ALTRUISM VS. EXCHANGE IN INTERGENERATIONAL TRANSFERS: NEW EVIDENCE FROM CHILDREN'S HEALTH CARE*

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ABSTRACT

We put in perspective two competing hypothesis on the nature of intergenerational transfers: altruism vs. exchange motivation. Unlike previous approaches, we concentrate on non-monetary transfers measured as the effort that parents need to make in order to prevent children's fatal health episodes. It is shown that, under the pure altruism hypothesis richer parents should be more prompt than poorer ones to exert this effort in the face of a bad-health signal. Inversely, richer parents would need to observe a higher signal than poorer when parents consider raising healthy children as an investment for the future times. Using data on frequency of utilization of the emergency room services and doctor's office visits by low-age children, infant mortality and home-accident preventive care, we reject the null of altruism. Instead, we conclude that exchange motives do not enter into contradiction with the evidence.

JEL Classification: D64, D91, I12, J13

Keywords: Intergenerational transfers, altruism and exchange motivations, child health.

1. INTRODUCTION

Understanding the determinants of the transfers between parents and children is an essential issue in several prominent fields of Economics. For instance, in some models of Public Economics those transfers have important consequences regarding the financial impact of taxes on Social Security systems because the determinants of savings by families cannot be fully understood without considering the economic links between parents and children. In other areas such as economic growth, investment in human capital and income distribution, a better understanding of the nature of this relationship is fundamental.

There are two main different paradigms with respect to this intergenerational linkage and economists have not yet reached an agreement on which of them describes more accurately the behavior of families. If the welfare of children enters directly into the preferences of their parents, (Barro, 1974; Becker, 1974, 1991), intergenerational transfers[3] will often be observed. We will refer to this approach as the *altruistic model*[4] henceforth. Alternatively, it is reasonable to think that parents may give transfers and invest in the human capital of their children mainly because they expect some type of return from their children in the future (see Bernheim, Shleifer, & Summers, 1985; Cox, 1987). We will refer to this approach as the *exchange model.*

As both paradigms do generate different predictions concerning several observable economic phenomena, it is reasonable to think that discriminating between the two

[3] In this case, the model predicts that parents will make *inter vivos* and *post mortem* compensatory transfers. See, for example, Altonji, Hayashi, and Kotlikoff (1997) and Cox and Rank (1992).

[4] In the context of our paper, the "joy of giving" approach in, for example, Andreoni (1989) and Hurd (1989) is equivalent to the *altruistic approach* in Barro (1974) and Becker (1974, 1991).

paradigms could be done on the basis of empirics (Altonji, Hayashi, & Kotlikoff, 1992) . Most of the empirical papers analyze monetary transfers (bequests in Tomes, 1981, gifts in Menchik, 1980) and investment in human capital such as education for children. The results, however, are inconclusive because it is hard to distinguish between transfers to children due to altruistic reasons and transfers that are part of an implicit contract between generations as a reaction to market imperfections. This paper adopts a novel strategy in that we focus on non-monetary transfers in the early ages of the offpsring . By doing so, we expect to reduce, when facing the empirical data, the distortion in the parents' transfers which is introduced by the income effect. In particular, we will construct a theoretical model that predicts a different pattern of parents' effort in children's health care with respect to their income in the altruistic and in the investment models. Namely, we will argue that under the altruistic approach, rich parents take their children more often to the Emergency Room (ER) than the poor *ceteris paribus*. On the other hand, in the investment model, a positive monotonic relation between parents' income and the use of the ER does not necessarily hold.

Moreover, this approach permits to exploit information from data bases which have not yet been used in this area. We use data from the 1999 and the 2000 National Health Interview Survey (NHIS, henceforth). This survey provides a rich source of information on socioeconomic and health conditions for a large number of US families. The empirical evidence from the NHIS clearly shows a strong negative relationship between the frequency of utilization of ER services and family income. Thus, our estimates provide more evidence in favour of a model where parents behave in a manner that is not purely altruistic.[5] The intuition behind our empirical finding is clear:

[5] An alternative interpretation of these results is that the purely altruistic model is

children are less important for rich families as an investment good than they are for the poor because they provide a relatively lower return in the future. In fact, this return should be related to the expected economic situation of the children in the future and if children in poor families are expected to be relatively richer than their parents it follows that the expected return on a child's investment is higher for poor parents than for wealthy parents. This also implies that in economies with a lot of intergenerational social mobility, i.e. where the relation between children's income and parents' income is very weak, rich families find it less profitable to invest in their children. We find that the data is also consistent with this prediction.

Our empirical approach to test the predictions of the theoretical model uses the frequency of ER utilization in the NHIS database and controls for many health and socio-economic factors. However, from a critic point of view it could be argued that our conclusions are the result of other complex economic and social forces behind the health provision market, due to an inappropriate control for unobservable variables. Thus, using data from the National Survey of Early Childhood Health (NSECH, henceforth), we will also cross-test our results with a different measure of parents' child-care effort. Here, we take the estimates of a model in which the endogenous variable is the home-accident preventive measures embraced by parents and we find that they provide additional evidence in favour of the investment model.

Furthermore, one should expect that if our previous findings are correct, children of rich families should face higher mortality rates from serious diseases whose prevalence is well-known to be independent of income compared to children from poor families.

more relevant among rich families while the investement model is more relevant among poor families.

We try to check whether this positive relationship between family income and infant mortality holds or not by using data from the 1988 Maternal and Infant Health Survey (MIHS henceforth). The analysis of the MIHS shows that such a positive relationship holds although not signifficantly because of the small sample size.

Overall, the paper provides evidence on the behaviour of parents regarding several types of health investment in children that is difficult to explain by just assuming the altruist approach, and thus we claim that the alternative investment approach fits such evidence better. Needless to say, the reader should not interpret this claim as equivalent to saying that the altruism is absent in intergenerational relationship. On the contrary, a sensible interpretation of the results is that, even though parents care about the welfare of their children, the investment motivation is also playing a role in developed economies and, in fact, one of greater relevance.

2. THE THEORETICAL MODEL

We consider a a model involving two time periods. We abstract from fertility decisions and consider families consisting of parents and a single daughter.[6] In the first period, the daughter is a child and only the parents work and consume. In the second period, the daughter becomes an adult and both parents and daughter work and consume. In the first period, parents consume their whole current income, y_p, and there is neither saving nor borrowing for the next period. During this first period the child might show symptoms indicating the possibility of her having a fatal disease and parents will have to decide whether to take her or not to the ER. Taking her to the

[6] A model where fertility is endogenous so that parents have to decide both on the number of kids and on the effort spent on their health would make the analysis much more complex and it would probably yield similar results

ER requires a non-monetary effort by the parents of magnitude c. Let's write $r = 1$ if the child gets the disease and $r = 0$ if she doesn't. Parents do not observe r but rather an informative signal $s \in [0, 1]$. This signal can be thought of as fever or other general symptoms which do not clearly identify the pathology of the child. We denote the (subjective) probability that the child has the disease conditional on observing signal s as $P(r = 1|s) \equiv p(s)$, where the function $p(s)$ is increasing in s. Thus, the higher the fever, the more likely it is that the child has a serious health condition such as, for example, meningitis.[7]

In the second period the child becomes an adult and her health status is realized. If during her childhood she had the disease but she was not treated, it is assumed that she becomes *disabled* in economic terms. This means that she is unable to have an independent productive life and dissapears as an economic agent. If, on the contrary, she did not have the disease or she did but was not treated, she grows in a perfectly healthy condition and becomes a healthy adult. In the second period, healthy daughters are endowed with an income y_c which is random with expected value $\overline{y}_c$. For simplicity, it is assumed that such an income takes the value $y_H = \varepsilon_H \overline{y}_c$ with probability $1 - \alpha$ and the value $y_L = \varepsilon_L \overline{y}_c$ with probability α, where $\varepsilon_H \geq 1$, $\varepsilon_L \leq 1$ and $(1 - \alpha) y_H + \alpha y_L = \overline{y}_c$. It is reasonable to assume that the expected income $\overline{y}_c$ depends on the parents' income $\overline{y}_p$ and is given by $\overline{y}_c = v(\overline{y}_p)$ where the function v is increasing

[7] Pathologies like meningococal infection, septicemia, meningitis, pneumonia, acute bronchitis and the like, normally course with apparently mild symptoms but they are often fatal if parents do not act soon enough. One can obtain crude estimates of $p(s)$, i.e., the probability of death after receiving a signal from one of these spells, using data from the National Vital Statistics Report, 2001, and from other sources in the National Center for Health Statistics. Using these data we found that such a probability was around 1/1000 on average. The details of how such an estimation was computed are available from the authors upon request.

and concave.[8] It should be noted that all the results in the paper can also be obtained adopting a deterministic approach in which $\varepsilon_L = \varepsilon_H$. Introducing a stochastic component, however, does not increase the complexity of the model substantially but instead helps to make the interpretation of the investment case more clear.

It is assumed that the parents' income in the second period is deterministic and of the same magnitude as their income in the first period, i.e. y_p. This assumption is made without loss of generality and similar results could be obtained in a model with economic growth where stochastic parents' income in the second period is stochastic. Also during this second period, monetary transfers are allowed between parents and daughter. To concentrate the analysis on the interesting cases, assume that $y_H > y_p$ and $y_L < y_p$.[9], i.e., in principle, transfers between parents and daughter can go either way in the second period.

Hence, the only decision variable of parents is whether to take their child to the ER when they observe s or not. Such a decision is made on the basis of two possible alternative consequences of their action

i) *Pure altruism*: Parents love their children and care about their welfare and, consequently, they want them to reach adulthood in an optimal health condition.

ii) *Exchange model:* Parents are selfish and they derive utility only from their own

[8] Mulligan (1997) for example, provides a discussion on this assumption and a survey on the empirical estimation of the function v.

[9] This assumption together with the previous one on ε_L and ε_H imply that

$$\varepsilon_L \leq \frac{y_p}{v(y_p)} \leq \varepsilon_H$$

for all y_p. It will be assumed that $v'' \leq 0$. In this case, the expression $\frac{y_p}{v(y_p)}$ is not bounded above. This is not a problem for the existence of ε_H if there is a maximum income level of, say, \$500.000.

consumption. However, they know they may receive help from their children in the future.

Casual observation and introspection indicate that both motives are present in current societies. The question is whether one of the two factors dominates the other and whether the above model allows us to build an implementable test of this question. A skeptical reader may argue that some of the assumptions above are unrealistic or too simplistic even if our model is intended to be instrumental and not a description of the determinants of ER services demand. Particularly, two assumptions are prone to such criticism and are central to our results: first, that the effort c is non-monetary and second, that $Prob(r = 1)$ and $p(s)$ do not depend on income. However, when building our testing procedures, we will control for those factors that may be correlated with income and at the same time affecting c, $Prob(r = 1)$ or $p(s)$, such as ex-ante health status, education of parents, type of insurance benefits, and others alike.

At this point it must be stressed that there is a potential criticism different from that above. One might argue that rich families face a higher value of c than the poor ones because the opportunity cost of taking the child to the ER depends on the implicit price of the time of the parents, and this is more expensive to the rich. However, one might also argue that the opposite is true, i.e. that the cost c should be lower for richer families since they usually have more regular baby-sitters and more flexible job schedules and, perhaps, better transportation. We are not aware of any empirical work dealing with this specific type of opportunity cost and we assume it to be independent of income as a first approximation.[10]

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[10] The reader may be skeptic on the independence of c with respect to income. In that case, the results in the empirical section could be seen as a proof that such a cost

2.1. The Altruistic Case

Altruistic parents, (Barro, 1974; Becker, 1974, 1991), care about the (future) welfare of their daughter and so they may be willing to make the effort c during the first period so that she has a healthy life in the second period. Moreover, by raising a healthy offpsring, the possible transfers that they might give to her in the second period will increase her welfare. Let $b \geq 0$ be the monetary transfer given to the child in the second period.[11] The budget constraint imposes that $b \leq y_p$. Parents care about their own consumption during the first and second period and their child's consumption in the second period. Let $u_p(.)$ be the utility function of parents in their second period of consumption, and $u_c(.)$. be the one of their child regarding her own consumption (also in the second period). These utility functions are assumed to have all the standard properties. Notice that we have dropped the first period consumption from the parents decision problem because our model does not allow for saving, the child does not consume in the first period and the cost c is non-monetary. Therefore, parents evaluate the consumption of the child and their own consumption according to $u_p(.) + \beta u_c(.)$ where β is the degree of altruism towards the child. Parents will give transfer $b > 0$ to the daughter if her income is y_L, and $b = 0$ if her income is y_H. We assume that parents do not want to give transfers to their child whenever she is richer than them, as $y_H > y_P$. This is assumed for simplicity and the results wouldn't change if we allow the degree of altruism towards the child to be so high that parents would

is lower for poorer families instead of seeing it as evidence in favour of the investment model. We believe that this possible alternative interpretation of our results might also be interesting in itself.

[11] In our model b is an *inter vivos* transfer. In a more general model this transfer could also be a bequest.

want to transfer even in the case where the child's income is y_H .

Thus, with probability α the child gets income y_L and her consumption is $y_L + b$ in the second period while her parents' consumption is $y_p - b$. With probability $1-\alpha$ the child gets income y_H and there are no transfers. Notice that our definition of altruism is one-sided. The case of two-sided altruism in which the child also cares about the utility of the parents is not considered here since it would yield a result (with respect to parent's behavior) similar to the one provided in the investment case considered in the next section.

If parents exert the effort c, the child will be healthy in the second period and the maximum expected utility parents get if they take the child to the ER is the solution to [12]

$$\max_b \alpha \left[u_p(y_p - b) + \beta u_c(y_L + b)\right] + (1-\alpha)\left[u_p(y_p) + \beta u_c(y_H)\right] - c. \qquad (1)$$

An interior solution to (1) satisfies the first order conditions:

$$\beta = \frac{u_p'(y_p - b)}{u_c'(y_L + b)} \qquad (2)$$

[12] There is some time inconsistence in the way we model parents' expected utility. The cost of taking the kid to the ED, c, takes place in the first period and the utility $\alpha\left[u_p(y_p - b) + \beta u_c(y_L + b)\right] + (1-\alpha)\left[u_p(y_p) + \beta u_c(y_H)\right]$ occurs in the second period. Nothing would change, however, if we adopt the correct specification of the expected utility function $\gamma(\alpha(u_p(y_p - b) + \beta u_c(y_L + b)) + (1-\alpha)(u_p(y_p) + \beta u_c(y_H))) - c$, where γ is the time discount factor. Notice also that in (1) the amount of the transfer b is decided in the first period. It is straightforward to see that this amount is also optimal in the second period, so that there is no time inconsistency.

If parents decide not to take the child to the emergency room, then, with probability $[1 - p(s)]$ the child will survive and their expected utility is $\alpha\left[u_p(y_p - b) + \beta u_c(y_L + b)\right] + (1-\alpha)\left[u_p(y_p) + \beta u_c(y_H)\right]$. Otherwise, with probability $p(s)$ the child dies and parents get utility $u_p(y_p)$.Thus, the maximum expected utility if parents do not take the child to the ER is the solution to,

$$\max_b \; [1 - p(s)]\left\{\alpha\left[u_p(y_p - b) + \beta u_c(y_L + b)\right] + (1-\alpha)\left[u_p(y_p) + \beta u_c(y_H)\right]\right\} + p(s)u_p(y_p) \tag{3}$$

Note that the solution to (3) is also given by condition (2). Let b^* be the solution to (2). This solution b^* depends on the parameters y_p and y_L. However, the income of the child is given by $y_L = \epsilon_L v(y_p)$ so that b^* is simply a function of y_p. We want to determine for which values of the signal s parents will take the child to the ER. The level of s^* that renders parents indifferent between taking the child to the ER or not is the one solving the following equation:

$$\begin{aligned} &\alpha\left[u_p(y_p - b^*) + \beta u_c(y_L + b^*)\right] + (1-\alpha)\left[u_p(y_p) + \beta u_c(y_H)\right] - c \qquad (4) \\ = \;& [1 - p(s)]\left\{\alpha\left[u_p(y_p - b^*) + \beta u_c(y_L + b^*)\right] + (1-\alpha)\left[u_p(y_p) + \beta u_c(y_H)\right]\right\} + u_p(y_p)p(s) \end{aligned}$$

The left-hand term in (4) represents the parents' utility when the child is taken to the ER and the right hand term the utility when the child is not taken to the ER. Since such value of s is a function of the income y_p we write it as $s^*(y_p)$. Thus, the child is taken to the ER whenever $s \geq s^*(y_p)$.

Proposition 1. ***The function $s^*(y_p)$ is decreasing. Thus, in the Altruistic model, the richer the parents are the more often they take their children to the ER.***

(The proof is provided in the Appendix)

The intuition is simple: the welfare of a child enters as a normal good into the preferences of the parents. Rich families want to consume more of their children so they would be more ready to pay the cost c. This cost is the same for rich and poor families so rich families would cross the hurdle more often and will make a more intensive use of ER services.

2.2. The Investment Case

Under the Investment approach parents want their child to have good health because they might receive resources from her. This might happen because the welfare of the parents enters into the utility function of the child or because of some social norm that obliges children to give resources to parents in certain circumstances.[13] Let's say that parents receive, in the second period, the amount $h \geq 0$, whenever the income of the child is y_H and the amount $h = 0$ whenever the income of the child is y_L. Thus, parents expect to receive a transfer only in the case where their income is smaller than their child's income.[14] It is natural to assume that, in principle, the magnitude of h

[13]In models with uncertainty about lifespan it is often assumed that transfers from children to parents are part of a *quid pro quo* agreement between parents and children. Parents leave a bequest in exchange for receiving financial (or emotional) support until they die, see Kotlikoff and Spivak (1981), Cox (1987) and Bernheim et al. (1985).

[14]Thus, the analysis becomes relevant only if the income, or the wealth, of the parents is below the income of the child at a certain point in time not too close to their death.

depends on the parents' income, y_p , and the child's income, y_H. Since $y_H = \epsilon_H v(y_p)$ the amount h can be seen as a function of y_p, and we write it as $h = h(y_p)$. It is not difficult to realize that our results will depend on the assumptions adopted regarding the function $h(y_p)$.

Parents don't care about the consumption level of their child, and their preferences depend exclusively on their total consumption–which is their income y_p plus the amount h given by the child–and the possible effort of taking the child to the ER. Thus, the expected utility (computed at the first period) that parents get if they take the child to the ER is

$$(1-\alpha)u_p(y_p + h(y_p)) + \alpha u_p(y_p) - c \tag{5}$$

If the child is not taken to the ER she will "die" with probability $p(s)$ and parents will receive nothing. Thus, in this case, parents' expected utility, after receiving signal s, is given by

$$(1-p(s))((1-\alpha)u_p(y_p + h(y_p)) + \alpha u_p(y_p)) + p(s)u_p(y_p) \tag{6}$$

Let $\widetilde{s}$ be the value of the signal that makes expression (5) equal to expression (6).

In the USA the average wealth at age 50 is higher than the average wealth for people over 65. See Budría-Rodriguez, Díaz-Gimenez, and Rull (2002).

I.e., signal $\widetilde{s}$ is such that

$$u_p(y_p + h(y_p)) - u_p(y_p) = \frac{c}{(1-\alpha)p(\widetilde{s})} \tag{7}$$

Since $\widetilde{s}$ in (7) depends on the income $y_p$we also write $\widetilde{s}(y_p)$. Thus, parents are indifferent as to whether they take the child to the ER or stay at home when the signal s takes the value $\widetilde{s}(y_p)$, and they prefer to take the child to the ER whenever $s > \widetilde{s}(y_p)$. We want to analyze the sign of $\widetilde{s}'(y_p)$, the derivative of $\widetilde{s}(y_p)$ with respect to the income y_p. It is clear from equation (7) that such sign depends on the specific function $h(y_p)$. Consider, for instance, the case in which the transfers from child to parents don't depend on the parents' income level so that $h(y_p) = \overline{h}$ for all y_p. In this case, it is straightforward to show that, by concavity of the utility function $u_p()$, the expression $u_p(y_p + \overline{h}) - u_p(y_p)$ is decreasing in y_p and, since $p(\widetilde{s})$ is increasing, equality (7) implies that $\widetilde{s}'(y_p) > 0$. The same result holds true for the case of decreasing transfers, i.e. when $h'(y_p) < 0$. Thus, we have a second result

Proposition 2. ***In the Investment case, if the transfers from children to parents are non-increasing in parent's income, i.e. if*** $h'(y_p) \leq 0$, ***we have*** $\widetilde{s}'(y_p) > 0$. ***Thus, the richer parents are the less often they take their children to the ER.***

One might claim, however, that the most realistic case is the one with $h'(y_p) > 0$. This might happen if rich parents have children that will be rich, and transfers from children to parents are given by an increasing function in children's income. In this case, to obtain that $\widetilde{s}'(y_p) > 0$ the term on the left-hand side in equation (7) must be decreasing on y_p, i.e. $u_p'(y_p + h(y_p))(1 + h'(y_p)) - u_p'(y_p) < 0$, and this inequality can be written as

$$1 + h'(y_p) < \frac{u_p'(y_p)}{u_p'(y_p + h(y_p))} \tag{8}$$

Inequality (8) may hold depending on the value of $h'(y_p)$. It is quite easy to provide (generic) examples of specific utility functions and specific functions $h(y_p)$ satisfying such inequality and, as a consequence, we can easily obtain examples with $\widetilde{s}'(y_p) > 0$.

An important case is the one in which the transfer from the child to the parents is endogenously determined as the solution to the maximization problem of the child.[15] When the child gets income $y_H \equiv \epsilon_H v(y_p)$ she will chose the level of transfer to her parents, h , that maximizes a weighted sum of her own utility and that of her parents':

$$\max_h : u_c(\epsilon_H v(y_p) - h) + \delta u_p(y_p + h) \tag{9}$$
$$s.t. \quad : \ h \geq 0$$

where δ is the degree of altruism from the child to the parents. Consider the class of utility functions given by $u_c(x) = \frac{x^{1-\theta}}{1-\theta}$. It is not difficult to show that in this case

[15] See Boldrin and Jones (2002) for an explicit solution to this problem and Cox and Stark (1994) for an explanation of the enforcement of this intergenerational agreement.

the solution to the maximization problem (9) is given by

$$h = Max\{0, \frac{\epsilon_H v(y_p) - zy_p}{1+z}\}$$

where $z \equiv \delta^{\frac{-1}{\theta}}$. Let's assume that the solution to (9) is interior[16] so that $0 < \frac{\epsilon_H v(y_p) - zy_p}{1+z}$. Thus, condition (8) becomes

$$1 + \epsilon_H v'(y_p) < (1+z)^{1+\theta}(\frac{y_p}{\epsilon_H v(y_p) + y_p})^{-\theta} \tag{10}$$

Assume that the expected income of the child is given by an increasing and concave function on parents' income, namely $v(y_p) = ky_p^\gamma$ where $k > 0$ and $0 < \gamma < 1$. Thus, condition (10) becomes

$$0 < -1 - k\gamma y_p^{\gamma-1} + (1+z)^{1+\theta}(\frac{y_p}{\epsilon_H k y_p^\gamma + y_p})^{-\theta} \tag{11}$$

Inequality (11) can hold or not depending on the values of the parameters. However,

[16] It might happen that the unrestricted solution to problem (9) is such that $h < 0$. This means that children would like to get transfers from the parents. If we allowed for this possibility, or considered corner solutions with $h = 0$, it would reinforce our results. If the function g is concave, as is often assumed, it is more likely that corner solutions happen for rich families. A child of rich parents is, in relative terms, poorer than his parents so that he would like to get transfers from them. Thus, from the point of view of rich parents the child will not report any positive return in the future and, as a consequence, their incentives to invest in the health of the child are lower than for poor families.

it is easy to provide robust examples satisfying such inequality. Consider an economy with the following realistic values of the parameters: the utility discount factor $\delta = 0.45$; the degree of relative risk aversion $\theta = 2$, and $k = 20; \epsilon = 1.25$ and $\alpha = 0.5$. Thus, with probability 0.5 the child will end up with an income 25% higher than her expected income. Let's take the specific function $p(s) = s$. The transfer from the child to the parents is given by the solution to the maximization problem (9). We compute the critical value $\widetilde{s}(y_p)$ for three different values[17] of the parameter $\gamma \in \{0.4, 0.5, 0.6\}$, and parent's income levels ranging from zero to $y_p = 40$. Figure 1 shows the results. In the three cases the function $\widetilde{s}(y_p)$ is increasing. We must emphasize that this example is quite robust to changes in all the parameters. Thus, we conclude that when the function $h(y_p)$ is not chosen *ad hoc* and it is the result of the maximization problem of the children, the result provided in Proposition 2 still holds for a (large) set of parameters. The intuition is also clear. The parameter γ can be seen as an index of social mobility. Most estimates (see Benabou, 2002) of this parameter give a value always less than unity, so that the function $v(y_p)$ is concave. And this implies that, in expected terms, the child of a rich family will become relatively less rich than her parents. Thus, investing in the child yields a higher return in poor families than in rich families. In other words, in an economy with social mobility where parents contemplate their offspring as an asset for the future, kids are more important for poor families than for rich families. This discussion, and the example in Figure 1, also suggest that in societies with a high level of social mobility (low values of γ) the function $\widetilde{s}(y_p)$ will be flatter. In the empirical section of the paper we will show some evidence supporting this possible relationship between social mobility and the slope

[17] See, for example, Mulligan (1997) for the empirical estimations of this parameter.

of $\widetilde{s}(y_p)$.

A key feature of this approach is the expectations that parents have about receiving help from their children. One might ask whether in reality these expectations are rational or not. In other words, do parents really get help from their kids? Fortunately, there is some empirical evidence showing the nature and size of this type of transfer. McGarry and Schoeni (1995) analyze the 1992 Health and Retirement Study and show that 7 percent of the parents receive an average transfer of $2.120. Couch, Daly, and Wolf (1999), using data from the 1988 wave of the PSID, show that transfers to parents are decreasing in parent's wealth. Rendall and Bahchieva (1998) argue that without transfers from children (and relatives and friends), the US elderly poverty rate would be double. Thus, it seems that financial help from children still plays an important role in the US, at least among an important part of the population.

3. EMPIRICAL EVIDENCE FROM DATA ON EMERGENCY ROOM UTILIZATION

The main conclusion of the above section is that the sign of the relationship between the threshold that parents put on a child's bad health signal and their income may differ under the alternative paradigms of altruist and selfish parents. In the altruistic case this sign should always be positive. If, on the contrary, parents have selfish motivations, this sign is ambiguous and depends on several factors. However, we identified conditions in the selfish model that guarantee that the richer the parents are the higher the threshold is.

In practice, parents' actions regarding health care are observable while this threshold is not. Consequently, an empirical test based on the second is troublesome. Nevertheless, under the assumption that the distribution of bad health signals is income-independent, the sign of the slope between parents' income and frequency of the effort c should be equal to the sign of $s(y_p)$. Thus, our proposed empirical test is based on this sign and it contemplates the altruistic paradigm as the null, while the alternative is considered to contain the investment model. Notice that the investment model may well support either a positive or negative slope depending on some other factors, like social mobility or equivalently, the degree of concavity of children-parents income function. For this reason, our procedure is simply a test on the null of the altruistic model. Further testing of the null of the investment model cannot rely exclusively on the sign of the slope and should require the development of new testable predictions. A first approach to this problem is also considered in our work.

In principle, one could have considered that the efforts toward a child's health involve a wide variety of actions such as ensuring adequate nutrition, paying visits to the doctor, making sure children put their seat belts on, and so on (see for example Case & Paxson, 2000). Even though we consider several of these measures at the end of this empirical part, we concentrate most of the analysis on the effort c associated with the visits to the Emergency Room, as presented in the theoretical model. We have two motivations for doing so: first, the quality and availability of the surveys from the National Center for Health Statistics, namely NHIS (National Health Interview Survey),[18] which provide empirical data on the use of the ER and the socioeconomic characteristics of the families. Second, we claim that the consequences of taking the child to the ER -recall that parents may face a fatal outcome if they do not-, involve

[18] Data available on-line in the http:\\www.cdc.gov\nchs site.

the kind of risk and non monetary cost bearings which are the key of the model in section 2. However, we will need to deal with at least three main problems: first, we must isolate as much as possible the effect of income on health from other factors which might contaminate the results. Second, the estimation of health services demand functions often implies the use of nonlinear models. And third, we must consider that there might be alternative actions, like doctor's office visits and regular infant check-ups which could be substitutes for ER utilization particularly for some low-income groups with difficult access to these alternative health services. These difficulties are not specific to our decision of using ER frequency as a measure of health investement, however. The manner in which we deal with them will be made clear in the following sections.

3.1. The NHIS sample data: an overview

The basic purpose of the National Health Interview Survey (NHIS) is to obtain information from U.S. families on the amount and distribution of illness, its effects in terms of disability and chronic impairments, and the kind of health services received. Data is collected on a yearly basis from a sample of households around the 50 states and it is structured on three layers of information requested at the household, family and personal levels.[19] If there is any non-adult member of the family, one is sampled

[19] The NHIS Basic core questionnarire was redesigned in 1997. The surveys are conducted by the U.S. Census Bureau interviewers which use a computer-assisted procedure instead of traditional paper-and-pencil formularies. The sample design includes stratification, clustering and multistage sampling. No person of the covered population has a zero probability of being sampled but Black and Hispanic households were slightly oversampled to increase the power of testing. For further details see the NHIS web site www.nhis.cdc.gov.

(say sample child) and the family respondent is prompted to answer about the kid's health status and her disabilities.

A total of 13500 families with children were interviewed in year 2000 and 12500 in 1999. Central to our interests is the ER variable which contains recoded information on the frequency of emergency room visits by the sample child. The recoding differed in years 1999 and 2000. In 2000, codes 1 to 9 corresponded to 0, 1, 2 to 3, 4 to 5, 6 to 7, 8 to 9, 10 to 12, 13 to 15 and more than 16 visits, while in the 1999 sample, codes 1 to 5 corresponded to 0, 1, 2 to 3, 4 to 9, 10 to 12 and more than 13 visits.

The information on income was also recoded in income intervals and the income/poverty level ratio. Measurement errors can be reduced by using recoding, but it complicates the estimation of the elasticity of emergency room visits with respect to income. For this reason, we computed a dollar value of family income using the original coded variables and additional information from the U.S Census Bureau for years 1999 and 2000. For each individual in the NHIS sample we computed the average income of families in the US Census Bureau data who matched their income category, age, education and race. Qualitative results are not affected by the use of the original or the attributed income measures and the choice of the latter is done solely for the purpose of obtaining an elasticity measure in dollars that can be more readily interpreted.

Table 1 constitutes a first approach to the problem. Here, a cross-frequency matrix between ER and income is shown for the year 2000 data. Among the 5,736 children that never went to the emergency room, 1,702 lived in families earning more than USD $75,000, 1,134 in the families with income between 55,000 and 75,000, 1,334 in families with income between 35,000 and 55,000 and 1,566 in the category of less than USD $35,000. Among those families in the top income category, 82.82% never visited the ER while this figure falls to 77.37% for the poorest. Moreover, if we consider those families that went at least once to the emergency room, the low-income ones tend to show longer tails of frequency counts: for instance, from the 49 children that went four or five times to the ER, 18 lived in families earning less than USD $40,000 while only 11 fell in the category of more than USD $75,000. Still, this does not constitute strong evidence in favour of a negative relationship between income and emergency room use since some other factors may be latent in an unconditional analysis like that of Table 1.

3.2. Choice of regressors and case selection

Our sample consists of biparental families with at least one child between 0 and 5 years old, covered by private insurance. Thus, we delete from the sample those families who reported that the sample child was not covered at the time of the interview or that was covered by Medicaid. The access to health services is in general related to the type of health insurance purchased by (or provided to) the family. In year 2000, 12% of children were not covered at the time of the interview and about a quarter of the covered received assistance from Medicaid or other state programs. The uninsured and Medicaid enrollees have a reputation for abusing the hospital emergency room services and not doing regular infant check-ups (see Sharma et al., 2000; Fosset & Thompson, 1999; Grossman, Rich, & Johnson, 1998; Billings & Mijanovich, 2000). Because Medicaid beneficiaries usually belong to the poorest layers of the society, much of the potentially observed relation between ER and income could be just reflecting this evidence. However, Halfon, Newacheck, Wood, and Peter. (1998) provide an alternative view suggesting that health insurance status is not a significant predictor of ER use. Furthermore, in our sample, less than 3% of individuals reported having the ER as a usual source of infant check-ups. In any case, since we only include children covered by private insurance our results cannot be explained because of the great use of the ER by the low-income groups.

Because we want to conduct a conditional analysis, we need to determine the factors that may be affecting ER use. We concentrated on four main groups of covariates:

3.2.1. Socio-economic factors

- sex
- race
- hispanic ethnicity

The above socio-economic factors are standard and need no further explanation.

3.2.2. Health related variables

- Age: Age in years of sample child
- Allergic spell: A dummy variable that controls for having suffered from allergic conditions like asthma and other respiratory and digestive allergies in the year of interview.
- Infectious spell: A dummy variable which control for having suffered from infectious spells, essentially otitis and urinary infections.
- Self Reported Health Status: A categorical variable which reports the health status of the sample child as reported by parents, ranging from bad (=5) to

excellent (=1).

That health and income are related has been widely documented for adults. Remarkably, Case, Lubotsky, and Paxson (2002) find that such a relation also holds during childhood even in developed countries like the U.S., so that poor parents with poor health conditions will have sickly children who will in turn perform worse in the job market and will grow poor. Their results are based on two different measures of health: parents assesment of the child's health status and objective information on chronic conditions. While reported bad health seems to diminish with income it must be noted that in the case of chronic conditions, the evidence is weaker and it is not homogeneous for all diseases and age or income intervals. In fact, among 75% of top income-rated families, the health/income slope is very small for conditions like asthma, bronchitis, hay fever or mental retardation,, especially for early ages.

Ideally, we would like to control for the risk of injury or accidents. Unfortunately, the sample does not provide detailed information on this factor. It must be noted however, that previous evidence (see Pickett, Garner, & King, 2002) seems to point in the direction of a null or poor significance of the slope between income and accident episodes.

3.2.3. Risk evaluation and family structure

- Parents' education level: Categoric variable ranging from 1 (never attended school) to 11(PhD)
- Step parents: dummy indicating whether any or both of parents are step.

- Number of siblings: trying to control for parents' experience with respect to bad health episodes.

Our model assumes that parents' ability to evaluate this risk does not depend on income. Such an ability may be in principle related to two main characteristics: the education level of parents and their experience. The existence of a link between education and income is well documented (see for instance Ashenfelter & Rouse, 2000). With respect to experience, it is reasonable to think that one of the prominent sources of experience in the detection and treatment of bad health episodes could be the presence of older people[20] in the household (Weitzman, Byrd, & Auinger, 1999; Ellen, Ott, & Schwarz, 1995) or older siblings in the family unit althoug the latter do not play a role in our sample as this is composed of biparental families with own biological or adopted children only.

3.2.4. Other socio-economic factors

- Region of household: dummy variables for the location of the household in one of four main U.S. regions: North, West, Midwest and South.
- Urban: dummy indicating whether the household is located in a Metropolitan Area Size zone.
- Health Management Organization: dummy indicating whether health insurance is managed by an HMO

[20] Or health professional relatives and/or friends. Such a possibility cannot be controlled on the basis of the available information. One might argue that rich parents are more likely to have a health professional relative or friend. We think that this argument, if valid but not properly controlled by education level, should be marginal.

In our theoretical model, the effort exerted by the parents is assumed to be of a non monetary nature. For this reason, we would like to prevent contamination steming from the different monetary costs of access to health system eventually faced by the poor and the rich. Factors such as proximity of health facilities could be correlated to family income (see Currie & Reagan, 1998). Also, it is well known that during the last decade, insurance companies have been progressively introducing health management organizations (HMOs) in order to reduce the impact of agency problems like induced demand, instead of the formerly more generalized fee-for-service scheme.

Finally, all regressions include our main regressor of interest, the attributed total income of family in 1999 dollars.

3.3. A regression model for ordered choice in latent counts data

The regression analysis on the ER variable would first need to take into account that each category of the dependent variable represents an interval of frequency counts of emergency room visits. Ordered choice models have been widely used in applications where an observable categoric variable y represents the re-scaling of a latent continuous variable y^* so that each category of y represents an interval of y^*. It is very standard to assume normality of the latent variable. Being analogous in nature, the problem we face here is that the dependent variable y represents a well-defined re-scaling of a latent discrete positive variable.

Hence, let $\{y_i, x_i\}_{i=1}^N$ be a random sample of an observable categoric variable y with support $\{1, \ldots, J\}$ and a vector of covariates x. We will assume that y_i^* is a transformation $T(y_i^*)$ from a latent count variable y_i^* which has probability distribution $G(\cdot| \; x_i, \theta_0)$ with support given by the natural numbers plus the zero. Therefore, it is inmediate that the conditional probability of category j in observation i is given by

$$P(y_i = j \mid x_i, \theta_0) = \sum_{y^* \in T^{-1}(j)} g(y^* \mid x_i, \theta_0) \tag{12}$$

Hence, the conditional probability function f of y_i is given by

$$f(y_i \mid x_i, \theta_0) = \sum_{j=1}^{J} 1_{\{y_i = j\}} \sum_{y^* \in T^{-1}(j)} g(y^* \mid x_i, \theta_0) \tag{13}$$

A Maximum Likelihood Estimator is available up to specification of the probability function of latent counts $g()$ by maximization in θ of the loglikelihood function. Notice that identification of (13) relies completely on identification of the model for the latent count. The literature on count data regression models starts with the basic Poisson linear exponential model where it is assumed that $y_i^* \mid x_i, \theta_0 \sim P(\lambda_i)$ with $\lambda_i = \exp(x_i' \theta_0)$. In our notation,

$$g(y_i^* \mid x_i, \theta_0) = \frac{\lambda_i^{y_i^*} \exp(-\lambda_i)}{y_i^*!} \tag{14}$$

The basic Poisson model is well known[21] for failing to capture some relevant features often appearing in applications, like an excess of dispersion and/or zero counts not

[21] See Cameron and Trivedi (1998) for a general reference on count data regression models.

suited to a Poisson process. A popular alternative is the Negative Binomial distribution which is characterized by a mean parameter λ which is linear exponential and an additional parameter α controlling the variance. An interesting feature of the Negative Binomial model is that it can be interpreted as a Poisson process with unobservable Gamma-distributed heterogeneity affecting the mean. In our context, if $y_i^* \mid x_i, \theta_0$ follows a Negative Binomial law then

$$g(y_i^* \mid x_i, \theta_0) = \frac{\Gamma(\alpha + y_i^*)}{\Gamma(\alpha)\Gamma(y_i^* + 1)} \left(\frac{\alpha}{\alpha + \lambda_i}\right)^{\alpha} \left(\frac{\lambda_i}{\alpha + \lambda_i}\right)^{y_i^*} \tag{15}$$

However, neither Poisson nor Negative Binomial seem appropriate choices in those cases where data shows an abnormal excess of zeros. As it is reported in table 1, zeros represent about 80% of the ER observations. The hurdle model can encompass both the Poisson or the Negative Binomial models by assuming that the observable counts are the result of the mixture of two different processes: one driving the zero/non-zero outcomes and another one which specifies the frequency counts conditional on non-zero category. Let $y_{1i}^*,\ y_{2i}^*$ be two count latent variables with distributions $g_1(y_{1i}^* \mid x_{1i}, \theta_{01})$ and $g_2(y_{2i}^* \mid x_{2i}, \theta_{02})$, the data generating process is defined as

$$y_i^* = \begin{cases} 0 & \text{if } y_{1i}^* = 0 \\ y_{2i}^* & \text{if } y_{1i}^* > 0,\ y_{2i}^* > 0 \end{cases}$$

Therefore,

$$g(y_i^* \mid x_i, \theta_0) = 1\{y_i^* = 0\}\, g_1(0 \mid x_{1i}, \theta_{01}) + \\ +1\{y_i^* > 0\} \frac{g_2(y_{2i}^* \mid x_{2i}, \theta_{02})}{1 - g_2(0 \mid x_{2i}, \theta_{02})} (1 - g_1(0 \mid x_{1i}, \theta_{01})) \qquad (16)$$

where a common shortcut is to assume that g_1 and/or g_2 are Poisson or Negative Binomial. The hurdle model roughly implies that the subpopulation of individuals who went at least once to the emergency room is allowed to differ in terms of their characteristics from the whole population. This model has often been applied in a health economics context where the above interpretation is particularly appealing to model some documented features of this market, like induced demand (see (Deb & Trivedi, 1997)).

3.4. Results of estimation and the role of social mobility

Table 2 shows the estimates for the ER variable of the ordered choice model from the above section, using alternative specifications for the conditional probability function $g()$. Column 1 specifies a Poisson process for the latent count variable as in (14). The income parameter is negative and significant at 1% level. Roughly, each 10,000 USD increment in family income reduces their use of ER facilities by 4% approximately. Other than that, age and white race affect negatively the ER utilization frequency while the regressors that control for health condition show the sign as expected. With respect to the family structure, the number of siblings, the education of the father, and being a step father or working mother affect the ER utilization significantly.

However, in view of the rows at the bottom of table 2, the Ordered Choice Poisson model fails to capture the frequencies of the observed data, raising doubts about the appropriateness of our choices. Alternatively, the NB model improves the fit significantly and is not rejected (see the Pearson's and Andrew's specification tests coefficients). In this model, the coefficient on income is slightly smaller (3.5%) but still significant and negative.

It could be argued that individuals having a zero observation may reflect two different subpopulations: either the child did not have a spell the previous year or she did but their parents did not take her to the ER. In any case, the income coefficient on the subpopulation of individuals who visited ER at least once should reflect more the kind of effect we are interested in investigating. We can analyze this subpopulation separately by using the hurdle model in (16). Once we do so, we still detect (see the last two columns of Table 2) the presence of a significant negative gradient between income and ER utilization both in the whole sample and in the subpopulation of individuals that went at least once to the ER. As a first conclusion then, not only the negative ER/income slope seems to be robust to the choice of $g()$, but also its size seems to be greater for the subpopulation of ER users.

Still we were worried about the possibility that these results could simply be reflecting differences in health care access for rich and poor families with private health insurance. Particularly, rich families could be enjoying better health insurance coverage and hence, they could be using regular care in doctors' offices to substitute their eventual demand of ER services. For instance, in a recent article, Christakis, Mell, Koepsell, Zimmerman, and Connell (2001) show that lower continuity of primary care implies a higher risk of ER utilization for children, while Billings and Mijanovich

(2000) say that economic constraints cause many of the uninsured to delay seeking treatment until their medical condition has seriously worsened.

For this reason, we investigate whether the observation of a negative income gradient is due to differences in the degree of ER/check-up substitutability between the poor and the rich. We estimate an ordered choice model where the dependent variable is the category of the frequency visits to a doctor's office whose results are shown in Table 3. The estimated coefficient on income using a Negative Binomial or a Poisson as the latent distribution was around 0.1% positive but non significant. Using a hurdle Negative Binomial distribution, coefficients showed opposite signs in the PROBIT and COUNT part. The overall elasticity of income was smaller than 0.4% quite unlike the negative 3.8% elasticity in the case of ER utilization (see Table 2). Therefore, we conclude that although there exists minor evidence of a higher substitution of ER demand for regular doctor's office check-ups for rich families, the magnitude of this effect is too small to explain the negative income/ER gradient.

Up to now, no distinction has been made between permanent and current income. It is sensible, however, to think that individuals elaborate long run decisions, like the ones implicit in our model of section 2 on the basis of permanent income and not using their current income profile. For instance, individuals with a current low wage (say, doctorate students) have a greater permanent or expected income. These people are being considered as poor in the sample, while their decisions are driven by the prospect greater wages in the future. If there is some unobservable factor that makes these individuals particularly prone to use emergency room services, then an incorrect measurement of income could be responsible for the large gradient found in the previous subsection. Measuring the permanent income is problematic due to its non observability. It is expected, however, that the gap between permanent and current income shrinks as the productive life of the individual reaches her retirement age. Hence, it is also expected that if the dichotomy between permanent and current income has a role, the estimated ER/income gradient should differ for those individuals whose permanent income is not actually far from his current income.

There is another topic we were interested in investigating. Recall that a sufficient condition in our investment model for predicting a negative relationship between income and ER utilization was both that children solve their utility maximization program by taking into account the utility of parents and that the intergenerational income transition function v is concave. Since the curvature of this function defines the level of intergenerational social mobility of the economy, one should expect that in regions where social mobility is higher, the ER/income gradient should be also more important.

Consequently, we include a new set of regressors to the equations estimated in the preceding section to control for both the role of permanent income and social mobility (see Table 4). In order to deal with the first problem just mentioned, we include the cross-product of income with a dummy that indicates if the head of the family is older than 40. To solve the second problem, cross-products of income and US region are also added as regressors. Notice (see Table 4) that including these regressors does not alter the income gradient for the Poisson and Negative Binomial. It turns out, however, that the hurdle model detects that the size of the gradient in the COUNT part is significantly higher for people younger than 40, where one would expect to find the greater differences between current and permanent income. Also, we detect that the gradient differs significantly for different US regions and more specifically for the Southern states. Figure 2 depicts a plot of the relationship between income and emergency room utilization. Notice that in the states of the South, where social mobility is lower (see Levine, 1999), this relationship is much flatter. As a conclusion, the above results show that the theoretical model of children as investment is consistent with the evidence analyzed here.

4. ADDITIONAL EVIDENCE

4.1. Home-accident preventive care

Altogether, the above evidence suggests that, when discussing parents-children decisions at the level of health care, the theoretical altruistic model proposed and their predictions do not match the observed data, whereas a model where parents contemplate their children as an investment good is not rejected. Still, a test of the theoretical model in section 2 using data on ER can have several weak points. The main objection against this conclusion is that, despite our efforts, we have not been able to control properly for market distortions and unobservable factors which may be misleading our conclusions. For this reason we wanted to cross-test the results above using a different approach.

We collected data from the National Survey of Early Childhood Health (NSECH, available by anonymous ftp at ftp.cdc.gov) which contains information on the actions that parents take in order to prevent home accidents, which comprehend putting up baby gates, locking cabinets containing cleaning agents, padding sharped edges, putting stoppers in electrical outlets, lowering hot water setting on the thermostat or having syrup of ipecac at home. All these investment measures imply a minimal financial cost and, in that sense, are consistent with the assumption of the model. In addition, the survey includes some socioeconomic and demographic information of the family (age, race, ethnicity, education level, region) including family income measured in income intervals, as well as family composition and structure (marital status, number of siblings, etc.). The survey was run during the first semester of year 2000 through computer-assisted telephonic interviews of 2,068 families with children aged between 4 and 35 months.

Table 5 contains the results of the estimation of an ordinal Probit model [22] where the dependent variable is the number of preventive measures that parents report to have taken from those listed in the interview. A significant and negative effect of family income confirms our previous findings on ER utilization frequency. Here one should mention the work of Case and Paxson (2000) where the authors use information from the 1988 National Health Interview Survey Child Health Supplement to analyze several questions about who invests in children's health. Although their primary objective is different from the one pursued here, these authors analyze the use of seat belts and find a positive relation between family income and children's seat belt use. We think that this finding does not enter in contradiction with our results: first, a positive relationship does not imply the falseness of the investment model in our theoretical

[22] An ordinal probit specifies that there exists an unobservable variable y_i^* which follows a linear regression model $y_i^* = x_i'\beta + u_i$ such that the observable variable y_i is a non-linear transformation of y_i^* on the set of integers $\{0, 1, ..., k\}$. This transformation is ordinal in the sense that there exists levels $\{\mu_0, \mu_1, ..., \mu_k\}$ such that

$$\begin{array}{ll} y_i = 0 & \text{if } y_i^* \leq \mu_0 \\ y_i = 1 & \text{if } \mu_0 < y_i^* \leq \mu_1 \\ ... & ... \\ & \text{if } \mu_{k-1} < y_i^* \leq \mu_k \end{array}$$

setup: it simply does not help to discriminate between the two competing models. Second, the information reported by families on the use of the seat belt might be contaminated by misreporting (for instance, if parents care about reporting a socially reproved behavior). Third, the above survey provides other types of evidence which enter in contradiction with the altruistic model. For example, there is a negative relation between the use of the seat belt and the number of children. This seems to be more in accordance with an investment approach since having more kids implies a less risky asset and therefore less effort might be needed on the care of each child. And finally, our test depends on a different selection of the control factors to avoid contamination of the gradient by heterogeneity in the risk of injury or accident with respect to different income levels.

Finally, it is interesting to notice that married or widowed mothers seem be to more careful in home accident prevention than non-married or divorced. Such a result seem consistent with Case and Paxson (2000) who found that a similar effect prevailed between biological and non-biological mothers. Also, age (in months) and the number of adults in the family affect positively the accident preventive care. The first can be due to the fact that sample children are 3 years old or younger, while the second, as in the case of married women, can also be related to the results in Case and Paxson (2000).

4.2. Infant Mortality Data

If rich parents show a more relaxed attitude towards their children's care then it would be sensible to think that mortality rates should be greater among rich families than among poor ones. In principle, this affirmation is against-evidence.[23] However, we think it is premature to reject all our previous findings based on this. In fact, many other factors such as parents' education, feeding, differences in cost of access and others likely correlated with income may be playing a role so that final observed mortality rates turn out to be decreasing.

With the help of a professional pediatrician, we identified a group of diseases which meet three conditions: first, there is no evidence that they affect differently the children of rich and poor families; second, these pathologies are acute and are considered dangerous if not treated in the first 24 hours and third, they course with symptoms which cannot be easily identified except by a professional (i.e., symptoms that can be misinterpreted, for instance, as in a simple cold). These diseases correspond to approximately 85 ICD (International Classification of Diseases) codes, and meningitis, septicemia and pneumonia are among the most prevalent ones in the population of children aged up to one year old.

We used data from the National Maternal and Infant Health Survey in 1988. This survey samples 13,417 live births from 1988 U.S. birth certificates and 8,166 infant deaths (below one year old) from death certificates. The survey includes not only information on the ICD code of the cause of death but also income of the family. Less than 3.7% of the infant death causes correspond to one of these diseases which leaves about 298 observations. Mean income for this group was of 28,701 USD, 6.8% higher than the mean income of the infant death sample and 3.7% higher than that of the

[23] In 1998, women with household incomes below the poverty level displayed an infant mortality rate that was 60% higher while the postneonatal mortality rate was twice as high as those for women living above poverty level. Figures are extracted from the *Morbidity and Mortality Weekly Report,* December 15, 1995.

live births sample. We performed several non-parametric Mann-Whitney tests on the income variable: income of live births and the sample of infant deaths caused by one of the diseases of interest, and this and the remaining causes of death were not found to be different with p-values of 0.879 and 0.211. The only significant difference was found between live births and the whole infant death sample with p-value of 0.010 favoring the alternative that death rates (of all causes) are higher among poor people. Summarizing, we find that the prevalence of the causes of death of interest is higher among rich families although not statistically significant for the small sample size used.

5. FINAL COMMENTS

We propose a two-period theoretical model where parents have to decide whether to take their children to the emergency room or not. Their decision is analyzed under two competing frameworks: either parents are motivated by altruism or their decisions are based on contemplating children as an investment. Under generic altruism, rich parents should *ceteris paribus* take their children more often to the emergency room when faced with a given bad health signal. We find that this testable prediction is not verified in an ordered latent count model where the frequency of emergency room utilization is regressed on a set of covariates which include family income. We also find that alternative explanations, other than those predicted by an investment model, do not affect this main result. First, although rich families could have better access to preventive care and hence replace the need for emergency room utilization by a more continuous well-baby check-up, this substitution effect is not enough to explain the magnitude of the observed gradient. Second, a similar result follows when we include controls for the differences between permanent and current income. And third, we find that the predictions of the investment model in terms of the relation between income gradient and social mobility are not rejected by the evidence at hand. Finally, we find that alternative measures of parental effort regarding children's health, like home accident prevention, do show the same sign of the gradient with respect to income as in the case of emergency room utilization.

The empirical evidence presented here suggests that children might still play an important role as assets for parents' old age in developed economies. Integrating parents' health investment in children with fertility decisions will be part of further research on this issue. There are other economic measures, different from the health investment decision analyzed here and the ones already considered in the literature, that should be studied as well. For instance, if our analysis is correct and children can be seen as an investment, adult parents might invest less in pension funds than adults with no children. This and other similar empirical questions will also be analyzed in future work.

References

Altonji, J., Hayashi, F., & Kotlikoff, L. (1992). Is the extended family altruistically linked? *American Economic Review*, *82*(5), 1177-1197.

Altonji, J., Hayashi, F., & Kotlikoff, L. (1997). Parental altruism and interv vivos transfers: Theory and evidence. *Journal of Political Economy*, *105 (6)*, 1121-1166.

Andreoni, J. (1989). Given with impure altruism: Applications to charity and ricardian equivalence. *Journal of Political Economy*, *97 (6)*, 1447-1458.

Ashenfelter, O., & Rouse, C. (2000). *Schooling, intelligence and income in america.* Princeton, N.J.: Princeton University Press.

Barro, R. (1974). Are government bonds net wealth? *Journal of Political Economy*, *82(6)*, 1095-1117.

Becker, G. (1974). A theory of social interactions. *Journal of Political Economy*, *82 (6)*, 1063-1093.

Becker, G. (1991). *A treatise on the family.* Cambridge: Harvard University Press.

Benabou, R. (2002). Tax and education policy in a heterogenous agent economy. *Econometrica*, *70(2)*, 481-517.

Bernheim, B., Shleifer, A., & Summers, L. (1985). The strategic bequest motive. *Journal of Political Economy, 93(6)*, 1045-1076.

Billings, J., & Mijanovich, T. (2000). Emergency room use: The new york story. *The Commonwealth Fund*, 1-11.

Boldrin, M., & Jones, L. E. (2002). *Mortality, fertility and saving decisions, in a malthusian economy* (Tech. Rep.).

Budría-Rodriguez, S., Díaz-Gimenez, J., & Rull, J. R. (2002). Updated facts on the u.s. distributions of earnings, income, and wealth. *Quarterly Review. Federal Reserve Bank of Minneapolis*, *26*(3), 1-35.

Cameron, J., & Trivedi, P. (1998). *Regression analysis of count data.* Cambridge University Press.

Case, A., Lubotsky, D., & Paxson, C. (2002). Economics status and health in childhood: The origins of the gradient. *American Economic Review*, *92 (5).*

Case, A., & Paxson, C. (2000). *Mothers and others: Who invests in children's health?* (Tech. Rep.). Research Program in Development Studies. Princeton University.

Christakis, D., Mell, L., Koepsell, T., Zimmerman, F., & Connell, F. (2001). Association of lower continuity of care with greater risk of emergency department use and hospitalization in children. *Pediatrics*, *103*(3), 524-529.

Couch, K. A., Daly, M. C., & Wolf, D. A. (1999). Time? money? both? the allocation of resources to older parents. *Demography*, *36, 2*, 219-232.

Cox, D. (1987). Motives for private income transfers. *Journal of Political Economy*, *95*(31), 508-546.

Cox, D., & Rank, M. R. (1992). Inter-vivos transfers and intergenerational exchange. *Review of Economic Studies*, *74 (2)*, 305-314.

Cox, D., & Stark, O. (1994). *Intergenerational transfers and the demonstration effect.* (Boston College and Harvard University, mimeo)

Currie, J., & Reagan, P. (1998). *Distance to hospitals and children's access to care: Is being closer better, and for whom?* (Tech. Rep. No. 6836). NBER Working Papers.

Deb, P., & Trivedi, P. (1997). Demand for medical care by the elderly: A finite mixture approach. *Journal of Applied Econometrics*, *12*(3), 313-336.

Ellen, J., Ott, M., & Schwarz, D. (1995). The relationship between grandmothers' involvement in child care and emergency department utilization. *Pediatrics Emergency Care*, *11*(4), 223-225.

Fosset, J., & Thompson, F. (1999). Back-off, not backlash in medicaid managed care. *Journal of Health Politics, Policy and Law*, *24*(5), 1159-1172.

Grossman, L., Rich, L., & Johnson, C. (1998). Decreasing nonurgent emergency department utilization by medicaid children. *Pediatrics*, *102*(1), 20-24.

Halfon, N., Newacheck, P., Wood, P., & Peter., R. (1998). Routine emergency department use for sick care by children in the united states. *Pediatrics*, *98*(1), 28-34.

Hurd, M. (1989). Mortality risk and bequest. *Econometrica*, *57 (4)*, 779-814.

Kotlikoff, L., & Spivak, A. (1981). The family as incomplete annuities market. *Journal of Political Economy*, *89 (2)*, 372-391.

Levine, D. I. (1999). *Choosing the right parents: Changes in the intergenerational transmission of inequality between the 1970s and the early 1990s* (Tech. Rep. No. 072-99). Institutte of Industrial Relations (University of California, Berkeley).

McGarry, K., & Schoeni, R. F. (1995). Transfer behavior in the health and retirement study: Measurement and the redistribution of resources within the family. *The Journal of Human Resources*, *30*, 184-226.

Menchik, P. (1980). Primogeniture, equal sharing and the u.s. distribution of wealth. *Quarterly Journal of Economics*, *94*, 219-234.

Mulligan, C. B. (1997). *Parental priorities and economic inequality.* Chicago: The University of Chicago Press.

Pickett, W., Garner, M., & King, M. (2002). Gradients in risk for youth injury associated with multiple-risk behaviours: A study of 11,329 canadian adolescents. *Social Science and Medicine.*

Rendall, M., & Bahchieva, R. (1998). An old-age motive for fertility in the united states? *Population and Development Review*, *24, 2*, 293-307.

Sharma, V., Simon, S., Bakewell, J., Ellerbeck, E., Fox, M., & Wallace, D. (2000). Factors influencing infant visits to emergency departments. *Pedriatics*, *106*(5), 1031-1039.

Tomes, N. (1981). The family, inheritance, and the intergenerational transmission of inequality. *Journal of Political Economy*, *89*, 928-958.

Weitzman, M., Byrd, R., & Auinger, P. (1999). Black and white middle class children who have private health insurance in the united states. *Pediatrics*, *104*(1), 151-157.

Appendix A. Proof of Proposition 1

Proof. The value of s that renders parents indifferent between taking the child to the emergency room and staying at home is the solution to equality (4), that we write here again:

$$\begin{aligned} & \alpha(u_p(y_p - b^*) + \beta u_c(y_L + b^*)) + (1-\alpha)(u_p(y_p) + \beta u_c(y_H)) - c \quad (17) \\ = \; & (1 - p(s))(\alpha(u_p(y_p - b^*) + \beta u_c(y_L + b^*)) + (1-\alpha)(u_p(y_p) + \beta u_c(y_H))) + u_p(y_p)p(s) \end{aligned}$$

Let $s^*(y_p)$ be the solution to the above equation. We want to show that $s^*(y_p)$ is decreasing in y_p. Simplifying terms (4) can be written as

$$\alpha(u_p(y_p - b^*) + \beta u_c(y_L + b^*) - u_p(y_p)) + (1-\alpha)\beta u_c(y_H) = \frac{c}{p(s)} \quad \text{(a)}$$

Since the function $p(s)$ is increasing in s and $u_c(y_H)$ is increasing in y_p, it is enough to show that $u_p(y_p - b^*) + \beta u_c(y_L + b^*) - u_p(y_p)$ is increasing in y_p . And this is equivalent to show that

$$u_p(y_p - b^*) + \beta u_c(\epsilon_L v(y_p) + b^*) - u_p(y_p) \quad \text{(b)}$$

is increasing in y_p. Notice that b^* is the solution to (2) and therefore it depends on y_p.

Thus, (b) is increasing whenever the following inequality holds

$$u_p'(y_p - b^*)(1 - b'^*) + \beta u_c'(\epsilon_L v(y_p) + b^*)(\epsilon_L v'(y_p) + b'^*) - u_p'(y_p) \geq 0 \qquad \text{(c)}$$

where b'^* and $v'(y_p)$ stand for the derivative of b^* and the derivative of $v(y_p)$ with respect to y_p. And inequality c is equivalent to

$$\beta u_c'(\epsilon_L v(y_p) + b^*)(\epsilon_L v'(y_p) + b'^*) \geq u_p'(y_p) - u_p'(y_p - b^*)(1 - b'^*) \qquad \text{(d)}$$

and from equality (2) we have $\beta = \frac{u_p'(y_P - b)}{u_c'(y_L + b)}$. It follows that inequality (d) is equivalent to

$$u_p'(y_p - b^*)(\epsilon_L v'(y_p) + b'^*) \geq u_p'(y_p) - u_p'(y_p - b^*)(1 - b'^*) \qquad \text{(e)}$$

And inequality (e) can be written as

$$u_p'(y_p - b^*)(1 + \epsilon_L v'(y_p)) \geq u_p'(y_p) \qquad \text{(f)}$$

By concavity of u_p, and since $b^* \geq 0$ and $v'(y_p) \geq 0$, it is easy to see that inequality (f) holds. It follows that inequality (a) also holds and this proves that $s^*(y_p)$ is decreasing.

∎

Appendix B. Figures and Tables

Table 1

	Family income (in thousands USD)				
ER freq.	**<35**	**35-55**	**55-75**	**>75**	**TOTAL**
0	1566 (77.37%)	1334 (79.40%)	1134 (82.77%)	1702 (82.82%)	5736 (80.46%)
1	280 (13.83%)	235 (13.99%)	170 (12.41%)	266 (12.94%)	951 (13.34%)
2-3	148 (7.31%)	96 (5.71%)	54 (3.94%)	76 (3.70%)	374 (5.25%)
4-5	18 (0.89%)	10 (0.60%)	10 (0.73%)	11 (0.54%)	49 (0.69%)
6-7	5 (0.25%)	1 (0.06%)			6 (0.08%)
8-9	5 (0.25%)		2 (0.15%)		7 (0.10%)
10-12	1 (0.05%)	3 (0.18%)			4 (0.06%)
13-15		1 (0.06%)			1 (0.01%)
16+	1 (0.05%)				1 (0.01%)
TOTAL	2024 (100%)	1680 (100%)	1370 (100%)	2055 (100%)	7129[(1)] (100%)

NOTE:

(1) Number of valid observations after listwise deletion of missing values.

(2) Figures in parenthesis show row percentages

Table 2.

	EMERGENCY ROOM UTILIZATION			
	OC-Poisson	**OC-NB**	**OC-Hurdle-NB**	
Parameters			**Probit part**	**Count part**
Constant	(***)-0.50627	(***)-0.46252	(***)-0.95116	(*)0.42543
Sex	0.00720	0.02476	(*)0.12617	(***)-0.23746
Age	(***)-0.06936	(***)-0.06464	(**)-0.04697	(***)-0.07892
White	(***)-0.28795	(***)-0.29059	(*)-0.16464	(***)-0.39091
Hispano	-0.06786	-0.07249	(*)-0.20543	(***)0.32016
Mother's education	0.00386	-0.00281	-0.01113	0.02955
Father's education	(***)-0.04171	(**)-0.04296	-0.03090	(*)-0.04904
Step Mother	-0.40305	-0.29702	-0.48814	0.07160
Step father	(***)0.81212	(*)0.71401	0.70336	0.53276
Mother works FT	(**)0.10406	0.09628	0.06000	0.13741
Number of Sibling	(***)-0.10969	(***)-0.10186	-0.06975	(***)-0.14788
Infectious spell/illness	(***)0.42188	(***)0.39809	(***)0.38324	(**)0.18120
Alergic spell/illness	(***)0.40880	(***)0.42580	(***)0.33182	(***)0.28241
Health status	(***)0.19649	(***)0.18333	(**)0.13464	(***)0.21682
Health insurance is HMO	(*)-0.09635	-0.06898	-0.02125	-0.14346
Urban	(***)-0.33289	(***)-0.34199	(***)-0.30307	(**)-0.20136
Midwest	0.01574	-0.02605	-0.12716	(**)0.31616
Northeast	(**)-0.19020	(**)-0.21704	-0.18251	-0.15980
South	0.03807	0.02542	0.02497	0.05482
Income	*(***)-0.04161*	*(***)-0.03565*	*(*)-0.02675*	*(***)-0.04995*
NB Variance constant		0.75702		-2.00149
Goodness of fit and specification tests				
Average Loglikelihood	-0.4056	0.2319		0.5728
Sample Size(1)	3379	3379	3379	724
LK ratio test		(2)0.0000	(2)0.0000	(3)0.0000
Count / (4)Observed				
0 / 78.57	73.55	78.87		78.55
1 / 15.12	21.71	14.15		13.96
2, 3 / 5.38	4.62	5.81		6.70
4+ / 0.91	0.10	1.16		0.76
Pearson's test	21.43	0.44		0.97

NOTES:

(1) Number of valid observations after case selection and deletion of missing values.

(2) P-Value of the null of OC-Poisson model.

(3) P-Value of the null of OC-Negative Binomial model.

(4) Figures in percentage points.

Table 3.

	DOCTOR OFFICE VISITS			
	OC-Poisson	**OC-NB**	**OC Hurdle NB**	
Parameters			**Probit part**	**Count part**
Constant	(***)1.18045	(***)1.20713	(***)0.79926	(***)1.23884
Sex	0.00078	0.00654	-0.03488	0.00976
Age	(***)-0.12528	(***)-0.12370	(***)-0.05704	(***)-0.12951
White	(***)0.12189	(***)0.11706	-0.00254	(***)0.13376
Hispano	-0.01410	-0.01578	0.03552	-0.02322
Mother's education	(***)0.01827	(***)0.01821	0.03078	(***)0.01591
Father's education	(***)0.01969	(***)0.01814	-0.01015	(***)0.02176
Step Mother	-0.03325	-0.02401	-0.34991	-0.01121
Step father	0.09573	0.10938	0.24792	0.11095
Mother works FT	(***)-0.04798	(***)-0.05103	-0.07222	(**)-0.04734
Number of Sibling	(***)-0.05367	(***)-0.05227	-0.02814	(***)-0.05399
Infectious spell/illness	(***)0.27626	(***)0.26592	(***)0.16351	(***)0.27178
Alergic spell/illness	(***)0.28584	(***)0.28514	(*)0.14170	(***)0.29309
Health status	(***)0.12101	(***)0.11625	(*)0.08214	(***)0.11644
Health insurance is HMO	0.00497	0.00447	0.02813	0.00258
Urban	(**)0.03111	(*)0.03516	0.01781	(*)0.03728
Midwest	0.00693	0.01021	0.08625	0.00117
Northeast	(***)0.08686	(***)0.08919	(*)0.16505	(***)0.07844
South	(***)0.04402	(**)0.04875	0.07997	(*)0.04384
Income	*0.00153*	*0.00119*	*(***)0.03832*	*-0.00374*
NB Variance constant		(***)-1.44047		(***)-1.68182
Goodness of fit and specification tests				
Average Loglikelihood	3.16284	2.8818	2.8220	
Sample Size(1)	3379	3379	3379	3254
LK ratio test		(2)0.0000	(2)0.0000	(3)0.0000

Count	Observed(4)	OC-Poisson	OC-NB	OC Hurdle NB
0	3.69	2.08	5.54	3.69
1	11.42	6.98	10.99	10.42
2, 3	32.49	28.37	27.75	28.28
4+	52.38	62.55	55.70	57.60
Pearson's test		(***)48.3237	(***)13.2006	15.63

NOTES:

(1) Number of valid observations after case selection and deletion of missing values.

(2) P-Value of the null of OC-Poisson model.

(3) P-Value of the null of OC-Negative Binomial model.

(4) Figures in percentage points.

Table 4

	MODEL			
	OC-Poisson	OC-NB	OC Hurdle NB	
Parameters			Probit part	Count part
Constant	(***)-0.50034	(**)-0.42680	(***)-1.06180	(***)0.77885
Income	(***)-0.04107	(**)-0.03928	-0.00800	(***)-0.11585
Income x Age>40	-0.00394	-0.00372	-0.02024	(***)0.05107
Midwest	0.12203	0.00924	-0.22325	(**)0.56974
Northeast	0.03908	-0.00480	0.26793	(*)-0.54946
South	-0.12343	-0.16388	0.11358	(***)-0.71433
Midwest x Income	-0.01770	-0.00592	0.01420	-0.05201
Northeast x Income	-0.03601	-0.03232	(*)-0.07027	0.06953
South x Income	0.02912	0.03202	-0.01475	(***)0.14455
Goodness of fit and specification tests				
Average Loglikelihood	-0.4017	0.2310	0.5649	
Sample Size[(1)]	3379	3379	3379	724
LK ratio test		[(2)]0.0000	[(2)]0.0000	[(3)]0.0000

Count	[(4)]Observed	OC-Poisson	OC-NB	OC Hurdle NB
0	78.57	73.56	78.87	78.55
1	15.12	21.68	14.15	14.08
2, 3	5.38	4.64	5.81	6.55
4+	0.91	0.10	1.16	0.80
Pearson's test		(***)21.32	0.44	0.77

Table 5.

Parameter	ACCIDENT PREVENTIVE CARE Estimate	Stnd.Dev.	P-Value
Constant - Levels for number of preventive measures			
Parents take 0 measures	-2.614	0.3805	0.000
" " 1 measure	-1.299	0.3518	0.000
" " 2 measures	-0.212	0.3452	0.538
" " 3 " "	1.048	0.3456	0.002
" " 4 " "	2.471	0.3514	0.000
Slope			
Male	0.1113	0.0973	0.252
White	0.1994	0.1062	0.060
Age in months	0.1912	0.0557	0.000
Hispano	0.1375	0.1117	0.218
Number of Siblings	0.0601	0.0529	0.248
Number of Adults in Family	0.1476	0.0626	0.018
Mother works full-time	0.0785	0.1014	0.437
Education of mother	-0.0623	0.0779	0.416
Mother widowed	0.1968	0.2323	0.399
Mother married	0.3942	0.1332	0.003
Age of mother	0.0069	0.0108	0.520
Northeast	0.3712	0.1498	0.013
Midwest	0.1874	0.1475	0.877
South	0.0195	0.1286	0.204
Income	-0.0693	0.0296	0.019
Goodness of fit and specification tests			
Sample Size			1382
LK ratio test			0.000
Pearson's test P-value			0.547

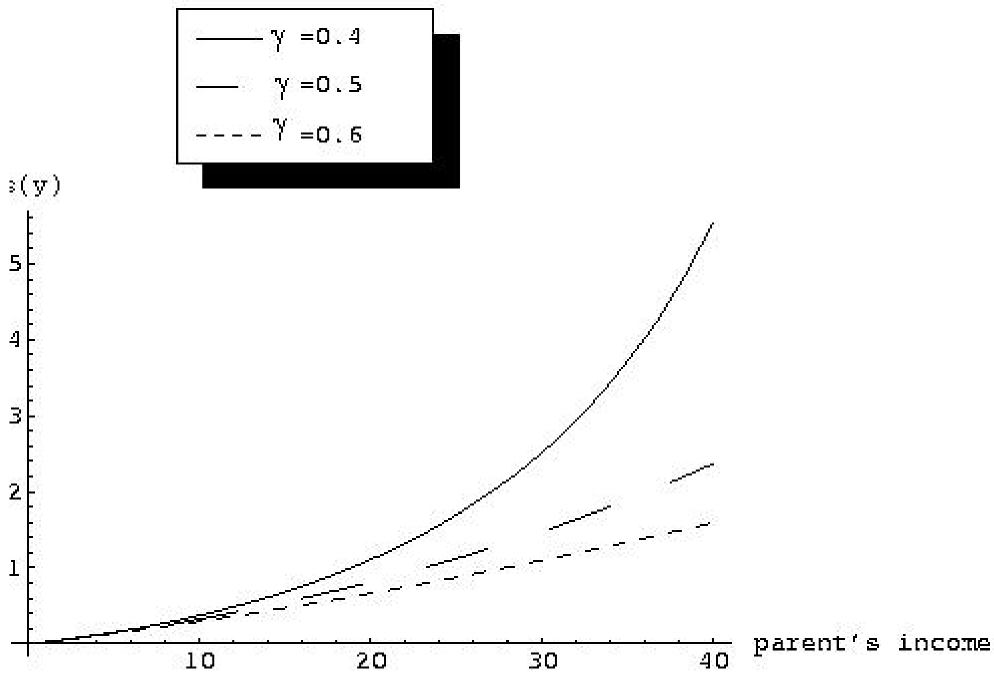
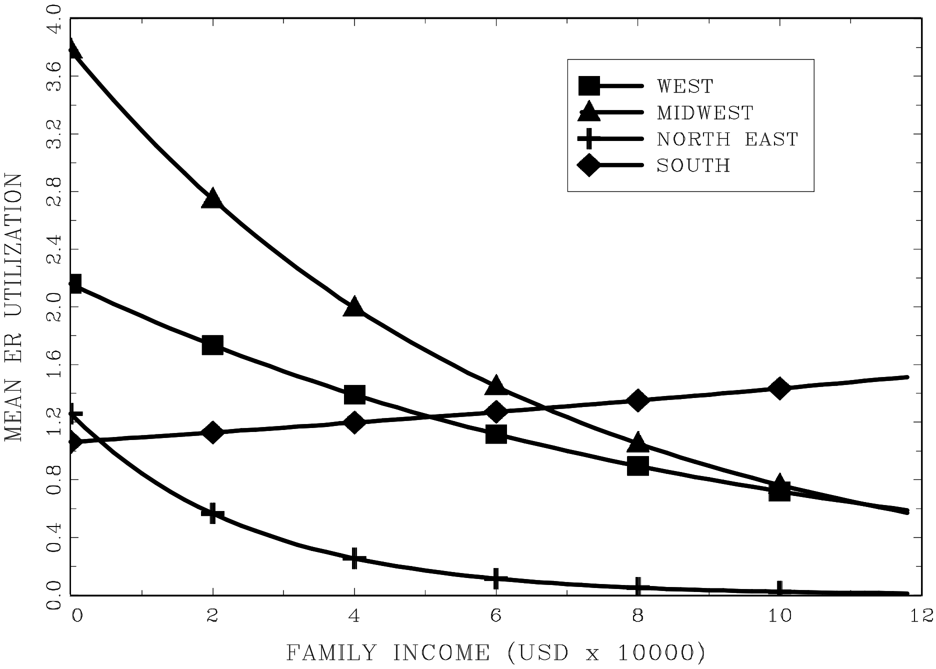


FIG. 1


MEAN ER UTILIZATION
4.0
3.6
3.2
2.8
2.4
2.0
1.6
1.2
0.8
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0
2
4
6
8
10
12
FAMILY INCOME (USD x 10000)
WEST
MIDWEST
NORTH EAST
SOUTH

FIG. 2