Human Capital Accumulation and Poverty Reduction in Developing Countries

The accumulation of human capital or human development is central to the development process and a key to the long-term reduction and eventual elimination of poverty. By human capital accumulation we mean improving people’s cognitive and non-cognitive abilities and skills, as well as their health. Because of its importance, human development is targeted by a variety of policies in developing countries. This proposal aims to improve our understanding of human capital accumulation in developing countries, thereby facilitating more effective policy interventions.

The process of human capital accumulation is complex, dynamic and incremental, and covers the whole life course. A variety of factors play important roles, including nutrition, health care, education, psychosocial stimuli, and the availability of infrastructure. The foundations for human capital accumulation are set very early in life, even before birth. Inputs, events and choices in early childhood have lasting effects on development. Yet the relative importance of these factors and the interactions between them are only partially understood. Moreover, the inputs themselves are the result of complex decision-making processes by households and other agents who operate within specific institutional and cultural environments and who face significant and changeable constraints. This complexity means that it is not obvious which policy interventions work best in which contexts, and how different interventions interact with each other.

Economic incentives and constraints play an important role in shaping the process of human capital accumulation, although they are by no means the only RELEVANT factors. The main aim of the proposed research is to gain a thorough understanding of these mechanisms, as part of the bigger picture. We will study the various dimensions of human capital accumulation from early infancy through adulthood, as well as the policies implemented to target these dimensions. Our methodology will combine econometric evaluation methods with micro-level economic models, the latter being used to interpret our findings. By exploiting variation in incentives, costs and environments we will estimate relationships between different factors (inputs), decisions taken by individuals, and outcomes of interest. In so doing, we will not only evaluate directly the effectiveness of a number of policies, but, most importantly, shed light on the mechanisms that underlie the accumulation of human capital. In many cases we will have the opportunity to use the exogenous variation generated by policy pilots to develop and estimate rich models.

We will assess how the effectiveness of different programmes vary, depending not just on the incentives provided, but also on how individual investments and behaviour respond and how families and communities mediate policies. This will put us in a position to set the human capital accumulation process within a more general framework, enabling us better to understand human capital investment throughout the lifecycle and the dynamic linkages between different investments at different stages.

One of the most important policy interventions we will consider is the Conditional Cash Transfer (CCT), which provides individuals with incentives for investing in nutrition, health and education. In a CCT, cash is granted to poor households (usually to female members) on fulfilment of certain conditions. These typically include
school attendance by children, the vaccination and/or monitoring of infants’ health, and sometimes mothers’ attendance at basic health courses. Some programmes provide nutritional supplements for very young children alongside the other (mainly) cash benefits. Finally, the programmes often involve community participation in targeting and other activities. CCT programmes have been implemented in several Latin American countries, as well as in Bangladesh and in other low-income countries around the world. They are widely favoured by international financial institutions and their implementation is currently being considered in many African countries (see Gertler et al., 2004 and Kakwani, Soares et al., 2005).

But CCTs are not the only form of intervention that we will be looking at. We will also examine community-based programmes - such as the provision of child-care in community nurseries - that are used to target nutrition and schooling at very early ages. Examples of such programmes include community nurseries in Colombia and perinatal community care in Nepal and India.

Our research will make extensive use of two data sets featuring CCT programmes: the data set collected for the evaluation of PROGRESA/Oportunidades in Mexico and the data for the evaluation of Familias en Acción in Colombia. For ease of reference, we provide a summary of the main features of these data as an attachment to the proposal. These surveys provide rich data that combine information on a wide range of variables with the exposure of sub-samples to specific interventions. They are therefore ideal to model the mechanisms at play in the process of human capital accumulation and to extrapolate lessons learned in one particular context to different contexts. It should be stressed however, that we will be making considerable use of data from other countries and on different programmes. We are currently involved in the construction of several datasets linked to different interventions in countries as different as Nepal, India, Malawi, Colombia and Mexico.

Even understanding the complex economic issues involved requires a multidisciplinary approach. Thus the work will involve researchers from other fields including nutritionists, public health specialists, epidemiologists, and education specialists. The researchers at IFS have already instigated collaboration with the International Perinatal Care Unit at the Institute of Child Health (ICH) at UCL as well as with Epidemiologists at UCL, and at the National Institute for Public Health in Mexico. We will also continue our collaboration with other international researchers.

While we think that our approach to identify the economic incentives behind the observed effects of specific interventions is a fundamental step in policy design, we are aware of the difficulties in applying a given intervention to a different context, as discussed in Ravallion (2005). Many environmental factors, including institutions, culture and non-economic effects are crucial in determining the process of human capital accumulation and the effectiveness (or otherwise) of specific policies. In our studies we will be striving to take into account these effects by using our local contacts and collaborating with researchers from other disciplines. In some specific context, non-economic factors, such as violence and institutions, will take centre stage in our research and we will study how they interact with economic incentives. Our approach will thus complement other approaches taken by other disciplines to tackle some of the same issues differently.
In the remainder of this proposal we sketch out our overall agenda, which will track the development of human capital throughout the life cycle. Our research will be articulated into four inter-related themes: (i) the development of human capital in early infancy and childhood. (ii) investment in health and nutrition in adulthood (iii) the role of different actors, external environment and institutions in the development of human capital; (iv) the dynamic process of human capital accumulation. Within these themes we consider the development of three key constituents of human capital - health, nutrition and cognitive and non-cognitive skills.

Within the first two themes, we will study the determinants of demand for a particular set of inputs (such as health services, nutrition and education services), along with the availability of such inputs both in terms of quantity and quality, at different phases of the life course. We will focus on the mechanisms that convert inputs into outcomes. For example, how subsidies affect food intake, and how this affects aspects of human capital such as nutritional status and cognitive, non-cognitive and physical development. Or how teachers and schools affect cognitive and non-cognitive development and how this affects academic achievement, and so on. We will investigate how inputs complement each other throughout this process.

The projects within the third theme will recognise the important fact that most policies are mediated by families and individuals, and that their impact depends not only on their merits and application, but also on whether for example they crowd out individual investment behaviour. We will also consider how the environment in which indigent households and individuals reside affects the relative effectiveness of policies. Factors we will consider include the natural environment, the institutions that prevail in a given society, attitudes towards women and the nature of family relationships to social capital.

Our fourth theme aims at providing a unified framework in which to consider dynamic linkages in human capital investment, and the process by which the various dimensions of health and skills are accumulated and assembled so as to form what economists generally think of as human capital.

1. **Human development during infancy and childhood.**

Nutrition and health status in early life and even in the womb are crucial for subsequent physical, cognitive and non-cognitive development. Yet young children and mothers in indigent households are exposed to a variety of health risks. What inputs children receive depends on many of factors, including resources available to their family, maternal information and education, access to formal and informal services, specific interventions and public policies. While public policies can be particularly important, they can be difficult to deliver to individuals most in need, as many children at risk live in remote locations and/or in households that have little contact with formal health systems.

Our research will study important issues that affect human capital accumulation in developing countries. In our first theme we will:
(i) Characterise how different interventions can change pregnant mothers’ information and behaviour and ultimately how this can affect outcomes such as birth mortality, birth weight and development in early stages of the life cycle.

(ii) Characterise the link between nutrition and other inputs (such as psychological stimulus) and cognitive and non-cognitive development among poor households.

(iii) Characterise the determinants of child food intakes and how these can be affected by interventions that change not only the amount of resources available to poor households, but also their distribution within the household and by other inputs, such as training and information.

(iv) The interaction of different policies based on individual and community interactions in determining the demand for health services for young children.

(v) How specific interventions can reach individuals most in need.

These goals will be pursued by looking at specific interventions in several developing countries, interacting with researchers of different backgrounds.

It is remarkable that, whilst these policies have important implications for long-term poverty reduction, almost all of the research on this relates to developed countries (see Bowles, Gintis and Osborne, 2000). Therefore our research will fill an important gap. Moreover, we will focus both on physical and cognitive development\(^1\) without neglecting non-cognitive skills\(^2\), which have been emphasised in recent literature as being more malleable at later ages than IQ.

**A. Health and nutrition policies in infancy**

We will consider how the demand for health services for infants and young children, both preventive and curative, is affected by different interventions: (i) CCTs (including a nutritional component) (ii) provision of information to mothers (iii) community interventions. Ultimately, we will consider how the health of children, measured using self-reported occurrence of illnesses and objective measures where available, is affected.

We will analyse data from CCT programmes in Colombia, Mexico and Honduras, and two community interventions in Nepal and India. Attachment 1 contains information on the CCT programmes in Colombia and Mexico. The interventions in Nepal and India focus on perinatal care and were designed for communities in which the provision of standard health care services is difficult, due to isolation of communities (Nepal) or extreme poverty (Mumbai). In Nepal, research carried out by the International Perinatal Care Unit at the Institute of Child Health (ICH) in UCL on a randomised trial, found that encouraging communal engagement in maternal and

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2 Research emphasises that non-cognitive skills have strong independent effects on school and labour market outcomes. See for example Heckman, Hsee and Rubinstein (2000), and Heckman, Sixtrud and Urzua (2005) for the US, and Carneiro, Crawford and Goodman (2005) for the UK.
infant issues amongst women, and providing basic information and resources, had important effects on newborn mortality. A similar intervention is being tried in a different context, the slums of Mumbai. We will collaborate with researchers from the ICH to determine both how the community intervention is mediated at the individual level and the extent to which the effects differ across communities. A characterisation of the communities in which the intervention is more or less effective can increase our understanding of the mechanisms through which policies work. To this end, we will enrich the surveys to evaluate these interventions, particularly in their economic component. We will use econometric models to explain the heterogeneity in success rates among communities. The random allocation of the programme across areas (in Nepal and Mumbai) is crucial for identifying the effects of these programmes.

B. Preventive care policies in infancy

We will investigate whether preventive care changes child food intake patterns. We are interested in two channels through which this may work: whether preventive care influences child nutrition patterns directly, either through a change in the distribution of resources within the household and/or through the type of food consumed by children, and whether preventive care increases parents’ labour supply and therefore total household resources. We will build a structural model to distinguish these effects.

We will model child nutritional intake as a function of attendance to preventive health care, total household consumption, percentage of household earnings earned by women, and other variables such as parental education, distances to school and to the health care centre, and municipality food prices, using the Colombian Familias en Acción household survey. As attendance to preventive care, total household consumption, and percentage of household earnings earned by women are endogenous, we will identify their effects using instrumental variables. As in Attanasio and Lechene (2000), we will use municipality wages to instrument total household consumption and the percentage of household earnings earned by women. We will use the average waiting time for a preventive consultation in the municipality to instrument attendance to preventive care. The main identifying assumption is that the average waiting time for a preventive consultation in the municipality influences food intake only through its effect on preventive care attendance. With panel data, the identification strategy will be strengthened: we will exploit differential changes over time, while controlling for permanent differences across localities and common time trends. The differential changes occur because of different intensities in promoting preventive care, which are induced by the different incentives described above; these in effect become a source of identifying power, while at the same time controlling for unobserved permanent confounding differences.

C. Nutritional interventions in early years and cognitive and non-cognitive development

There is mounting evidence that early years nutritional interventions have lasting effects on the physical and cognitive development of children. Behrman et al. (2005) have shown this for Guatemala, while Grantham-McGregor et al. (1991) and Baker-Henningham et al (2005) have found striking evidence of this in Jamaica.
In Colombia and Mexico, CCTs have been shown to have increased the intakes of food, especially of protein-rich ones, by children (see Attanasio and Mesnard, 2005, Gertler et al. 2004, Angelucci, Attanasio and Shaw, 2005). Subsequent waves of panel data will be used to establish the effects on cognitive development. The Mexican case is particularly interesting because it will allow us to study the importance of an early nutritional intervention; as explained in Attachment 1, the PROGRESA treatment localities started receiving the programme in 1998, while the (randomly selected) control communities started receiving it in 2000. By considering children born in 1997/1998, we will have a sample of children that received the programme very early on and others that received it later. Using the 2003 data we can then compare the cognitive and non-cognitive development of children who received the intervention between 6 and 30 months to that of children who started receiving it after 30 months. For measuring skills, the PROGRESA/Oportunidades survey includes data on cognitive skills (MacArthur Communicative Development Inventories, Test de Vocabulario en Imagines Peabody), motor development (McCarthy Scales of Children’s Abilities), and socio-emotional and behavioural development (Achenbach Child Behaviour Checklist).

D. How different early year interventions interact with each other

Policymakers have often seen CCTs as alternatives to community-based programmes. However, they might be complements, and the appropriate intervention may differ depending on the age of the child and type of community. Moreover, community-based programmes are often easier to implement: in the case of the provision of health services for example, the delivery of professional health services may be limited by the remoteness of localities and/or budgetary constraints, thus rendering community-based intervention easier to enforce.

Rural Colombia offers an interesting environment to compare different interventions. Familias en Acción was superimposed on a pre-existing nutrition programme based on community nurseries, in which children are sent to a ‘community mother’ who receives food from the government and who takes care of up to twelve children in the community. Beneficiaries in towns in which the CCT programme was implemented had to choose between the two. There is some evidence that the two programmes were more complements than substitutes both in terms of the households that would benefit from each and the ages of the children (see Attanasio et al. 2005, Attanasio and Vera-Hernández 2005). We will model the choice between the two programmes, assess whether the programmes serve different population profiles and consider their relative merits. This is also relevant for providing advice to the Colombian government that is considering scaling down the nurseries programmes so as to expand the CCT one. As the community intervention programme is a universal one that started many years ago, we will model participation in the various programmes assessing their cost of participation and use an instrumental variable approach. The key to identification is to understand why certain households decide to participate in community nurseries and others not. Availability of the programme at a reasonable distance is one way to achieve this. It turns out that this measure of availability is not correlated with permanent differences between children, such as birth weight, lending support to the idea that this is a valid way of explaining programme take-up.
2. Adult Investments in Health and Nutrition

A. Can competition between public and private health providers harm the provision of preventive care?

The World Bank and other multilateral agencies see the development of the private sector as a way of improving health care provision in developing countries, and health care reforms that widen the coverage of private health care providers have been widely introduced, thus increasing competition with public health providers. In Colombia, private and public health care providers receive a fixed amount of money for every patient enrolled. This money should cover, on average, both curative and preventive care of patients.

Though the packages of preventive care are regulated, their functioning is imperfectly monitored. Providers can thus distort the preventive services provided in order to increase profits: as richer and better educated individuals are already aware of the importance of preventive care, providers might reduce resources devoted to preventive care services in order to attract richer individuals.

If health care providers follow these monetary incentives, and the allocation of private providers in some villages but not others is random, then one should observe higher rates of attendance to preventive services in villages that only have public provision than in villages in which public and private provision compete. We will corroborate our hypothesis by testing the correlation for a sample of sixty villages in Colombia, through matching household-level data with details on the composition of private and public health care providers in the village. A caveat is that private providers will not allocate randomly in villages. To address this problem, we will exploit the sampling design of Familias en Acción that focused on relatively homogenous municipalities, in terms of population size, degree of urbanisation, education, and health infrastructure. Moreover, this survey contains information on household and municipality variables that will allow us to control for observable confounding factors. We will use matching to study how the use of preventive care is affected by the availability of private health care providers in the municipality.

B. Economic implications of nutrition interventions targeted at HIV and tuberculosis patients

We will work in collaboration with Professor Andrew Tomkins and colleagues from the Institute of Child Health in association with researchers in Africa, to study the effect of different nutritional supplementation protocols on labour market outcomes.

Professor Tomkins is currently evaluating the effect of delivering nutritional pastes to adults and children as part of the nutritional management of HIV/AIDS and severe malnutrition in different countries in Africa. This nutritional paste is made up of peanuts, a vitamin supplement, and minerals, and is manufactured locally which renders it cheaper and more sustainable than interventions that provide supplements manufactured in Europe.

The studies, which build on existing research underway in Kenya, Zambia and Tanzania, involve randomised controlled trials and the data allow for an evaluation of
the impact of nutritional supplements on days in hospital, days off work, earning capacity and poverty reduction. In this research, we will investigate how nutrition interventions can reduce the economic impacts of infectious diseases, by examining the impact of nutritional interventions among children and their families affected by HIV/AIDS. A key focus will be on adult family members but we will also collect data on school attendance and academic achievement of children. This is because the schooling and nutritional status of children may be adversely affected because their parents do not perform well in the labour market due both to the illness itself and the accompanying weakness induced by lack of appetite. In particular, we will study how this nutritional intervention affects:

- **patient’s labour market outcomes**: wages, earnings, hours of work
- **patient’s medical expenses**: drugs, days in hospital
- **children’s outcomes**: nutritional status, schooling, child labour
- **transfers**: whether transfers that households receive from the community decrease when their nutritional status improves
- **externalities**: whether the rate of infection to other members of the community decreases because patient’s immunological system improves due to the intervention

These elements can then be incorporated into a Cost-Benefit analysis of the intervention. We will work in collaboration with the ICH team to augment their survey so as to include questions relevant for studying the economic implications of the nutritional intervention. This project will rely on funds to expand both the original questionnaire and the sample size.

Our evaluation methodology will exploit the fact that some communities randomly (for logistic reasons) receive the intervention later than others. This will allow us to evaluate the effect of the intervention on various outcomes of interest in an unbiased way.

3. **How families/communities/environments mediate the effects of policy**

Most government policies are mediated by communities, families and individuals, and their impact thus depends on the actions of all these parties. While economists often consider the family as a monolithic decision unit, recent evidence and theory has stressed that this can be a bad approximation to reality, with the relative power of different individuals within the family playing an important role in determining outcomes. Becker (1981) argued that public programmes for children may crowd out parental investments, especially when parental and government investments in children are very substitutable. For instance Jalan and Ravallion (2003) argue that pipe water infrastructure might crowd out parental investments in health. Jacoby (2002) examines this issue in the context of school nutrition interventions. Parents can substitute away from private expenditure on nutritious food if schools increase the provision of such goods to children. However, the same programme can complement other types of parental investment. And, of course, the specific environment where poor individuals live, the type of institutions (or lack thereof), markets and other environmental factors - such as the prevalence of violence - are of crucial importance. Some of the programmes we will study explicitly change the balance of power within the household, targeting women as the recipients of subsidies. Moreover, in the case
of Colombia, the programme is implemented in an extremely volatile and violent environment. The availability of data on these programmes constitutes, therefore, an important opportunity.

We will not only consider whether policies, such as Oportunidades and Familias en Acción, affect household and individual human capital outcomes, but also how household and individual investment behaviours may further affect outcomes, or counteract investments. The objective will be to open the "black-box" impact of the intervention to understand if the presence or absence of long term gains in outcomes can be explained by post-intervention changes in household and individual behaviour. To this end, we will address a number of issues.

A. The allocation of resources within families and its effect on human capital accumulation

Many CCT programmes are targeted to women and there is some evidence (Attanasio and Lechene, 2002) that this is an important aspect of such programmes. Impacts measured using existing CCTs are thus specific to the case in which the subsidy is granted to a woman. Yet it is still common practice to use models in which the household is treated as a single decision unit.

To investigate whether and how this matters we can use different tools and different data. First, existing evaluations of CCT programmes in Colombia and Mexico point to the fact that the increase in food consumption as a consequence of the transfer is as large as the increase in overall consumption. This robust result contrasts with estimates obtained from Engel curves that assume a single decision unit among similar households not receiving the programme. Such evidence generally shows that the share of food should decrease as total consumption increases. This evidence might then be an indication of the fact that a CCT of the type implemented in Mexico and Colombia not only increases the resources available to households, but also changes the relative bargaining power of women and thus the mechanisms through which resources are allocated.

Second, we have evidence that the consumption of specific food aggregates, such as proteins, increases most. Again, one can compare the prediction from Engel curves to results estimated using experimental variation. If the observed consumption increase is different from that predicted by the Engel curve, one can estimate a more sophisticated model and check whether the increased share of women’s income might explain the difference.

Additional evidence on these mechanisms can be gained using survey information on individual consumption. For instance, both the Mexican and Colombian surveys contain information (albeit not complete) on individual food intakes. We can model how these vary with total consumption and whether this function has been changed by the programme and by the fact that women receive the subsidy. Care must be exercised to account for the fact that cash transfers are linked to specific activities, such as school enrolment and participation in health activities. Here we can either model jointly the changes in behaviour due to the subsidy or exploit the fact that some groups do not respond to CCTs. An example is households with primary school children. As enrolment of primary school children changes very little after the
programme, it is equivalent to an unconditional transfer of resources to women for households with young children.

We will also use information on individual food intakes and total household food consumption and expenditure in Colombia and Mexico to characterise how resources are allocated within the household in different circumstances and how this process is affected by CCT programmes. In the case of Mexico, we will collaborate with Lynnette Neufeld and Juan Rivera from the Mexican National Institute of Public Health (INSF).

**B. Education interventions and the demand for education: how do CCTs work?**

Whilst the literature finds that CCT programmes increase school enrolment of targeted children, much less is known about both the mechanisms through which such programmes operate and their effects on individuals not directly targeted but who live in treated communities. Both aspects are important to consider if one wants to refine the design of such policies.

We will develop a structural model of education and work choices to study this and to provide a framework within which we can assess how such programmes would perform if one were to change some of their features. In contrast to the existing literature (Attanasio et al, 2005), we will consider as outcomes the time devoted by children to activities, rather than participation at the extensive margin only. Moreover, we will not take school and work to be mutually exclusive activities. We will use the exogenous variation induced by CCT programmes in several countries, which affects the relative prices of child labour and education, to analyse how education choices respond to such programmes. In addition, within our model in which school and work are not mutually exclusive it we will study the impact of work on schooling outcomes. Whilst work can distract from study, it can also add to household resources thus increasing the possibility of working well due to improved nutrition and better schooling aids.

Our model will be enriched by information on returns to education. An important factor that affects schooling decisions is the *perceived* (rather than actual) return to schooling (Willis and Rosen, 1979). The perceived return is extremely difficult to know, depending as it does on factors such as household expectations regarding the occupation of the child as an adult, the individual’s ability, and geographical mobility. Most studies use models of occupational choice and earnings equations to estimate it, thus proxying the perceived return with a less than perfect measure of the market return. In contrast, our model will embed these expectations directly. The Colombian survey asks questions of household heads relating to expectations of the returns to achieving complete primary and secondary education. We will use these perceived returns to estimate a structural model of education choices and to understand how they influence choices. One important issue is that these perceptions may be an ex-post justification of school decisions and thus not exogenous to school choices. One strategy is to use average perceptions within villages, which will reflect local labour market opportunities, to identify the effect of expected returns on education investment decisions.
We will also consider the effects of CCT programmes on individuals not directly targeted by the programme but living in treated areas. One way in which one might expect the programme to affect their behaviour, is through changing local area wages. If CCT programmes reduce the amount of time that targeted children spend working, wages respond to re-align labour demand and supply on local labour markets. Labour responses amongst non-targeted individuals will depend on such factors as how the subsidy affects the wage as well as on the degree of substitutability between child and adult labour. By considering these factors, we will embed general equilibrium effects of such programmes into a dynamic setting of education and work choices. For this, we will take advantage of detailed information on local conditions. We will use information on non-eligible households in surveys such as the PROGRESA programme. We will exploit information on wages received by different groups such as men, women and children, whose labour supplies may be more or less substitutable with each other, to consider the effect of the programme on average wages and labour supply of non-eligible individuals in these groups.

Finally, conditional cash transfers are likely to have different effects depending on poverty levels. Moreover, combining these with infrastructure spending may substantially increase their effectiveness. Using data from Honduras and Nicaragua we can extend the scope of the analysis to even poorer environments and examine richer policy interventions. This will also address the importance of local conditions and contexts for programme design. The programme in Nicaragua, for instance, is provided to households that are considerably poorer than those in Colombia or Mexico, which is reflected in lower primary school attendance rates. The programme in Honduras combines demand (CCT) and supply (school construction) interventions. Moreover, different combinations of these interventions were randomised across different areas, allowing the possibility of estimating the importance of supply effects exploiting genuinely exogenous variation.

The structural model will allow us to vary features of policies and predict the effects on enrolment, child labour and other outcomes. It will also allow us to also consider the effects of such policies on non-beneficiaries. It will provide an important basis for policy makers for fine-tuning policies.

C. Intergenerational links in poverty through health and education

Families play an important role in mediating the effects of human capital policies on children’s outcomes. The impact of interventions is likely to depend on family environments, parental actions and child characteristics (as well as on community characteristics, as emphasised above). In particular, parental health and education are likely to be to crucial determinants of the response of parents to policies, and the family environment is likely to influence the response of the child to the policy.

Education has important impacts not only on labour market outcomes, but also on outcomes ranging from health (e.g., Grossman, 2005, de Walque, 2003), to criminal behaviour (Lochner and Moretti, 2003), to family environments and parental investments in children (e.g., Currie and Moretti, 2004, Carneiro, Meghir and Parey, 2005, Behrman, Foster, Rosenzweig and Vahsishtha, 1999). Similarly, health is considered to affect one’s ability to work in the market place.
education levels of the current generation will lead to improved health and schooling outcomes of future generations: the human capital of parents affects the human capital of their children. Similarly, a strong intergenerational link is likely to exist in terms of health. For example, maternal health is likely to influence the child even after pregnancy, by affecting both investments and environments.

There exists little literature on this topic for developing countries, although these issues are implicit in much research on child development. For example, several papers examining determinants of child development include parental characteristics in the model. Furthermore, when evaluating the impact of a particular programme on outcomes, it is not uncommon to analyse how the programme impact interacts with parental characteristics such as maternal education.

Our aim is to measure the importance of parental schooling and health on child development, and to understand the channels through which such influences occur. Using data from Colombia and Mexico, we will start by measuring the effects of parental education on children’s outcomes (cognitive and non-cognitive skills, schooling, social behaviours and health). Then, using rich household and community data, we will focus on mechanisms which mediate the role of parental education and health for child development, such as: family environment and the technology of skill formation, parental investments in children, capacity to generate household resources, quality of household production, and responses to government investments in children. In particular, we will estimate the effect of parental education on measures of parental investments, parental practices and home environments, and examine the interaction of government programmes and parental education. One potential by-product of this study is a richer understanding of whether one should target programmes directly to children, to parents (e.g., information campaigns, literacy programmes, teaching of skills) or both, if the aim is to improve the welfare and life chances of children in a cost effective way. By understanding how household characteristics affect child outcomes we can learn about the effect of policies that change such characteristics on child development.

D. The role of insurance and the uncertainty of the environment on household investment behaviour

Indigent households in LDCs often face considerable risk. In the presence of thin insurance and credit markets, households mitigate risk using self-insurance mechanisms. We will analyse the links between risk and household self-insurance and the implications for the accumulation of human capital. In contrast to existing work on this we will consider a broader concept of risk, along with a wider range of self-insurance mechanisms. The existing literature tends to align the notion of risk with the actual occurrence of adverse shocks (e.g. Beegle, Dehejia and Gatti, 2005), ignoring the possibility of adverse shocks (an exception to this is Fitzsimons, 2004), and each study tends to consider just one particular risk-coping strategy, rather than a portfolio of possible strategies.

We think of “risk” as a multi-faceted concept which may take different forms. It may be specific to a household, or it may affect an entire community or village. This distinction is important in the context of self-insurance mechanisms, because

12
individuals and households will be in a worse (better) position to pool risk with neighbours if the income risks that they face are (not) covariant. But the notion of risk can be further refined. In particular, it can be associated with the realization of unanticipated adverse shocks (ex-post risk), or it can be considered as a deep-rooted phenomenon that is associated with probabilities of adverse events occurring (ex-ante risk). Insofar as actual and perceived distributions of adverse events differ, this distinction is important.

To study this, we will quantify ex-post and ex-ante risk, and decompose both into that which is household-specific and that which is more pervasive. Ex-post risk will be measured using longitudinal information in the Familias en Acción and PROGRESA data on adverse shocks including deaths, illnesses, and fires and floods. A novel aspect of our research will be to use new measures that are intended to capture households’ ex-ante perception of how risky their income is. This is made possible by the fact that the surveys for some of the contexts we will study (Colombia and Mexico) include innovative questions that elicit from households their perception of the income risk they face. We will use these questions to construct a measure of ex-ante household-specific risk. Moreover in rural Colombia, a region of pervasive violence and political instability, we observe indicators of violence in villages, in both the Familias en Acción survey and from village level data on violence and population displacement from the Colombian Department of National Planning. These provide insight into the instability of environments in which households reside. Our data also include rich longitudinal information on households living in communities that do and do not receive welfare programmes, and we will control for wealth and thus consider how conditional on income levels, risk affects behaviour.

Education is undoubtedly one of the most important and profitable investment opportunities available to indigent households. Investment in education, as measured by time spent in school, might also be affected by uninsured events that cause sharp reductions in household income. At the same time it is also a possible mechanism for coping with risk, through building up precautionary wealth. Having novel and reliable measures of risk (both ex-ante and ex-post) we will be in a strong position to assess the effect that risks of different types have on education and child labour choices.

We will also examine the effect of uncertainty on school choices in Indonesia, using the Indonesian Family Life Survey (IFLS). For this, we will employ a different strategy, developed by Carneiro, Hansen and Heckman (2003) and Cunha, Heckman and Navarro (2005). We will estimate a selection model of schooling and wages, and by contrasting ex-ante education choices with ex-post wage realisations we will identify the information set of agents at the time they make schooling decisions, under different assumptions about insurance and credit markets. To identify the selection model we will use measures of distance to different types of schools to instrument school choices.

The impact of access to credit and insurance markets on education choices is important, yet there is limited research on this for developing countries. Even in developed countries, credit constraints in education and in consumption and other household investments are never considered in a unified framework. It may be easier
to conduct a unified study in developing countries, since one can more easily find household surveys with data on household consumption, household investments, investments in human capital, household income and assets, and household access to formal and informal credit markets. Using the IFLS we will study the determinants of school attainment, paying particular attention to the role of access to credit.

More generally, we will also consider the effects of risk on household investments, including investment in productive assets and migration decisions. Resulting from these decisions, we will model transfers within and between villages as a risk diversification strategy. The interaction between different risk-coping mechanisms is important. For example, if migration is a way to cope with shocks, the fact that some assets (e.g. human capital) are more portable than others (e.g. physical capital) might affect household investment choices. We will focus on the effects of a particular form of risk, violence, that not only affects income uncertainty, but that may also destroy assets and thus affect households’ incentives to invest in different kinds of human and physical capital in the first place. The detailed data on all of these outcomes in the Familias en Acción survey will put us in a strong position to estimate a general model of household risk diversification under extreme poverty.

Finally this framework will be used to assess whether CCT programmes act as effective safety nets, by considering whether the effects of risk are mitigated by CCT programmes that are available to the poorest households in these communities. This agenda will have important implications for policymakers intervening in the provision of insurance in LDCs.

4. A general framework for considering dynamic linkages in human capital investments and the role of human capital policy over the life cycle

To understand the role of education policy and to design innovative and effective interventions, it is crucial to understand the process by which individuals develop into skilled adults. It is of course impossible to experiment with every intervention one can think of and to choose those that perform best. Rather, one needs a framework within which to interpret the limited data at our disposal, and to simulate the impact of alternative policies. The ultimate goal of our work is to develop such a framework.

This framework recognises that there are many types of skill, that skill formation is a life-cycle process affected by multiple inputs from individuals, families, communities and government, that there are links between investments and events at different ages, that human capital investments affect multiple dimensions of one’s life, and that education choices are often made in a context of uncertainty, with information and expectations about returns to human capital influenced by families and communities. In our work we will consider the technology of skill formation, preferences and culture, government policy and market constraints, and investment behaviours in a unified framework, in an environment consistent with that observed in developing countries.

Each of the projects in our proposal contributes to a piece of the model we will develop, and at the same time developing such a model allows us to understand how these pieces relate to each other. We start by recognising that there are multiple skills
and that human development is a comprehensive process. In that sense we link health and skill formation within a common process: they are affected by common inputs and they affect each other, both in a contemporaneous and a dynamic sense (early skill and health formation affect the impact of future skill and health investments).

We also model the determinants and consequences of parental investments, and how they interact with community environments and government policies. Families are probably the most important actor in the human development of a child, and in much of our agenda we will attempt to open the black box of what goes on inside the family, both in terms of allocation of investments across individuals and time periods, and in terms of characterising household technologies. Another point worth emphasising is our recognition of the importance of education and health investments not only for labour market outcomes, but also for other outcomes and processes, such as household production.

Our work on risk and on access to credit and insurance will allow us to model expectations and formal and informal financial markets, crucial elements of any investment analysis, with investments in human capital being no exception.

Our framework is not only conceptual but is intrinsically empirical. Our goal is not only to construct a theoretical framework which we can use to interpret and link our findings in a unified way, but also to construct a general model to estimate using existing data and to use to quantitatively assess the effects of different policies. A model is needed in particular to examine the effects of never-implemented policies, the effects of existing policies in different environments, the dynamic and contemporaneous interactions between different policies (we rarely observe one policy in isolation from others, there may be synergies in developing simultaneous policies, and the impact of future policies depends on policies currently in place), and the dynamic and long run impact of policies on investments and outcomes. A model will allow us to determine the effect of different policies in different environments and in different periods of the life-cycle; it will allow us to evaluate the role of human capital policy over the life-cycle.

Dynamic schooling models with and without uncertainty have been estimated for developed countries (e.g., Cameron and Heckman, 1998, 2001, Eckstein and Wolpin, 1999) and developing countries (e.g., Attanasio, Meghir and Santiago, 2005, Wolpin and Todd, 2005). A framework for analysing life-cycle skill formation is currently being developed, although is still in its initial stages (Carneiro and Heckman, 2003, Cunha, 2004, Cunha, Heckman, Lochner and Masterov, 2005). Models of life-cycle health formation are also very much underdeveloped in economics.

To implement our model empirically to examine linkages between different investments in health, cognitive and non-cognitive skill and education over time, we benefit from having access to panel data, and rich information on skills and health measurement, parental investments and household environments. The various datasets we use (e.g. PROGRESA, Familias en Acción, the Indonesian Family Life Survey) are rich in all of these dimensions, and their panel structures, despite being relatively short, allow us to study the evolution of the human capital of children across different ages. Furthermore, we expect newer waves of these and other panels to become available in the near future.
Using this data we aim to estimate a dynamic model of parental investments into education and health of children. This model will embed a flexible technology of skill and health formation that allows investments at different stages to be substitutes or complements. We will also consider explicitly the role of different market environments (credit and insurance markets), uncertainty and access to information. We will estimate our model under different assumptions about expectations and credit market settings. Furthermore, the rich community and family network variables in the datasets, as well as information on formal and informal credit institutions can be used to choose among alternative specifications. Finally, the findings of the projects described throughout our proposal will help us to specify the relevant technologies of skill and health formation, market constraints and to model behaviours.

In our model parents make investments in children subject to technological and market constraints. Once the model is specified and estimated a variety of different policies can be simulated, as for example in Attanasio, Meghir and Santiago (2005). As emphasised in this and other papers, it is crucial to have exogenous sources of variation to identify several features of the model, such as the technology of skill formation and the parental investment function. For example, since many inputs into the production of skills are endogenous (being the results of parental decisions) it is crucial to find exogenous variation in them to identify the technology. This is true whenever we want to study the effect of investments on outcomes: since investments are endogenous we require sources of exogenous variation. As in the above paper, we obtain these from the nutrition and CCT programmes incorporated in the datasets that we use.