to create new corporations and associations. He also supports some of Putnam’s claims about the connection between societal trust and democracy and good governance. Using the World Values Survey he carries out a cross country comparison using primarily correlation analysis and summary statistics to demonstrate the basic claim about the positive effect of social capital on a civic society.

Knack and Keefer [1997]
Knack and Keefer treats societal trust and civic norms as social capital, which they actually consider to be mirror images of each other. Their claim is that social capital matters for measurable economic performance. Using the World Values Surveys for a sample of 29 market economies, they carry out an analysis
in the spirit of growth regressions\textsuperscript{17} to show that social capital variables exhibit a strong and significant relationship to growth. Although they do not find that memberships in formal groups, which is Putnam's measure of social capital, is associated with trust or with improved economic performance, they do find evidence that trust and civic norms are stronger in nations with higher and more equal incomes, with institutions that restrain predatory actions of chief executives, and with better-educated and ethnically homogeneous populations.

\textbf{Serageldin and Grootaert [1999]}

They argue that social capital is the missing link in the explanation for the East Asian economic miracle. Social capital is the underlying phenomena in the economic disparity between northern and southern Italy and the recent economic upturn in Somalia. Besides the subsequent land productivity increase social capital is responsible for the mobilization of communities and formation of joint forest management that led to cessation of violence between local people and government officials over forest management in Gujarat, India.

\textbf{Paldam and Svendsen (2000)}

They claim that social capital led to successful cooperative movements in Denmark between 1850 and 1900, in Tanzania during the colonial days, and in

\footnote{\textsuperscript{17} Besides OLS they sometimes use 2SLS to minimize endogeneity problems.}
Bangladesh in recent years. Social capital is responsible for decentralization and cooperation that takes place within successful firms. In their view, elements in the society that facilitate institution building, especially in the LDCs, represent social capital and, the implication is that the lack of social capital is one of the reasons behind the collapse of the socialist soviet system.

Others

Coleman [1999] claims that social capital is an explanation for children’s school drop out rate (social capital within the family). In Furstenberg and Hughes [1995], Coleman’s concept of social capital is argued to have played a part in enabling youth at risk to negotiate their way out of disadvantage. Narayan and Pritchett [1996] find that, in a sample of Tanzanian villages, higher levels of associational memberships are related to higher incomes. Goldin and Katz [1999] show that social capital facilitated the rise of high school in the Midwest of the USA.

Most empirical researchers who studied the effect of social capital used various proxies of social capital and tried to relate them to an observed outcome. This approach has been criticized heavily by many.18 In general, there is a lack of appropriate and adequate micro-foundation in social capital.

18 See Durlauf [2000, 2002] and Sobel [2002] for some of these criticisms.
research. As Durlauf [2000] emphasizes, there is a “… lack of attention to the nature of individual decision-making.” An understanding of the purposeful behavior requires an “… explicit formulation of the constraints, preferences and beliefs that determine an individual’s choice. This choice-based perspective can then be used to ask how individuals are influenced by the choices of others or the past behaviors of a given individual. Without going through this type of analytical exercise, one cannot develop a satisfactory causal theory of the relationship between social capital and observed behavioral patterns.” Therefore, a researcher of social capital must address the individual’s decision mechanism in a direct manner. Neoclassical capital theory has been extensively used to address issues of physical and human capital [Lucas 1978, Ben-Porath 1967, Heckman 1976]. Studying social capital using the same framework is a natural extension.

3.2. Social Capital at the Individual Level

3.2.1. Review of Literature

Social capital at the individual level refers to the social connectedness of the individual; it is a system of interpersonal networks [Dasgupta 2002]. These networks influence market outcomes through the channeling of information and reduction of search costs. In a large number of instances, mutually
beneficial trades take place not through the market but due to these interpersonal relationships.

Diverse areas of research emphasize the beneficial aspects of social networks.\textsuperscript{19} Networks serve to channel information about new technology, employment, and market opportunities. Networks of businessmen help circulate information about breach of contract in the business community and thereby enabling business groups to penalize and exclude cheaters. Social capital reduces incentive problems in teams by circulating information about effort levels. In the literature on knowledge spillover, social ties and contacts play a crucial role not only in dissemination of ideas but also in the cross breeding of ideas through social interaction [Jacobs 1969, Krugman 1991].

Role of social capital in entrepreneurship is well documented. Bosma, Praag, Thurik, and Wit [2004] show that on a sample of Dutch entrepreneurs, higher levels of a business founder’s social capital are associated with greater performance of the firm. Figueiredo, Guimarães, and Woodward [2002] show that social networks may play a role in location preferences of the entrepreneurs. They argue that personal ties and friendships attach investors to their existing business locality.

In the context of search costs, the most widely discussed outcome of social networks is in the labor market where interpersonal relationships process information about jobs and job applicants [Granovetter, 1995]. Labor economists have long recognized that workers find jobs through social networks. Personnel researchers argue that employee referrals are a useful device for screening job applicants. Montgomery [1991] uses an adverse selection model to show that workers who are well connected might fare better in getting a job than poorly connected workers and that firms hiring through referrals might earn higher profits. Based on a number of studies, he finds that approximately 50 percent of all workers employed at the time found their jobs through social networks.

A number of studies show that social networks play crucial roles in creation of economic opportunities. Utilizing data on research proposals submitted to the National Science Foundation (NSF) Economics Program over a 5-year period, Feinberg and Price [2004] argue that social capital stock of grant applicants enhance their access to research resources by increasing the probability of being awarded a research grant. Social capital has been argued to be a crucial ingredient in the functioning of successful cooperative movements in Denmark between 1850 and 1900, in Tanzania during the colonial days, and in Bangladesh in recent years [Paldam and Svendsen, 2000]. Furstenberg and
Hughes [1995] argue that social capital plays a positive role in the individual outcomes especially in case of disadvantaged youths.

Networks also deliver several non-market benefits. They often work as insurance during bad times as people can fall back on personal connections for financial as well as other supports. Carter and Maluccio [2003] in a study of South African households showed that households with more social capital seemed better able to weather shocks. Social networks are an integral part of everyday life where people do each other favors such as baby sitting or airport drop-off in situations where the market option is not immediately available (or costly). Social ties and contacts have other non-economic returns such as prestige, respect, and social recognition of wealth and other attributes [Lin, Cook, and Burt, 2001].

Social networks have implications in personal well-being. An important motivation for individuals to engage in socializing is the satisfaction from interacting with others [Durlauf and Fafchamps 2004]. Dasgupta [2002] describes socializing as ‘pleasurable activity’. In the General Social Survey, when asked how important it is for close friend to be enjoyable company, 48 percent responded that it is ‘extremely important’, 40 percent responded ‘very important,’ and 10 percent responded ‘fairly important’.
3.2.2. Lifecycle of Social Capital of the Individual

While a wealth of research shows that social capital can explain a broad range of social and economic outcomes, there exists a lack of rigorous research addressing the process of social capital formation. In particular, the literature suffers from an absence of formal modeling of the evolution of social networks over an individual’s lifecycle. Filling this gap is an important goal of this paper. Neoclassical capital theory has been used extensively to address the lifecycle issues of physical and human capital [Lucas 1978, Ben-Porath 1967, Heckman 1976]. Studying social capital using the same framework is a natural extension where individual’s decision mechanism is addressed.20

By focusing on the lifecycle aspects we are able to address a number of issues that are fundamentally dynamic in nature. The individual has a finite lifespan which impacts his or her life-time decision mechanism. Additionally, various features of the decision mechanism, such as cost of investment and depreciation rates, are essentially time varying. These imply that there is a rationale for adopting a dynamic framework. There is also the need to appreciate the differences across various groups, not just at a given point in time, but in terms of the entire life profiles of social capital.

20 See Glaeser et al. [2002] for further discussion of this ‘economic approach’ to study social capital accumulation.
CHAPTER 4

SOCIAL CAPITAL FORMATION AS DYNAMIC DECISION
MAKING OF THE INDIVIDUAL

This chapter discusses the theoretical approaches to study social capital accumulation. Section 4.1 discusses the existing literature and its treatment of social capital formation. Section 4.2 proposes a model of social capital that is nested in the neoclassical investment framework.

4.1. Theoretical Approach to Analyzing social capital formation: Background

One type of literature where social ties and contacts become relevant is the social interaction literature. As Blume and Durlauf [1998] emphasize, the basic issue in this literature is the collective behavior of a group of interacting, heterogeneous agents. In terms of substantive departures from other types of economic modeling, the interaction-based approach focuses on direct interdependencies that arise through the joint participation of economic actors.
in a set of markets. Thus, this literature appeals to the embeddedness hypothesis of Granovetter [1985] in a more direct way. The various types of interactions that have been the primary area of study in this literature are generally the interactions that are not mediated by market structures. Standard examples include peer group and role model effects or interdependent preferences.

The approach taken in this study to investigate social capital diverges from the social interaction literature in a fundamental way. We start with the premise that the focus is on the individual; what we want to examine is how the individual behaves to create and maintain social contacts over her lifecycle where her objective is to maximize lifetime net returns. Having said that, there is no denying that community level variables are influential determinants of social capital formation of the individual and that there are intricate issues involved that the interaction literature emphasizes. However, individual decision making regarding social capital merits attention in its own right. The objective of this paper is studying the mechanism of the individual’s social capital formation and its lifecycle issues. For simplicity, various neighborhood effects and related complexities are assumed away.

There are two parallel literatures on groups and networks that are relevant for the concept of social capital. The first one is the literature on

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21 Glaseser et al. [2002] emphasizes this point.
cooperation, while the other is the literature on networks. The issues they address are very similar but how they look at the problems is rather different. The research on cooperation is more in line with the trust/cooperation view of social capital. The basic motivation of that research stems from the fundamental principles of repeated games where cooperation is easier when individuals expect to interact more often in the future. In this literature, the concept of networks is more closely related to the idea of groups.

The conceptualization of social capital in this literature is different from that described in section 2. Following Annen [2003], social capital is defined as a player’s (a person or an organization) reputation for being cooperative in a social network where a social network is a set of players and a pattern of information and/or goods among these players. The issues in this literature are different too. First of all, a large part of the debates involve the sustainability of cooperation, punishment and community enforcement, and search for conditions under which cooperative strategies are evolutionary stable (North [1991], Kandori [1992], Nowak and Sigmund [1998], Boyd and Richerson [1989]). Issues of group formation are also widely discussed; Landa [1981], Carr and Landa [1983], and Cooter and Landa [1984] discuss optimal club formation. There is also the consideration of network exchange and relative efficiency between network exchange and impersonal market exchange (Kranton [1996], Kali [1999]).
The network approach to social capital is closest to a theoretical attempt at analyzing social capital at the individual level. Lin [2001], Burt [2001] and Woolcock [1998] discuss this approach. In chapter 2, this is the approach that has been adopted to define social capital. In the network literature, it is the sociologists that address the particular problem of social capital while the economists are more concerned with the theoretical foundation of networks.

The social network literature is quite mature and has flourished in a big way in the recent years. This predominantly theoretical literature concentrates on formalizing networks. The focus in this literature is on outcomes of networks, network formation, stability and efficiency of networks, network values and their allocation, etc. As tools these theories borrow heavily from cooperative game theory. The dynamic models in this literature (Watts [1997], Jackson and Watts [2002]) address questions such as stability of networks.

Although this research is careful with the conceptualization of social capital, there is an absence of formal modeling of the evolution of social capital over an individual’s lifecycle that can be tested using data. That is exactly what is attempted here. In doing so, we’ll appeal to the standard dynamic model of investment in the practice of neoclassical economics. In the network approach – although not among economists but among sociologists – quite a large amount

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22 A great reference is a survey by Mathew Jackson [2003].
of empirical research exists.\textsuperscript{23} However, none of them attempted structural estimation.

The model that is presented in the next section is inspired by Glaeser et al. [2002] where a dynamic programming framework is used with the individual as the decision maker who takes the environment around him as given. However, as will be discussed in the subsequent sections, Glaeser et al. [2002] model is a rather restrictive special case of the more generalized model presented below. The most important departure from Glaeser et al. [2002], however, is in the conceptualization of social capital. First of all, a very different definition has been adopted here and, secondly, Glaeser et al. [2002] do not adequately address the fact that social capital is different in some substantial ways from the other forms of capital.

4.2. Developing a Model of Social Capital Accumulation of the Individual

In the model developed below, the problem of investment in social capital is studied in isolation, abstracting from the problems of choosing consumption, investment in physical, human, and social capital simultaneously. Consider a representative individual who solves a lifetime

\textsuperscript{23} Lin, Cook and Burt (eds.) [2001] \textit{Social Capital: Theory and Research} presents a number of empirical research papers.
investment problem under a finite horizon $T$. Let, $x_t$ be the flow of investment in social capital at time $t$, where $t = 1, \ldots, T$. It includes all the activities that the individual engages in at $t$ to build new network links and maintain old links. This could include the number of visits to friends and neighbors over the weekend (to maintain and strengthen existing relationships) and dropping by at the new neighbor’s house-warming party (perhaps to make new relationships). These activities require sacrifices of time and monetary resources.

The stock of social capital at $t$, denoted by $s_t$, is the network links that the individual has at $t$. It represents the social ties and contacts that the individual has retained over the period starting from $0$ through $t$. Stocks would, for instance, include the total number of friends that the individual has at time period $t$.

The reward function of the individual is,

\begin{equation}
    f(s_t, x_t, t) = R(s_t, x_t) - C(s_t, x_t, t),
\end{equation}

where $R(s_t, x_t)$ is the return on investment and $C(s_t, x_t, t)$ is cost of investment, both measured in utility.\textsuperscript{24} Return from social capital depends explicitly on $x_t$.

\textsuperscript{24} In this general framework, $x_t$ can have multiple controls and $s_t$ can have multiple state variables. As we will see in the empirical sections, the data does not have that many dimensions. However, the model can accommodate a more complex treatment of the problem. For instance, controls may include time as well as monetary resources. Similarly, the states may
the investment activity. This captures the fact that part of the reason why people create and maintain social relations is the utility from the investment activity itself. When one goes to a party to meet old friends and make new ones, one also ends up having an enjoyable evening. The investment thus yields an instant return in terms of enjoyment from socializing. Social capital, therefore, has a two fold return and the reward function can be written as,

\[ f(s_t, x_t, t) = r(s_t) + h(x_t) - C(s_t, x_t, t), \]

where \( R(s_t, x_t) \) is decomposed into \( h(x_t) \), the instantaneous return from investment flows of social capital, and \( r(s_t) \), the usual lagged return from stocks of social capital. An important aspect of the instantaneous return is that both the investment activity \( x_t \) and the return \( h(x_t) \) take place at \( t \). This simultaneity has an important lifecycle implication. Since the model is of finite horizon and there is perfect and complete information about the end period, the individual – knowing when he is going to die (at \( T \)) – is not going to invest if all the returns accrue at \( T + 1 \). In that case, investment will plunge to zero at \( T \). However, if at least part of the return is instantaneous, there exists a parameterization that prevents investments from falling dramatically at period \( T \). In this model,

\[ \text{include number of friends as well as some intensity measure of the friendships. The network links may also be separated into intra and extra community links, and so on.} \]

\( ^{25} \text{Separability of} \ s_t \text{ and} \ x_t \text{ is assumed for simplicity.} \)

\( ^{26} \text{The return is on} \ s_t \text{ where, by equation (4),} \ s_t = g(s_{t-1}, x_{t-1}, t-1). \text{Thus,} \ s_t \text{ is determined at} \ t-1. \)
equation (2) has a return component that is instantaneous. With this specification, because there exits a return even at the end period, the individual has an incentive to invest even in the end period \( T \). Without this feature the model will resemble the physical capital model where investment goes to zero at period \( T \).\textsuperscript{27}

Because of lifecycle variations in labor supply and changes in family composition, the opportunity cost of time is likely to vary over the lifecycle. This is captured in \( C(s_i, x_i, t) \), where cost explicitly depends on \( t \). Although time cost is likely to be the primary component of the cost, it is not just the time from work that the individual has to sacrifice. To invest in social relations, the individual has to sacrifice time for work, family, and own leisure. Another aspect of the time cost is that, after retirement, it is no longer the wage rate that reflects the opportunity cost of time. The time horizon \( T \) in this model goes well beyond the retirement age.\textsuperscript{28} Therefore, the cost of investment in social

\textsuperscript{27} There exists alternative ways to obtain similar features, e.g., incorporating a bequest motive or introducing an uncertainty about horizon \( T \). The assumption that intergenerational transfer of social networks must wait until the individual dies is unrealistic. Besides bequests of social networks may be very important for families with significant wealth and social stature, but may not be as common for most families. The alternative assumption that the horizon \( T \) is unknown is, perhaps, more plausible. However, this will make the problem stochastic and computationally burdensome. The instantaneous return assumption, on the other hand, not only allows a deterministic treatment, but also is an important phenomenon that merits a direct treatment.

\textsuperscript{28} The value of \( T \) has been set to the maximum life expectancy number over the periods 1900-2001 by any individual (which happens to be the life expectancy of a white woman born in 2001 and the life expectancy is 80.2 years). See \textit{National Vital Statistics Reports}, Volume 52, number 14, February 18, 2004, National Center for Health Statistics.
capital is specified as a utility cost; an observed variable such as the wage rate may not be an adequate proxy of this cost.

At each point in time, the budget constraint of the individual is,

\[ 0 \leq x_t \leq d, \]

where \( d \) is the upper bound on \( x_t \). The upper bound on the control can be a function of the state variable(s), the return, or other individual attributes.

There is a law of motion that describes the evolution of the stock over time,

\[ s_{t+1} = g(s_t, x_t, t). \]

\( g() \) being a direct function of \( t \) allows for a time varying depreciation rate. Social capital depreciates when interaction decreases or ceases. Because of the high mobility rates during the first half of the individual’s life, the depreciation rate is unlikely to be constant throughout the lifecycle.

The individual has a finite horizon \( T \). There is no uncertainty. The Bellman equation of the problem is the following. Given \( \delta \), the time discount factor, \( \forall s_t \) with \( t = 1, \ldots, T, \)

\[ V_t(s_t) = \max_{0 \leq x_t \leq d} \{ r(s_t) + h(x_t) - C(s_t, x_t, t) + \delta V_{t+1}(g(s_t, x_t, t)) \}, \]

\[ V_{T+1} = 0. \]

This is quite a generalized model. It is flexible enough to accommodate a wide range of parameterizations. When parameterized, the model is capable of
simulating life-paths of stocks and flows of social capital. In chapter 6, this model is parameterized and estimated using a simulated method of moments estimation method.
CHAPTER 5

EMPIRICAL MEASURES OF SOCIAL CAPITAL AND
SOME DESCRIPTIVE ANALYSIS

This chapter describes the General Social Survey (GSS), 1972-2002, which is the data source in this study. The latter part of this chapter is devoted to some reduced form analysis focusing on demographic variations in social capital investment.

5.1. The General Social Survey

The General Social Survey (GSS), 1972-2002, is a repeated annual cross-section of 1372 to 2992 adult respondents (between age 18 and 89). This survey has demographic information, information on education and so on. What makes this survey unique and the preferred data source for this paper is that it asks direct and specific questions about social networks.
5.1.1. Network Measures of Social Capital

A number of simplifying assumptions have been made in order to utilize the data from the GSS that would make the network definition of social capital presented in chapter 2 operational for the lifecycle model of chapter 4. Only the 0-1 links are considered here. A 0-1 link refers to network links where all that matters is the existence of a link and not the intensity of the links. In many situations, especially when links represent friendships, intensities of links may be important. This restriction is motivated by data constraints. The GSS does not have information about the intensities of links. Much of the literature on network formation has dealt with links that are either present or absent with no intensities associated with them [Jackson, 2003]. The estimation that follows focuses only on the number of links that each respondent has and is not concerned with the entire network. Although both intra and extra community ties are considered, no distinction is made between the two types of ties.

The GSS reports “the number of close friends that the respondent has” at the time of the interview.29 These variables measure accumulated social capital of the individual at a point in the individual’s lifecycle. This information is available for years 1986, 1998 and 2002. Pooling all these years we have multiple

\[\text{Notice that this information only counts the number of friends and thereby measures the number of 0-1 links. It does not contain information about the social characteristics of friends, and the nature and intensity of ties.}\]
observations of number of friends for each age between 22 and 80. This allows for a lifecycle of 59 years to be studied.\textsuperscript{30} This variable is labeled \textit{stock of friends}.

Flows of investment measure the actions that the individual takes to build up a stock of friends. The GSS asks “how frequently the respondent spends an evening with friends and neighbors”.\textsuperscript{31} The frequency of meeting friends and meeting neighbors are combined together to construct a total investment measure for each person. It is the ‘number of meetings a year with friends and neighbors (who are friends)’. This information is available for years 1974-75, 1978, 1982-83, 1985-86, 1988-91, 1993, 1994, 1996, 1998, 2000, and 2002. The years have been pooled yielding multiple observations of the number of meetings for each age between 22 and 80 (again, over a 59-year lifecycle). The natural logarithm of this variable is labeled \textit{log of the number of meetings} that is the investment flow in social capital.

These measures of social capital focus on the strongly ‘social’ aspects of the social networks. They do not include networks at the workplace. Under the

\textsuperscript{30} As explained earlier, the horizon has been chosen in light of the estimates of National Vital Statistics Reports. The reason observations are started from age 22 is because there are no college graduates in the GSS who are less than 22 years old.

\textsuperscript{31} These variables have been used by other researchers such as Costa and Kahn [2001]. However, they used these variables for aggregate as opposed to individual level analysis. The variables take values from \{0,1, . .6\} where, 6 = almost daily, 5 = several times a week, 4 = several times a month, 3 = once a month, 2 = several times a year, 1 = once a year, 0=never. In this paper these variables have been converted to ‘number of meetings a year’ with the following assumptions: 6 = 365 times a year, 5 = 156 times a year (i.e. 3 times a week), 4 = 60 times a year (5 times a month), 3 = 12 times a year, 2 = 6 times a year, 1 = once a year, 0 = never. Experiments with different assumptions such as 6 = 312 times a year (i.e. 6 times a week), 5 = 104 times a year (i.e. 2 times a week) and so on do not change the results in any significant way.
assumption that networking activities in the work-place are work-related activities, networks at the work-place are kept aside in this study. For analysis of work-related networks see Borghans, Weel, and Weinberg and [2005].

5.2. Demographic and Neighborhood Variables

Table 1 is a description of the demographic and neighborhood variables. Not all the information is available for all the years. The table below presents a subset of the data for which all the variables are non-missing. All the monetary variables are deflated by Consumer Price Index (CPI) to year 2000 dollars.

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32 In chapter 6 when structural parameters are being estimated the number of observations is significantly increased because fewer covariates are required for that estimation.
<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Mean</th>
<th>St. dev</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
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<td>Log number of meetings</td>
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<td>Proportion of sample from 1977</td>
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<td>0.26</td>
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<tr>
<td>Proportion of sample from 1978</td>
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<td>0.26</td>
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<td>Proportion of sample from 1982</td>
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<td>0.28</td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Proportion of sample from 1983</td>
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<td>0.07</td>
<td>0.26</td>
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<td>1.00</td>
</tr>
<tr>
<td>Proportion of sample from 1985</td>
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<td>0.26</td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Proportion of sample from 1986</td>
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<td>1.00</td>
</tr>
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</tr>
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<td>Proportion of sample from 1989</td>
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<td>1.00</td>
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<tr>
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</tr>
<tr>
<td>Proportion of sample from 1991</td>
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<tr>
<td>Proportion of sample from 1993</td>
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<tr>
<td>Proportion of sample from 1994</td>
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<td>Proportion of sample from 1996</td>
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<td>Age 30-39</td>
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<tr>
<td>Age 40-49</td>
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<td>Age 50-59</td>
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<td>1.00</td>
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<td>Age 60-69</td>
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<td>1.00</td>
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<td>Age 70-80</td>
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<td>1.00</td>
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<td>Married</td>
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<td>0.00</td>
<td>1.00</td>
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<td>First generation</td>
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<td>0.24</td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Second generation</td>
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<td>0.34</td>
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<td>1.00</td>
</tr>
<tr>
<td>Third or older generation</td>
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</tr>
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<td>College graduate</td>
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</tr>
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<td>College dropout</td>
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<td>High school or less</td>
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<td>0.50</td>
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<td>1.00</td>
</tr>
<tr>
<td>Population (100,000)</td>
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<td>3.48</td>
<td>11.86</td>
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<td>78.95</td>
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<tr>
<td>Real household income ($10,000)</td>
<td>17775</td>
<td>5.27</td>
<td>4.62</td>
<td>0.06</td>
<td>27.30</td>
</tr>
<tr>
<td>Regional income ($10,000)</td>
<td>17775</td>
<td>4.21</td>
<td>0.47</td>
<td>2.99</td>
<td>5.08</td>
</tr>
</tbody>
</table>

Table 1: Descriptive Statistics
5.3. Demographic and Neighborhood Characteristics: Hypothesis

The next order of business is to examine the determinants of social capital investment. Some of the demographic and neighborhood variables will be considered potential candidates.

5.3.1. Gender

Since we are dealing with individual’s behavior regarding social ties there are many reasons why males and females might differ in their behavior in terms of the social ties they make and maintain. One source of these differences would be purely historical and cultural that determines how men and women pursue social ties and contacts. Historical and cultural factors also determine economic aspects of interactions. In a study on business start-ups and gender differences Renzulli and Moody [2000] show that a high proportion of females in the network or being female are critical disadvantages facing potential small business owners. This implies that it could be costlier for a woman to build networks. Gender is generally controlled for in studies where determinants of social capital are examined (for example, Lindstrom et al. [2002], Subramanian, Lochner and Kawachi [2002]).
5.3.2. Immigration Status

It is generally argued that mobility and distance from previous social capital stocks would negatively affect investment in social capital. Immigrants, by this notion, would have a natural disadvantage in social capital investment; they have moved to a place where most things are unfamiliar and their previous social connections are at a prohibitive physical distance. Furthermore, immigrants may be subject to discrimination and alienation that could hinder their social capital investments. Woolcock [1998], however, introduces an interesting twist on the issue. Initially immigrants are protected by their closed community, but as they move out of their closed community they are exposed to discrimination and alienation. This would suggest that being a first generation immigrant may be advantageous vis-à-vis a second generation immigrant.

On the other hand, Stanton-Salazar and Dornbusch [1995], studying Mexican-origin students, argue that bilingual students may have unique advantages in acquiring the institutional support that is needed for success in school and social mobility. In other words, there could be certain advantages

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34 Stanton-Salazar and Dornbusch [1995] study data on the information networks of Mexican-origin high school students. They find that there exists some evidence of the relationship between grades and status expectations, and measures of social capital but the language measures yield the strongest associations.
of being an alien in acquiring social capital. This, in a way, indicates to the popular notion that immigrants have stronger intra community ties. These ties arise partly form cultural familiarities and partly from insurance motives.

5.3.3. Education and Income

The connection between human capital and social capital is much discussed in the social capital literature. There can be a number of sources through which education can affect social capital investment. Buerkle and Guseva [2002] shows that the social component of education – friends, acquaintances and other connections accumulated while in school – is nontrivial and significant. People who have spent more time in school made valuable contacts relatively easily; it will be much more costly for a person to acquire similar contacts without going to school. Given that the schooling decision is generally considered a self selection [Cameron and Heckman 2001], one can argue that people who stay in school longer have a lower cost of investment in social capital. Glaeser et al. [2002] points out another connection: individuals with higher levels of human capital may have better communication skills and exposures making it easier for them to make contacts.

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36 Using data from Czech and Polish samples of the Social Stratification in Eastern Europe after 1989 General Population Survey, they show that social capital accumulated in school reduce the uncertainty inherently present in the hiring process and eventually translates into higher income.
The reduced form regressions in Glaeser et al. [2002] show that education has a positive effect on social capital formation.

At the same time, given the strong correlation between income and education, there is an opportunity cost channel that would have a dampening effect; a better home security system can substitute for one’s time spent getting to know one’s neighbors better. Another reason for higher opportunity cost for people with higher levels of human capital is insurance; it may be cheaper for them to substitute social capital with some other instruments as insurance for bad times.

5.3.4. Race

It is often argued in the literature that race is an important determinant of social capital formation.\textsuperscript{37} Whether race matters or not is obviously important but what is a more pertaining question is the underlying social and economic factors that race embodies. Using trust as a social capital proxy, researchers have found that blacks are more likely to report mistrust.\textsuperscript{38} A symmetric result may not hold while using the network measures of friendship related variables. In fact, it is quite possible that the opposite is true. Dominguez and Watkins [2003] study minority low income mothers and elaborates how they use social

\textsuperscript{37} Using the Multi-City Study of Urban Inequality Smith [2003] shows that white men are likely to mobilize extra-community, white, male, and influential contacts.

\textsuperscript{38} See Subramanian, Lochner and Kawachi [2002], or Putnam [2000].
capital for ‘support’ and ‘leverage’. As in the case of immigrants there is a general notion that minorities have stronger intra community ties that may remain even after controlling for income (or education in the present study). There might be a tendency to ‘stick together’ as a reaction against the general disadvantages of being minorities in a stratified society. Thus, it might be less costly for non-whites to make non-white contacts.

5.3.5. City Size

When people decide how to behave, they take into account the social, economic and legal implications of their action (which is part of the embeddedness thesis of Granovetter [1985]). These implications depend on the environment in which the decision is being made. Social capital is also subject to strong interpersonal complementarities in investment; having a friend could be more useful if that friend has more friends. Glaeser et al. [2002] argue that people who belong to an environment with more social capital will tend to invest more in social capital themselves. Subramanian, Lochner and Kawachi [2002], using trust perception as the social capital variable, show that there is significant variation across neighborhoods.39

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39 They use 1994-95 Community Survey of the Project on Human Development in Chicago Neighborhoods (PHDCN).
Social capital is generally considered to be heavily influenced the population size of a neighborhood. Hofferth and Iceland [1998] show that social capital is more common among families in rural communities than urban communities.\footnote{Using data from the 1988 wave of the Panel Study of Income Dynamics, they find that families living in rural areas are more likely to exchange exclusively with relatives.} There could also be a population composition effect whereby lower income inequality and higher ethnic homogeneity is associated with higher levels of social capital (membership in particular).\footnote{See Alesina and La Ferrara [2000], Knack and Keefer [1997], Costa and Kahn [2001].} The reduced form equation tests for these neighborhood differences.

### 5.4. Reduced Form Analysis

Table 2 presents reduced form regressions in the spirit of an exploratory analysis. Two regressions are reported. The dependent variable is the log of the number of meetings with friends and neighbors, which measures the socializing behavior of the respondents. Among the explanatory variables, the omitted categories are year dummy for 1996, white, age group 21-29, third or older generation immigrants, and college drop-outs.
<table>
<thead>
<tr>
<th>Explanatory variables</th>
<th>OLS</th>
<th>2SLS</th>
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</thead>
<tbody>
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<td></td>
<td>Coefficient</td>
<td>p-value</td>
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<td>Constant</td>
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</tr>
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<td>Year dummy for 1977</td>
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<td>Year dummy for 1978</td>
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<td>Year dummy for 1982</td>
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<td>Year dummy for 1983</td>
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<td>Year dummy for 1988</td>
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<td>High school or less</td>
<td>-0.1287</td>
<td>0.0000</td>
</tr>
<tr>
<td>Population (100,000)</td>
<td>0.0020</td>
<td>0.0420</td>
</tr>
<tr>
<td>Real household income ($10,000)</td>
<td>0.0055</td>
<td>0.0450</td>
</tr>
<tr>
<td>Regional income ($10,000)</td>
<td>0.0089</td>
<td>0.7210</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>No. of observation</th>
<th>17775</th>
<th>17775</th>
</tr>
</thead>
<tbody>
<tr>
<td>( R^2 )</td>
<td>0.0843</td>
<td>0.0850</td>
</tr>
</tbody>
</table>

Table 2: Reduced Form Regressions
In the OLS regression, household real income is significant. However, because of well documented economic benefits of social capital, an instrumental variable regression is also reported where household real income is instrumented with regional real income (9 regional categories). The discussion below is in terms of the instrumental variable regression (the first stage of the 2SLS regression is reported in Appendix C).

In the instrumental variable regression real income no longer matters. Variables that do matter are: year, sex of the respondent, age, marital status, education, and population size of residential location. The year dummies show that compared to the early years in the survey, socializing has declined in the later years. The coefficients of the age spline show a steady decline in socializing over age. Males socialize more than women, singles socialize more than married people, second generation Americans socialize more than first generation immigrants as well as those who are third generation or older, college graduates socialize more than those who did not attend college. And, finally, socializing increases with size of the residential location.

Chapter 6 of this study conducts structural estimation of an optimization model of social capital accumulation of the individual. Not all the aspects that matter in the reduced form analysis are addressed in the structural estimation. The estimation technique used in the structural estimation does not allow for time trends because it makes the model intractable and too complex to render
itself to a feasible estimation strategy. The analysis also does not explicitly incorporate marital status. Marital status and mobility are time varying characteristics that are extremely difficult to incorporate in the dynamic framework adopted in chapter 6.\textsuperscript{42} However, effects of both marital status and lifecycle mobility are addressed indirectly through a time varying depreciation rate.

The dynamic model, however, emphasizes the lifecycle implications. In fact, the structural parameters are able to capture complex dynamics over age that may not be apparent in the reduced form analysis. Among other factors that the reduced form analysis emphasizes are: gender, immigration status, education, and size of residential location. The analysis with structural estimates confines itself to analyzing the effects of education and location, and leaves the issues of gender differences and immigration status as possible future studies.

\textsuperscript{42} Besides, the GSS doesn’t have a usable mobility measure, which is why the regressions in Table 2 do not have a mobility measure. The age spline captures some of the effects of lifetime mobility.
CHAPTER 6

STRUCTURAL ESTIMATION OF THE DYNAMIC MODEL
OF SOCIAL CAPITAL INVESTMENT

One of the goals of this study is estimating the structural parameters of the dynamic decision problem of the individual. Glaeser et al. [2002] has been the only study that uses a formal lifecycle model. However, they did not estimate the structural parameters of their model; rather, they used the first order conditions as a guideline for a reduced form regression. Furthermore, they do not have any treatment for flow of investment and they carry out their entire analysis only in terms of their measure of stock, the membership variable.

In contrast, this study matches life cycle profiles generated by the intertemporal decision model presented in chapter 4 to life cycle profiles estimated from the General Social Survey using a GMM-type minimum distance estimation procedure. Matching these profiles allows us to identify structural parameters of the choice model and deduce lifecycle behaviors of the individual. Measures of both stocks and flows are incorporated in carrying out
a complete estimation. Once these estimates are in hand we can analyze a number of issues: we can study the lifecycle patterns, we can also compare various groups such as college graduates and those who did not go to college, or compare city with rural residents, etc.

This chapter starts with a description of the data that is used for the structural estimation. Then, the parameterization of the general model of chapter 4 is described. Explanation of the estimation technique follows. Detail analyses of the findings conclude the chapter.

6.1. Data Set for Structural Estimation

A specific focus of this study is to compare social capital stocks and flows between education groups. The following two groups have been constructed to study the relationship between human capital and social capital: one with individuals with 16 or more years of schooling (the college graduates) and the other with 12 years of schooling or less (the ‘non-college’ group). Sample sizes and descriptive statistics of the groups as well as the full sample are presented in tables 3 and 4. With regards to residential location, the sample is divided into three groups: city, suburb and small rural. The 100 largest SMSAs where population is at least 500,000 are considered cities. The ‘suburb’ category includes the 100 largest suburbs while the areas that are neither cities
nor suburbs and have a population of less than 5,000 are in the ‘rural’ category. Sample sizes and other descriptive statistics of all these groups are presented in tables 3 and 4.
### Table 3: Sample Sizes

<table>
<thead>
<tr>
<th>Groups</th>
<th>Description</th>
<th>N</th>
<th>m*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full sample</td>
<td>All groups combined</td>
<td>23928</td>
<td>100</td>
</tr>
<tr>
<td>Non-college</td>
<td>Never went to college</td>
<td>13321</td>
<td>56</td>
</tr>
<tr>
<td>College</td>
<td>College graduate</td>
<td>5157</td>
<td>22</td>
</tr>
<tr>
<td>City</td>
<td>100 Largest SMSAs with population ≥ 500,000</td>
<td>2736</td>
<td>11</td>
</tr>
<tr>
<td>Suburb</td>
<td>100 Largest suburbs</td>
<td>6016</td>
<td>25</td>
</tr>
<tr>
<td>Rural</td>
<td>Smaller areas with population less than 5,000</td>
<td>5059</td>
<td>21</td>
</tr>
<tr>
<td>Non-college, city</td>
<td>City residents who never went to college</td>
<td>1348</td>
<td>6</td>
</tr>
<tr>
<td>Non-college, suburb</td>
<td>Suburban residents who never went to college</td>
<td>2746</td>
<td>11</td>
</tr>
<tr>
<td>Non-college, rural</td>
<td>Rural residents who never went to college</td>
<td>3498</td>
<td>15</td>
</tr>
</tbody>
</table>

*m = % of full sample

### Table 4: Descriptive Statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Mean</th>
<th>std</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock of friends</td>
<td>3220.00</td>
<td>6.62</td>
<td>5.39</td>
<td>0.00</td>
<td>25.00</td>
</tr>
<tr>
<td>Investment:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>log of number of meetings</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>with friends and neighbors</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full sample</td>
<td>23928.00</td>
<td>3.88</td>
<td>1.53</td>
<td>0.00</td>
<td>6.60</td>
</tr>
<tr>
<td>Non-college</td>
<td>13321.00</td>
<td>3.76</td>
<td>1.65</td>
<td>0.00</td>
<td>6.60</td>
</tr>
<tr>
<td>College</td>
<td>5157.00</td>
<td>4.02</td>
<td>1.29</td>
<td>0.00</td>
<td>6.60</td>
</tr>
<tr>
<td>City</td>
<td>2736.00</td>
<td>4.03</td>
<td>1.54</td>
<td>0.00</td>
<td>6.60</td>
</tr>
<tr>
<td>Suburb</td>
<td>6016.00</td>
<td>3.86</td>
<td>1.46</td>
<td>0.00</td>
<td>6.60</td>
</tr>
<tr>
<td>Rural</td>
<td>5059.00</td>
<td>3.77</td>
<td>1.57</td>
<td>0.00</td>
<td>6.60</td>
</tr>
<tr>
<td>Non-college, city</td>
<td>1348.00</td>
<td>3.89</td>
<td>1.66</td>
<td>0.00</td>
<td>6.60</td>
</tr>
<tr>
<td>Non-college, suburb</td>
<td>2746.00</td>
<td>3.72</td>
<td>1.60</td>
<td>0.00</td>
<td>6.60</td>
</tr>
<tr>
<td>Non-college, rural</td>
<td>3498.00</td>
<td>3.71</td>
<td>1.64</td>
<td>0.00</td>
<td>6.60</td>
</tr>
</tbody>
</table>

Table 4: Descriptive Statistics
6.2. Parameterization

6.2.1. Parameterization in Glaeser et al. [2002]

The Glaeser et al. [2002] model can be viewed as a special case of the model proposed in section 4.2 of chapter 4. They use the following specification,

\[ R(s_t, x_t) = ps_t, \]
\[ g(s_t, x_t, t) = \beta s_t + x_t, \quad \beta < 1, \]
\[ C(s_t, x_t, t) = qx_t^\gamma, \quad \gamma > 1, \]

Here, \( p \) represents the neighborhood social capital, \( q \) is the opportunity cost of time, \( \beta \) is the parameter that represents a time invariant depreciation of social capital. Cost is also time invariant and \( \gamma > 1 \) implies that cost is convex on \( x_t \).

![Simulated Life-paths of Glaeser et al. [2002] Model](image)

Figure 2: Simulated Life-paths of Glaeser et al. [2002] Model

The results are typical of the physical capital models: the life-path of investment plunges at \( T \) and the life-path of stock has an inverted U-shape.
Figure 2 presents the simulated paths generated by this model where $\gamma = 2$, and $\beta = 0.9$.$^{43}$ What needs to be underscored here is that whatever the parameter values are, this model always predicts a stock path that is inverted U-shaped and an investment path that goes to zero at the end of the lifecycle. Another prediction of the model – and the authors also emphasize this prediction – is that social capital investment does not increase with age.

### 6.2.2. Empirical Clues

Glaeser et al. [2002] use Putnam’s instrument – the membership variable – as their proxy for stock of social capital. The friendship related social capital measures, however, do not conform to the predictions of Glaeser et al. [2002]. Figure 3 presents means by age of the two variables of interest: stock of friends and log of number of meetings (i.e. investment flow) for the full sample as well as for the college group. These series can be interpreted as life profiles of stocks and flows of a representative individual.

First, the stock path does not show an inverted U-shape. Secondly, there exists lifecycle variation in social capital investment: it decreases at a higher rate during the first half of the lifecycle. However, at no point over the lifecycle does social capital investment increase with age.

---

$^{43}$ For simplification, I have also assumed that $p = 1$, $q = 1$ and that the problem is unconstrained. The implication of assuming $p = 1$ is that per capita social capital of each location is assumed constant. The focus here is individual lifecycle and not the aggregate time trends. Besides, the debate on the issue of time trend does not yet have a clear verdict [Putnam 1995, Putnam 2000, Paxton 1999, Costa and Kahn 2001].
investment go to zero, i.e., people continue to engage in socializing throughout their life including the periods toward the end of the lifecycle (as well as at the end period $T$). And finally, the investment profile of the college group does show an upward tendency towards the end of the lifecycle contradicting the prediction of Glaeser et al. [2002].

![Figure 3: Life-paths of Stocks and Investment Flows](image)

The model of the section 4.2 of chapter 4 addresses these limitations of the above model. In what follows, the proposed model of chapter 4 is parameterized. These structural parameters are also estimated. The analyses that follow show that this model can address and explain these observed features of the data that the Glaeser et al. [2002] model filed to accommodate.
6.2.3. Parameterization: Two-part Return, Time Varying Cost of Investment, and Time Varying Depreciation Rates

Equation (2) shows a two-part return on social capital: the instantaneous return component and the lagged return component. Let,

\[ h(x_t) = \eta \log(x_t), \]

where \( x_t \) denotes log of number of meetings. The function \( h(x_t) \) imposes large penalties on very low levels of investment and strict concavity on \( x_t \). At any point in life having no socializing is too costly an option (net return goes to \( -\infty \)).\(^4\) This parameterization is particularly useful for the later part of the lifecycle as it prevents investment from falling to zero by providing an incentive to invest in the end period \( T \) even when the individual knows that she will not live in period \( T + 1 \). The parameter of instantaneous utility, \( \eta \), determines the shape of the instantaneous utility function. When \( \eta \) increases the lifetime investment profile has a parallel shift upwards.

The lagged return is a Constant Relative Risk Aversion (CRRA) utility function,

\[ r(s_t) = \frac{s_t^{1-\sigma}}{1-\sigma}, \]

\(^4\) This kind of an approach has been used by Carroll [1992] to explain buffer-stock savings in a consumption model where the marginal utility of consumptions approaches infinity as consumption becomes sufficiently low. Consequently, the households are unwilling to accept very low consumption.
where $s_t$ denotes stock of friends and $\sigma$ is the coefficient of relative risk aversion. In a deterministic model, attitude towards risk is not directly relevant. An alternative interpretation of $\sigma$ – as elasticity of substitution – is more applicable: the smaller the value of $\sigma$, the slower marginal utility falls as stock rises, and so, the individual is more willing to allow his stock of social capital to vary over time. If $\sigma$ is close to zero, utility is almost linear and the individual is willing to accept large swings in his stock of social capital between two points in time. In terms of investment behavior, a higher $\sigma$ depresses investment. A large amount of empirical work has estimated $\sigma$ under the assumption that it is constant. Although results vary substantially, the estimates usually lie around and below unity.

Let the utility cost of investment in social capital be,

\begin{equation}
C(s_t, x_t, t) = \alpha_t x_t,
\end{equation}

where $\alpha_t = \exp\left(\sum_{k=0}^{K} \alpha_k t^k\right)$ is the coefficient of the cost of investment. Being a function of $t$, $\alpha_t$ is nonstationary thus permitting the opportunity cost to vary over the lifecycle. By the choice of $K=2$, $\alpha_t$ has a flexible specification that allows various shapes over the lifecycle. With this specification, the parameters $\alpha_0$, $\alpha_1$, and $\alpha_2$ determine the shape of the lifetime profile of cost of investment.

To incorporate a time varying depreciation rate, the law of motion is specified as,
where $\beta_t = \exp\left(\sum_{m=0}^{M} \beta_m t^m\right)$ and $\varphi(x_t) = \tau x_t$. The time varying depreciation parameter $\beta_t$ has the interpretation that at time $t$ social capital depreciates at a rate $(1 - \beta_t)$. By assuming $M = 2$, $\beta_t$ has a flexible specification that allows various shapes over the lifecycle. The combination of parameters $\beta_0$, $\beta_1$, and $\beta_2$ determine the shape of the lifetime depreciation profile. Because of the exponential functional form, $\beta_t$ is restricted to be non-negative. However, $\beta_t > 1$ is permissible. This implies that a ‘decay’ of social capital is not mandatory. The second term in the law of motion is $\varphi(x_t)$, which converts $x_t$ into units of $s_t$. Thus, at each $t$, if the individual takes investment actions $x_t$, she makes $\varphi(x_t)$ friends at $t + 1$. For simplicity, $\tau$ is assumed constant.

The upper bound on the budget constraint is assumed to be a fixed value $\bar{d}$ that denotes the maximum number of meetings a year allowed by the individual’s total time endowment. The budget constraint is,

$$0 \leq x_t \leq \bar{d}.$$  

The optimization problem formulated above is nonstationary as both the reward function and the law of motion depend on time. Furthermore, the reward function has three parts: a CRRA form, a log form, and a part that
involves a polynomial of \( t \). This problem cannot be solved analytically.\(^{45}\) It has been solved numerically to simulate time paths of stocks and flows for \( T = 59 \) (the lifecycle starts at age 22 and ends at age 80).\(^{46}\)

### 6.2.4. First Order Condition

The constrained problem has the first order conditions,

\[
\pi_t = \frac{\eta}{x_t} - \alpha_t + \delta \tau \mu_{t+1},
\]

\[
\mu_t = s_t^{-\sigma} + \delta \beta_t \mu_{t+1},
\]

where,

\[
\alpha_t = \exp \left( \sum_{k=0}^{\xi} \alpha_k t^k \right),
\]

\[
\mu_t = \frac{dV_t}{ds_t}, \quad \text{and}
\]

\[
\beta_t = \exp \left( \sum_{m=0}^{M} \beta_m t^m \right),
\]

with \( K = 2 \) and \( M = 2 \). The complementary slackness conditions are,

\[
0 \leq x_t \leq \bar{d}, \quad x_t > 0 \Rightarrow \pi_t \geq 0, \quad x_t < \bar{d} \Rightarrow \pi_t < 0.
\]

---

\(^{45}\) See Miranda and Fackler [2002] for a discussion of the restrictive nature of the set of problems (e.g., linear-quadratic problems) that may be solved analytically. Also see Bertsekas [1987] for a general discussion.

\(^{46}\) The solution method is backward recursion using the collocation method discussed in Miranda and Fackler [2002].
6.3. Hypotheses

6.3.1. Empirical Life-paths

The prediction of the theoretical model in Glaeser et al. [2002] is that the life-path of stock of social capital has an inverted U-shape. They use Putnam’s instrument – membership in voluntary organizations – as their proxy for stock of social capital and find that it supports this prediction. The friendship related social capital measures used in this study, however, do not conform to the predictions of Glaeser et al. [2002]. Figure 4 presents means by age of the two variables of interest: the stock of friends and log of number of meetings (i.e. investment flow) for the full sample. These series can be interpreted as life profiles of stocks and flows of a representative individual.

![Image: Empirical Life-Paths of Stocks and Investment Flows of Social Capital]

Figure 4: Empirical Life-Paths of Stocks and Investment Flows of Social Capital
First, the stock path on the left panel of Figure 4 does not show an inverted U-shape. In fact, it shows a slightly declining tendency during middle age and an increasing pattern then on, up to age 75, which is almost the end of the lifecycle. Secondly, the flow path on the right panel of Figure 4 exhibits lifecycle variation in social capital investment; it decrease at a higher rate during the first half of the lifecycle. Finally, at no point over the lifecycle does investment go to zero; people continue to engage in socializing throughout their life including the end period \( T \). The economic explanations of all these lifecycle features of the stock and flow paths can be offered using the structural parameter estimates.

6.3.2. Evolution Process of Social Capital: The Issue of Depreciation Rate

In chapter 4 it has been argued that depreciation rate may not be constant throughout the individual’s life and, therefore, equation (4) allows the depreciation rate to be time varying. Another interesting aspect of the depreciation rate is that in the social capital literature, it has argued that social capital may not decay. This is a fundamental difference that social capital has with other forms of capital, especially physical capital. Solow [1999] argues that while stock of physical capital can be readily measured by summing past investments net of depreciation, the same idea may not be applied to social capital. In fact, Ostrom [1999] argues that social capital need not even
depreciate with use the way physical capital depreciates. In important instances, making use of social capital increases the stock of social capital available for future use.47 The hypotheses that will be tested are whether depreciation rate is indeed time varying and whether social capital decays or not.

6.3.3. Links between Human Capital and Social Capital

The connection between human capital and social capital is widely discussed in the social capital literature. In fact, Glaeser et al. [2002] describe this connection to be one of the most robust empirical regularities. Figure 5 reproduces means by age of log of number of meetings (i.e. investment flow) of the two groups: college and non-college. It is evident that the college group invests more in building and maintaining social networks.

47 The notion that owing someone a favor may be advantageous is not counterintuitive in strategic models where receiving a favor signals the availability of a compatible trading partner. Using social capital may also have positive third party effects. Expanding someone’s network indirectly increases social capital of everyone linked to her by giving them access to a larger network.
There are a number of possible channels through which education can affect social capital investment. Buerkle and Guseva [2002] show that the social component of education – friends, acquaintances, and connections accumulated while in school – is significant. Therefore, at age 22, college graduates have relatively more social capital stock vis-à-vis the non-college people, which requires higher level of investments in the form of maintenance. Glaeser et al. [2002] argue that individuals with higher levels of human capital may have better communication skills making it easier for them to make contacts. These skills would encourage college graduates to invest in making new contacts. College graduates are also likely to have better access to and higher processing skills of information which could enable them to get more out of their social capital.

Figure 5: College versus Non-College - Empirical Life-Paths of Investment Flows of Social Capital
At the same time, given the strong correlation between income and education, there are channels that can have dampening effects on social capital investment. Schooling is strongly related to earnings. To spend time with friends and neighbors, college graduates have to give up earnings that are higher than the non-college group. There are some less obvious channels as well. Higher income individuals are more likely to have a home security system and thus not invest in the alternative of having their neighbors watch their house. Similarly the insurance motive for bad times could be less effective with higher income as better access and processing capacity of information, it may be cheaper to substitute for social capital with financial instruments.

The reduced form regressions in Glaeser et al. [2002] show that the effect of education on social capital formation is positive. However, their theoretical model predicts that people with higher time costs invest less in social capital. Drawing from these findings, this study proposes the following hypothesis: college graduates have a higher cost of investment compared to the non-college group but, at the same time, their return from social capital also is higher. Thus, their net benefit may be higher than the net benefit of the non-college group.48 Another difference between the two groups may arise in the lifecycle patterns. In Figure 5, in the later part of their lives, the college group increases its

48 Although Glaeser et al. [2002] do not incorporating it in their formal analysis, they do discuss the possibility that higher educated people may obtain more utility from socializing.
investment. To address this variation, the model had to allow for nonstationarity. The two sources of nonstationarities in the model are: the cost function and the depreciation rate.

6.3.4. City Size

When people decide how to behave, they take into account the social, economic and legal implications of their action, which is part of the *embeddedness* thesis of Granovetter [1985]. The implications depend on the environment in which the decision is being made. Subramanian, Lochner and Kawachi [2002], using trust perception as the social capital variable, show that there is significant variation of social capital across neighborhoods.49 Residents of big cities and individuals who live in apartment buildings are more likely to socialize with their neighbors and go out to dinner [Glaeser and Sacerdote, 1999]. This finding indicates the importance of physical proximity on social connectedness. The critique of urban sprawl also emphasizes this point. Urban sprawl is an overexpansion that drives spatial growth away from the optimum level of residential concentration.50 One of the negative effects of this is likely to be a decline in social interactions.51 Festinger, Schacter and Back [1950] find that

49 They use 1994-95 Community Survey of the Project on Human Development in Chicago Neighborhoods (PHDCN).
50 Brueckner [2000] reviews the causes and consequences of urban sprawl.
51 In fact, Putnam [2000] argues that urban sprawl is associated with less social capital formation.
people who are spatially far apart are less likely to form social connections. A yet another argument is related to the concept of matching [Helsley and Strange 1990]. When the population in a location increases the pool and variety of available individuals to make friends with also increase. By this token in big cities, it will be easier to find people to make friends.

![Figure 6: Differences in Investment in Social Capital (All Education Groups)](image)

Figure 6 shows that the differences in lifetime investment profile among city, suburb, and small rural areas. Investments in cities – particularly in the first half of the life – are higher than in the suburbs and the rural areas.
Figure 7: Differences in investment in social capital (Non-college Only)

Figure 7 presents the same pictures as Figure 6, but now the sample consists only of people who did not attend college. The visual differences are slightly reduced if the effects of education are removed from the sample.

6.4. Estimation

6.4.1. Simulated Method of Moments

With the parameterization proposed above the Bellman equation, equation (5), can be rewritten as,
\[
V_i(s_i; \Theta) = \max_{x_i} \left\{ f(s_i, x_i, t; \sigma, \eta, \alpha_0, \alpha_1, \alpha_2) + \delta V_{t+1}\left(g(s_i, x_i, t; \beta_0, \beta_1, \beta_2, \tau)\right) \right\},
\]

where \( t = 1, \ldots, T \) and \( \Theta = (\sigma, \eta, \alpha_0, \alpha_1, \alpha_2, \delta, \beta_0, \beta_1, \beta_2, \tau) \).

The data is, \( \{ s_i^h, x_i^h \mid i_i = 1, \ldots, n_i, j_i = 1, \ldots, m_i, t = 1, \ldots, T \} \), where \( s_i^h = (s_i^1, s_i^2, \ldots, s_i^j, \ldots, s_i^n) \) and \( x_i^h = (x_i^1, x_i^2, \ldots, x_i^j, \ldots, x_i^n) \) are the stocks and flows, respectively. Here, \( s_i^j \) is the stock level of the \( i \)-th individual in the age group \( t \), and \( x_i^j \) is the investment level of the \( j \)-th individual in the age group \( t \).

Starting from age 22 to age 80, with each age being considered an age group, \( T = 59 \). Note that the \( n_i \)'s are different for different \( t \) and the same is true for the \( m_i \)'s.

Trying to estimate all the parameters simultaneously is not feasible as it makes the numerical solution unstable. Consequently, the following assumptions have been made. First, a time preference parameter value of \( \delta = 0.95 \) is assumed. Second, a sequential procedure is used. In stage 1, \( \Theta_1 = (\beta_0, \beta_1, \beta_2, \tau) \), the parameters of the law of motion, are estimated. In stage 2, these estimates are plugged in and the remaining parameters \( \Theta_2 = (\sigma, \eta, \alpha_0, \alpha_1, \alpha_2) \), the parameters of the reward function, are estimated.
In each stage of estimation, a minimum distance estimation procedure is used.\textsuperscript{52} Let $\hat{\Phi}_T$ be an initial unrestricted estimate of the parameter vector $\Phi_0$, $A_T$ be a symmetric positive semidefinite weighting matrix, and $\xi(\Phi_0) = 0$ be a vector of parameter restrictions. By writing the restrictions in terms of a parameterization $\xi(\Phi_0) = \Psi(\Theta_0)$ the vector of functions $\hat{\Phi}_T - \Psi(\Theta)$ can be viewed as comparable to the empirical moment function of the GMM procedure. The minimum distance procedure finds the values of the parameters that minimize the squared generalized length of $\hat{\Phi}_T - \Psi(\Theta)$ with respect to $A_T$, i.e.,

$$
(12) \quad \hat{\Theta} \equiv \underset{\Theta}{\operatorname{argmin}} \left[ \hat{\Phi}_T - \Psi(\Theta) \right]' A_T \left[ \hat{\Phi}_T - \Psi(\Theta) \right],
$$

where $\hat{\Theta}$ is the minimum distance estimator. An efficient choice of $A_T$ is a consistent estimator $\hat{V}_T^{-1}$ of the inverse of the asymptotic variance $V_0$ of $\hat{\Phi}_T$.

In stage 1 where the parameters of the law of motion are being estimated, for $t = 1, \ldots, T$,

(i) $\hat{\Phi}_T = (\bar{s}_2, \ldots, \bar{s}_{T+1})$, where $\bar{s}_{t+1} = \sum_{i=1}^{n_{t+1}} s_{t+1}^i / n_{t+1}$.

\textsuperscript{52} A similar method is frequently used in the recent monetary policy literature. See Christiano, Eichenbaum and Evans [2001], and Boivin and Giannoni [2003].
(ii) $\Psi(\Theta_t) = (g_1, \ldots, g_T)$, where $g_t = g(s_t, x_t, t) = \exp(\beta_0 + \beta t + \beta^2 t^2) x_t + \tau x_t, \bar{x}_t$ and $\bar{\tau}_t$ are obtained from the data as $\bar{x}_t = \sum_{j=1}^{\nu} x_t / m_t$ and $\bar{\tau}_t = \sum_{i=1}^{n_t} \tau_i / n_t$, respectively, and

(iii) $A_T = \hat{V}_T^{-1}$, where $\hat{V}_T$ is the estimated variance-covariance matrix of $\hat{\Phi}_T$.

Thus, stage 1 minimizes the weighted distance between the left hand side and the right hand side of the law of motion, equation (9), for $t = 1, \ldots, T$. Here, $\hat{V}_T$ is assumed to be a diagonal matrix with the implication that there is correlation within each age group but observations across age groups are not correlated.  

In stage 2, parameters of the reward function are estimated by minimizing the weighted distance between the time path of investment projected by data and the time path of investment generated by the model.  

For $t = 1, \ldots, T$,

(i) $\hat{\Phi}_T = (\bar{x}_1, \ldots, \bar{x}_T)$, where $\bar{x}_i = \sum_{j=1}^{\nu} x_t / m_t$,

---

53 One may like to use the complete variance-covariance matrix which is the most efficient choice of the weighting matrix. But this approach relies on many more estimated elements, which seems to adversely affect the numerical stability of the minimization problem. For the same reason, similar diagonal matrices are used in Christiano, Eichenbaum, and Evans [2001], and Boivin and Giannoni [2003].

54 In contrast, the econometric methodology involved in the monetary policy literature involves selecting the structural parameters that minimize the distance between the estimated VAR responses and the model-based responses.
(ii) \( \Psi(\Theta_2) = (x_i'(\hat{\Theta}_1, \Theta_2), \ldots, x_i'(\hat{\Theta}_1, \Theta_2)) \), where \( x_i'(\hat{\Theta}_1, \Theta_2) \) is the simulated time path of the flow generated from the solution of the Dynamic Programming (DP) problem,

\[
V_i(s_i; \hat{\Theta}_1, \Theta_2) = \max_{\alpha_i} \left\{ \frac{s_i^{1-\sigma}}{1-\sigma} + \eta \log(x_i) - \exp \left( \sum_{k=0}^{2} \alpha_i t^k \right) x_i \right. \\
+ \left. \delta V_{t+1} \left( \exp \left( \sum_{m=0}^{2} \hat{\beta}_m t^m \right) s_i + \hat{\tau} x_i \right) \right\},
\]

(13)

\( V_{T+1} = 0 \).

The procedure is the following. Pick any \( \Theta_2 \) and solve the DP. This produces optimal policy \( x(s; \hat{\Theta}_1, \Theta_2) \). Then, simulate the time path of the flow of investment \( \{x_i'(\hat{\Theta}_1, \Theta_2) | t = 1, \ldots, T\} \).

(iii) \( A_T = \hat{V}_T^{-1} \), where \( \hat{V}_T \) is the estimated variance-covariance matrix of \( \hat{\Phi}_T \).

Each iteration performs two tasks: solve the dynamic program, and calculate the distance between the empirical life-path and the simulated life-path that came off the solution of the dynamic program. Therefore, when the iterations come to an end we have the solution to the dynamic program that generates a simulated life-path closest to the empirical life-path. Again, \( \hat{V}_T \) is assumed to be a diagonal matrix with the implication that there is correlation within each age group but observations across age groups are not correlated.
6.4.2. Chi-Square Tests

In this minimum distance estimation procedure,

\[(14) \quad \left[ \hat{\Phi}_T - \Psi(\hat{\Theta}) \right] A_T \left[ \hat{\Phi}_T - \Psi(\hat{\Theta}) \right] \xrightarrow{D} \chi^2(T - q), \]

where \( T \) is the number of age groups and \( q \) is the number of parameters. This statistic can be calculated for the full sample as well as each of the education groups. These tests with ‘own parameters’ are carried out as a goodness of fit test.

To test restrictions, the procedure starts by separating the sample into various groups. Consider the groups \( j = 1, \ldots, J \), with parameter estimates for each group from minimum distance estimation, \( \{ \Theta^j \mid j = 1, \ldots, J \} \). Define,

\[
R = \begin{pmatrix}
\left( \Phi_T^j \right) & \left( \Psi(\hat{\Theta}^j) \right) \\
\vdots & \ddots & \vdots \\
\left( \Phi_T^j \right) & \left( \Psi(\hat{\Theta}^j) \right)
\end{pmatrix}, \\
S = \begin{pmatrix}
\left( \Phi_T^j \right) & \left( \Psi(\hat{\Theta}^j) \right) \\
\vdots & \ddots & \vdots \\
\left( \Phi_T^j \right) & \left( \Psi(\hat{\Theta}^j) \right)
\end{pmatrix}, \quad \text{and} \quad \Omega = \begin{pmatrix}
\left[ \frac{A_T^j}{\Delta} \right] \\
\vdots \\
\left[ \frac{A_T^J}{\Delta} \right]
\end{pmatrix}.
\]

Then,

\[(15) \quad S' \Omega S - R' \Omega R \xrightarrow{D} \chi^2 \left( \sum_{k=1}^{J} q_k \right), \]

where \( R' \Omega R \xrightarrow{D} \chi^2(JT - q_1 - \ldots - q_J) \), \( S' \Omega S \xrightarrow{D} \chi^2(JT - q) \) and \( q_j \) is the length of vector \( \hat{\Theta}^j \). Note that because \( A_T^j \)'s are diagonal matrices, \( \Omega \) is a diagonal matrix.
To test whether college and non-college parameters are different, the following restrictions are tested: $\hat{\Theta}_j^{\text{college}} = \hat{\Theta}_j^{\text{non-college}}$. In both cases, $J = 2$. Three restrictions are tested for the city groups: $\hat{\Theta}_j^{\text{city}} = \hat{\Theta}_j^{\text{suburb}}$, $\hat{\Theta}_j^{\text{city}} = \hat{\Theta}_j^{\text{rural}}$, where $J = 3$. Similar tests are carried out for the three non-college city groups. Results are reported in Appendix 4.

6.5. Results

6.5.1. Parameter Estimates

Stage 1 is estimated only for the full sample. Estimates $\hat{\Theta}_1$ of the first stage of estimation are reported in Table 5. In stage 2, Separate estimates of stage 2, parameters $\hat{\Theta}_2$, are carried out for the following groups: the full sample, college graduates, and the non-college group (Table 6).

---

55 Because the sample has to be partitioned into various subgroups, we run short of observations rather quickly. Stock data is not available for large enough number of people so that stage 1 can be estimated for each group separately.
Law of motion: \( s_{t+1} = \exp(\beta_0 + \beta_1 t + \beta_2 t^2) s_t + \tau_t \)

<table>
<thead>
<tr>
<th></th>
<th>( \beta_0 )</th>
<th>( \beta_1 )</th>
<th>( \beta_2 )</th>
<th>( \tau )</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Full Sample</strong></td>
<td>(-4.231360)</td>
<td>(0.139468)</td>
<td>(-0.001595)</td>
<td>(1.415366)</td>
</tr>
<tr>
<td></td>
<td>((0.223292))</td>
<td>((0.009968))</td>
<td>((0.000117))</td>
<td>((0.011883))</td>
</tr>
</tbody>
</table>

Table 5: Parameter Estimates of Stage 1

Reward: \( f_s(s_t, x_t, t) = \frac{s_t^{1-\sigma}}{1-\sigma} + \eta \log(x_t) - \exp(\alpha_0 + \alpha_1 t + \alpha_2 t^2) x_t \)

<table>
<thead>
<tr>
<th></th>
<th>( \sigma )</th>
<th>( \eta )</th>
<th>( \alpha_0 )</th>
<th>( \alpha_1 )</th>
<th>( \alpha_2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Full Sample</strong></td>
<td>(0.602146)</td>
<td>(11.213203)</td>
<td>(1.029667)</td>
<td>(0.015584)</td>
<td>(-0.000199)</td>
</tr>
<tr>
<td></td>
<td>((0.037339))</td>
<td>((0.859521))</td>
<td>((0.073643))</td>
<td>((0.000078))</td>
<td>((0.000002))</td>
</tr>
<tr>
<td><strong>Non-college</strong></td>
<td>(0.596488)</td>
<td>(11.174733)</td>
<td>(1.055034)</td>
<td>(0.014422)</td>
<td>(-0.000175)</td>
</tr>
<tr>
<td></td>
<td>((0.054286))</td>
<td>((1.206787))</td>
<td>((0.103745))</td>
<td>((0.000110))</td>
<td>((0.000002))</td>
</tr>
<tr>
<td><strong>College graduates</strong></td>
<td>(0.473916)</td>
<td>(13.628385)</td>
<td>(1.186759)</td>
<td>(0.017662)</td>
<td>(-0.000250)</td>
</tr>
<tr>
<td></td>
<td>((0.065179))</td>
<td>((2.018988))</td>
<td>((0.141903))</td>
<td>((0.000144))</td>
<td>((0.000003))</td>
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<tr>
<td><strong>City</strong></td>
<td>(0.600429)</td>
<td>(11.251592)</td>
<td>(1.009787)</td>
<td>(0.013344)</td>
<td>(-0.000148)</td>
</tr>
<tr>
<td></td>
<td>((0.104742))</td>
<td>((2.437334))</td>
<td>((0.208355))</td>
<td>((0.000215))</td>
<td>((0.000004))</td>
</tr>
<tr>
<td><strong>Suburb</strong></td>
<td>(0.497659)</td>
<td>(11.300234)</td>
<td>(1.065729)</td>
<td>(0.015548)</td>
<td>(-0.000197)</td>
</tr>
<tr>
<td></td>
<td>((0.061688))</td>
<td>((1.496147))</td>
<td>((0.126201))</td>
<td>((0.000141))</td>
<td>((0.000003))</td>
</tr>
<tr>
<td><strong>Rural</strong></td>
<td>(0.448915)</td>
<td>(11.254021)</td>
<td>(1.095252)</td>
<td>(0.015635)</td>
<td>(-0.000199)</td>
</tr>
<tr>
<td></td>
<td>((0.069236))</td>
<td>((1.626071))</td>
<td>((0.137984))</td>
<td>((0.000165))</td>
<td>((0.000003))</td>
</tr>
<tr>
<td><strong>Non-college, City</strong></td>
<td>(0.448647)</td>
<td>(10.160639)</td>
<td>(1.041220)</td>
<td>(0.008517)</td>
<td>(-0.000070)</td>
</tr>
<tr>
<td></td>
<td>((0.117768))</td>
<td>((2.562807))</td>
<td>((0.236967))</td>
<td>((0.000364))</td>
<td>((0.000006))</td>
</tr>
<tr>
<td><strong>Non-college, Suburb</strong></td>
<td>(0.586034)</td>
<td>(10.392235)</td>
<td>(1.001195)</td>
<td>(0.014573)</td>
<td>(-0.000176)</td>
</tr>
<tr>
<td></td>
<td>((0.108532))</td>
<td>((2.303755))</td>
<td>((0.211209))</td>
<td>((0.000234))</td>
<td>((0.000005))</td>
</tr>
<tr>
<td><strong>Non-college, Rural</strong></td>
<td>(0.490035)</td>
<td>(10.389349)</td>
<td>(1.013479)</td>
<td>(0.015801)</td>
<td>(-0.000194)</td>
</tr>
<tr>
<td></td>
<td>((0.084338))</td>
<td>((1.784454))</td>
<td>((0.164321))</td>
<td>((0.000208))</td>
<td>((0.000004))</td>
</tr>
</tbody>
</table>

Table 6: Parameter estimates of Stage 2
6.5.2. Chi-square Tests

The goodness-of-fit-type Chi-square tests are carried out for the stage 1 estimation as well as for each group in stage 2. The estimates for each group show good fit (Table 7). Two Chi-square tests of restrictions are carried out to test whether the two education groups are indeed different from each other. The results indicate that college and non-college groups have a different set of parameter estimates (Table 8).

The visual fits between the data and the predicted paths are presented in Appendix D. The accuracy of the numerical approximations, measured by the calculations of approximation residuals, is presented in Appendix E. These residuals are reported for all the 9 cases: full sample, education groups, location groups and the non-college location groups. The residuals are calculated at the estimated values.
<table>
<thead>
<tr>
<th>Statistic</th>
<th>df</th>
<th>1%</th>
<th>5%</th>
<th>10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Sample: Law of Motion</td>
<td>55.73</td>
<td>55.00</td>
<td>82.29</td>
<td>73.31</td>
</tr>
<tr>
<td>Full sample</td>
<td>80.77</td>
<td>54.00</td>
<td>81.07</td>
<td>72.15</td>
</tr>
<tr>
<td>College</td>
<td>52.82</td>
<td>54.00</td>
<td>81.07</td>
<td>72.15</td>
</tr>
<tr>
<td>Non-college</td>
<td>48.84</td>
<td>54.00</td>
<td>81.07</td>
<td>72.15</td>
</tr>
<tr>
<td>City</td>
<td>54.32</td>
<td>54.00</td>
<td>81.07</td>
<td>72.15</td>
</tr>
<tr>
<td>Suburb</td>
<td>80.45</td>
<td>54.00</td>
<td>81.07</td>
<td>72.15</td>
</tr>
<tr>
<td>Rural</td>
<td>58.54</td>
<td>54.00</td>
<td>81.07</td>
<td>72.15</td>
</tr>
<tr>
<td>City, non-college</td>
<td>42.29</td>
<td>54.00</td>
<td>81.07</td>
<td>72.15</td>
</tr>
<tr>
<td>Suburb, non-college</td>
<td>64.12</td>
<td>54.00</td>
<td>81.07</td>
<td>72.15</td>
</tr>
<tr>
<td>Rural, non-college</td>
<td>61.66</td>
<td>54.00</td>
<td>81.07</td>
<td>72.15</td>
</tr>
</tbody>
</table>

Table 7: $\chi^2$ Tests in the Spirit of Goodness of Fit

<table>
<thead>
<tr>
<th>Statistic</th>
<th>df</th>
<th>1%</th>
<th>5%</th>
<th>10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\hat{\Theta}$ of Non-college</td>
<td>144.84</td>
<td>5.00</td>
<td>15.09</td>
<td>11.07</td>
</tr>
<tr>
<td>$\hat{\Theta}$ of College</td>
<td>289.26</td>
<td>5.00</td>
<td>15.09</td>
<td>11.07</td>
</tr>
<tr>
<td>$\hat{\Theta}$ of City</td>
<td>204.72</td>
<td>10.00</td>
<td>23.21</td>
<td>18.31</td>
</tr>
<tr>
<td>$\hat{\Theta}$ of Suburb</td>
<td>46.56</td>
<td>10.00</td>
<td>23.21</td>
<td>18.31</td>
</tr>
<tr>
<td>$\hat{\Theta}$ of Rural</td>
<td>88.97</td>
<td>10.00</td>
<td>23.21</td>
<td>18.31</td>
</tr>
<tr>
<td>$\hat{\Theta}$ of City, non-college</td>
<td>109.95</td>
<td>10.00</td>
<td>23.21</td>
<td>18.31</td>
</tr>
<tr>
<td>$\hat{\Theta}$ of Suburb, non-college</td>
<td>22.69</td>
<td>10.00</td>
<td>23.21</td>
<td>18.31</td>
</tr>
<tr>
<td>$\hat{\Theta}$ of Rural, non-college</td>
<td>22.46</td>
<td>10.00</td>
<td>23.21</td>
<td>18.31</td>
</tr>
</tbody>
</table>

Table 8: $\chi^2$ Tests of Restrictions
6.6. Discussion and Analysis of the Findings

6.6.1. The Lifecycle Depreciation Rate

From stage 1 estimation of the parameters of the depreciation rate \( \beta \), we have two important results. First, \( \hat{\beta}_t < 1, \ t = 1, \ldots, T \). Thus, social capital decays and it does not support Ostrom’s [1999] conjecture that \( \hat{\beta}_t \) may exceed unity. Secondly, \( \beta_1 \) and \( \beta_2 \) are each significantly different from zero implying that the rate of depreciation is time varying.

![Figure 8: Predicted Time Path of Depreciation Rate](image)

Lifecycle depreciation rate show the following pattern: it steadily decreases (Figure 8) until age 65 and then starts to increase. Friends that people make depreciate at a very high rate during the first quarter of the lifecycle. High

---

56 Because the depreciation rate \( (1 - \hat{\beta}_t) > 0, \ t = 1, \ldots, T \).
rates of mobility are likely to be an important contributor to this high depreciation rates during that stage of the lifecycle.

![Mobility Fraction by Age](image)

**Figure 9: Mobility Rates by Age 1990-95 (US Census)**

Figure 9 presents the percentage of population at various ages of the lifecycle who moved in the last five years. The shape generally conforms to the life profile of the depreciation rate. During the retirement ages, the depreciation rate is the lowest and shows an upward tendency in the last quarter of the lifecycle. The deterioration of health and increased mortality are likely explanations for this rising depreciation rate during this last quarter.\footnote{The depreciation rate in Figure 8 incorporates not only the mobility rate of the individual but also those of the people who are in the individual’s network. That is why the kinks that appear in Figure 9 do not create a conflict in corresponding to the smoothened out line of Figure 8.}
6.6.2. Lifecycle Patterns of Stocks and Flows

The lifecycle characteristics of the stock and flow paths are the following: the stock path is not inverted U-shaped, there is lifecycle variation in investment profile, and investment does not fall to zero at the end period $T$. We now explore the forces that govern these characteristics. The top panels of Figure 10 show the predicted life-paths of stocks and flows for the full sample, based on the estimated parameters of the model.

Figure 10: Predicted Time Paths (Full Sample)
The stock of social capital over the lifecycle (top left panel) does not peak during the middle age. In fact, it actually reaches a trough in the late 30s, after that it keeps increasing to peak in the late 60s and early 70s, and then it decreases again. The shape looks like a ‘tilted-S’, quite different from an ‘inverted-U’ or a hump shape. There are a number of factors that contribute to this result. The dominant factor is the time varying rate of depreciation. All the way up to the retirement ages depreciation decreases. The intuition is that as people grow older they tend to settle down – geographically and otherwise – and consequently retain more of their friends that they make each period. During the old ages, due to deteriorating health and higher mortality, depreciation rate tends to increase again leading to a declining trend in accumulation of friends. Another factor that explains the stock path is the life-path of investment (see equation (9)).

The lifecycle profile of investments is governed by three aspects of the model: first, there is a return from investment itself (the instantaneous return), secondly, the time varying cost of investment has an inverted U-shape peaking at age 60 (the bottom panel of Figure 10), and thirdly, the fact that investment at each point in time is motivated by the remaining horizon of the lifecycle that governs the expected future returns.

The investment path (top right panel of Figure 10) declines until middle age is reached and then onwards there is a slight increasing tendency (except
the last few periods when it declines again). Throughout the period when the opportunity cost of investment is rising, flows of investment are falling. Starting from the retirement ages, as opportunity cost starts to fall, investment tends to increase. During the very last few periods of the lifecycle, even though opportunity cost is falling, because the remaining horizon is small, the expected future returns become less and less important. This, coupled with health limitations of old age, explain the sharp decline in investment during the end periods of the lifecycle.

Throughout the lifecycle, receiving instantaneous utility from investment in social capital allows investment to be at a higher level vis-à-vis the model where the only source of benefits is a lagged return from stocks. For the same reason the investment path does not fall to zero even at the last period. Therefore, not only do people enjoy interacting with friends and neighbors, the situation where there is no one to talk to is unacceptable.58

### 6.6.3. Links between Human Capital and Social Capital

Panels 1 and 2 of Figure 11 show the differences in the predicted flow and stock paths, respectively, of the college and the non-college groups; college

58 That investment never going to zero even in the end period is a feature of the data. The predicted investment path on the top right panel of Figure 5 shows that even when investment takes a sharp downturn during the end periods, it still remains significantly greater than zero. This model prediction has been achieved by assuming an instantaneous return that imposes heavy penalty on zero investment (property of log specification).
graduates invest more and have a higher stock path than the non-college group. As an average over the lifecycle, the predicted investment of college graduates is 28 percent higher than that of the non-college group.

Panels 3, 4, and 5 of Figure 11 present components of the return function based on the estimated parameter values. There are three components: benefits from stocks of social capital (the lagged return), benefits from flows (log utility component, the instantaneous return), and the time varying cost of investment. The smaller the value of $\sigma$, the parameter of lagged utility, the more slowly marginal utility falls as stock rises, and the individual is more willing to allow his or her stock of social capital to vary over time. From Table 6, $\hat{\sigma}$ of the college group is smaller than that of the non-college group giving the college group an advantage. Because the college group has a higher $\hat{\eta}$, they extract more from flows in the form of instantaneous benefits vis-à-vis the non-college group (panel 4, Figure 11).

For the college group, the lifecycle opportunity cost of time peaks at age 55 while that for the non-college group occurs at age 62 (panel 5, Figure 11). The decline thereafter is sharper for the college group. The college group, however, has a higher lifecycle opportunity cost of time vis-à-vis the non-college group throughout the lifecycle.

---

59 This is not immediately obvious form the picture in panel 3 of Figure 11. We need to perform some comparative dynamic analysis to see it more clearly, which is discussed in the next paragraph.
Figure 11: College/Non-college - Reward Function Components
Panels 1, 2, and 3 of Figure 12 present the differences among the two education groups in terms of behavior. It presents a comparative dynamic analysis using the predicted time paths of investment.

Figure 12: College/Non-college - Counterfactuals

To examine the difference the parameter of lagged utility $\sigma$, first the predicted investment path of the non-college group is generated and then by replacing the $\hat{\sigma}$ of non-college with the $\hat{\sigma}$ of the college group – keeping everything else the same – the predicted investment path is generated again.
Both these paths are presented in panel 1. Panel 2 shows the same analysis for the parameter of instantaneous return ($\hat{\eta}$), and panel 3 for the parameters of the lifetime cost profile ($\hat{\alpha}_0, \hat{\alpha}_1, \hat{\alpha}_2$). With the $\hat{\sigma}$ of college graduates, the average investment over the lifecycle of the non-college group increases by 16 percent. With the $\hat{\eta}$ of the college graduates the average investment over the lifecycle of the non-college group approximately doubles. With ($\hat{\alpha}_0, \hat{\alpha}_1, \hat{\alpha}_2$) of the college graduates the average investment over the lifecycle of the non-college group decrease by 39 percent. From the cost side the non-college group has an advantage in having a lower lifetime opportunity cost of investment but that is offset by the greater instantaneous and lagged benefits that college graduates extract from their stocks and flows of social capital.

The estimates, however, do not necessarily suggest a policy implication that higher levels of human capital would cause higher levels of social capital. The comparison establishes that ‘those who attend college’ engage in higher levels of investment in social capital for the remaining of their life after college. Because sorting takes place when the schooling decision is made, this is a combined effect of sorting as well as human capital accumulation that takes place in college.
6.6.4. Links between City Size and Social Capital

Figures 13 and Figure 14 present the counterfactuals of life-paths of predicted flows for city, suburb and rural groups. Figure 13 is for all education groups while Figure 14 is for non-college people only. These are the same experiments that have been carried out with college and non-college groups in Figure 12.

Figure 13: Counterfactuals: City, Suburb, Rural (All Education Groups)

Observed differences are smaller compared to the education groups. Differences remain as we look at only non-college individuals across city, suburb and rural areas (Figure 14). In Figure 13 we see that the rural group has
an advantage in terms of benefiting from the stock, while both the city and the suburb groups have an advantage over the rural group in lifetime costs (although the advantage of the city group is greater).

Figure 14: Counterfactuals: City, Suburb, Rural (Non-college Only)

In Figure 14, the advantage that the rural group had in \( \hat{\sigma} \) remains and so do the cost advantages of the suburb and the city groups. The city group now has a very small disadvantage in instantaneous benefit. The cost disadvantage of the rural group vis-à-vis the suburb and the city (and also the suburb vis-à-
vis the city) may reflect the fact that physical distance is a hindrance to connectedness for geographically sparse people.

Similar to the case of the education groups, it is difficult to say that the above differences are independent effects of the locations. Because sorting takes place when the mobility decisions are made, this is a combined effect of sorting as well as the locations that the individual lives in.
CHAPTER 7

SUMMARY AND CONCLUSION

This study formulates a dynamic model of social capital accumulation to address the problem of individual’s decision-making. It adopts the network view of social capital that is conducive to an individual-based treatment. The dynamic program that formulates this problem shows that the time paths of stocks and investment flows have interesting lifecycle characteristics. The structural parameters of this model are estimated using simulated method of moments.

A number of characteristics that are specific to social capital have been incorporated in this general framework. To capture the feature that people enjoy socializing, the model introduces and makes operational the idea of ‘instantaneous return’ on social capital investment. The fact that the opportunity cost of time has important lifecycle implications also is captured in this model. A finding about the evolution of stock of social capital is that social
capital decays and the depreciation rate is not constant but varies over the lifecycle.

The estimated structural parameters help verify the following results. First, the life-path of stock of social capital does not have an inverted U-shape, i.e. it does not peak during middle age. In fact, it reaches a trough in the late 30s, then keeps increasing to peak during the late 60s and early 70s, and then starts to decline again. What drives this finding is the depreciation rate. The estimates show that the depreciation rate, which is time varying, is lower in the second half of the lifecycle conforming to a pattern of lifecycle mobility rates that is higher during the first half.

Secondly, there is lifecycle variation in the flow of investment in social capital that is primarily governed by the time-varying cost of investment profile. The estimates show that the costs of investment peaks just before the retirement ages which explains the steady decline in investment starting at age 22 unto the retirement ages. The investment profile also captures the feature that people enjoy socializing in the form of an instantaneous return. Another implication of this feature is that zero socializing is too costly to be acceptable, which explains why even at the end period of the lifecycle, people continue socializing and investment does not fall to zero.

Thirdly, the study explains the observed feature of the data that people with higher education invests more in social capital despite having a higher
opportunity cost of investment. The estimates show that college graduates have a higher cost of investment than those who did not attend college, but also college graduates have a higher return from their social capital. Empirically, it turns out that their net return is higher than the net return of those who did not attend college, which leads college graduates to invest more in social capital.

The final set of results is about the difference in social capital investment across geographical locations. We find that people in cities invest more in social capital than people in the suburbs and small rural areas. The findings suggest the following explanations: there is a matching argument in the sense that it may be easier to find friends in a big city where the number and the variety of people are greater. A yet another explanation is that physical distance dampens social connectedness and therefore big cities with congested living are conducive to social capital investment.

These results are important from a number of different standpoints. Studying the evolution process of social capital helps understand lifecycle aspects of the investment decision mechanism; it establishes an understanding of how lifecycle costs, lifecycle depreciation, and the fact that the time horizon is finite, affect the investment decision and the accumulation process. The analysis across various education groups shows why it is important to obtain the structural parameters of the model because that helps us decompose the costs and return components. The result on location has an interesting
implication that arises in the context of urban sprawl. Because of greater physical distance among people, sprawl is likely to reduce individual’s well-being by reducing social connectedness.

Emphasizing the instantaneous return of social capital investment is one of the important objectives of this study. Rational individuals value socializing as a pleasure in itself and it has real consequences in how people spend their resources. This study addresses the event of socializing explicitly, and unless we do that we cannot fully understand the behavior of the ‘socialized man’. 
APPENDIX A

THE TWO VIEWS OF SOCIAL CAPITAL

A1. The Trust/Cooperation View

Trust/cooperation view is the more popular view of social capital. A number of celebrated empirical studies adopted this view – Putnam [1993, 1995, 2000], Furstenberg and Hughes [1995], Knack and Keefer [1997], and Narayan and Pritchett [1999], to name a few. The trust/cooperation view takes more of an institutional approach. It emphasizes the existence and functioning of informal relations and non-market interactions. Paldam [2000] makes an attempt to organize all these considerations into a series of coherent steps that clarify much of the ambiguities that arise whenever a concept takes an interdisciplinary trip from Sociology to Economics.
Definition A1: Trust/cooperation Definition of social capital

(1) Ease of Cooperation definition of SK: Agents’ ability to work voluntarily together with others in his group.

(2) Trust: Mutual expectation that arises within a community based on common shared norms.

(3) Assumption: Trust ⇔ Ease of Cooperation + error

(4) Trust definition of SK: Amount of trust the agent has in others and the amount of goodwill the agent possesses with others.

[Trust Payoff definition – amount of benefits agent can draw on his goodwill]

(5) Social capital of the group: Some weighted average social capital of all agents within the group.

(6) Measurement/Proxy: Density of a variable pertaining to social capital.

Example: Putnam’s instrument.

[Putnam’s Instrument – A measure of associations with voluntary organizations is a proxy for individual social capital while the density of voluntary organizations in the group is a proxy for group social capital.]

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60 This is not a mathematical relation. The idea is similar to approximating function $f$ with a Taylor expansion $g$ that gives an error term $e$: for instance, $f \approx g \Leftrightarrow f = g + e$. Furthermore, the word ‘trust’ as such doesn’t restrict itself to a positive interpretation such as trust between friends. One can ‘trust’ a burglar to rob him. However, we shall rule out such confusions arising from semantics and only allow for ‘positive’ trust as defined by this assumption.

61 It is generally a monetary question such as “How much money do you think you can borrow from your friends” or “How much money will you be willing to lend your friend”. As such there is always a problem of truthful revelation with this approach.
Paldam [2000] emphasizes that ‘trust’ can have multiple dimensions. Two important dimensions of trust are, generalized trust and special trust. Generalized trust is defined as ‘trust towards people in general’, while special trust is the ‘trust in known people or in particular institution(s)’. Suppose that trust at the individual level is the proxy for micro social capital while trust at the societal level is the proxy for macro social capital. Also suppose that within the group, people know each other or are able to check each other’s trustworthiness at a negligible cost from people they already trust. Then all trust within the group takes the form of special trust. However, at the macro level trust has to take the form of generalized trust.

To measure trust, a number of studies have used the question “Generally speaking, would you say that most people can be trusted or that you can’t be too careful in dealing with people?” This is a question about individual’s expectation of trustworthiness averaged over a number of situations. It does not measure the quantity of trust the agent has in others in her group. It also does not say anything about her trustworthiness with the others in her group. Therefore, it may be a proxy for generalized trust but cannot be a proxy for special trust. To calculate trust at the micro level we need

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62 Because organizations differ in terms of the intensity of contacts the individual has, appropriate intensity weights are required to calculate this measure.
63 Glaeser, Laibson, Scheinkman, and Soutter [1999], Inglehart et al. [1998], Fukuyama [2000].
64 Glaeser, Laibson, Scheinkman, and Soutter [1999].
to ask the individual “How many people (within the groups that you belong to) do you trust and how many people in these groups trust you?” Then, to examine how micro trust gets translated into macro trust, we need a theory that tells us exactly how answers to these two questions are related. There is no \textit{a priori} reason why they should be related. One piece of evidence that emphasizes this point is the following.

The most widely used proxy in the social capital literature has been Putnam’s instrument. It is generally used as a macro proxy. If Putnam’s instrument shows a high score, we should expect a high level of generalized trust. However, as Paldam [2000] argues, some studies have found areas with low generalized trust to have high special trust in some fields. It has been consistently documented that Latin less developed countries, despite having some high special trust measures, have lower generalized trust measures than Germanic/British developed countries. We, therefore, cannot overlook the need for a plausible theory to describe the relationship between generalized trust and special trust before we start using them as macro and micro proxies, respectively.

The other aspect of trust/cooperation definition that the above argument emphasizes is that we also need a justification for using Putnam’s instrument. The following section discusses the limitations of Putnam’s instrument.

Membership in voluntary organizations is the so called ‘Putnam’s Instrument’. Putnam’s instrument is vulnerable to the following criticisms raised in Paldam [2000], Sobel [2002], and Fukuyama [2000].

Although a relationship might exist between the density of voluntary organizations and trust among people, no theoretical attempt has been made in the current body of social capital literature to show exactly where this relationship is coming from or how it fits into the decision-making process of the rational, self-interest maximizing individual.

The dividing lines between voluntary organizations, businesses and government organizations are not as obvious as calculations of Putnam’s instruments require them to be. Voluntary organizations and government organizations are often closely linked. While sometimes voluntary organizations may be instruments of some government organizations operations (ministries may create voluntary organizations to obtain a pressure group), in other times government organizations may turn into voluntary organizations (Bolivian ‘agricultural syndicate’). Businesses often hide behind fronts that make them look like voluntary organizations. Voluntary organizations may turn into businesses over time. Sometime businesses and voluntary organizations are closely linked. AOL is a business but various chat groups or newsgroups are voluntary organizations. This also raises the
question whether online voluntary organizations should be included, and if so, how would they be measured since internet activities are so difficult to identify and keep track of.

Memberships in voluntary organizations with weak intensity could also be difficult to keep track of. Especially in developed countries, voluntary organizations exist with memberships that cost little and demand little contact. Such voluntary organizations may claim a large membership while many people do not even remember that they are members. The justification for using intensity weights come from the fact that, while such voluntary organizations exist, there are voluntary organizations that are very demanding and come to dominate lives of it’s members (church affiliations, for instance). However, the practical problems of choosing these weights are going to be high and subject to heavy value judgments.

The fact that social capital does not have to be benign also creates a conceptual problem. Many of these organizations are criminal, racist and violent and should be assigned negative weights. However, the malign voluntary organizations, more often than not, operate under a clandestine existence and hence would end up with zero weight in most practical purposes.

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65 Klu Klux Klan, Michigan Militia, etc.
A2: Trust/Cooperation Versus The Network View

Whenever a question of comparison arises it is important to be clear about the criteria that are being used; in the present case, the adopted paradigm is neoclassical investment theory.

As a starting point, we need an individual-based treatment of the problem. This facilitates tracking down causalities and the problems of ‘functional’ characterization and ad hoc proxies do not arise. Neoclassical capital theory allows for an individual-based treatment. It also has the advantage of clearly identifying stocks, flows, and returns. This could effectively reduce the tendency to label everything ‘social’ as social capital.

However, as we try to fit trust/cooperation view into the same framework, the first problem we face is the idea of ‘group’. The concept of group is essential for the logic and mechanism of the formation of social capital under the trust/cooperation view. The fundamental logic behind the trust/cooperation view is that members within a group are interacting with each other, which creates trust and cooperation; and that trust and cooperation are useful in a ‘production’ sense. Under the network view, we look at each individual and her own network. Each individual has an incentive and
preference to create a network because it is useful; the concept of group is no longer operationally important.

It might be possible to use the concept of trust in the individual-based network framework. We can think of investment in social capital to be actions that build trustworthiness and finding people who can be trusted. The stock of social capital could be the number of people the individual trusts and the number of people who trust him. Returns on these investments, then, can be viewed as cooperation that the individual can create out of his ‘trust network’. Another argument is that trust should be considered a contextual variable that affects social capital formation where social capital is defined by the network view. This is a line of argument that Subramanian, Lochner and Kawachi [2002] put forward. They suggest that “trust can be seen more as a predisposed factor that leads to the creation of social capital rather than being a component of social capital itself.”

One common criticism of social capital research is that social capital is a byproduct of ‘other’ activities and that it is not the result of conscious efforts by the individual. People make friends because making friends increases their utility; social ties that are created because of that are externalities. A more realistic view would be to consider the action of making friends to have a two-fold motive – having a good time as well as making useful contacts to reap economic and non-economic returns. Adopting the network view this study
makes an attempt to resolve this issue by emphasizing the intrinsic value of social capital investment.

In terms of measurability, the networks of an individual may be observed under the definitions used in this study, whereas ‘trust’, in a sense, is a fundamentally an abstract concept. For the former we found a direct measure from the GSS, but for the latter various indirect proxies will have to be used. The problem with any proxy is that it needs some qualification. Most studies that adopt the trust/cooperation view use generalized trust and/or Putnam’s instrument. One might want to demand a theoretical justification for using those variables as proxies. As mentioned in Appendix A1, there are not obvious proxies of the trust/cooperation view of social capital.

Some limitations of the trust/cooperation view, however, may carry over to network view as well. Aggregation problems arise from social capital externalities and the fact that social capital does not have to be benign. Under the network view, if we calculate naïve density functions over the stocks and flows of the individuals to calculate the aggregate social capital of a community, we remain agnostic about the externalities they generate and whether they are benign or not.
APPENDIX B

SOCIAL CAPITAL AT THE MACRO LEVEL

Definition B.1: Embeddedness

For the economy as a whole, embeddedness refers to the state-society relationship.

Definition B.2: Autonomy

At the economy level, autonomy refers to organizational integrity such as institutional coherence, competence, and capacity.

Definition B.3: Social Capital (SK)

SK at the economy (macro) level consists of the state-society relations and organizational integrity.

Note that, it is not obvious from the above definition whether the macro concept of social capital is some sort of aggregation over social capital of all the

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66 These definitions are reproduced from Wookcock [1998].
individuals in the economy. Theoretically, the macro level of social capital should be some sort of aggregation calculated across all the individuals in that community. However, social capital is unique, and serious conceptual and practical problems exist when it comes to the issue of aggregation. The definition above basically suggests the use of proxies to identify social capital at the macro level. It remains to be seen exactly what mechanism translates social capital from individual level as described in chapter 2 to the notion of macro level of social capital as defined in definitions B.1-B.3.

It is beyond the scope of this study to address the aggregation issues. However, just to get a flavor of the obstacles that aggregation face, we can think of the following features that social capital has. First, social capital is associated with very high levels of externalities; when an individual joins a network other members of the network benefit. Secondly, a source of potential complexity would come from the fact that social capital is not necessarily benign, as discussed in section 2.3.2. This implies that a simple aggregation would not result in the true measure of aggregated social capital. Thirdly, note that social capital is subject to very high level of interpersonal complementarities – if A makes friends with B, B has made a friend in A with very little investment (may be by simply acknowledging A’s initiatives). These complementarities imply large social multipliers [Glaeser et al. 1999, Glaeser et al. 2002, Glaeser and Scheinkman 2000].
### APPENDIX C

Dependant Variable: Real household income ($10,000)

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Table 9: First Stage Estimates of the 2sls Regression
APPENDIX D

MATCH BETWEEN DATA AND THE PREDICTED PATHS

continued . . . .
Figure 15: Match between Data and Predicted Paths
APPENDIX E

APPROXIMATION RESIDUALS

continued . . .

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Figure 16: Approximation Residuals
BIBLIOGRAPHY


