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Quality of social networks and educational investment decisions

by

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Abstract

All individuals belong to a social network with certain quality level. This paper analyzes the role of the quality of the social network in the educational decision making process. We propose a measure for quality of network based on the schooling level and the labor position of the members of the net. Our analysis compares individuals who are similar in at least two characteristics: socioeconomic level and intellectual ability. Although they belong to the same type of community (poor), they differ in the composition of their social network. The higher the quality of the network, the higher the probability of investing in education. Hence, socially disadvantaged and equally intelligent individuals may end up acquaring different schooling levels..

1 Introduction[1]

It is well known that the level of family income play an important role in determining the amount of human capital investment that an individual is willing to undertake. Although public education is free in many countries at basic and medium level of schooling - there is no fee - and relatively cheap at the superior level, there are other costs like transport, food and clothes, among others, that poor families cannot afford. Besides, credit markets are incomplete and exclude most of the low income potential applicants.

What we can observe in cities like Cali (Colombia) and many others in LatinAmerica, is that young poor people tend to leave school much

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earlier than wealthier individuals. In Cali, the lack of attendance rate among youngsters from 18 to 26 years old is around 82% in the poorest neighborhoods (eastern and mountainside areas), while for the wealthier zone the rate is 50%. In the case of 11-17 years old youngsters, the rates are 19% and 10% for the poorer and the wealthier areas respectively (Zuluaga and Benitez, 2010). Perhaps what is driving the poorer to skip school is a belief that, either way, investing or not in schooling, good jobs will be given to the wealthier. This belief may discourage the decision maker to attain higher levels of education, as he believes the instrumental value of education is low.[2]

This paper aims at exploring the existence of an additional factor influencing the educational investment decisions, i. e. the social networks[3] that individuals belong to. Social network theory goes beyond traditional researches in which the individual's social and economic decisions are only determined by individual traits. Instead, network theory states that both personal characteristics and links with the members of the social network are important determinants of individuals' behavior and decisions.

One example of this influence is the impact of social networks in altering the incentives that individuals have to acquire education. In particular, we state that the "quality" of the network influences the perceived returns to education, encouraging or discouraging individuals' investment in additional years of schooling. For our purpose, we define the "quality" of a social network as determined by the schooling level and links with the labor market of the network's members or ties (e.g. family members, neighbors, colleagues, friends, classmates, teachers, among others). It is worth mentioning that the term "quality" is used here as an attribute (ascribable) of the network, which is not related to the value of the individuals belonging to the network. In this sense, the meaning of quality that we use here is close, in nature, to the meaning that Becker and Lewis (1973) and other authors used in their papers referring to children´s quality, which is different from referring

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[2]Education has both intrinsic and instrumental value. The first refers to the value of acquiring knowledge itself and the second refers to the positive influence of education on (among others) the capacity of individuals to get higher economic positions. If the individual experiences higher opportunity cost of schooling and lower chances to get a good job compared to an equally educated wealthier person, this affects his perception of the instrumental value of education.

[3]There is no a standard definition of social network in the literature. Jackson (2005) defines it as the group of people "with whom we share information and favors on a regular basis". According to Requena (2003), a social network is a set of social actors linked to each other through a number of relationships with properties like intensity of the relation, position of the actor inside the network, and accessibility of the actor with respect to the others.

to the value of a son or a daughter. In their context, a child's quality is a combination of endowment (inheritance) and household expenditure on the child. Having clarified this important point, the quotation marks for the word quality will not be used any more in the text.

There are no previous works that focus on defining quality of networks. It is more usual to find definitions of the quality of a tie referring to the strength of the relationship (Granovetter (1983)). Our definition of network quality is associated with the idea that certain characteristics of the members of the network may (positively or negatively) influence the individual's behavior and decisions. Perhaps other members' attributes besides schooling and occupational position are also important to capture this impact, however, this paper will only focus on these two characteristics. Specifying a method to estimate network quality will allow us to empirically verify the influence of networks on the schooling investment, or any other socioeconomic achievement. In this analysis, the impact of parents' characteristics is separated from the effect of the rest of members of the network. The idea is to check the influence of networks, after controlling for parental background.

It is possible to find individuals belonging to the same community or neighborhood, who share certain attributes like family income and ability, ending up at different schooling levels, expected future income and expected social mobility. The analysis of social networks may offer us an attractive hypothesis to explain this phenomenon and to explore why policies of educational expansion favor only a small portion of low income individuals.

This paper proceeds as follows. The second section corresponds to the literature review, where previous contributions about the influence of social interactions on schooling investment are briefly reviewed. In the third section of the paper, it is made explicit how the social network quality affects educational investments of individuals. The network's quality has a potential relevant effect on the individuals' perception of the returns to education, which in turn influences their educational decisions. We propose a specific measure for the quality of social networks, whose information requirements are: i) quality of each member of the network, based on educational level and labor position, and ii) the weight of each member.

An important definition is the "key tie". This is a concept characterizing a non-relative member of the network who plays a decisive role in determining the overall quality of the social network. A key tie is an initially weak tie (under the kinship criterion) who turns up to be a strong tie if we adjust his weight by factors like closeness, intimacy, economic support and admiration. Although the concepts of weak and

strong ties are commonly used in the literature of social networks, there is no consensus on their precise definition. We do not pretend to be more accurate in defining the concepts here, instead, we adopt an ordering for strength of ties originally based on kinship: family (stronger), friends and acquaintances (weaker), and subsequently modified by the mentioned adjustment factors (closeness, intimacy, economic support and admiration). These adjustment factors may lower the weight of originally strong ties and could make a weak tie become a key tie.

The fourth section corresponds to the empirical calculations. Existing databases do not allow us to determine the members of an individual's network, nor their characteristics. In order to obtain the required information for measuring the network quality of a group of individuals, a survey was carried out. This survey was applied to a target group and a comparison group. Individuals in both groups are similar in their intellectual ability and socioeconomic conditions - they live in the same type of poor neighborhood -. Those in the first group have continued studying after secondary school whereas those in the comparison group have not. Through the survey, we find out the schooling level and the labor position of each member of the individuals' network in order to estimate the quality of the network. We then specify a Logit model to test the influence of the network quality on the decision of individuals to continue studying, controlling for parental background and network size. The information captured through the survey is valuable because it helps us to determine the appropriate reference group likely to influence our individuals' decisions. The last section gives some conclusions and recommendations.

2   Literature Review

The existing economic literature on social networks and their effects on problems resolution, decision making process and socioeconomic achievements levels is very extensive. There is also a vast literature on the formation of networks and their efficiency and stability conditions (See Jackson (2003, 2005) for a good review). Given the rich nature of social networks, studying their characteristics with no other goal is already very interesting academically. Yet, this paper will not focus on how social networks are established nor on their nature, but on how they influence the educational investment decisions.

Social networks play a relevant role in many economic situations: market labor interactions, risk-sharing loans in underdeveloped areas, research and development, trade agreements, among others. In the case of risk - sharing loans, Fafchamps and Lund (2003) explore the relevance of networks in the ability of households to face adverse shocks. In the

same line of research, Dercon (2001) and Bold and Dercon (2009), analyze social networks as an informal group-based mechanism or strategy of households to managing risk and coping with adverse shocks.

In the case of the networks' impact on the labor market, Calvo-Armengol and Jackson (2005) argue that the probability for an individual to get a job is a function of his network's size (quantity of ties) and the labor position of the members of his network, through whom he acquires information about available jobs. In the same line, Contreras et al. (2007) stress the social network as an effective channel, not only to find a job, but also to guarantee the good quality of those jobs. In their paper, social network is empirically defined as the average outcome (employment rate) of people living in the same neighborhood, finding that the network helps the woman in finding more easily salaried jobs, whose quality is higher than self-employment occupations.

Another group of previous studies contributes to the analysis of networks by exploring how individuals learn from each other through the social interaction. These contributions are crucial to our analysis, since they make reference to the so-called role models, who influence the decision making process on schooling, among other things. For instance, Benabou (1993) presents a model relating the choice of neighborhood, schooling, decisions and efficiency issues, where the assumption of human capital spillovers plays a fundamental role. The more people with high schooling level in a given neighborhood, the easier it is for a young inhabitant to pursue any educational goal. In this context, the effect of social networks is twofold: the more high skilled adults in the neighborhood, the higher the possibilities for an individual of having information on good labour positions. Moreover, those high skilled adults act as role models, revealing the value of education.

In addition, Overman (2002) explores the neighborhood effects on schooling dropout rates. The author finds that the educational level of inhabitants of the large neighborhood - coverage area of the school where the individual is enrolled - influence the dropout rate, because it is related to the structure of the local labor demand. Moreover, the low socioeconomic background of the inhabitants of the immediate neighborhood - where the individual's household is located - increases the likelihood of dropping out. The previous suggests that the spatial scale of neighborhood effects goes beyond the socioeconomic level of the immediate neighborhood.

Table 1 shows a few contributions to the discussion about the influence of social interactions on educational decisions that were relevant to our own purposes. They are based on the idea that the perceived returns to education are influenced by the characteristics of people with

whom the schooling investment decision makers interact and/or cohabit in a common geographical space.

The studies by Calvo-Armengol and Jackson (2005), Anderberg and Andersson (2007), and Moizeau et al. (2004) are exclusively theoretical, while Yamauchi (2005) and Streufert (2000) also present an empirical analysis relating social interactions and schooling investment decisions. Yamaushi uses a farm household panel corresponding to the beginning of the Green revolution in India (where new technology arrived). He shows that schooling is positively correlated with income differences between educated and uneducated households, and that the strength of such influence depends on the schooling distribution of parents' generation. This is due to the intergenerational externalities to schooling investment in children: schooling distribution of parents influences the agent´s learning speed or response to returns signals. The previous suggest that educational decisions are determined by social learning, which is influenced by neighborhood effects. The author´s results allow him to conclude that heterogeneous neighborhoods (mixed educated and uneducated adults) are more appropriate for youth to learn about schooling returns, hence, they make better schooling decisions.

Streufert calibrates a model of underclass social isolation to test the hypothesis that isolation depresses educational investment. He assumes that i) role models shape individuals' perception of the incremental benefit of an additional year of schooling, and ii) underclass youth observe a sample with no high-income role models. Isolation is modeled by truncating the sample above with respect to the income variable, i.e. eliminating the high income observations at each level of schooling. The isolation simulation corroborates the conjecture. However, a theoretical counterexample shows that social isolation does not always reduce schooling because it has two contrary effects. First, it decreases the perceived additional income that higher schooling would bring and, second, it reduces the perceived forgone income while attending school, which makes school more attractive. Thus, isolation reduces schooling only if the reduction on the perceived additional income that schooling brings is big enough to overcome the reduction in the perceived forgone income.

The reviewed studies compare groups of individuals from different communities with different socioeconomic levels. In this paper we intend to compare groups inside the same type of community, i.e. poor. These individuals, in spite of belonging to the same type of neighborhood, partially differ in the composition of their social network. This type of focus, applied to schooling decisions, constitutes a contribution to the existing economic literature on social networks.

It is worth noting that there are no previous studies trying to mea-

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Table 1: **Some previous work on the influence of social interactions on schooling investment**

Y: Income, S: Years of schooling, R: Social Network,
α: Returns to education, i: individual.

Author	Channel	Main idea
Calvó-Armengol and Jackson (2005)	Social Networks (R)	The higher the S level of R's members, the higher i's expected α. Sensitivity of i's decisions w.r.t. R's composition determines perpetuation of inequality.
Moizeau et al. (2004)	"Information effect" neighborhood	Children form their idea on α from experiences of older generations. Segregation makes individuals from poor neighborhoods be misinformed about α, lacking incentives to invest in S.
Anderberg and Andersson (2007)	Social environment	Social environment is the only channel transmitting intergenerational success. If i's neighbors have good positions (high wages), i perceives higher α and invest more in S.
Streufert (2000)	Social isolation of low classes	Poor youths lose high income role models: they observe a distribution of Y truncated above. Truncation shifts schooling back, since the perceived incremental benefit of each additional year of schooling shifts down.
Yamauchi (2005)	Social learning and neighborhood effects	In a Bayesian model of learning, i learns about α by observing the Y level of her neighbors. People decide on schooling restricted by subjective uncertainty on α.
Durlauf (1996)	Incentives & aspirations	Parents´ election of neighborhood determines role models who influence aspirations & expectations of children, and available funds to finance S in the community.

sure network quality. Our interest to measure it is justified at least for two reasons: i) in order to compare the differences in quality among individuals with similar socioeconomic and intellectual traits and, however, different schooling attainments, ii) in order to count with a variable that can be used as explanatory in a regression to analyze the determinants of different socioeconomic achievements.

Another set of studies useful to this paper's purpose are those related with the strength of ties or relative importance of the members of a network. What is the appropriate method to assign a weight to each member of the network? How to consider factors that, besides kinship, influence the weight of a member? Available literature sheds little or no light on this problem. However, to help ordering ties according to their strength, there are important contributions especially by Granovetter (1983) and Marsden and Campbell (1984). Granovetter (1983) suggests that "the strength of a tie is a (probably linear) combination of the amount of time, the emotional intensity, the intimacy (mutual confiding) and the reciprocal services which characterize the tie". Marsden and Campbell (1984) were inspired by this intuitive definition, going further in the effort to empirically test the best indicators for strength. They argue that a measure of closeness or emotional intensity of the relationship is the best indicator of the strength of ties, in comparison with other suggested measures like "breadth of discussion topic" and mutual confiding. They emphasize that measures related to time spent in a relationship like frequency and duration of contact are no good indicators of the tie's strength, since they overestimate the strength of neighbors/coworkers and relatives respectively.

In addition, Marsden and Campbell analyze how accurate it is to assume that relatives are strong ties and neighbors/coworkers are weak ties, concluding that, although the assumption is accurate, the results also show that "the combined ability of the predictors to account for strength is limited". Hence, they recommend focusing on closeness when determining strength of ties. In this paper, we use the information obtained through a survey, from which it is possible to figure out the appropriate reference group and the closeness of individuals with each member of their networks.

2.1 The role of the network quality on schooling decisions

In this section we are going to describe the mechanism through which the social network quality influences the educational decision-making process of individuals. Let us think of a group of agents living in a poor

neighborhood.[4] One characteristic of this type of neighborhood is the lower average schooling and income levels of its inhabitants, compared to non-poor neighborhoods. In spite of sharing the same neighborhood, the social network R that each agent belongs to is not the same for all of them – although they inevitably do share part of their network.

The fact that individuals do not choose their family and, at a young age, do not choose their place of residence and school either, makes their network, at least in a good part, exogenous. Let R_i be the social network of individual i. There is a quality level associated to each social network. R_i^q expresses that individual i belongs to a social network of quality q. Definition 1 (below) explains more precisely how to determine the quality of a network.

In our analysis, individuals share at least two characteristics: they are intelligent (enough to participate at high educational levels), and they come from disadvantaged social backgrounds. They have not chosen their neighborhood.

Individuals decide the amount of educational investment they want to undertake (S). Their perception of the returns to human capital investment (α) is a fundamental determinant of this decision. It is proposed that the perceived returns to education that individuals form are closely related to the nature of their social network. Thus, the perceived returns for individual i may be written as follows

$$\alpha_i = \alpha(R_i^q, \ X_i) \tag{1}$$

Where X corresponds to other factors affecting the perceived schooling returns.

Why would individuals care about the characteristic of their role models? Would not be enough to consider only their own ability and other characteristics of themselves in order to form their perceptions on educational returns? It is not difficult to defend the idea that a rational individual would take more information into account when deciding schooling investment. The reason is that the individual does not know with certainty if the effort he should exert when studying will be sufficiently compensated. Thus, the rule for the investment decision is:

$$\text{if} \quad \alpha_i > E_i + u_i \rightarrow \text{Investment takes place}$$
$$\alpha_i < E_i + u_i \rightarrow \text{No Investment takes place}$$

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[4]Although it is possible to find non-poor people living in poor neighborhoods, here the focus is on low income individuals living in poor neighborhoods.

i.e. if the perceived schooling returns are greater (lower) than the effort (E) individuals should exert (plus a stochastic term u), they will (not) continue studying.

As a rational individual, he considers all information at hand when making the schooling decision. The characteristics of his role models or members of his network, what the individual observe of his role model's outcomes (success or failure), are part of this relevant information.

Equation (1) is pointing out a specific mechanism where social networks play a key role in information transmission among the network's members. Why does the quality of the social network affect the perceived returns to education? There are several potential reasons for this kind of influence. Let us mention three: expected attainable jobs, expected future income, and aspirations.

First, the social network is a job connections source. An individual belonging to a low quality network may (perhaps correctly) believe that his chances to get a good job are lower than someone with better connections, which discourage him from investing in education. In the literature (see for instance Contreras et al. (2007)), it is well-recognized that the structure of an individual's social network determines who gets certain type of job, and the individuals' incentives to continue investing in schooling and participating in the labor market.

Calvó-Armengol and Jackson (2004) describes the job information mechanism as follows: if an agent gets information about an open job position and has already an employment, then the agent randomly chooses an unemployed acquaintance to give the information of the job. The links with the labor market of the individuals' social network influence the individual's probability of getting a job.

Second, individuals have an idea about the relationship between education and income, which is based on what they observe from the sample of individuals accessible to them, i.e. their role models. Thus, if an individual belongs to a low quality network, his perception of the incremental benefit of an additional year of education would be based on a sample that excludes high income observations at each schooling level. The influence of the network quality on schooling decisions might also be described in terms of the perceived costs of dropping school. Individuals from high quality networks may have a more accurate perception of the difference between (monetary and non-monetary) earnings of educated people (their high quality role models) with respect to uneducated people (average individual in their neighborhood). As a consequence, a young individual belonging to a high quality network perceives a higher cost of abandoning school - thinking of the education "premium" - compared to the perception of individuals from low quality networks.
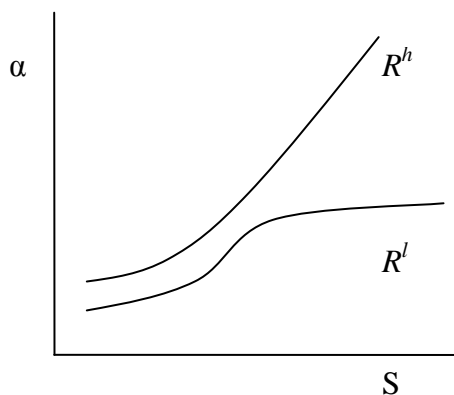
Figure 1: Perceived Returns to Education. These returns might be thought in a broad sense, for they do not only correspond to the expected monetary benefit of education (or any other instrumental value of education), but also to the intrinsic value or the value of knowledge itself.

Finally, a poor person belonging to a low quality network may fail in detecting how education will positively affect his welfare, which pulls down his educational aspirations. This aspiration trap arises because they have few opportunities to experience how educational choices influences their well-being,[5] not only through the higher expected earnings but also through other non-monetary impact channels of education. In general, the quality of the social network has an influence on the motivation level of individuals towards educational investment. Attending school requires an effort that only sufficiently motivated individuals are willing to exert. Achievements of high quality role models enhance individual's motivation and willingness to exert effort, since he feels encouraged by the possibility to catch up with his high quality role models.

Individuals from low quality networks (R^l) form a perception of the returns to education that is lower than the perception of individuals from high quality networks (R^h), and that will not always increase with years of education. Figure 1 illustrates this point.[6] The return function of individuals from lower quality networks becomes flat for high schooling levels.

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[5] Heifetz and Minelli (2006) quote Appadurai (2004) arguing that a poor individual is less conscious of the relation between "their fundamental aspirations and the available commodities". One reason is that poor people have "fewer opportunities to experience how a choice of a commodity influences their fundamental well-being".

[6] The difference in the quality of the social network may also influence the individuals ´expected probability of failure in educational achievements.

There is an additional characteristic of the social network that may influence the perceived schooling returns: the size. The rationale for this influence is the information transmission. In fact, larger networks imply a higher number of role models to compare to each other, wider information to be used by the decision maker when forming his expectations about the returns to schooling. The size is relevant when thinking of the network as a mechanism for information transmission of available jobs, as Calvó-Armengol and Jackson (2004) pointed out. The empirical model in the next section includes this variable as explanatory, given its potential role for more intensive information flow.

2.2 Quality of networks

Let $r_{ix} \in R_i$ be i's role model x, where $R_i = \{r_{i1}, r_{i2} \ldots r_{im}\}$ denotes i's social network. The length of vector R_i determines the network size or number of role models in the network, which may differ among individuals.

r_{ix}^q is the quality of i's role model x.[7] The value associated to r^q reflects the educational level and links with the labor market of a network's member, where $0 < r^q \leq 1$. The closer r^q is to 1, the higher the quality of the role model. Thus, the quality of the network will depend on the quality of the role models.

Each r_{ix} may have a different weight (θ_x) in determining the quality of the social network, which will be denoted by R_i^q. The weight depends on the relative importance of the members in the network. There are difficulties in determining the relative importance of members though, since this is a subjective matter guided by emotional attachments, power relationships, among other factors. We will work out later the determinants of the weight.

Definition 1 (Quality of a network) *Let each r_{ix} have a weight θ_x. The quality of a network is denoted by R_i^q and is determined as follows*

$$R_i^q = \sum_{x=1}^{m} \theta_x r_{ix}^q \qquad (2)$$

where $\theta \in [0,1]$, $\sum_{x=1}^{m} \theta_x = 1$ and $0 < R_i^q \leq 1$.

In general terms, we propose that the higher the quality of the network, the higher the schooling level of the individual. The empirical model in the next section will test the impact of quality network, measured as proposed here, on the probability for an individual to continue studying after secondary school.

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[7]Recall that, as mentioned in the introduction, the term quality as used here, has nothing to do with the value of individuals.
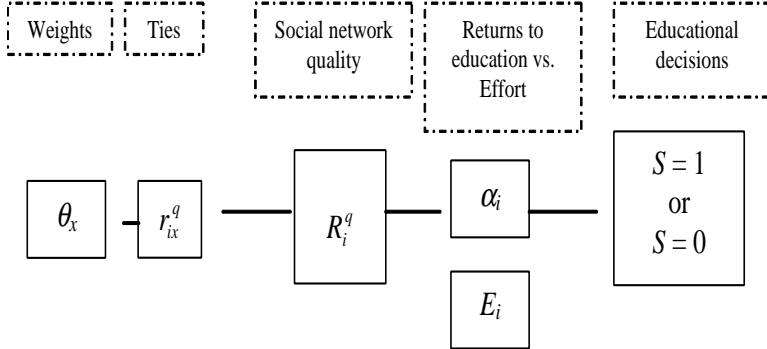
Figure 2: Summarizing the influence of the quality of networks on educational decisions.

2.3 The decision

Let $S_i = 1$ if individual i reaches high educational levels, $S_i = 0$ otherwise. We want to show that the probability that $S_i = 1$ increases with the quality of the network . As explained above, a high quality network offers advantages to the individuals such as higher information on the true benefits of additional education, enhancement of motivation to study and higher capacity to aspire, among others.

Figure 2 summarizes the process through which the quality of the network influences the individual's decisions on education. From the center of the figure to the left, each individual i belongs to a social network with quality q (R_i^q). His network is composed by m individuals, each of them with a given quality r_{ix}^q. The weight of each member is denoted by θ_x (section 4.2. describes the definition of weights). The weighted sum of the quality of the members determines R_i^q (definition 1). In turn, the quality of the network is a variable affecting the perceived returns to education α of individual i. The higher the expected return to education, the higher the probability of deciding to invest in schooling.

Individuals base their schooling investment decisions on the expected educational returns and the effort they would have to exert for acquiring a given level of education. As mentioned, an individual will be willing to invest in education only if the perceived schooling returns are greater than the effort he should exert, plus a stochastic term u. In other words,

$$P(S = 1) = P[\alpha(R_i^q, \ X_i) - E_i > u_i]$$

Assuming a logistic distribution function, we may work out a Logit model in order to verify the potential influence of network quality on the likelihood of investing in education.

The Logit model has the following form,

$$P(S = 1|R_i^q) = \Lambda(\beta_0 + \beta_1 R_i^q + \mathbf{X}\boldsymbol{\beta}) \tag{3}$$

where $\mathbf{X}$ is a vector compiling other variables that might affect the schooling decision, such as number of siblings and size of the network (social background and ability are similar for all individuals). Parental background is controlled by including the schooling level and labor position of parents. β_1 is expected to be significant and positive. The network size is expected to have a positive influence on schooling as well, since larger networks allow individuals to have more information when setting up their expectations on the returns to schooling, by comparing the relative situation of their different ties.

Key ties and quality of networks

Individuals living in a poor neighborhood may differ in the quality of their social network, hence, in their perceptions about α. Consider individuals i and j with network's quality denoted by R_i^q and R_j^q respectively. Sharing the same neighborhood makes it likely for i and j to share some of the role models of their networks. However, there might be at least one role model $r_{ix} \in R_i$ who does not belong to R_j and makes the difference. We claim that the presence of at least one high quality member - i.e. r_{ik}^q is close to 1 (0.9 or higher) - with high enough θ may positively influence the educational decision. We call this member a 'key tie' or 'key role model'.

The key tie or key role model crucially helps in determining the quality of the social network. A key tie has two characteristics i) (s)he is a no-family member[8] high quality tie, , and ii) his weight θ, initially lower than those of relatives, ends up being as high or higher than originally stronger ties due to different adjustment factors (e.g. intimacy, admiration, emotional or economic support), that will be explained in section 4.2. The key tie is crucially helping in enhancing motivation, aspirations, and in general, non-cognitive skills of the individual.

For individuals living in a poor neighborhood, strong ties (family, closest friends) are likely to be low-educated, so there might be some cases in which a weak tie turns up to be a key tie, pulling up the network's quality and influencing individual decisions.

This is important in the context we are analyzing. Our individuals share the same type of poor neighborhood. Their strong ties are normally of similar characteristics. If poor and/or low-educated people only

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[8]The reason why a key tie is defined as a non-family member is that we are referring to a network member who may eventually counterweight the influence of low educated strong ties (parents and close family).

interact with their equally disadvantaged strong ties, the possibility of widening their life perspectives is lower. Granovetter (1983) points out that "the heavy concentration of social energy in strong ties has the impact of fragmenting communities of the poor into encapsulated networks with poor connections between these units". The problem with these encapsulated social networks is that poor individuals lose the potential advantages of wider information received through their weak ties' own networks, which may be, according to the author, "one more reason why poverty is self-perpetuating". The argument is that weak ties are a richer source of information on vacancies than strong ties, because they connect different groups in a social space, providing the individual with no redundant information, while strong ties most probably have no different information than the individual already has.

In some cases, admiration for someone different to our strong ties may exert an important role in shaping our behavior.[9] In this sense, the presence of one or several high quality members in the network can be as important as the schooling level of the parents. Hence, it is not necessary that poor individuals observe many high quality role models (a complete reference group) in order to change their fate, a key tie may suffice. Besides, the link might be undirected (i belong to j' networks and j belongs to i network) or directed (i belongs to j's networks but j does not belong to i's). The last one is possible, since someone we know, admire and interact with may likely influence our behavior, with no reciprocity. These type of links are commonly identified in the network literature.

4. Data and results

4.1. The Survey

> "Given that identification based on observed behavior alone is so tenuous, experimental and subjective data will have to play an important role in future efforts to learn about social effects" (Manski 1993)

We applied a survey to individuals divided in two groups. The first group (64) is composed by university students - first year scholars at

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[9]Weak ties refers to acquaintances and excludes media personalities. Members of the network are those with whom there actually exists some type of personal interaction. Media personalities might influence behavior - for instance, a national tennis champion may encourage youngsters to enroll to tennis schools - but we can hardly claim that they belong to the social network of all individuals who admire them. Moreover, they most probably are equally 'accessible' for everyone in a poor neighborhood.

Universidad Icesi (Cali, Colombia) - coming from poor neighborhoods. These students are admitted based on their academic performance, acquiring also a scholarship. They also have to prove that their economic conditions are low enough to qualify for the scholarship. Family income, neighborhood and other characteristics are corroborated by a committee to approve the benefit.

The second group (35) is a sample of individuals similar in ability and socioeconomic background to those in group 1, but not enrolled (nor planning to enroll) in superior education programs. We made sure that the reason for individuals from group 2 not to continue studying after secondary school was not lack of intellectual ability. We did it by checking their school grades and results from the National test to access higher education (ICFES),[10] which were similar to those of individuals from group 1.

In order to form group 2, individuals from group 1 were asked for references from young acquaintances with the following characteristics: 1) poor neighborhood inhabitants and low family income, 2) (intellectually) capable to continue higher education, 3) not enrolled - no planning to enroll - in any higher education program. We contacted them and selected those who were indeed similar in socioeconomic and academic traits to group 1 individuals. Although group 2 is not to be considered as a control group, it serves to compare their members' network quality with those from group 1, who have the opposite educational choice. In our case, the choice is whether to continue or not higher schooling.

We are aware of the potential problems of this sampling procedure, related to the potential sources of endogeneity. It is worth clarifying that at least one source of endogeneity is excluded i.e. students going to college have, in average, better network quality not precisely because they go to college. The reason is that we have interviewed students from the first year and asked them for their friends and close people, excluding those appearing after college. We should recognize, however, that there might be another source of endogeneity. For instance, unobservable personality factors that influence both schooling decisions and network's quality. Specifically, the simultaneity problem may arise because certain factors affecting the individual's outcome also impact the outcomes of other agents in the network. We deal with this problem in the next subsection.

The survey helped us detect, i) educational level and labour position of each of the members of the individual´s network. Table 7 in the

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[10]The specific grade of each individual was not registered. We only made sure that they had good school performance (outstanding or excellent) and that the ICFES test results were at the upper 30% at a national level.

appendix shows the quality values (from 0 to 1) attached to the actual schooling or job level. The quality of a tie (r_{ix}^q) corresponds to the average of these two quality values. $ii)$ the weight of each member (θ_x), by considering the different adjustment factors as explained in the next subsection. Based on $i)$ and $ii)$ we were able to calculate the quality of the social network for all individuals in our sample, according to equation (2).

The social network is composed of parents, siblings, closest cousins, closest aunts and uncles, closest family in law, closest friends, closest professors, godparents, sentimental partners, closest neighbors, closest mates from associations or organizations, and relevant acquaintances. An advantage of the survey used for this research is that it helps us to accurately determine the relevant reference group of individuals, this is, people potentially influencing behavior and decisions. Note that the survey does not only ask for family or closest friends, but also for professors and acquaintances that somehow (in many cases due to admiration) have served as role models.

Table 2 provides some descriptive information on the quality of the network for both, the target and the comparison group (See the questions of the survey in appendix 2).

Table 2: **Characteristics of the networks' members**

	Target Group			Comparison Group		
	Mother	Father	Rest	Mother	Father	Rest
SCHOOLING (%)						
Non education	0.0	0.0	0.4	8.0	12.5	3.1
Less than secondary	22.6	19.7	8.3	52.0	37.5	23.4
Secondary	31.0	28.8	29.8	24.0	16.7	37.6
Studying higher educ			25.0			10.5
Technic/ Technology	23.9	21.3	6.5	8.0	20.9	5.5
University	21.1	27.3	27.4	8.0	12.5	19.3
Graduate	1.4	1.5	2.5	0.0	0.0	0.7
OCCUPATION (%)						
Unskilled job	29.3	45.8	18.9	33.3	82.6	45.1
Technic/ Technologic	22.4	20.8	5.8	3.7	4.3	4.0
Skilled job	19.0	33.3	31.2	3.7	13.0	21.2
Housewife	29.3		9.8	59.3		20.9
Student			34.2			8.8

4.2. The weights

Each individual i belongs to a network with m role models, where the number of models might differ among individuals. A role model x has a weight θ_x, when determining R_i^q the quality of the network. We have that $\theta \in [0, 1]$ and $\sum_{x=1}^{m} \theta_x = 1$.

There are basically three categories of role models: relatives (r), friends (f) and acquaintances (a). In principle we assume that θ is higher for family, followed by friends and finally acquaintances. However, there are certain factors like intimacy or closeness, emotional support, financial support, admiration, confidence, among others, that make θ differ among the members' subsets of family, friends and acquaintances. For instance, admiration may enhance the weight of apparently weak ties (acquaintances). An appropriate definition of θ_x might reveal cases in which parents background may loose importance in influencing individuals' decisions.

In order to calculate R_i^q, we use three ways to assign the weights to each member of the network. First, a uniform weight for all members

$$\theta_{x\_uniform} = 1/m \tag{4}$$

Second, a weight adjusted by kinship, considering the three identified categories, relatives, friends, and acquaintances. Then, kinship is considered a relevant adjustment factor (af_1) for the uniform weight.

$$\theta_{x\_kinship} = \theta_{x\_uniform} * (1 + af_1) \tag{5}$$

In order to operationalize (5), a numeric value for af_1 is required. It is plausible to assume that $af_1^r > af_1^f > af_1^a$, i.e. that the adjustment factor is the greatest for the relatives and the lowest for the acquaintances. However, with the available information, there is no formal way to estimate this kinship adjustment factor. We then assume arbitrary small values to apply to $\theta_{x\_uniform}$, $af_1^a = 0$, $af_1^f = 0.5$, and $af_1^r = 1$. Giving different values to af_1 does not imply relevant changes in the results shown in the next section.

Third, the weight is adjusted by other factors such us economic support, emotional support, confidence, and admiration. We assume that all factors alter the weight in the same proportion, with $af = 0.5$. This means that, in the case of a network's member for which all four adjustment factors apply, we will have,[11]

$$\theta_{x\_adjusted} = \theta_{x\_kinship} * (1 + 4af) \tag{6}$$

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[11] The weights have been renormalized so as to make them sum to one.

Equations (5) and (6) are intuitively reasonable. However, the empirical application may seem rather ad hoc, since the only alternative to operationalize the weights is assigning an arbitrary small value to the adjustment factor. However, the exercise is worth doing because uniform weights ignore the higher relevance of certain members of the network who potentially influence an agent's decisions.

With the purpose of verifying that the results are robust, we run the Logit model with three different calculations of the variable *quality of the network*. The three calculations follow definition 1, but they differ in the weight (θ) applied to each member of the network (lets us call them R, $R2$ and $R3$). R was calculated using $\theta_{x\_adjusted}$, $R2$ was calculated using uniform weights for all members and $R3$ using $\theta_{x\_kinship}$. The quality of network appears to be significant with the three types of calculations.

4.3. Results

We calculated the quality of the network (R_i^q) for each individual that participated in the survey, by using equation (2). Figure 3 shows the histograms of the quality corresponding to group 1 (above), group 2 and the complete sample. It is observed that the frequencies for group 2 are more concentrated below the value 0.5, while the bars for group 1 are located mainly to the right of 0.5. Those individuals who have continued their studies after secondary school, belong, in average, to higher quality social networks.

Besides the quality of the network, we have to include in the vector X other variables that may influence the decision to continue studying after secondary school. Recall that at least two of the relevant variables are similar for the two groups, since all individuals belong to the same type of socioeconomically disadvantaged neighborhood and posses around the same level of intellectual ability. The control variables considered are *size of the network* (m, number of ties), *number of siblings, gender* and *parental background*. The last variable is an index from 0 to 1, calculated in the same way as the quality index, giving an equal weight to both parents. Table 3 shows the mean of the independent variables. We observe that individuals in the target group have in average a higher number of members in their social network, and 0.5 less siblings than the individuals in the comparison group. As it can be already deduced from table 2, the mean of the parental background index for the target group is higher than the mean for the other group.

As mentioned before, it is necessary to deal with the potential endogeneity problem. The usual procedure is to use instrumental variables. For instance, Contreras et al. (2007) use neighborhood housing prices as an instrument for average outcome of the network. This instrument

Figure 3: Histograms, Network Quality.
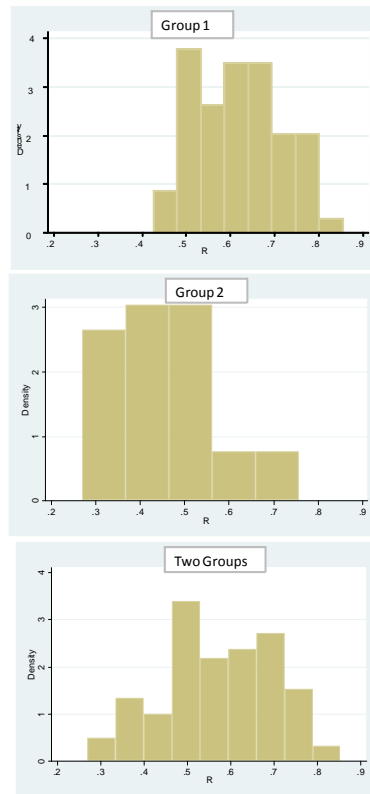
Table 3: **Mean of the variables**

	Parents	Size of network	# of siblings
Target group	0.582	24.7	1.7
	(0.229)	(8.4)	(1.0)
Comparison group	0.318	17.1	2.2
	(0.218)	(6.2)	(1.3)

is not suitable in our case, because housing prices should be quite similar among all individuals in the survey, given that individuals live in the same type of neighborhood. Even if some heterogeneity in prices existed due to differences in size of the house, that information is not available to us. We suggest an alternative instrument in this paper: a dummy variable equal to 1 if the individual belongs to a cultural, religious, or communitarian group, and equal to 0 otherwise. Belonging to those groups reveals the ability of individuals to socialize - expanding their network beyond their socially disadvantaged strong ties - and it is unrelated to the decision to continue studying or not.

The next step was running the test of Hausman to detect endogeneity by using the suggested instrument. The coefficient for the residuals in the second stage is not significant, which means that the suspected endogenous variable - the network quality - is exogenous and we may trust the results of the Logit Model (3).

Table 4 shows the results. Contrary to what we expected, the coefficient for number of siblings - although it has the expected negative sign - is not significant to explain the probability to continue superior studies, nor is the individual's gender (Column (1)), which left us with a simpler model whose results appear in the columns (2). The coefficient for network quality has the expected positive sign and it is significant. The average marginal effect indicates that the quality of the network does increase the probability of an individual to continue studying after secondary school. Even controlling for parental background, the quality of the network is important in explaining our dependent variable.

The size of the network appears to be also important to explain schooling decisions. This is expected since a higher number of (relevant) role models allow individuals to compare the situation of their different ties and have more information when forming their expectation on the returns to schooling. A bigger size of the group may reflect the presence of role models beyond the family members, which gives an individual the possibility of acquiring non redundant information, through ties linking different social spaces (Granovetter (1983)).

As table 4 shows, conclusions from the results do not vary when we use different measures of quality: R, $R2$ and $R3$, explained in subsection 4.2. Still, the network quality coefficient and the marginal effects are higher using R.[12] We consider these results (using R) better than those obtained by using $R2$ and $R3$, because they take into account a theoretically superior measure of network quality, which involves the adjustment factors explained above in order to determine the weight of

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[12]The statistical difference between the marginal effect for R and $R2$ is not significant though.

Table 4: **Network Quality and Schooling**

	(1)	(2)		
(R)	9.916	8.290		
	(3.968)	(3.550)		
marg eff	1.368	1.168		
$(R2)$			6.091	
			(3.180)	
marg eff			0.878	
$(R3)$				7.848
				(3.453)
marg eff				1.137
Parents B	3.745	3.730	4.386	3.631
	(1.655)	(1.650)	(1.591)	(1.648)
	0.529	0.526	0.632	0.526
netw size	0.145	0.145	0.150	.141
	(.0516)	(.0515)	(.0503)	(.0506)
marg eff	0.0204	0.0204	0.0216	0.0204
Sex*	0.952			
	(0.678)			
marg eff	0.128			
# siblings*	-0.077			
	(.2901)			
marg eff	-.0108			
_cons	-7.799	-8.045	-7.337	-7.602
	(2.216)	(2.029)	(1.980)	(1.934)
LRX_2	47.46	45.43	42.99	45.17
Prob>X_2	0.00	0.00	0.00	0.00
Log lik =	-31.59	-32.62	-33.83	-32.75
PseR2	0.429	0.411	0.389	0.408

* Non significant
Standard errors in parenthesis

each tie.

Two additional estimations were made as sensitivity analysis in order to compare the previous results with more conventional regressions, not involving the network quality index. Instead, average schooling and labor position of the network's members and parents were used as explanatory variables. Results are shown in table 5.

First, the schooling dummy was regressed on parent's schooling (SP) - taking the highest level between the mother and the father - and the average schooling of the members of the network (SN) (column (1)). Second, we use as explanatory variables two dummies reflecting labor position of parents and the social network. $D1$ is equal to 1 if the mode of the labor position of the network's members is non-skilled job, zero otherwise. $D2$ is equal to 1 if both parents have a non-skilled job (or if one parent has a non-skilled job and the other does not work), zero otherwise (column (2)).

We can observe that the two social network variables (SN and $D1$) are relevant to explain the probability for individuals to continue studying after secondary school, even after controlling for parental background. These results correspond to a simple social mobility model, where the significance and sign of the coefficients indicate whether there is upward or downward social mobility with respect to the parents and network position.

4.4. Key ties

The information obtained through the survey is explored in further detail, in order to identify key ties such as described in section 3.3. A key tie is a high quality non family member of the network crucially helping in determining the quality of the social network.

As mentioned, we found that the quality of the network for individuals in the target group is in general higher than for individuals in the comparison group (Figure 3). Likewise, the average quality of the family members is higher. For instance, 21% (27%) of the mothers (fathers) of individuals in the target group have university education, while only 8% (13%) of the mothers (fathers) of individuals in the control group obtained a university degree (See table 2 above). This indicates that in several cases, strong ties are playing a decisive role in determining the high quality of the network (parents, siblings, uncles, aunts, cousins).

However, there are also several cases where non-family members play an important role. 53% of individuals in the target group have at least one high quality non-relative member of the network with more than one weight adjustment factor applying. We found that 38% of individuals

Table 5: **A simple Social Mobility Model**

	(1)		(2)
SN	0.6182	D1	-1.5081
	(0.3232)		(0.6239)
marg eff	0.0923	marg eff	-0.2270
SP	0.2487	D2	-1.5665
	(0.1019)		(0.6611)
marg eff	0.0371	marg eff	-0.2219
netw size	0.1550	netw size	0.1614
	(0.0519)		(0.0487)
marg eff	0.0231	marg eff	0.0237
_cons	-11.921	_cons	-0.1497*
	(3.706)		(0.928)
LRX_2	45.43		35.34
Prob>X_2	0.00		0.00
Log lik =	-32.62		-37.66
PseR2	0.411		0.319

* Non significant
Standard errors in parenthesis

have a key role model, this is, a non-relative high quality member of the network whose weight, thanks to the adjustment factors, ended up being as important or more than the weight of family members. These key ties are, in most of the cases, teachers, friends or family friends.

It is interesting to notice that teachers may play a relevant role in an individual´s network. Table 6 shows the percentage of cases where a teacher's weight had to be adjusted. The adjustment was more frequent for teachers in the network of group 1 individual compared to group 2. The average number of teachers in the network for each individual was 2.6 (1.7) for group 1(2).

Interaction with people different to their strong ties has apparently widened individuals' life perspectives. A less encapsulated social network allows the potential advantages of positive influence from high quality role models.

5. Conclusions and some recommendations

This paper explores the role of the network quality on the schooling decisions of individuals. We want to show that, beyond socioeconomic background, individuals with higher quality of network - compared to their peers living in the same type of neighborhood - will experience

Table 6: **Adjustment factors to the weight of teachers**

# of adjustment factors	% of Group 1	Group 2
4	17.2	0.0
3	21.9	7.4
2	20.3	3.7
1	17.2	11.1
0	21.9	66.7
No teacher in the network	1.6	11.1

higher probability to continue studying. Specifically, the network quality influences the perception of individuals on the returns to education, which determines the probability to continue higher education.

We compare two groups of people belonging to the same type of poor neighborhood and with similar intellectual ability. The difference between them is that individuals in the first group have continued studying after secondary school, while those in the comparison group have not continued. A survey was applied to individuals of the two groups in order to obtain information about the quality of their social networks.

A measure for quality network is proposed, based on the weighted sum of the qualities of the network's members. The quality of role models is related to their schooling level and their position at the labor market.

As for the weight of each member, it is considered that the type of relationship (relative, friends or acquaintances) is not sufficient criterion to determine it. Other factors such us intimacy, confidence, emotional and economic support are relevant and may convert an initially weak tie into a key tie.

Social networks are important in shaping the motivation, aspirations and expectations of individuals. These, in turn, affect the behavior and decisions of people in crucial aspects such as investment in human capital. It suggests, in line with the existing literature, that educational achievements of members of poor communities may generate a multiplicative effect, through social networks, beyond the private return of the educated individual.

Results of the Logit model suggest the relevance of the quality of the network in schooling decisions, controlling for parental background. This might be one of the reason why it is possible to find individuals belonging to the same type of community or neighborhood, who share certain attributes like family income and ability, ending up at different levels of schooling, expected future income and expected social mobility.

If we accept that social networks matter, a relevant question could be then: how can the quality of networks for individuals in poor neighborhoods be strengthened? Let us mention (not develop) some strategies towards that direction. The two last strategies do not follow directly from the analysis of this paper. Still, they are mentioned for their relevance to improve the network's quality of impoverished individuals.

- We have seen that, in several cases, the positive influence of a teacher plays an important role in shaping individuals behavior. From the target group, 17% (22%) of the individuals had teachers whose weight was adjusted by 4 (3) factors. There should be some mechanisms to strengthen the relationship teacher-students to better exploit this channel of positive influence.

- Cities must offer more spaces to be indistinctly used by people from different income groups. Cities in Colombia are designed to promote polarization, which decreases the opportunities for poor youth to expand their social networks, losing the potential advantages of higher information received through possible weak ties. At least from the government initiatives, this practice should be reversed in order to avoid segregation.

- Social housing (viviendas de interés social) should not be constructed in isolated places, as it is usual in Colombia. It is important that they are integrated to the city so that inhabitants may benefit from the infrastructure of the city and may easily socialize.

- Students from high quality private universities have more chances to engage in the labour market, because of the good networking and prestige of the academic programs. Education in Colombia is polarized and poor students normally are excluded (not in theory but in practice) from private universities. Thus, good students from public schools should be guaranteed a given number of undergraduate scholarships in high quality private universities. This should not reduce the opportunity for them to access the scarce current scholarship offers.

- A more ambitious but highly beneficial proposal is that at least one member of each family should benefit from a scholarship to cover the complete educational cycle. This member will have a positive incidence in the whole family group.

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Appendix

The survey

The following information was obtained from parents, siblings, cousins, uncles, aunts, relatives in law, Godmother, Godfather, friends, family friends, sentimental partners, school teachers, neighbors, people from groups or associations, other relevant people not included before. All the information is about the closest people at each category. There are cases where individuals have relevant relationships with nobody in some categories. We made sure that only the relevant reference group was included.

1 Gender

2 Age

3 Level and year of education

4 Occupation

5 Frequency of Contact (daily, weekly, monthly, etc.)

6 Type of contact (personal, virtual, phone)

Once the previous information was registered, we ask the individual from (to) whom of those listed in the survey she/he:

7 receives economic support

8 asks him/her for advice

9 gives him/her advice

10 receives emotional support

11 admires him/her

Table 7: **Schooling and Occupation Categories**

	Mother
SCHOOLING	
Non education	0
Primary	0.2
Incomplete Secondary	0.3
Secondary	0.5
Studying higher educ	0.6
Technic/Technology	0.75
University	0.9
Graduate	1
OCCUPATION	
Unskilled job	0.2
Technic/ Technologic	0.6
Skilled job	1

Note: This quality value allocation reflects the so-called sheepskin effects that has been pointed out in the literature of returns to education. According to this concept, there are higher increments in the returns in those years of schooling that represent the culmination of an educational level. The jump in returns is higher for complete universitary education (Gonzalez et al. (2004)).