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The Human Development Trap in Mexico

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Abstract

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*Resumen**

El desarrollo humano se caracteriza por trampas intergeneracionales que frenan el crecimiento económico. En México existe una trampa de esta naturaleza, con rendimientos crecientes a la educación a los cuales no tiene acceso la mayoría de la población. Además, la salud y nutrición infantiles se asocian fuertemente con los logros educativos posteriores. La distribución de la escolaridad tiene picos múltiples correspondientes a dos clases sociales: una con secundaria completa o menos, y otra con 15 o más años de escolaridad. La inversión en educación del grupo bajo la provee, principalmente, la educación pública. Para promover efectivamente el crecimiento económico de largo plazo, es necesario complementar las reformas pro-mercado con políticas que apoyen la nutrición, la salud, el desarrollo infantil temprano y la educación de los jóvenes.

**Una versión anterior de este trabajo, "Market Failures in Health and Education Investment for the Young, Mexico 2000" fue escrita para el proyecto de investigación "Nutrición y capital humano en México: Retornos y transmisión Intergeneracional" de la Organización Panamericana de la Salud, y galardonada con la Medalla de Oro para la investigación sobre el Desarrollo en la categoría de Reformas Pro-mercado y Pobreza en la Quinta Conferencia del Global Development Network, Nueva Delhi 2004.*

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Human development is characterized by intergenerational traps that slow economic growth. Such a trap exists in Mexico, with increasing returns for education not accessed by most of the population. In addition, early child health and nutrition are strongly associated with later educational achievements. The distribution of schooling is multiple peaked with two social classes, those with complete lower secondary schooling or less, and those with 15 or more years of education. The lower group's schooling investment responds mainly to public education. Policies supporting nutrition, health, early child development and education must complement pro-market reform to effectively promote long-term economic growth.

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Introduction

Health and education investment in Mexico are subject to barriers that result in a long-term intergenerational poverty trap that slows economic growth. This is an intergenerational human capital trap characterized by the following constituent elements. Education has increasing returns which are not tapped by a major portion of the population, while the role of health is two-fold. First, early child health and nutrition are strongly associated with the probability of obtaining a higher education later in life, over and beyond parental education, income and wealth. Second, adult health contributes to adult income. The first of these channels is of a large enough magnitude that attainable improvements in early child development can play an important role in overcoming the barriers to investment in higher education, and therefore in overcoming the human development trap itself.

Historical and macroeconomic studies have measured an important impact of nutrition and health on long-term income and economic growth. Nevertheless, disentangling the underlying causal channels has presented a major challenge to microeconomic research. Studies on the productivity effects of adult health on income have accounted for only a small proportion of the impact. The magnitude found here for the effect of child nutrition and health on education and therefore on adult income accounts for an important part of the impact of health on economic growth found at the macroeconomic and historical levels. These results are supported by recent related research on the 'gradient' of adult health along income using databases for developed countries, which place childhood health at the origin of the gradient.[1] *The intergenerational nature of human capital accumulation, in which early child development plays a key role, and the market failures and traps that characterize such investment, lie at the core of the process of human development and of its relation with economic growth*. Policies aimed at achieving long-term growth must include a focus on intergenerational human capital accumulation and on early child development.

In today's globalized world, most people's income depends directly on their skills. Emergence from poverty can only occur through a population-wide accumulation of human capital. The diffusion and use of knowledge in economic activities has become one of the crucial determinants of cross-country economic growth. Pro-market reforms tending to ease restrictions on capital and trade and to augment technological flows have made the accumulation of skills, as well as the production, adoption and use of knowledge, even more crucial to economic growth.[2]

[1] Case, Fertig, and Paxson (2003), Case, Lubotsky and Paxson (2002).

[2] See for example Arrow (1962), Uzawa (1965), Frankel (1962), Romer (1986), Lucas (1988), Romer (1990), Aghion and Howitt (1992), Howitt and Aghion (1998) for the role of knowledge and skills in economic growth. The importance of education for population-wide incomes has been verified

For these reasons, closing the gap in education and technology has become a central focus for development policy.[3] The presence of an intergenerational poverty trap has important implications for policy. For example, although a series of pro-market reforms implemented in Mexico since the mid 1980's led to rises in the returns to education, the distribution of schooling in the adult population remained almost unchanged. Thus potential reform benefits did not materialize, partly due to a lack of human resources, and have concentrated on those able to obtain an education. Acknowledgement of the existence of poverty traps by leading economic institutions, and the integration of the corresponding policies with those for globalization, would have enormous welfare benefits.

In the following discussion I first develop a conceptual framework for understanding the relation between human development and economic growth. This conceptual framework provides a natural context for the discussion of the effects of pro-market reform on the poor. To construct it I first review the evidence on the historical and macroeconomic relation between nutrition, health and economic growth. This motivates a long-term conception of human development including *technophysio evolution* (Fogel, 2002). I then explain how the relation between human development and economic growth is characterized by a series of intergenerational market failures in human capital accumulation. Then the role played by early child development in intergenerational human capital formation is reviewed.

The second, empirical part of the paper, shows for the case of Mexico that the intergenerational human development traps discussed here actually exist. Thus I next discuss how empirical evidence for the existence of a poverty trap will be constructed. As far as I am aware, empirical counterparts establishing the existence of low human capital traps are absent in the literature. The possible market failures leading to the shortfall in human capital investment are discussed. Finally, the disappointing results of pro-market reforms carried out in Mexico are reviewed in relation to the ongoing poverty trap.

Nutrition, health and economic growth

In recent studies, health has joined education in a unified conception of human capital. Nobel Prize winning historical studies by Fogel (1991, 1992, 1994[a], 1994[b]) find that a third or even one half of the economic growth in England over the last 200 years is due to improvements in nutrition and health. Arora (2001) finds comparable results for seven advanced countries using 100- to 125- year time series

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microeconomically (Mincer, 1962, 1974) and macroeconomically (Mankiw, Romer and Weil, 1992). The complementary relation between human capital and the effectiveness of trade and FDI in promoting economic growth has been verified by Borensztein, De Gregario and Lee (1998), Cunningham (2002), Romer (1993), Schiff and Wang (2002), Xu (2000).

[3] For instance at the World Bank, see De Ferranti et al (2003).

of diverse health indicators. This line of research has concluded that the synergism between technological and physiological improvements has produced a rapid, culturally transmitted form of human evolution that is biological but not genetic. This process, which continues in both rich and developing nations is called *technophysio evolution* by Fogel (2002). The present day role of health in raising income and education has also been ascertained in a series of macroeconomic studies (e.g. Barro 1991; Barro and Lee, 1994; Barro and Sala-i-Martin, 1995; Barro, 1996; Knowles and Owen, 1995, 1997; Bhargava, Jamison, Lau, and Murray, 2000; Easterly and Levine, 1997; Gallup and Sachs, 2000; Mayer, 2001a; Mayer, 2001b; Sachs and Warner, 1995; Sachs and Warner, 1997). However, their microeconomic counterparts measuring the impact of adult health on productivity (e.g. Schultz, 1992, 1997, 1999; Thomas, Schoeni and Strauss, 1997; Strauss and Thomas, 1998; Savedoff and Schultz, 2000;) tend to find a smaller impact than could be expected from the macroeconomic and historical studies. Here we show that the impact of nutrition and health on the productivity of education and therefore on income is much stronger.

The momentous secular rises in stature, weight, life expectancy, education,[4] and in other human capabilities (Sen, 1999) such as cognitive development, fertility preferences, and ethical development, whose changes can only be surmised, give a whole new meaning to the concept of long-term *human development*, as a process of technophysio evolution to which are added the educational and cultural dimensions of achievement in the modern world. The scope for human development can of itself explain the universal emergence from stagnation to growth (Cervellati, 2003; Mayer-Foulkes, 2003b).

Human development and economic growth

Human development is typically subject to what may be thought of as a sequence of market failures that occur as development proceeds. These require public action to improve the efficiency and pace of the process. Several kinds of such barriers to human capital accumulation have been modeled theoretically. A first example, occurring at very low levels of income, is the possibility of a low productivity trap due to low nutrition, addressed by the efficiency theory of wages (e.g. Leibenstein, 1957; Mazumdar, 1959; Mirlees, 1975; Stiglitz, 1976; Bliss and Stern, 1978; Dasgupta and Ray, 1984, 1986; Dasgupta, 1991) whose study has documented substantial effects of nutrition on labor productivity (for surveys see Barlow, 1979; Martorell and Arrayave, 1984; Strauss, 1985; Srinivasan, 1992; Behrman and

[4] For example, average stature rose from 164 to 181 cm in Holland between 1860 and 2002 and from 161 to 173 cm in France and Norway between 1705 and 1975. Average weight rose from 46 to 73 kg in Norway and France, 1705 to 1975. Life expectancy rose from 41 to 78 years in England between 1841 and 1998; and from 29 to 60 years in India between 1930 and 1990. Schooling rose from 2.3 to more than 11 years in England between 1800 and the 1980's. (Fogel, 2002; Cervellati, Matteo and Uwe Sunde, 2003.)

Deolalikar, 1988). Arcand (2001) shows that nutrition has substantial effects on economic growth both directly and through life expectancy, and possibly schooling, and constructs evidence for a nutrition-related cross-country low income trap. A second kind of poverty trap, occurring at later stages, when education becomes important, is found in Galor and Zeira (1993), who show that increasing returns in skill acquisition leads to multiple equilibria in the presence of credit constraints to human capital accumulation. Under these conditions, the distribution of human capital is an important determinant of the pattern of economic development (Galor and Tsiddon, 1997). Azariadis and Drazen (1990) show that increasing social returns to scale in the accumulation of human capital may also lead to multiple equilibria. Durlauf (1996) and Benabou (1996) show that neighborhood choice in the U.S. according to school quality may also lead to persistent income inequality. Similar phenomena surely occur in relation to private and public schooling in underdeveloped countries. In more recent work, Galor and Mayer-Foulkes (2002) show that threshold requirements of nutrition and health for the acquisition of education may lead to persistent educational inequality at low and/or high levels of education. Other mechanisms that could lead to poverty traps in human capital accumulation include unequal inheritance of social capital, knowledge, and early child nurture and stimulation. These may be deficient in families with low levels of income and education and unavailable through the school system (Van Der Gaag, 2002). These problems may be more persistent in the presence of child labor traps (Emerson and Souza, 2003).

Thus the process of human development (including technophysio evolution) can be understood as an intergenerational cycle of investment in nutrition, health and education that is beset by market failures. This process provides the main economic inputs for production and technological change – labor, skills and knowledge – and is a determinant of capital accumulation. In turn, the intensity of intergenerational human development depends on the resulting income and technology levels (see Figure I). In a theoretical paper incorporating these assumptions, Mayer-Foulkes (2003) shows that the universal emergence from stagnation to modern growth is characterized by prolonged transition and stratification across countries.

To understand economic growth it is necessary not only to understand the positive forces that underlie it, such as human and physical capital accumulation and technological change, but also the negative forces that hold it back. Here we have been discussing one of the main examples –market failures in human capital accumulation, but there are others, such as institutional failures, and low technology traps that may result from knowledge thresholds (Howitt and Mayer-Foulkes, 2002) or underdeveloped financial systems (Aghion, Howitt and Mayer-Foulkes, 2003). These forces, due to market failures or to non convexities in production, accumulation or technological change, are strong enough to induce deficient steady states, causing poverty traps or slow transitions that prevent individual and country incomes from converging to higher equilibria. They account for the historical and present day divergence of global income levels (Pritchett, 1997; Quah, 1993;

Maddison, 2001; Mayer-Foulkes, 2002), and the possible presence of global convergence clubs (Mayer-Foulkes, 2001, 2002). To overcome these barriers, it is necessary to apply public policy. In the case of human capital, either institutions must be established or strengthened causing a sufficient flow of private funding for investment, or public funding must be put into place. Note that the hallmark of advanced countries' institutions is their ability to promote the functioning of the markets and to overcome economy-wide market failures.5 Specifically, public education and research systems have been crucial to capitalist development throughout its history.6

Pro-market reforms facilitating economic growth will only realize their full potential if they are accompanied by policies overcoming the market failures slowing economic growth, including those for human development (see Figure I).

The role of early childhood health in human capital formation

Work such as Fogel's (op. cit.) has focused attention on the secular rise in nutrition, health and longevity, its relation to economic growth, and on its interconnections with such indicators as stature and weight. Related research has found that most stature loss is determined irreversibly in the first two years of life, and is a predictor of life-long health and longevity (Schürch and Scrimshaw, 1987; Steckel, 1995). A wave of research has focused on the biological mechanisms through which these interconnections occur. These concerns have led to a focus on early child development (ECD), the combination of physical, mental and social development in the early years of life. Numerous links are now known between malnutrition, beginning in utero, early infection, the crucial period of brain development in utero and shortly after birth (Barker 1998; Ravelli, 1999), and such adult ailments as blood pressure, respiratory function, schizophrenia, diabetes, reduced stature as an adult, chronic bronchitis, acute appendicitis, asthma, Parkinson's disease, multiple sclerosis, chronic pulmonary disease, cardiovascular disease, coronary heart disease, and stroke (see Van der Gaag, 2002).

Programs in ECD stress the complementary roles that nutrition, health and education have in the formation of human capital.[7] They commonly address

[5] For a few examples in an endless list consider: Roosevelt's policies to end the Great Depression; the Marshall plan; the welfare state and Keynesian policies in their time (addressing amongst others imperfections in the labor, health and investment markets); and present day policies and regulation ensuring the functioning of the financial market place.

[6] Howitt and Mayer-Foulkes (2002) explain the great divergence in incomes that occurred from the late 19th Century in terms of the presence of such institutions supporting R&D. Maloney (2002) discusses how Latin America's paltry educational systems were one reason why it fell behind in the 19th Century, and conversely, how past and present economic growth successes in Australia, Canada and Scandinavia are related to public support of the education and innovation sectors. De Ferranti et al (2003) discuss various policies supporting education and technological change that may apply at different stages of development.

[7] I closely follow Van der Gaag (2002) in the following exposition.

nutrition, health, cognitive development, and social interaction of children in the early years (Myers 1992; Young 1997). Children participating in ECD programs receive psychosocial stimulation, nutritional supplementation, and health care, and their parents receive training in effective childcare. The importance of ECD for school performance and for the crucial rapid development of the brain is supported by extensive scientific evidence in neurophysics, pediatrics, medicine, child development, education, sociology and economics (Cynader and Frost 1999; Mc-Cain and Mustard 1999; Myers 1992; Young 1997). Children who have participated in these programs show higher intelligence quotients and improvements in practical reasoning, eye and hand coordination, hearing and speech, and reading readiness (Myers 1992). Grade repetition and dropout rates are lower, performance at school is higher, and the probability that a child will progress to higher levels of education increases (Barnett, 1995, 1998; Grantham-McGregor et al, 1997; Karoly et al, 1998; Schweinhart et al, 1993), consistently with the findings here on the impact of stature on school permanence. ECD also benefits life-long health. It is associated with decreased morbidity and mortality among children, fewer cases of malnutrition and stunting, improved personal hygiene and health care, and fewer instances of child abuse. ECD also leads to more socially adapted adults who are less aggressive, more cooperative (Kagitçibasi 1996; Karoly et al 1998), and show reduced criminal behavior and less delinquency, (Schweinhart et al 1993; Yoshikawa 1995; Zigler, Taussig, and Black 1992).

The effects of health and nutrition on education in developing countries have been studied in some detail in an attempt to detect specific links which may be addressed cost-effectively (World Bank, 1993). As part of the effort to improve and extend basic education services and to universalize primary schooling conducted by UNDP, UNESCO, UNICEF and the World Bank, survey studies have been undertaken on the consequences on education that low nutrition can have (Levinger, 1992). Nutrition and health pose the following obstacles to the *achievement of child quality* (a conceptualization of the objectives of education that echoes the essence of the concept of human capital formation). Temporary hunger is related to inattentiveness. Protein-energy malnutrition (especially in early childhood), often worsened by a child's parasite load, is significantly related to poorer cognitive and school performance, and to worsened general conceptual ability, problem solving, mental agility and capacity.[8] Micronutrient deficiency disorders also impair school performance. Iodine deficiencies are associated with reduced intelligence, psycho-motor retardation, mental and neurologic damage, and cretinism. Iron deficiency anemia, which affects 1.3 billion people, of whom 210 million are school age children, has been associated with lower mental and motor development test scores. Vitamin A deficiencies are associated with eyesight problems and other conditions. Helminthic infection generates very high levels of morbidity associated with impaired cognitive function, absenteeism, under enrollment, and attrition. Untreated

[8] See Pollitt (1984, 1990) for a review of many studies on the effects of pre-school malnutrition.

sensory impairment, such as vision or auditory problems constitute significant educational risk factors. 42.8% of the children under 5 in 21 Latin American countries show moderate and severe stunting, a clear sign of malnutrition associated with poorer educational performance.

In an extensive, up to date study also reporting on technological progress in the provision of vitamin and micronutrient supplements, The Micronutrient Initiative and United Nations Children's Fund (2004) report that as many as a third of the world's people do not meet their physical and intellectual potential because of vitamin and mineral (VM) deficiencies.[9] At the same time, they report that "controlling vitamin and mineral deficiency is an affordable opportunity to improve the lives of two billion people and strengthen the pulse of economic development."

These are the types of mechanisms through which childhood health affects later health and education. Clarifying the origin of the income gradients observed in adult health, Case, Lubotsky and Paxson (2001) and Case, Fertig and Paxson (2003) find that early childhood health is a critical link through which household wealth is transmitted to the next generation, forming the basis for future adult income and health (See Figure II). In the empirical study, I use stature as a direct indicator of early child nutrition, or more generally early child development. It is found to play an important role in the intergenerational transmission of poverty.

Empirical evidence for a low human capital trap

The concept of a poverty trap is very well established in the economic literature on poverty and development and is usually based on the existence of convexities and market failures. Nonetheless, the empirical counterpart to this concept is almost absent in the econometric literature. Estimates exist on the determinants and mechanisms of poverty and the economic discussion includes many references to

[9] Verbatim from the report, iodine deficiency is estimated to have lowered the intellectual capacity of almost all of the nations reviewed by as much as 10 to 15 percentage points. Iron deficiency in the 6-to-24 month age group is impairing the mental development of approximately 40% to 60% of the developing world's children. Vitamin A deficiency is compromising the immune systems of approximately 40% of the developing world's underlives and leading to the deaths of approximately 1 million young children each year. Iodine deficiency in pregnancy is causing almost 18 million babies a year to be born mentally impaired. Folate deficiency is responsible for approximately 200,000 severe birth defects every year in the 80 countries for which Damage Assessment Reports have been issued (and perhaps as many as 50,000 more in the rest of the world). The deficiency is also associated with approximately 1 in every 10 deaths from heart disease in adults. Severe iron deficiency anemia is also causing the deaths of more than 60, 000 young women a year in pregnancy and childbirth. Iron deficiency in adults is so widespread as to lower the energies of nations and the productivity of workforces - with estimated losses of up to 2% of GDP in the worst affected countries. "Vitamin and mineral deficiencies," says the World Bank "impose high economic costs on virtually every developing nation." In practice, vitamin and mineral deficiencies overlap and interact. Half of children with VM deficiency are in fact suffering from multiple deficiencies - adding up an immeasurable burden on individuals, on health services, on education systems, and on families caring for children who are disabled or mentally impaired.

poverty traps and market failures, but there are very few, if any, specific empirical demonstrations that these exist.

An example of a typical poverty trap is provided by Galor and Zeira's (1993) credit constraint trap in human capital accumulation. However, besides the concept of a poverty trap, there are two other related concepts. The first is a *dynamic poverty trap* and the second is a *prolonged transition*. A dynamic poverty trap is a situation in which multiple steady states exist, as in a poverty trap, but in which the variables defining these steady states, such as income, human capital or technology, are subject to long-term growth. Income in a low equilibrium may grow but experiment a permanent proportional lag – or worse –to income in a higher equilibrium. Examples of dynamic traps are provided by Howitt and Mayer-Foulkes' (2002) and Aghion, Howitt and Mayer-Foulkes' (2003) models of technological convergence clubs. In these models growth in the leading technological edge drives growth in each of the multiple steady states through technological transfer. The lower equilibria grow at rates slower or equal to the higher equilibria, therefore defining dynamic traps.

The concept of prolonged transition is weaker than the concept of a static or dynamic poverty trap, and refers to dynamics that may remain for a long-time near what is almost a steady state, with faster growth then occurring along the transition to a higher steady state (as in Kremer, Onatski, and Stock, 2001[10]).

How do these concepts apply in showing the existence of a human capital poverty trap in Mexico? Since market failures slow the transition to an equilibrium, I shall refer to an empirical situation of systematic, prolonged, under investment in human capital as a prolonged transition. The transition corresponding to the perfect market counterpart would be faster. If the convexities or market failures are strong enough, theory predicts that lower equilibria will appear, which may be static or dynamic. Here the concept of dynamic trap is useful in that it removes the objection that in a poverty trap there must be absolute stagnation. Empirically, what must be shown is evidence for multiple equilibria. This is provided, for example, by multiple peaks in the distribution of schooling, or by evidence that no transition is occurring from lower to higher levels of education, in particular, that *privately funded* increases in schooling are negligible at lower steady states.

Part of the difficulty of showing the existence of a human capital poverty trap lies in the intergenerational nature of human capital accumulation, since the education and health of the young is determined by the wealth, health and education of their parents. These interrelationships are difficult to disentangle. The long-term nature of these processes means that the appropriate data is not usually available and that the theoretical concept, especially of a poverty trap, is limited to playing the role

[10] These authors propose that countries remain in a poor steady state while they search for the appropriate institutions (property rights, a market economy and so on) to foster growth. Once the search is successful, convergence to a higher steady state becomes possible. It is appropriate to add that it is necessary to select not only institutions enabling the positive forces of economic growth to function, but also institutions that can successfully address market failures and overcome traps.

of a parable. Microeconomic data do not usually include, for example, parental educational level and place of birth for present-day workers.[11] Under these conditions strategies for constructing empirical evidence for possible poverty traps or slow transitions are very much dependent on the available data.

To construct evidence for the presence of a low human capital trap (which may or not be dynamic) in Mexico, I decompose the concept of a poverty trap in the acquisition of health and education – the main dimensions of human development – into its *constituent elements* and find empirical support for the existence of each. In view of the lack of more specific data on human capital investment problems, an appeal to theory argues that a class of market failures must be present to explain the empirical findings. Childhood nutrition turns out to play an important role for education, and to hold a key for overcoming the barriers to higher secondary and tertiary education.

To test for the presence of a human capital poverty trap in Mexico, I find empirical evidence for the following constituent elements:

- Increasing returns to education in adult income (the essential assumption in Galor and Zeira, 1993).
- Substantial returns to children's health in the acquisition of education, as measured by school permanence (the essential assumption in Galor and Mayer-Foulkes (2002).
- Transmission from parental wealth, health and education to the health and education of their young (an essential assumption in any intergenerational model of human capital accumulation).
- The increasing returns just mentioned above hold at higher educational levels than those achieved by most of the population.[12]

Conceptually, these constituent elements imply there is a functional relationship between parental wealth (including human capital assets) and their children's future income which has a region of increasing returns. The only remaining distinction between a poverty trap and a slow transition is whether multiple equilibria actually exist or not. The following evidence to distinguish between these two alternatives, based on the study of eight national surveys[13], is provided:

[11] The benefits for understanding poverty of including intergenerational data, as well as stature and other health indicators, in demographic, health and economic surveys, would be enormous.

[12] Regressions not reported here also support increasing returns to parental education in the acquisition of education, in the sense that parental support for their children to reach their own level of education is significantly higher. A poverty trap model can be built on this assumption alone.

[13] The seven ENIGH income and expenditure surveys in the period 1984 to 2000 and ENSA 2000.

- The distribution of households according to spouses' education is multiple-peaked, with the main separations occurring between lower and higher secondary schooling.
- Changes in the distribution of schooling in the low group have occurred almost exclusively in response to the increased availability of public schooling.

Thus, the main empirical findings are the following. 1) Education has increasing returns for adult income. 2) Early childhood health has a strong, probably causal relation on permanence in school throughout the educational career. 3) The population classifies itself into two social classes, those with lower secondary schooling or less, and those above. Investment in schooling in the lower group mainly responds to public investment in education.

Each of these findings is supported by other studies. First, increasing returns to education in Mexico are confirmed by Zamudio (1999), Angulo and Velazquez (2000), Mayer-Foulkes and Stabridis (2003), De Ferranti et al (2003, page 88) and Legovini, Bouillon and Lustig (2001).

Second, a series of studies support the strong relation between nutrition and education found here.[14] Moock and Leslie (1986) and Jamison (1986) find that taller children complete more grades than shorter children in Nepal and China respectively. Glewwe and Jacoby (1995) find that delayed enrolment is caused by the effects of nutritional deficiencies in early childhood on "child readiness" for school. Glewwe, Jacoby and King (2001) find that early child nutrition is an important determinant of academic achievement. In a recent study using the Mexican Family Life Survey on Mexico which includes cognitive data as well as parental environmental background factors, Rubalcava and Teruel (2004) show that stature significantly influences mother's cognitive ability, and that this in turn has a more significant impact on the acquisition of children's stature than mother's stature. Thus early childhood development as reflected in stature is an important determinant of the intergenerational transmission of cognitive ability and health. These mechanisms through which nutrition affects educational investment and its effectiveness may lie behind its effects on school permanence studied here. The strong impact that nutrition has on education makes it an important link in the intergenerational transmition of wealth. The large magnitude of the impact of early childhood health on schooling and therefore on adult income is confirmed in a study based on the 1958 National Child Development Study, which has followed all children born in Great Britain in the week of March 3, 1958 from birth to age 42 (Case, Fertig and Paxson, 2003). These authors find, as here, that "controlling for parents' incomes, educations and social status, that children who experience poor

[14] A Markov matrix transitional analysis of the distribution of schooling based on the current transmission from household heads to children presented in a previous version of this paper also supports the presence of a barrier at lower secondary schooling. However, it is based on more assumptions than the evidence presented here.

health have significantly lower educational attainment, and significantly poorer health[15] and lower earnings on average as adults".

The presence of a barrier to higher secondary schooling is supported by a series of other studies, for example De Ferranti et al (2003, page 86), who argue that in most Latin American countries there is a 'bottleneck' at secondary education.

The impact of nutrition improvements on the distribution of schooling is quite different than the profile of the current impact of public schooling programs, since it involves considerable increases in higher education. A back of the envelope calculation below shows that nutritional supplementation programs are viable just from the ensuing gains in education and go a long way in explaining the long-term impact of nutrition and health on economic growth. Thus improving child nutrition and early child development provides a viable economic policy for improving human capital formation and weakening the hold of the human capital trap.

The main implications of the empirical work are the following:

- Social welfare can be improved by promoting the education of the majority of the Mexican population, which under invests in human capital.
- Improvements in early child development, which are subject to under investment, will promote education and will help to overcome the barrier to higher education.[16]

The empirical evidence supports the existence of a poverty trap in Mexico. The bulk of the population is unable to invest enough in nutrition and schooling to benefit from the higher returns to higher education.

Possible market failures

From the point of view of economic theory, it would be simplest if babies were born with a bank account and an omniscient trust manager took their decisions as to how much to invest in food, medicine, stimulation and schooling, so as to maximize their expected utility. According to received theory, *any* important and systematic deviation from this standard is due to some kind of market failure such as imperfect credit or missing markets, has important consequences for social welfare, and justifies public policies to bridge the necessary funding. Of course, any such attempt must be tempered by the efficiency problems inherent in public policy implementation.

It is argued theoretically below that the main possible explanations are market failures[17] including the following.

[15] The impact of early childhood health on adult health is not studied in this paper.

[16] According to unreported regressions, education of the young beyond the level achieved by their parents, at which point there appears to be a barrier to continuing education, must also be promoted.

- Imperfect parenting: parents unavailable, malnourished, unhealthy, unknowledgeable or uncaring.
- Credit constraints, or the impossibility to acquire: nutrition, health, education and complementary inputs to education such as capital, social capital, or early child development. These are accentuated by indivisibilities present in the educational system.
- Uncertainty or lack of information or foresight on the benefits of early child development: nutrition, health and education.
- Excessive impatience or risks due to poverty.
- Unavailability of necessary public goods in health or education.

Pro-market reform and human capital market failures

How do pro-market reforms work in the presence of human capital market failures? How do they affect the poor? Our conceptual framework (see Figure I) points to some of the answers. Assume that pro-market reforms lead to rises in production and technological change, and to higher returns to human capital. There will be higher incentives and more resources for investment in human capital. Families in higher equilibria who already supply human capital will benefit both in the present and in the future. Families in lower equilibria will benefits less in the present, and if these benefits are insufficient, they will not supply additional human capital in the future either. Inequality will increase and the growth process – which could yield accelerated convergence to a higher steady state – will subside.

The presence of this process of interaction between pro-market reform and human capital accumulation in the period beginning with Mexico's entry into GATT in 1986 and culminating with the North American Free Trade Agreement (NAFTA) is described by Legovini, Bouillon and Lustig (2001), who show that the rise in returns to tertiary education in Mexico has increased income inequality. It is generally accepted that this rise in returns in Mexico and other Latin American countries is due to increased demand for skills. A structure of increasing returns for education in Mexico has been present since at least 1984 (Zamudio, 1999; Angulo and Velazquez, 2000; Mayer-Foulkes and Stabridis, 2003; De Ferranti et al, 2003, page 88, Legovini, Bouillon and Lustig, 2001).[18] The returns to higher education increased through several mechanisms induced by skill-biased technological change and opening to trade and investment, both of which have been promoted by pro-market reforms (De Ferranti et al, 2003, Chapter 3; Hanson and Harrison, 1995; Revenga, 1995; Tan and Batra, 1997; Cragg and Epelbaum, 1996; Robertson, 2000).

[17] I use "market failure" as a general term to mean that organization through markets fails for reasons including: missing markets, perhaps due to the absence of institutions creating or strengthening them; convexities in the utility or production functions, and so on.
[18] This implies that the parents in our sample who did not invest in higher education for their children could have had the foresight to do so.

However, even though these higher returns should have lead to higher investment in higher education, evidence presented below shows that this investment did not occur. As Scott (2003a) notes, NAFTA has failed to deliver the accelerated convergence predicted by traditional growth and trade theory. These benefits have occurred in fairly comparable countries such as Portugal. Yet in Mexico, the post-NAFTA period has been characterized by regional (north-south), sectoral (urban-rural) and even intra-sectoral polarization, and increasing income inequality at the household level. According to Scott (2003a), convergence failed to materialize because of a deficit in human capital, a lack of infrastructure, and poor institutions.[19] Market failures in human capital investment, as well as poor provision of public goods and poor institutions, have limited the benefits of reform.

Human capital traps and economic policy

The recognition of the existence of market failures and traps in human capital accumulation involving most of the population has important consequences for policy. The main one is that pro-market reform must be complemented by policies promoting human capital investment, beginning with health and nutrition (or ECD) for the young.

Human capital traps also have consequences for optimal taxation. The conclusion that capital (as opposed to labor) must not be taxed, changes when human capital accumulation is considered (Lucas, 1990; Pecorino, 1994; Stokey and Rebelo, 1995; Kim, 1998; Hendricks, 1999; Grüner and Heer, 2000). Under these conditions it may be optimal not to tax salaries (Gómez-Suárez, 2004), especially of the poor. Optimal educational subsidies and taxes on food and medicine will also be quite different.

The presence of credit constrained families investing as much as possible on their children also surely has consequences for optimal macroeconomic policies in the presence of income shocks. The expenditure of credit constrained families is much more susceptible to income fluctuations and thus multiplies the negative economic and welfare effects of macroeconomic shocks or shock treatments.

Much of the controversy that exists concerning globalization and the market policies proposed by the leading international economic institutions would at least be partly resolved if their economic models and policies truly acknowledged the existence of economy-wide traps and multiple equilibria. In particular, people subject to a human development trap will experience pro-market policies as unfair if these do not address overriding market failures, because the reform benefits will tend to accrue to people in higher equilibria not subject to them.

The rest of this article contains the empirical results and is organized as follows. First the data is reviewed. Next the estimates are described, presented and

[19] Of course, achieving convergence in the European Union is facilitated by a series of programs in regional and infrastructure support and by the free flow of labor.

discussed, showing how these support the presence of human development traps in Mexico. Finally the conclusions are stated.

The Data

The 2000 National Health Survey (ENSA 2000) includes the following variables for household members 12 years and older: height; gender; age; income and type of work; health insurance; health institution preference; educational level; first language; as well as household composition; type of construction (walls, roof, floor, finishings, kitchen, number of rooms, water source, bathroom, drainage); electricity; telephone. Stature was the main health variable used, although parental weight was also used as a control.[20] Most other health variables in the survey reflected recent medical treatment not covering every individual and were therefore not used.[21]

The relevance of stature as an indicator of population-wide welfare has been extensively studied (see for example Steckel, 1995). Height is known to reflect early childhood nutrition and to predict life-long health. Glewwe and Jacoby (1995) and Larrea, Freire and Lutter (2001), for instance, show that stunting due to malnutrition becomes established in the first 2 to 3 years of life. Stunting has been shown to be cumulative and non-reversible and therefore provides an excellent if perhaps noisy measure of chronic malnutrition and its effects.

Two databases were constructed using the ENSA 2000 data, one for adults (aged 20 and above) and one for adolescents (12 to 19 year olds) containing 42,970 and 19,493 observations respectively including both health and education. The data base for adolescents includes parental characteristics. It is worth mentioning that, by comparison with the 2000 National Income and Expenditure Survey (ENIGH 2000), the ENSA 2000 survey underrepresents an already small sample of male household heads with higher education. Compared to what would be predicted by the ENIGH sample, the ENSA sample contains only 48% of male household heads with 17 years of schooling (1,102 observations) and 77% with 19 years of schooling (74 observations).

Econometric Analysis

The analysis consists of three parts. The first is a fairly standard Mincerian estimate including health, showing that schooling has increasing returns for adult income. The second is a probit analysis of decisions for the young to continue in school for further three year periods from lower primary to higher secondary school. The results show that early childhood health plays a strong, probably causal role in

[20] Jamison (1986) and Moock and Leslie (1986) find height for age is more closely associated with school performance than weight for height, which measures acute malnutrition.
[21] Note that the absence of appropriate health status indicators results in a higher emphasis on nutrition, as compared to health, than may be warranted.

school permanence. These two analyses imply that there is significant under investment in education and nutrition. Possible market failures holding up human capital investment are discussed. The third is an analysis of the schooling distribution showing that its shape and dynamics conform to the presence of a human capital accumulation trap in Mexico. Finally, the role that nutrition may play as a policy lever for education is briefly evaluated.

Adult income estimates

The returns to education and health in adult income were evaluated using Mincerian (1962, 1974) regressions. These are carried out for each gender separately. It is customary to instrument for health, because this variable may be jointly determined with education (Schultz, 1997; see Savedoff and Schultz, 2000 for details). In this case, however, since the variable representing health is stature, its instrumentation was found to be either unnecessary or infeasible. The reason is that adult stature conveys information about conditions far in the past, which reduces the endogeneity problem, and that health instruments were only available for the present and were not very powerful. To control for local conditions that could be correlated to both income and health, however, local fixed effects referred to municipal residence were included. It is also customary to correct the estimates for selection bias due to labor participation, using the Heckman correction method for example (again see Savedoff and Schultz, 2000 for details). Two specifications were used for the selection correction, which was nevertheless not very reliable for men or for women. However, the qualitative nature of the results was robust to all of the specifications, and coincides with those obtained by other authors. Other problems that may arise in the estimation include heterogeneity and unobserved variables, such as family background and ability. To control for these the following variables were included: type of employment and indigenous language dummy; wealth variables such as type of walls, roof, floor, water supply, drainage, number of rooms, presence of electricity, telephone and kitchen. Many of the control variables for wealth obtained significant coefficients. These control for assets other than education that may be contributing to income. Instrumental variables may also be used to address these problems. Using family background instrumental variables, Patrinos (2003) finds slightly higher earnings (10%) for education. Overall, our results are fairly standard and are supported by other research in the literature (cited below). The variables and regressions were defined specifically to obtain *marginal returns* for human capital assets, by interacting the health and experience human capital variables with dummies for the three year educational levels and by assigning to each adult a system of ‘marginal educational dummies’ each of having a value of one for *each* completed educational period.[22]

[22] Thus an adult having completed lower but not higher secondary school would have a 1 in the ‘marginal dummies’ for incomplete or complete primary and lower secondary and a zero for the

The results of the income regressions can be seen in Table I. The main finding is that the returns of additional three-year periods of education and its associated complementary inputs are increasing for both men and women after completed lower secondary schooling. Two standard deviation corridors for the coefficients are shown in Figures III.1, III.2.[23] The returns to health are small but significant and similar to those found in other microeconomic studies (Savedoff and Schultz, 2000), yielding a maximum of about 1% increase for stature increases of 1 cm. They show no clear tendency according to educational level (Figures III.3, III.4). These findings are obtained consistently in the OLS regressions and in both applications of the Heckman selection correction model.

Good instruments for why women or men might decide to participate or not in the labor workforce are unfortunately not available. The main instruments used in the selection equation were number of dependent children and number of dependent adolescents. The first application includes the human capital variables in the selection equation, while the second excludes them. The results are in the last four columns of Table I.[24] In both cases the selection correction was insignificant for men, as is to be expected since most men work, so that the OLS estimates are more efficient and therefore to be preferred. For women, on the other hand, the selection correction was significant in both cases, with different implications with respect to the role of human capital. When human capital is included in the selection model 'Heckman I', it appears significantly and therefore the estimation of the productivity of female human capital is corrected downward. In the second application, 'Heckman II', these variables are not included in the selection model and are therefore corrected upwards. If it is believed that more educated women participate more in the labor market because they are more productive, schooling should not be considered to bias the productivity estimates. Then the Heckman II model, whose estimates of female productivity more closely correspond to the estimates of male productivity, is more reliable. If instead it is considered that the educational indicators are signals for ability, and that therefore the productivity estimates are biased upwards, then additional indicators of ability would be needed for the correction, but these are unavailable. The OLS estimates lie in between the two Heckman estimates and therefore also seem the most reliable in the case of women. In a study on Mexico by Zamudio and Bracho (1994), the Heckman correction is found to increase the returns for women and urban zones.

The experience variables, when significant, exhibit the expected signs. These variables are not significant for lower levels of education, when health and strength can be expected to be more important to labor capacity and may be inversely related

higher secondary dummy. The marginal returns for education remain almost identical if stature is not interacted with the educational dummies, implying that their estimate is unaffected by the possibly nonlinear returns to stature.

[23] The t-statistic testing the schooling coefficient relations $C_{15\text{ or more}} \geq C_{12\text{ or more}} \geq C_{9\text{ or more}}$ for the OLS income regressions in Table I are 3.95, 3.025 for women and 8.14, 1.93 for men.

[24] The selection regressions are available form the author in Tables I′ and I″.

to experience. If this is the case, the expected sign for experience would be negative. This can explain its insignificant results for low levels of education, and would also bias the coefficient for stature downwards, since stature is correlated with age.

Increasing returns to education are found in several other studies on Mexico, as mentioned above. Zamudio (1999) and Rojas, Angulo and Velázquez (2000) and De Ferranti et al (2003, page 88) also find increasing returns to human capital since at least 1984 (see Tables II.1 to II.3). Results by Mayer-Foulkes and Stabridis-Arana (2003) based on seven ENIGH surveys estimating marginal returns to education are shown in Figure IV; marginal returns to tertiary education are higher than for other levels and tend to increase during the period.

Adolescent schooling decision estimates

Preliminary examination of the distribution of schooling by ages for the ENSA 2000 sample of children and adolescents shows that the young drop out of school mostly at the end of primary, lower secondary or upper secondary school, as expected. Schooling has definite jumps at 6, 9 and 12 years of education. The critical decisions for achieving schooling occur at the end of these educational cycles and consist of deciding to continue on a further three-year period of schooling. They are thus best represented as separate 0-1 variables for subsequent stages of education. Hence probit regressions were estimated to study the impact of child nutrition, and parental schooling, income and wealth, on the decision to acquire a further three years of education.[25]

In the ENSA 2000 survey, stature is only available for adolescents, and not for children. Thus to evaluate the schooling decisions of the young in a homogeneous manner, I choose the sample of 17 to 19 year old adolescents to analyze the probability with which they continued on a further three years of study. I thus have a homogenous group of people born between 1980 and 1982 whose educational career can be followed and who are still at home so data is available on their parents. Most of the people in the sample started primary school at 6 or 7, so schooling decisions up to higher secondary are well represented in the sample. Chronic malnutrition is definitely present in the sample. Weighting for representativity, 20.3% of the women and 18.1% of the men aged 17 to 19 had height for age Z-scores less than –2.0.

For each adolescent i, the following variables J_{bi} are defined to indicate when a further three year period of study was attempted, given that the child entered the previous three year period:

[25] A multiprobit on schooling is not appropriate because the educational decisions are not simultaneous but sequential and therefore independent. The relation between subsequent educational decisions is also quite nonlinear (as would be predicted by a poverty trap model). Although this multiprobit was nevertheless attempted, it did not converge.

$$J_{bi} = 1 \text{ if } s_i > b, J_{bi} = 0 \text{ if } b-3 < s_i \le b,$$

with J_{bi} defined as missing if $s_i \le b-3$, where s_i is the adolescent schooling level (so that the sample is $s_i \ge b$), and b = 3, 6 and 9, corresponding to continuing into higher primary, lower secondary and higher secondary school.

The probit estimate is the following.

$$P(J_{bi} = 1) = F(\mathbf{X}_i, Gender_i \times \mathbf{X}_i, \mathbf{W}_i, \eta_{\text{mun}(i)}) \quad (1)$$

The variables $\mathbf{X}_i$ include children's stature, constant and age dummies, mother's and father's schooling, total household income, mother's proportion of income, non parental proportion of income and number of children. In a final set of regressions, $\mathbf{X}_i$ included in addition one parent's stature and weight. ENSA 2000 only contains this information for one adult, so a dummy was included indicating the gender of this adult. $Gender_i$ is a gender dummy, and each of the variables in $\mathbf{X}_i$ was interacted with $Gender_i$. The variables $\mathbf{W}_i$ include indigenous language dummy; wealth variables including type of walls, roof, floor, water supply, drainage, number of rooms, presence of electricity, telephone and kitchen.[26] The variable $\eta_{\text{mun}(i)}$ represents municipal fixed effects defined by residence. These control at least partially for local availability of schooling and health services and for local differences in wealth, tastes for child rearing and so on, for example defined by Mexico's diverse cultural geography. Since current parental nutrition and health decisions have a negligible impact on child stature, parental weight variables control for the ability and taste for producing nutrition at the family level which could be correlated with educational ability , while the parental stature variables control for long-term nutritional and health assets, possibly inherited in the parents' family of origin.

Two main econometric issues arise with the use of stature as a health indicator. The first and most prominent, as it turns out, is that stature is a very noisy health indicator. For instance, Glewwe, Jacoby and King (2001) find in their sample that a regression of current children's stature on stature at age two, age and sex has an R^2 of only 0.49, just the right amount of noise to explain the huge bias toward zero of their OLS as compared to their instrumented coefficients for stature, a common finding for stature. The second is endogeneity, arising because health and education investments may be determined simultaneously. This issue is described by Schultz (1997) and Savedoff and Schultz (2000), who recommend using health policy variables as instruments if possible. In the particular case we are concerned with, two factors reduce the endogeneity issue. First, much of the effect of nutrition on stature is determined before the age of three (Glewwe and Jacoby, 1995; Larrea,

[26] Interacting each of the variables in $\mathbf{W}_i$ with $Gender_i$ would sacrifice too many degrees of freedom. Instead it may be thought that some of the wealth variables, such as those related to kitchen and water availability or to wealth in general are sufficiently related to ongoing gender distinctions and discrimination that the full set in fact adjusts for gender effects.

Freire and Lutter, 2001; Schürch and Scrimshaw, 1987), while the educational decisions we study occur later on in childhood and hence are influenced by independent events, reducing the correlation of errors.[27] The second is the educational variable used here is a binary decision variable. Thus the correlation between its errors and stature will concentrate on a much smaller region and therefore be much smaller than in the case of a continuous variable.

The estimates deal with the noise and endogeneity issues together by instrumenting stature. This requires instruments correlated with stature but not directly influencing decisions on education. To choose them, we rely on the observation that stature is mostly determined in early childhood, before the educational decisions studied here are made. By age six, much of the variation in stature has been determined by genetic factors, the history of nutrition and health inputs, and illness. The instruments used were membership and preferences over public health insurance institutions as available in the dataset. The membership variables were dummies running over the following health insurance categories: IMSS, ISSSTE, PEMEX, SEDENA, SEMAR, Private-Worker, Private-User, State and none. The preference variables were dummies running over: IMSS, ISSSTE, PEMEX, SSA, IMSS-Solaridad, Private-Worker, Private-User, none and other. Some of these institutions, mainly IMSS, also provide early child care services that may be correlated with education decisions. A child that has received child care service may be more likely to continue on to school. Therefore we chose for instruments sets that survived the Basman-Sargan test for overidentifying restrictions, meaning that the instruments had no significant effects on education that did not work through stature.

Some additional comments on the instrumentation can be made. First, since the probit estimate is nonlinear it may be more appropriate to think that in the first stage a less noisy and less endogenous component of stature indicating nutrition and health was constructed, to be used *instead* of rather than to approximate the original, noisy indicator. Second, in constructing this component, the parental stature[28] and weight variables were excluded. This made the final results more significant because by excluding these variables, the noise related to the genetic endowment of weight and height was excluded. Instead, the selected component, a linear combination of economic and health service variables *only*, picks up the economic and health component of stature.

Three sets of probit estimates (1) were performed for adolescents to examine the decision to continue from lower to higher primary, primary to lower secondary, lower to higher secondary and higher secondary to tertiary schooling. The first set was not instrumented while the second and third sets were. The second set excludes

[27] This argument is also made by Glewwe and Jacoby (1995), who find for their database that most of the shortfall in height for age Z-score occurs before the age of two. Also, Martorell et al. (1990) find that, across the population, stature at age 5 is not correlated with changes in stature after age 5.
[28] A possible instrument.

and the third set includes parental stature and weight variables as controls for parental abilities, tastes and (possibly genetic) assets for nutrition and health.

The instrumented results are presented in Table III.[29] Variables other than stature obtaining significant, credible results were the following. Male adolescents are less likely to continue to higher secondary school when mother's proportion of income is high (4% to 6% significance). Adolescents are less likely to continue to higher secondary school when the proportion of income not provided by household head and spouse is high (better than 1% significance), but concomitantly it is more likely that younger males continue to upper primary school than females (9% significance). Mother's schooling contributes to females' continuing to higher primary and lower secondary, and father's schooling to males continuing in school (both better than 1%). Father's schooling contributes to continuing to higher secondary schooling in the case of both genders (better than 1%). When the household reports more children, it is more likely that more stages of schooling will be attempted (1% at lower levels, 4% for higher secondary) although this is somewhat less true for males at lower levels of schooling (4%). Parental stature variables are mostly less significant than parental weight variables, which is consistent with weight reflecting current conditions as they affect the children (the significance pattern is hard to interpret). Other variables obtaining positive significant (better than 10%) results include indigenous language dummy; kitchen; number of rooms; electricity; wood, tile or other finishings. Variables obtaining negative significant results include wooden, adobe or non reported housing walls; cardboard, metal sheet or, asbestos sheet roofs; earthen or non reported floors; septic tank, non reported or no drainage.

Because income variables are not very significant (except for mother's presence at home or employment of some of the children) the credit constraint hypothesis does not receive strong support.

For the results on stature turn to Table IV, which compares the three sets of regressions, includes the marginal probabilities associated with a 1 cm increase in stature, and presents the Wu-Hausman test for endogeneity and the Basman-Sargan tests for overidentifying restrictions. The first observation is that there is a considerable rise in the magnitude of the stature coefficients when this variable is instrumented, as is common in many studies. Although the individual significance of the stature variables falls, the joint significance remains better than 1% after instrumenting in all cases. Once the marginal probabilities are calculated (recall the probit is non-linear) the 90th percentile level rises from about 1% to 4% and above in all cases. The next observation is that when parental stature and weight variables are introduced as controls, the magnitude remains stable for continuing to higher

[29] The first stage regressions are available from the author (Table III′). Amongst the significant variables are gender, mother's schooling, household income, mother's proportion of income, proportion of income not parents', indigenous language dummy, number of rooms, telephone, and several of the instrumental variables, IMSS and PEMEX coverage, and preferences for IMSS, PEMEX, SSA, IMSS-Solidaridad.

primary or lower secondary but somewhat decreases for continuing to higher secondary school. I therefore regard these results as my preferred, conservative estimate on the effect of stature on the decision to continue in school. In this case the Basman-Sargan test shows that the instruments do not affect success in school through any other channels than stature, while the Wu-Hausman reject exogeneity of stature except for continuing to higher secondary schooling. Thus in the case of continuing to higher primary or lower secondary the instruments are mostly correcting for noise. In the case of higher secondary, when in fact parents must exercise a more purposeful choice[30], they are also correcting for some degree of endogeneity. These results also hold for the case when the parental stature and weight variables are not included as controls, except for the Basman-Sargan test. In this case, if the 'culprit' instruments are eliminated the coefficients remain almost identical in magnitude, with a somewhat reduced significance.

There are some additional issues to consider in measuring the impact of nutrition on school permanence by using stature as an indicator. However, their solution involves data requirements that escape the possibilities of the ENSA 2000 dataset used here. The use of this data, however, is essential for determining the state of the human development process *in Mexico*. However, comparison with two very closely related studies on nutrition and education to evaluate the possible biases that may be present in the estimation due to deficiencies in this data supports the validity of the present results.[31] The first, Glewwe and Jacoby (1995), studies the effect of stature on school enrolment age in Ghana. It finds that delayed enrolment is caused by nutritional deficiencies in early childhood, the main link being "child readiness" for school.[32] The second, Glewwe, Jacoby and King (2001), studies the role of early childhood nutrition on academic achievement in the Philippines. Both studies conclude that stature is a good indicator for early child nutrition and that early child nutrition has a significant effect of a considerable magnitude on the productivity of education. The authors conclude that early childhood interventions in nutrition and health can lead to substantial increases in lifetime wealth.

Both these articles amply discuss the econometric problems involved in using stature to estimate the effects of early nutrition on measures of educational

[30] Primary school was 'obligatory' for all children in the sample. Lower secondary school became obligatory in 1993, before most of the children in the sample graduated from primary school.

[31] As Behrman and Deolalikar (1988) state in the Handbook of Development Economics, the "catalog of possible estimation problems is *not* meant to lead to despair about the possibility of learning anything systematic about health, nutrition and development…" Instead, applied studies should "…control for the most probable difficulties, see what difference they make, …replicate studies" for robustness, and "be aware of the range of possible problems and try to judge how important is each."

[32] The authors construct a theoretical model to show that it may be rational to delay a malnourished child's enrolment in primary school until her physical and mental development compensates for her initial retardation. Their model is appropriate for the present study since it implies that low nutrition leads to fewer years of schooling as well. Note that school delay poses a clear problem in human capital theory since in the absence of nutritional problems it would be less costly to send a child to school as early as possible, when the value of the child's time is lower.

achievement. In both studies, enough intra household information is available to control for several sources of possible spurious correlation between nutrition and investment in education. Parental allocations of nutritional inputs could conceivably respond to unobserved variation in learning efficiency, such as child ability or motivation, both across and within households. Parents with a high taste for child investment may provide their children with better nutrition as well as better education. Thus unobserved child or household-specific factors may affect both nutrition and school permanence, leading to correlation even though no causation exists. Both articles control for these possible problems and find a large effect of stature on educational attainment. An idea of their magnitude can be obtained as follows. Glewwe, Jacoby and King (2001) find that a 2 cm increase in stature obtained by nutritional supplementation given to malnourished children (Z-scores less than –2.5) would result in a gain in academic achievement equivalent to about 1.2 years of schooling. Similarly, the results in Glewwe and Jacoby (1995) imply that a 2 cm rise in average stature would have a marginal effect on child delay equivalent to doubling expenditures or to increasing mother's schooling by three and a half years.[33]

Because the school permanence estimates presented here do not control for fixed child or household effects, it is important to obtain an idea of how much this omission might bias the stature coefficients. Fortunately, a comparison is possible with the Glewwe and Jacoby (1995) study on delayed primary school enrolment. Of course, there are difficulties involved in comparing studies carried out in countries as different as Ghana and Mexico. Moreover, a direct coefficient comparison for stature is impossible because primary enrolment decisions are different to continued education decisions. Nevertheless, the nature of these decisions is similar enough for it to be plausible that the ratio (relative magnitude) between the stature and the mother's schooling[34] coefficients should be similar. Table V compares the coefficient ratios obtained in this study (with stature coefficients rescaled to female Z-score coefficients) and the two results in Glewwe and Jacoby's (1995) study for which the two necessary coefficients are reported, corresponding to a full instrument set (preferred) and to a reduced one. The similarity between the ratios obtained for delayed enrolment in primary by Glewwe and Jacoby (1995) and for continuing to upper primary or lower secondary in our study are remarkable. They are within 10% of each other. Our stature coefficients might be slightly biased upward according to this comparison. On the other hand, Glewwe and Jacoby's (1995) also compare their

[33] The coefficients for schooling delay obtained in the main regressions for Z-score, mother's schooling and log income are -0.346, and -0.194 and -0.039. A 2 cm rise in stature corresponds approximately to a 0.4 rise in Z-score. Thus the marginal effect of 2 cm on delayed enrolment is equivalent to a marginal rise in log expenditure of $0.4 \times 0.346 / 0.194 = 0.713$, equivalent to multiplying incomes by $\exp(0.713) = 2.04$. Alternatively, they are equivalent to a marginal rise in mother's schooling of $0.4 \times 0.346 / 0.039 = 3.55$ years. Note that these are estimates of *direct* expenditures and mother's schooling effects *not* working through nutrition.

[34] Mother's schooling is widely accepted to be an essential variable in human capital formation.

own coefficients including child and household fixed effects with an estimate only controlling for mother's height, therefore similar to our own (which also includes municipal fixed effects) and find that in this case their Z-score coefficient is underestimated by about one third. Thus it can broadly be concluded that the order of magnitude of the estimates presented here is correct.

The two papers we have discussed also provide possible explanations for why nutrition affects school permanence decisions. Glewwe and Jacoby (1995) show that the improvement in "child readiness" that nutrition entails is the main mechanism advancing enrolment, while credit and supply constraints are not important causal links. As their theoretical model shows, in a perfect credit world parental income should not be a significant determinant of time of enrolment or total investment in schooling. Only parental education should intervene, as a factor increasing the productivity of investment in education. These results are confirmed in the present study as well. On the other hand, Glewwe, Jacoby and King (2001) show that nutrition leads to higher academic achievement. Similarly, Rubalcava and Teruel (2004) show that early child development, as measured by stature, is associated with cognitive ability. Combining these conclusions, higher nutrition leads to higher levels of school readiness, cognitive ability and academic achievement, hence to higher returns for educational investment, and therefore contributes to permanence in school. The main failures behind this mechanism would be inadequate knowledge of the benefits or of the production of, or incomplete credit markets for obtaining, nutrition of the young (more generally, early child development), as in Galor and Mayer-Foulkes (2002).

The magnitude of the effect of early childhood nutrition and health on education is much larger than what has been found for the effect of health on income and is therefore more commensurate with the long-term economic effects of nutrition and health mentioned above, such as those found by Fogel (op. cit.).

Market failures

All children are born equal; at least potentially so, for malnutrition can begin in-utero with life-long consequences in health including cognitive development (Van Der Gaag, 2002).[35] For babies to grow up into productive adults realizing their full potential, it is necessary that an investment be made in nutrition, health, early child development, and education. Let us examine how this process of investment occurs. As mentioned above, *any* important and systematic deviation from this standard is due to some kind of failure of the market system, such as imperfect credit, incomplete markets, or imperfect expectations, has important consequences for social welfare, and justifies public policies to bridge the necessary funding.

Do the regressions on adult income and school performance provide evidence that there is an important, and systematic degree of under investment in

[35] That is, I assume that the genetic inheritance of ability is distributed equally across the population.

health and education? The evidence is unequivocal. The regression on adult income shows that investment in education and its complementary inputs is highly rewarding. Every additional three-years period of education gives additional returns and thus has a larger net return than the previous three year investment, assuming that costs are proportional to forgone income and educational level.[36] Moreover, this has been true at least since 1984 (see Table II.1 and Figure IV), so that informed, rational decisions in pursuing secondary and higher education would have taken this fact into account. The probit estimates on school permanence also identify under investment in nutrition, which would yield higher probabilities for continuing in school at each crucial decision point beyond primary level.

Summarizing, there are returns to education and nutrition that go untapped by many children in the population, whose human capital investment decisions depend on their family situation and parental assets. This implies that the market mechanisms for human capital investment fail.

Let us now analyze how investments in human capital occurring according to the incentives of the market system may fail to occur. The first intergenerational models (Diamond, 1965) simply ignore the problem, because they assume there is no human capital and the young simply start working. To define individual preferences that should be equivalent to a social welfare function in the case of identical agents, models including human capital resort to infinitely lived dynasties or intergenerational altruism. In both cases it is effectively assumed that parents care for their children's welfare as for their own[37], with somewhat different implications about discounting. In reality, the people around the child, or the government, provide for her education.

The first problem might of course be that there is nobody to carry out the investment. For example, there are 30 million street children worldwide with minimal access to nutrition, health and education,[38] and a large potential for future social problems (Van Der Gaag, 2002). A second example would be incomplete or dysfunctional families, weakening the altruism and resources from which the child can tap, a phenomenon that may be correlated with poverty. Another example would be children brought up by single mothers. This occurs often in Mexico, with children often left in charge of their grandparents while their single mother works in a different town.

Let us assume, though, that somebody does carry out the investment. Following economic theory, the first step these providers will take is to evaluate the benefits of investment in nutrition, health, child development and education. Systematic problems in this evaluation could lead to under investment. This includes

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[36] A more careful argument is needed if the returns do not increase. For example, at a discount rate of 5%, a group of 30 people with a given salary and level of education, expecting to work or study for another 40 years, would pool up to 45 of their salaries for three years to receive the services of an educational institution yielding a salary increase of 10% per year studied.

[37] I define imperfect parenting as the absence of parenting with this degree of altruism.

[38] Information from Fundación Junto con los Niños de Puebla A.C., http://www.upaep.mx/juconi/.

lack of information or foresight on the benefits of investment, which is more likely for example if the parents have experienced only a lower level of learning. Uncertainty and risk aversion as to the realization of these benefits, and higher impatience[39] or risks due to poverty than would hold if basic needs were satisfied can also lead to under investment. This reasoning is expressed in terms of the child's viewpoint or that of her mentors, but additional reasons for under investment occur from the point of view of social welfare, which may be less risk averse, less impatient, and which may take higher social returns into account.

Once the human capital investment providers have evaluated the investment they must proceed to carry it out. Two kinds of problems may occur. The first is that the necessary resources are not available and there is a credit constraint. This might be particularly hard to solve in the case of food and early child development more generally (Galor and Mayer-Foulkes, 2002). The next problem may be that the needed investment goods may not be available for purchase. Examples are: public good inputs in health or education that the government may fail to provide; knowledge that mentors transmit to their children or need to take care of them properly, especially at young ages.

Establishing the main failure mechanisms is important, especially for public policy, but requires better data. Even so, the probit regressions presented here show that low health and nutrition are important determinants of continuing in school.

The school permanence estimates and the adult income estimates imply the existence of untapped high returns to health and education inputs. These indicate the severity of the failures, since the investments do not occur even in the presence of high returns to them. It also implies that considerable returns may be obtained from appropriate public policy. Human capital accumulation transition is occurring slower rather than faster, with more of the intergenerational steps spent in poverty.

Slow transition or poverty trap?

The above empirical and theoretical analyses establish the presence of failures in health and education investment in Mexico. Increasing returns to education in income, and to nutrition and health in schooling, imply that these failures cause a considerable slowdown in the investment on health and education and that the income of the more educated tends to rise faster than that of the less educated, a temporary divergence in incomes that may last several generations. Thus the transition to an educated society is prolonged. The next question is whether the failures are so severe as to cause a poverty trap.

To answer this question, I first examine the distribution of households according to female and male spouses' schooling, using ENSA 2000 data (Figure V.1) and also data from the seven ENIGH surveys from 1984 to 2000 (Figure V.2). This distribution has two main peaks. The first one occurs with both spouses having

[39] A convexity in intertemporal preferences.

lower secondary or less. The second occurs with both spouses having higher education. Comparison of the Figures based on the ENSA and ENIGH surveys show that their representativity is somewhat different. In the case of the ENSA 2000 survey (Figure V.1), a third peak occurs due to gender bias in acquiring higher education: male spouses with higher education and female spouses with lower secondary education or less. A fourth but very small peak holds the opposite relation. In Figure V.2, it can be appreciated that the 'lower class' peak is in transition from incomplete to complete primary in 1984, centers at complete primary school in 1989, and then shifts through the years to a peak at complete secondary school in 1996 and 2000. Spouses with no schooling, perhaps belonging to rural areas, cease to be present; their progress may be reflected in the high primary frequency in 1998.

Because marriage is a matching that is at least partially hierarchical according to economic status (Fernandez, Guner and Knowles, 2001), these multiple-peaked figures show that the population classifies itself into two classes of people that can be identified by their educational status: a low one with completed lower secondary school or less, and a higher one with 15 or more years of schooling.[40]

Next, I examine the distribution of schooling for adults between 25 and 30. Figure VI, based on the same ENIGH surveys, shows this distribution is remarkably steady except for a very clear pattern of changes. As can be seen in Figure VII, which plots the profile of the trends of change in the distribution from 1989 to 2000[41], the main changes are that a higher proportion of men and women have completed lower secondary school (and higher in the case of men) instead of having no schooling or incomplete or complete primary schooling. These changes have been similar for men and women. However, throughout the period the proportion of men with completed lower secondary schooling or less (the low class) has remained approximately constant at an average of 75.02% (there is no significant trend). The corresponding proportion of women has shown a tendency to decrease of about 0.5% per year. However, these could be women in the high class who are catching up with men. This catch up is also occurring in higher education (see Figure VII).

If we now turn to Figure VIII, showing the population of students in public and private schools by level of schooling, it becomes apparent that by far most of the increases in adult schooling correspond to a higher population of students in public schooling. Higher investment in education at all levels is occurring under the impact of public investment. In fact, between 1989 and 2000 the relative level of private to public investment as measured by student population decreased at the lower and upper secondary levels from 8.7% and 32.5% respectively to 8.3% and 27.2%

[40] I use the term "class" sparingly because of its strong connotations, although it may well be that human development traps lie at the origin of class systems.

[41] These trends are obtained by regressions on the data in Figure VI. I exclude the 1984 survey because it is an outlier at every level of the distribution, either because of sampling issues or because of the objective differences in the state of education observed in Figure V.2.

respectively. The corresponding changes were 6.0% to 8.0% at the primary level and 21.7% to 58.6% at higher levels of education. The latter increase is due to a decreased population in public schools.[42] Moreover, 58.2% of public education expenditure at tertiary levels of education was received by students in deciles VIII and above (Figure IX). Thus it is quite possible that much of the higher education in Mexico would not occur without public support.[43]

It can thus be concluded that 1) the population classifies itself into two social classes, those with lower secondary schooling or less, and those above; 2) the proportion of adults between 25 and 40 with completed lower secondary schooling or less remained almost unchanged; 3) in the lower portion of the population, more adults reached lower secondary education, mostly because of the increased availability of public schooling at that level rather than through private investment. These three propositions support the presence of a low human capital accumulation trap with a barrier at lower secondary schooling, rather than a single-peaked, slow transition.

The overall finding of a barrier for higher secondary schooling is supported by De Ferranti et al (2003, page 86), who argue that in most Latin American countries there is a 'bottleneck' at the secondary education level, requiring a policy focus so as to facilitate a transition to higher education. However, although these authors recommend policies helping individuals to overcome market failures, they do not analyze the role of early child nutrition and health in determining the educational potential of the young, nor do they consider the full implications of the presence of a poverty trap.

The dynamics and shape of the distribution of adult schooling, are consistent with multiple equilibria and therefore a human capital accumulation poverty trap in Mexico, rather than a slow transition.[44]

Nutrition as a policy lever for education

According to the empirical results, investments in nutrition lead to a significant rise educational productivity. To assess the economic returns of policies supporting nutrition, I conduct a back of the envelope calculation of their viability. Since there are few nutritional supplementation programs whose outcome has been carefully studied using anthropometric measures, I refer (following Glewwe, Jacoby and King, 2001) to the Narangwal project (Kielman and Associates, 1983), which provided nutritional supplements for children less than 3 years of age, along with intensive health surveillance and nutrition education, in several Punjabi villages

[42] Figures based on SEP (Ministry of Education) statistics on public and private education.

[43] The changes in the distribution of schooling observed across time in Figure VII are very similar to those which result from comparing adults aged 19 to 24 with adults aged 25 to 40 using the ENSA 2000 data.

[44] Since education and wealth have increased somewhat in both classes (albeit with public intervention) the poverty trap may be considered to be *dynamic* in the sense defined above.

from 1968 to 1973. A statistically significant 2cm improvement of average height was achieved at a cost of about US$150 (1994 dollars). About a third of this cost was for food, representing a transfer that will therefore be ignored. Multiplying the remaining US$100 cost by the relative PPP index for Mexico compared to India (3.047 in 1994) and converting into 2000 dollars (this adds 16.2%), the cost of an equivalent program in Mexico would be about US$354 or $3,350 Mexican pesos. To be conservative, I suppose that malnutrition is not as severe in Mexico as in India, so that only a 1 cm improvement of average height is obtained from the program. Using the minimum of the instrumented results for the most needy population (percentile 90), this improvement in stature implies additional probabilities 8.8%, 5.5%, 4.5% of obtaining schooling levels of 3-6, 7-9 and 10-12 years (rather than 3 years less), and therefore average adult wage improvements of 33.8%, 36.6%, and 39.3% respectively (starting from $18,018 Mexican pesos a year). Discounting at 4% a year, and assuming a lifetime of work beginning on graduation this implies benefits of $7,539, $6,529 and $7,334 Mexican pesos respectively, about twice the cost of the program. Thus the nutritional supplementation program is viable, even without evaluating many other benefits of improved nutrition, such as health.

If instead we consider a stature increment of 5 cm, which is the increment experienced in Korea between 1960 and 1995 (Weil, 2001) or 10 cm (the increment experience over more than a century in Europe), the benefits are so large that it is clear that the increase in human capital must explain a very important proportion of economic growth, as is found in historical and macroeconomic studies mentioned above.

There may be cheaper alternatives leading to significant improvements in nutrition. For example, Muñoz de Chávez and Chávez (2002) find that important nutritional improvements result from enriching traditional maize *tortillas* with soy (obtaining a complete protein), vitamins and minerals, adding only about 10% to the cost.[45] In a rural Otomi community, children eating the improved tortilla suffered 25% less illness, and the weight of newborn babies from mothers eating the improved tortilla was about 10% higher. Thus an important part of the nutritional problem may be addressed by implementing technological improvements in food.

Nutrition and health of the young and poor have been promoted in Mexico by the program Progresa, now Oportunidades. This program could be expanded to include a stronger focus in early child development covering more of the population and a clearer awareness of the educational productivity returns of nutrition.

Conclusions

The discussion of how children come to be endowed with nutrition, health, early child development and education by their surrounding mentors and society shows

[45] Since a subsidy for tortillas is already in place the marginal policy cost might be small. Other enrichment programs using amaranto seed also exist.

that this process is subject to market failures including mainly: imperfect parenting (one or both parents missing, unhealthy, unknowledgeable or uncaring); imperfect credit or the impossibility to acquire nutrition, health, education and complementary inputs to education such as capital, social capital, or early child development; uncertainty or lack of knowledge, information or foresight on the benefits of early child development, nutrition, health and education; excessive impatience or risks due to poverty or the unavailability of necessary public goods in health or education.

The Mincerian estimates on labor income show that there are increasing returns to education in Mexico at levels not achieved by most of the population and therefore that there is substantial under investment in education. The probit estimates show that school permanence is more likely with higher child nutrition and health, for which there is evidence of substantial returns. Thus there is also substantial under investment in nutrition and early child care. Barriers to education that the market system cannot surmount on its own are posing an important problem to social welfare and economic growth, since they give rise to substantial under investment in human capital across most of the Mexican population.

The presence of substantial increasing returns implies that a poverty trap or a slow transition exists, with the income of the less educated growing more slowly. The distribution of schooling across household partners, however, is multiple peaked, evidencing the existence of two classes of people: those with complete lower secondary and below, and those above. Moreover, the proportion of the population in the lower group has remained almost unchanged, and its educational investment has only improved in response to public investment. This supports the hypothesis that there is a barrier to education beyond lower secondary school.

The probit results show that improvements in nutrition would have a very considerable impact on the schooling distribution, with high improvement rates in higher education. The increasing marginal rates of return to education suggest that almost 90% of the population – those with less than higher education – would benefit from increased levels of nutrition, health and education. Although there may be a premium to higher education caused by the present low supply of human capital (itself accentuated by the low investment trap), it is unlikely that in today's high technology production environments the demands for human capital will be saturated very soon. Indeed, the tendency has been for returns to primary, secondary education to decrease, while those of higher education increase (Figure IV).

The magnitude of the interaction of health variables with education is much larger than what has been found for the effect of adult health on income and is therefore more commensurate with the long-term economic effects of nutrition and health mentioned in the introduction. At the current stage of development in Mexico (and for countries at lower stages), nutrition and health lie at the core of the intergenerational dynamics of human capital accumulation. The consistent correlation of stature with many aspects of adult economic performances and its direct relation with early child nutrition and health, makes it clear that policies supporting early child development can have a very important long-term impact on equity, living standards and economic growth. It cannot be doubted that support for nutrition, health and education bridging a series of market failures would yield enormous benefits by leading to large rises in human capital levels, although it is beyond the scope of this paper to indicate what the efficient mechanisms for this would be. Let us venture to say, however, that what is needed is a second generation of policies moving beyond the first generation, whose main objectives were literacy and numeracy, that brought schools everywhere and pushed the educational barrier up to completed primary and then lower secondary schooling from previously lower levels (Figure V.2). Today, a broader conception of human capital demands integrated, egalitarian and socially unifying policies that include nutrition, health and early child development and support for all levels of education. To this must be added an intense concern for quality and scrupulous selection by merit and ability so as to promote the efficiency of systems whose returns will be higher the lower are their costs.

In common sense terms, since education is essential for adult income, today's young must be brought up with adequate nutrition and quality education if the cycle of poverty is to be broken. Much further study and practical experience is necessary to establish a best practice for mitigating and overcoming human capital accumulation traps. Nevertheless, simply the practical recognition by leading international economic institutions of the empirical existence of poverty traps requiring specific policy solutions would resolve some of the controversy that exists concerning globalization and pro-market policies, which are experienced as unfair by people subject to overriding market failures.

While it is true that the low institutional quality of public health and school systems have lead to widespread inefficiencies, *achieving the institutional capacity to overcome failures in the market system* is an indispensable governance objective. Pro-market reforms facilitating economic growth will only realize their full potential if they are accompanied by policies dissolving market failures for human development, as well as other market failures. In Mexico, as in many countries, the educational advances of the previous generations were based on government action. These advances can probably only continue if public action responds to the continuing nutritional, educational and health demands of the young. More generally, optimal strategies for economic growth must be two-pronged. On the one hand, the appropriate conditions for the markets to function have to be established, for otherwise (in the case of skills), who will have the appropriate incentives in production and technological change to effectively employ the human capital that may be supplied? On the other, the main market failures holding back economic growth must be overcome through government policies, for otherwise, where will the human capital come from? Only such dual strategies will rally the productive forces needed to emerge from poverty. Without appropriate public policy, human capital accumulation will be slow, a mass of human potential will be wasted, the coming generation will continue to be poor and Mexico – as well as many other countries – will experience low rates of development.

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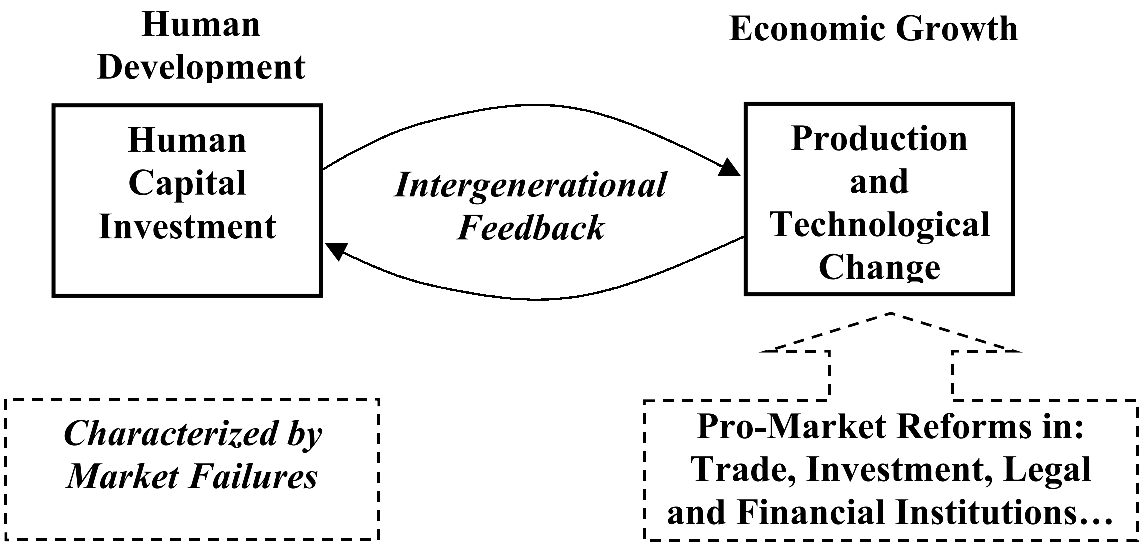


Figure I. Intergenerational relation between human development and economic growth. Market failures in human capital accumulation and pro-market reforms.

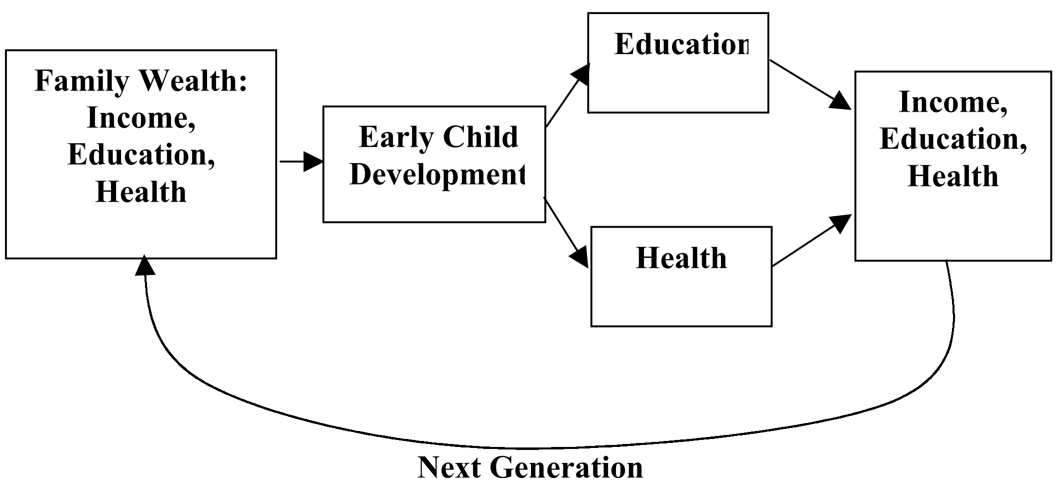


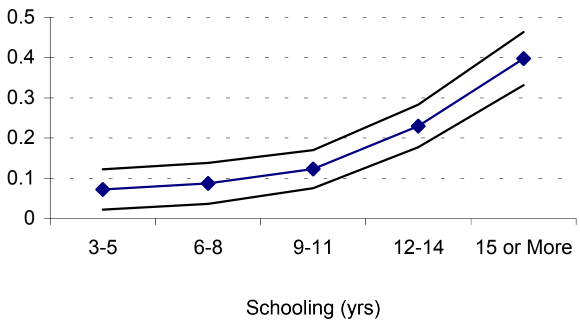
Figure II. The role of early child development in the intergenerational cycle of human capital formation. Early child development is strongly affecte by family wealth. In turn, it is an important determinant of young adult education and health and therefore of lifelong income, education and health.

Figure III. Human Capital Marginal Returns for Adult Income by Educational Level

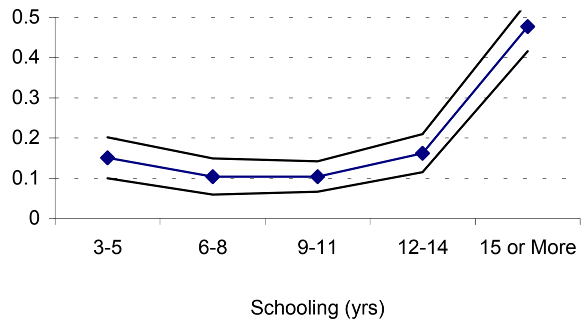
(Two Standard Deviation Corridors for OLS coefficients)

Marginal Human Capital Returns Asociated with Three-Year Periods of Schooling

III.1 Female

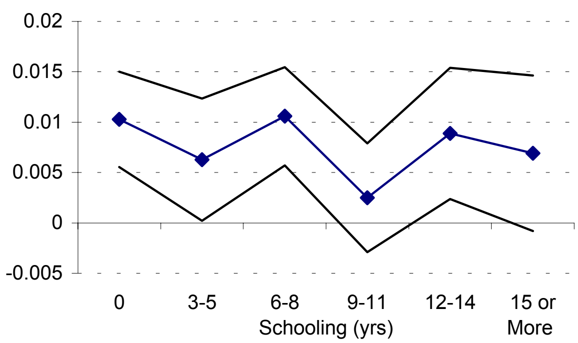


III.2 Male



Marginal Returns of Stature by Schooling Levels

III.3 Female



III.4 Male

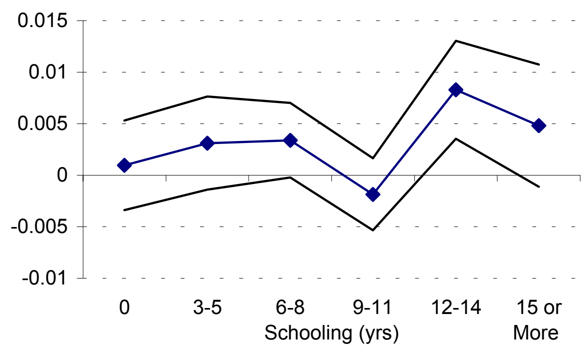
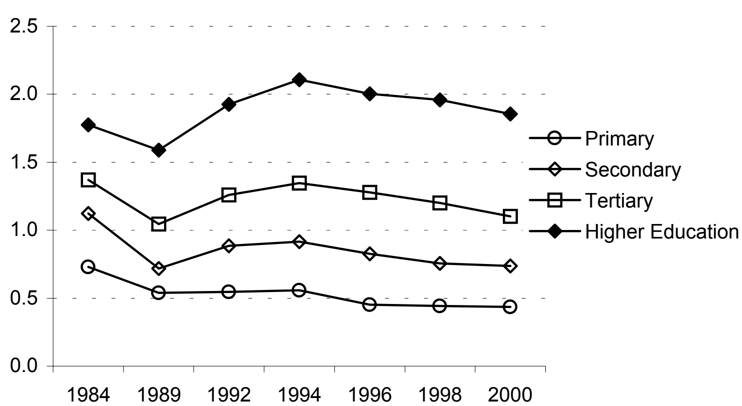


Figure IV. Marginal Returns to Schooling in Mexico, 1984-200
(Estimates based on ENIGH surveys)
OLS

Schooling Wage Factor



Source: Mayer-Foulkes and Stabridis-Arana (2003)

Table I. Adult Income Estimates
(Municipal Fixed Effects in ENSA 2000 Database for Individuals)

	OLS		**Heckman I**		**Heckman II**	
	Female	**Male**	**Female**	**Male**	**Female**	**Male**
Stature (cm), 0-2 Years of Schooling	**0.0103**	0.001	**0.0115**	0.0009	**0.01166**	0.00095
	(0)	(0.66)	**(0)**	(0.658)	**(0)**	(0.659)
Stature (cm), 3-5 Years of Schooling	**0.0063**	0.0031	*0.0072*	0.0031	*0.00724*	0.00312
	(0.038)	(0.167)	*(0.014)*	(0.16)	*(0.014)*	(0.16)
Stature (cm), 6-8 Years of Schooling	**0.0106**	*0.0034*	**0.0109**	*0.0034*	**0.01081**	*0.00341*
	(0)	*(0.061)*	**(0)**	*(0.056)*	**(0)**	*(0.056)*
Stature (cm), 9-11 Years of Schooling	0.0025	-0.0019	0.0024	-0.0018	0.00237	-0.00185
	(0.355)	(0.288)	(0.371)	(0.281)	(0.369)	(0.282)
Stature (cm), 12-14 Years of Schooling	**0.0089**	**0.0083**	**0.0092**	**0.0083**	**0.00927**	**0.00831**
	(0.006)	**(0)**	**(0.004)**	**(0)**	**(0.004)**	**(0)**
Stature (cm), 15 or More Years Schooling	**0.0069**	0.0048	*0.007*	*0.0048*	*0.00662*	0.00481
	(0.073)	(0.106)	*(0.066)*	*(0.099)*	*(0.081)*	(0.1)
3 or More Years Schooling	**0.0723**	**0.1509**	**0.0889**	**0.1483**	*0.0528*	**0.15005**
	(0.004)	**(0)**	**(0.001)**	**(0)**	*(0.032)*	**(0)**
6 or More Years Schooling	**0.0874**	**0.1045**	**0.0965**	**0.1029**	**0.08133**	**0.10394**
	(0.001)	**(0)**	**(0)**	**(0)**	**(0.001)**	**(0)**
9 or More Years Schooling	**0.1228**	**0.1043**	**0.1155**	**0.1035**	**0.12712**	**0.10418**
	(0)	**(0)**	**(0)**	**(0)**	**(0)**	**(0)**
12 or More Years Schooling	**0.23**	**0.1625**	**0.1517**	**0.1633**	**0.25025**	**0.16276**
	(0)	**(0)**	**(0)**	**(0)**	**(0)**	**(0)**
15 or More Years Schooling	**0.3975**	**0.4773**	**0.2329**	**0.4759**	**0.411**	**0.47737**
	(0)	**(0)**	**(0)**	**(0)**	**(0)**	**(0)**
Experience, 0-2 Years of Schooling	-0.0047	0.0043	-0.0053	0.0039	-0.00187	0.00442
	(0.33)	(0.441)	(0.292)	(0.481)	(0.688)	(0.417)
Experience, 3-5 Years of Schooling	-0.0028	*-0.0086*	-0.0081	*-0.0086*	-0.00332	*-0.00853*
	(0.641)	*(0.091)*	(0.188)	*(0.084)*	(0.573)	*(0.088)*
Experience, 6-8 Years of Schooling	0.0028	**0.0148**	-0.0042	**0.0145**	-0.00084	**0.01485**
	(0.541)	**(0)**	(0.374)	**(0)**	(0.85)	**(0)**
Experience, 9-11 Years of Schooling	**0.0188**	**0.0194**	0.0067	**0.0188**	**0.01223**	**0.0193**
	(0)	**(0)**	(0.178)	**(0)**	**(0.007)**	**(0)**
Experience, 12-14 Years of Schooling	**0.0259**	**0.0334**	**0.014**	**0.0325**	**0.02113**	**0.03324**
	(0)	**(0)**	**(0.007)**	**(0)**	**(0)**	**(0)**
Experience, 15 or More Years Schooling	**0.0535**	**0.0446**	**0.0437**	**0.0439**	**0.04683**	**0.04454**
	(0)	**(0)**	**(0)**	**(0)**	**(0)**	**(0)**
Experience2, 0-2 Years of Schooling	0	**-0.0002**	0	**-0.0002**	-0.00002	**-0.00016**
	(0.566)	**(0.007)**	(0.878)	**(0.009)**	(0.621)	**(0.006)**
Experience2, 3-5 Years of Schooling	0	0	0	0	0.00002	0.00003
	(0.744)	(0.665)	(0.576)	(0.638)	(0.797)	(0.656)
Experience2, 6-8 Years of Schooling	-0.0001	**-0.0003**	0	**-0.0002**	-0.00002	**-0.00025**
	(0.132)	**(0)**	(0.833)	**(0)**	(0.797)	**(0)**
Experience2, 9-11 Years of Schooling	**-0.0003**	**-0.0003**	*-0.0002*	**-0.0003**	*-0.00019*	**-0.00029**
	(0)	**(0)**	*(0.03)*	**(0)**	*(0.021)*	**(0)**
Experience2, 12-14 Years of Schooling	**-0.0004**	**-0.0005**	*-0.0002*	**-0.0005**	**-0.00026**	**-0.00048**
	(0)	**(0)**	*(0.024)*	**(0)**	**(0.004)**	**(0)**
Experience2, 15 or More Years Schooling	**-0.0009**	**-0.0008**	**-0.0008**	**-0.0008**	**-0.00077**	**-0.00077**
	(0)	**(0)**	**(0)**	**(0)**	**(0)**	**(0)**
Journal Worker (Employed as Reference)	*0.145*	**-0.166**	*0.1072*	**-0.166**	*0.1122*	**-0.16594**
	(0.011)	**(0)**	*(0.055)*	**(0)**	*(0.044)*	**(0)**
Entrepreneur	*0.2087*	**0.2735**	*0.2138*	**0.2733**	*0.21872*	**0.2734**
	(0.037)	**(0)**	*(0.032)*	**(0)**	*(0.027)*	**(0)**
Self Employed	**-0.33**	**-0.2152**	**-0.3275**	**-0.2152**	**-0.32185**	**-0.21523**
	(0)	**(0)**	**(0)**	**(0)**	**(0)**	**(0)**
Work Without Pay	**-0.6094**	**-1.1358**	**-0.6007**	**-1.1359**	**-0.59245**	**-1.13608**
	(0)	**(0)**	**(0)**	**(0)**	**(0)**	**(0)**
Not Reported	**-0.4177**	**-0.428**	**-0.4291**	**-0.4283**	**-0.41582**	**-0.42825**
	(0)	**(0)**	**(0)**	**(0)**	**(0)**	**(0)**

1% Confidence in Bold, 10% Confidence in Italics, p Values in Parenthesis

Table I. Adult Income Estimates (Continued)
(Municipal Fixed Effects in ENSA 2000 Database for Individuals)

	OLS		Heckman I		Heckman II	
	Female	Male	Female	Male	Female	Male
Wooden Walls (Bricks as Reference)	**-0.0959**	-0.0173	**-0.107**	-0.018	**-0.10725**	-0.01802
	(0.009)	(0.618)	**(0.006)**	(0.597)	**(0.007)**	(0.598)
Adobe Walls	**-0.1103**	*-0.0743*	**-0.1146**	*-0.0734*	**-0.12199**	*-0.07292*
	(0.001)	*(0.017)*	**(0.001)**	*(0.017)*	**(0)**	*(0.017)*
Others or Not Reported	*-0.1194*	-0.0631	*-0.1298*	-0.0624	*-0.12791*	-0.06192
	(0.011)	(0.114)	*(0.01)*	(0.111)	*(0.011)*	(0.114)
Cardboard or Metal Sheet Roof	**-0.1525**	**-0.1203**	**-0.1485**	**-0.1209**	**-0.14623**	**-0.12058**
	(0)	**(0)**	**(0)**	**(0)**	**(0)**	**(0)**
Asbestos Sheet Roof	**-0.1069**	**-0.0954**	**-0.103**	**-0.0958**	**-0.10155**	**-0.09559**
	(0)	**(0)**	**(0)**	**(0)**	**(0)**	**(0)**
Wooden or Thatched Roof	**-0.1551**	**-0.1003**	**-0.1417**	**-0.1004**	**-0.14027**	**-0.10001**
	(0)	**(0.005)**	**(0)**	**(0.004)**	**(0)**	**(0.004)**
Tiled Roof (Concrete as Reference)	**-0.1678**	*-0.1071*	**-0.153**	**-0.1065**	**-0.15768**	*-0.10597*
	(0)	*(0.01)*	**(0.001)**	**(0.009)**	**(0.001)**	*(0.01)*
Others or Not Reported	-0.0405	0.1345	-0.0615	0.1347	-0.05723	0.1349
	(0.712)	(0.113)	(0.606)	(0.106)	(0.635)	(0.106)
Earthen Floor (Cement as Reference)	**-0.1428**	-0.0417	**-0.156**	-0.0412	**-0.15963**	-0.04095
	(0)	(0.167)	**(0)**	(0.166)	**(0)**	(0.169)
Wood, Tile or Other Finishings	**0.1396**	**0.1315**	**0.1338**	**0.1317**	**0.10824**	**0.13126**
	(0)	**(0)**	**(0)**	**(0)**	**(0)**	**(0)**
Others or Not Reported	0.1976	-0.0271	0.123	-0.0255	0.12618	-0.02414
	(0.146)	(0.82)	(0.411)	(0.829)	(0.402)	(0.837)
Kitchen	-0.0143	0.0197	-0.015	0.0214	-0.02811	0.02162
	(0.659)	(0.472)	(0.66)	(0.427)	(0.415)	(0.422)
Number of Rooms	**0.0054**	0.0027	**0.0085**	0.003	**0.0074**	0.00303
	(0.009)	(0.541)	**(0.001)**	(0.501)	**(0.004)**	(0.495)
Piped Water Outside House (Inside as Reference)	**-0.0703**	**-0.0519**	**-0.0779**	**-0.0522**	**-0.06288**	**-0.05197**
	(0.001)	**(0.003)**	**(0)**	**(0.002)**	**(0.003)**	**(0.002)**
Others or Not Reported	**-0.1198**	**-0.0887**	**-0.1229**	**-0.0902**	**-0.10742**	**-0.0902**
	(0.001)	**(0.009)**	**(0.001)**	**(0.007)**	**(0.005)**	**(0.007)**
Bathroom	**0.1332**	0.0154	*0.0747*	0.0151	*0.07208*	0.015
	(0)	(0.612)	*(0.045)*	(0.612)	*(0.055)*	(0.615)
Drainage to Septic Tank (Public Sewage as Reference)	**-0.0778**	**-0.0816**	**-0.0766**	**-0.0818**	*-0.06761*	**-0.08166**
	(0.003)	**(0)**	**(0.005)**	**(0)**	*(0.015)*	**(0)**
No Drainage	**-0.173**	**-0.1552**	**-0.2148**	**-0.1548**	**-0.20936**	**-0.15451**
	(0)	**(0)**	**(0)**	**(0)**	**(0)**	**(0)**
Others or Not Reported	-0.0215	*-0.0884*	-0.0235	*-0.0876*	-0.01348	*-0.08744*
	(0.685)	*(0.061)*	(0.671)	*(0.059)*	(0.809)	*(0.059)*
Electricity	*0.1043*	0.0484	*0.0985*	0.0484	*0.09824*	0.04791
	(0.044)	(0.341)	*(0.07)*	(0.333)	*(0.073)*	(0.338)
Telephone	**0.2554**	**0.1758**	**0.243**	**0.1771**	**0.20119**	**0.17711**
	(0)	**(0)**	**(0)**	**(0)**	**(0)**	**(0)**
Indigenous Language Dummy	**-0.1322**	**-0.1625**	**-0.1371**	**-0.1626**	**-0.13606**	**-0.1625**
	(0.002)	**(0)**	**(0.001)**	**(0)**	**(0.001)**	**(0)**
Rho (standard deviation in parenthesis)			*-0.6642*	*-0.0415*	*-0.6854*	*-0.05225*
			(0.025)	*(0.023)*	*(0.025)*	*(0.031)*
Sigma (standard deviation in parenthesis)			*0.9542*	**0.6917**	*0.96983*	**0.69184**
			(0.015)	**(0.007)**	*(0.016)*	**(0.007)**
Lambda (standard deviation in parenthesis)			*-0.6338*	*-0.0287*	*-0.66472*	*-0.03615*
			(0.033)	*(0.016)*	*(0.034)*	*(0.022)*
Number of obs	12997	11447	29063	14674	29063	14674
R Squared	0.506	0.492				
Uncensored obs			12997	11447	12997	11447
Wald chi2			14672	10152	15327	10267
Log likelihood			-34316	-18926	-34612	-19108
Wald test for rho=0, chi2			321.01	3.24	326.51	2.8
Wald test for rho=0, Prob			0	0.0719	0	0.0943

1% Confidence in Bold, 10% Confidence in Italics, p Values in Parenthesis

Table II.1 Mean Returns to Education

Study based on ENIGH 1984, 1989, 1992, 1994, 1996

	1984	1989	1992	1994	1996
Primary	12.1	9.95	10.62	11.01	8.75
Secondary	9.25	7.55	10.1	11.42	12
Tertiary	19.04	14.13	15.78	17.13	16.7
Higher	10.04	14.65	16.9	20.17	18.76

Source: Zamudio (1999)

Table II.2 Mean Internal Rate of Return to Education

Study based on ENIGH 1992

	Average	Men	Women
Primary	5.97	7.03	6.61
Secondary	4.35	4.53	4.3
Tertiary	6.91	6.69	8.21
University	6.32	8.35	6.49
Postgraduate	12.95	11.67	18.13

Source: Rojas, Angulo and Velazquez (2000)

Table II.3 High Rates of Return to Tertiary Education, and Modest Rates to Secondary School in Most of Latin America

	"Rate of Return" to Secondary School	"Rate of Return" to Tertiary Education
Argentina	0.05	0.11
Bolivia	0.08	0.14
Brazil	0.19	0.19
Chile	0.08	0.22
Colombia	0.05	0.18
México	0.06	0.13

Note: The rate of return is approximated by the wage increment divided by the number of years in a cycle.

Source: De Ferranti et al (2003, page 88)

Table III. Probit Estimates for School Permanence with Stature Instrumented

(Adolescents Ages 17-19 of both genders, Municipal Fixed Effects in ENSA 2000 Database for Individuals)

	Parent's stature and weight not included as controls			Parent's stature and weight included as controls		
	Lower to Higher Primary	**Primary to Lower Secondary**	**Lower to Higher Secondary**	**Lower to Higher Primary**	**Primary to Lower Secondary**	**Lower to Higher Secondary**
Stature (cm)	*0.262*	*0.135*	**0.181**	*0.315*	*0.141*	*0.113*
	(0.033)	*(0.055)*	**(0.002)**	*(0.04)*	*(0.086)*	*(0.085)*
Stature * MaleDummy	-0.131	0.001	0.066	-0.113	-0.002	0.164
	(0.578)	(0.996)	(0.514)	(0.701)	(0.989)	(0.156)
MaleDummy	17.696	-0.487	-11.777	16.768	1.141	-25.927
	(0.613)	(0.979)	(0.441)	(0.703)	(0.959)	(0.139)
Household Income	-0.101	-0.033	0.01	-0.023	-0.04	0.076
	(0.496)	(0.694)	(0.88)	(0.901)	(0.676)	(0.323)
Household Income * MaleDummy	0.189	-0.119	-0.14	0.02	-0.028	-0.234
	(0.584)	(0.514)	(0.278)	(0.963)	(0.896)	(0.117)
Mother's Proportion of Income	-0.14	0.045	0.174	0.171	0.019	0.231
	(0.634)	(0.792)	(0.265)	(0.644)	(0.92)	(0.19)
Mother's Proportion of Income * MaleDummy	-0.192	-0.129	*-0.437*	-0.58	-0.142	*-0.445*
	(0.607)	(0.589)	*(0.039)*	(0.211)	(0.598)	*(0.06)*
Proportion of Income not Parents'	-0.177	-0.069	**-0.308**	-0.315	-0.069	**-0.455**
	(0.425)	(0.564)	**(0.004)**	(0.276)	(0.631)	**(0)**
Proportion of Income not Parents' * MaleDummy	*0.571*	0.03	0.09	*0.701*	-0.018	0.234
	(0.086)	(0.871)	(0.613)	*(0.088)*	(0.936)	(0.264)
Mother's Schooling	**0.167**	**0.073**	0.016	**0.211**	**0.1**	0.024
	(0)	**(0)**	(0.298)	**(0)**	**(0)**	(0.154)
Mother's Schooling * MaleDummy	**-0.209**	*-0.062*	-0.029	**-0.24**	*-0.09*	-0.038
	(0.001)	*(0.068)*	(0.272)	**(0.003)**	*(0.026)*	(0.214)
Father's Schooling	-0.007	0.016	**0.036**	-0.018	0.015	**0.04**
	(0.761)	(0.179)	**(0)**	(0.494)	(0.252)	**(0.001)**
Father's Schooling * MaleDummy	**0.129**	**0.075**	0.016	**0.158**	**0.088**	0.006
	(0)	**(0)**	(0.266)	**(0)**	**(0)**	(0.719)
Number of Children	**0.075**	**0.044**	*0.034*	**0.092**	**0.06**	*0.033*
	(0.007)	**(0.004)**	*(0.014)*	**(0.007)**	**(0.001)**	*(0.039)*
Number of Children * MaleDummy	*-0.068*	-0.031	-0.029	*-0.083*	*-0.046*	-0.035
	(0.046)	(0.12)	(0.158)	*(0.044)*	*(0.053)*	(0.136)
One parent's Stature (cm)				-0.002	0.007	-0.01
				(0.847)	(0.28)	(0.105)
One Parent's Stature * MaleDummy				-0.022	-0.014	-0.003
				(0.17)	(0.145)	(0.704)
Father's (1) or Mother's (0) Stature				-0.946	-0.808	0.281
				(0.567)	(0.269)	(0.693)
Father's (1) or Mother's (0) Stature * MaleDummy				**-2.585**	(dropped)	0.359
				(0)		(0.779)
One Parent's Weight (kg)				*-0.014*	-0.002	**0.008**
				(0.021)	(0.551)	**(0.007)**
One Parent's Weight * MaleDummy				**0.03**	0.003	-0.004
				(0)	(0.503)	(0.343)
Father's (1) or Mother's (0) Weight				0.642	0.511	-0.279
				(0.695)	(0.482)	(0.693)
Father's (1) or Mother's (0) Weight* MaleDummy				(dropped)	**4.909**	-0.328
					(0)	(0.796)
Indigenous Language Dummy	*0.705*	0.085	-0.005	*0.907*	0.205	-0.134
	(0.023)	(0.662)	(0.976)	*(0.015)*	(0.37)	(0.514)
Dummy for Age 17	-0.094	-0.016	-0.108	-0.13	-0.018	-0.129
	(0.52)	(0.835)	(0.136)	(0.455)	(0.839)	(0.121)
Dummy for Age 19	0.121	-0.072	-0.068	0.15	-0.033	-0.134
	(0.432)	(0.381)	(0.394)	(0.429)	(0.728)	(0.14)

1% Confidence in bold, 10% confidence in italics, p values in parenthesis.

Table III. Probit Estimates for School Permanence with Stature Instrumented (continued)

(Adolescents Ages 17-19 of both genders, Municipal Fixed Effects in ENSA 2000 Database for Individuals)

	Parent's stature and weight not included as controls			Parent's stature and weight included as controls		
	Lower to Higher Primary	Primary to Lower Secondary	Lower to Higher Secondary	Lower to Higher Primary	Primary to Lower Secondary	Lower to Higher Secondary
Kitchen	0.064	*0.194*	0.054	0.129	*0.21*	-0.033
	(0.72)	*(0.062)*	(0.671)	(0.526)	*(0.067)*	(0.816)
Number of Rooms	0.043	**0.071**	**0.094**	-0.001	**0.091**	**0.119**
	(0.279)	**(0.001)**	**(0)**	(0.984)	**(0.001)**	**(0)**
Bathroom	-5.631	6.229	6.549	-5.145	6.428	6.602
	(0.996)	(0.545)	(0.438)	(0.996)	(0.593)	(0.486)
Electricity	-0.018	0.196	*0.533*	0.174	*0.375*	*0.722*
	(0.949)	(0.25)	*(0.035)*	(0.582)	*(0.069)*	*(0.015)*
Telephone	-0.035	0.038	0.04	0.018	0.033	0.05
	(0.821)	(0.648)	(0.574)	(0.927)	(0.736)	(0.537)
Walls (Bricks as Reference) Others	0.09	-0.179	0.12	-0.02	*-0.315*	0.156
or Not Reported	(0.741)	(0.256)	(0.542)	(0.949)	*(0.091)*	(0.492)
Wooden Walls	*-0.409*	*-0.253*	-0.022	*-0.393*	*-0.276*	0.01
	(0.034)	*(0.027)*	(0.87)	*(0.075)*	*(0.032)*	(0.944)
Adobe Walls	*-0.344*	*-0.227*	0.003	-0.287	-0.196	0.027
	(0.067)	*(0.038)*	(0.976)	(0.205)	(0.113)	(0.839)
Roof (Concrete as Reference)	0.005	*1.055*	0.051	-0.77	(dropped)	-0.045
Others or Not Reported	(0.994)	*(0.069)*	(0.896)	(0.41)		(0.93)
Cardboard or Metal Sheet Roof	0.07	**-0.309**	-0.119	0.12	*-0.326*	-0.211
	(0.721)	**(0.007)**	(0.391)	(0.606)	*(0.011)*	(0.164)
Asbestos Sheet Roof	0.027	*-0.186*	*-0.144*	-0.039	**-0.237**	*-0.167*
	(0.847)	*(0.013)*	*(0.058)*	(0.818)	**(0.006)**	*(0.054)*
Wooden or Thatched Roof	0.383	0.003	-0.071	0.357	-0.042	-0.172
	(0.143)	(0.986)	(0.614)	(0.239)	(0.803)	(0.285)
Tiled Roof	0.2	0.072	0.165	0.178	0.043	0.222
	(0.35)	(0.573)	(0.234)	(0.486)	(0.778)	(0.189)
Floors (Cement as Reference)	(dropped)	(dropped)	*-0.752*	(dropped)	(dropped)	*-0.752*
Others or Not Reported			*(0.083)*			*(0.097)*
Earthen Floor	-0.181	-0.139	0.103	-0.213	*-0.223*	0.072
	(0.293)	(0.168)	(0.438)	(0.289)	*(0.05)*	(0.629)
Wood, Tile or Other Finishings	-0.156	**0.211**	**0.153**	-0.2	*0.18*	*0.136*
	(0.214)	**(0.003)**	**(0.006)**	(0.187)	*(0.029)*	*(0.034)*
Toilet Water (Inside as Ref) Others	-5.543	6.109	6.314	-4.901	6.458	6.503
or Not Reported	(0.996)	(0.552)	(0.453)	(0.996)	(0.591)	(0.491)
Toilet Water From Bucket	-0.026	-0.121	-0.096	0.014	-0.071	-0.021
	(0.846)	(0.101)	(0.172)	(0.937)	(0.413)	(0.797)
Toilet Water Unavailable	0.02	-0.002	-0.193	0.051	0.044	-0.149
	(0.929)	(0.988)	(0.128)	(0.851)	(0.748)	(0.297)
Drainage (Public Sewage as Ref)	*-0.509*	**-0.418**	0.018	*-0.537*	**-0.502**	0.005
Others or Not Reported	*(0.03)*	**(0.007)**	(0.92)	*(0.056)*	**(0.005)**	(0.98)
Drainage to Septic Tank	*0.282*	*-0.181*	*-0.143*	*0.46*	*-0.19*	*-0.217*
	(0.069)	*(0.026)*	*(0.062)*	*(0.013)*	*(0.045)*	*(0.014)*
No Drainage	-0.255	*-0.174*	*-0.288*	(dropped)	-0.162	*-0.348*
	(0.129)	*(0.085)*	*(0.01)*		(0.16)	*(0.006)*
Number of Observations	3349	5212	3620	2363	3998	3620
Chi2	366.02	1242.67	1081.06	353.85	1093.37	1081.06
Prob Chi	0	0	0	0	0	0
Log Likelihood	-599.11	-1938.36	-1908.53	-449.46	-1476.45	-1908.53
Pseudo R-squared	0.234	0.243	0.221	0.283	0.27	0.221

1% Confidence in bold, 10% confidence in italics, p values in parenthesis.

Table IV. Comparison of the Effects of Stature in Several Probit Estimates for School Permanence. Wu-Hausman and Basman-Sargan Tests.

(Adolescents Ages 17-19 of both genders, Municipal Fixed Effects in ENSA 2000 Database for Individuals)

	Lower to Higher Primary	Primary to Lower Secondary	Lower to Higher Secondary
		Stature not instrumented	
Stature (cm)	0.024	**0.037**	**0.024**
	(0.137)	**(0)**	**(0.001)**
Stature * Male Dummy	*-0.044*	**-0.039**	-0.009
	(0.091)	**(0.001)**	(0.389)
Joint p for Stature	0.1977	**0.0001**	**0.0005**
Marginal Probability [p10, p90], Female	[0, 0.009]	[0.001, 0.014]	[0.002, 0.01]
Marginal Probability [p10, p90], Male	[-0.005, 0]	[-0.001, 0]	[0.001, 0.006]
Observations	928	2060	2061
		Stature instrumented, parent's stature and weight not included as controls	
Stature (cm)	*0.262*	*0.135*	**0.181**
	(0.033)	*(0.055)*	**(0.002)**
Stature * Male Dummy	-0.131	0.001	0.066
	(0.578)	(0.996)	(0.514)
Joint p for Stature	**0.0033**	**0.0004**	**0**
Marginal Probability [p10, p90], Female	[0, 0.068]	[0.005, 0.052]	[0.024, 0.072]
Marginal Probability [p10, p90], Male	[0.001, 0.033]	[0.002, 0.052]	[0.036, 0.097]
Wu-Haussman p	0.9941	*0.0489*	**0**
Basman-Sargan p	0.6196	0.1214	**0.0062**
Observations	3349	5212	4612
		Stature instrumented, parent's stature and weight included as controls	
Stature (cm)	*0.315*	*0.141*	*0.113*
	(0.04)	*(0.086)*	*(0.085)*
Stature * Male Dummy	-0.113	-0.002	0.164
	(0.701)	(0.989)	(0.156)
Joint p for Stature	**0.0018**	**0.0013**	**0**
Marginal Probability [p10, p90], Female	[0, 0.088]	[0.004, 0.055]	[0.014, 0.045]
Marginal Probability [p10, p90], Male	[0.001, 0.06]	[0.002, 0.053]	[0.039, 0.109]
Wu-Haussman p	0.9672	0.143	**0.0003**
Basman-Sargan p	0.5185	0.5091	0.1333
Observations	2363	3998	3620

Coefficients show 1% confidence in bold, 10% confidence in italics, p values in parenthesis.
Confidence for marginal probability intervals, percentiles 10 and 90, not marked.

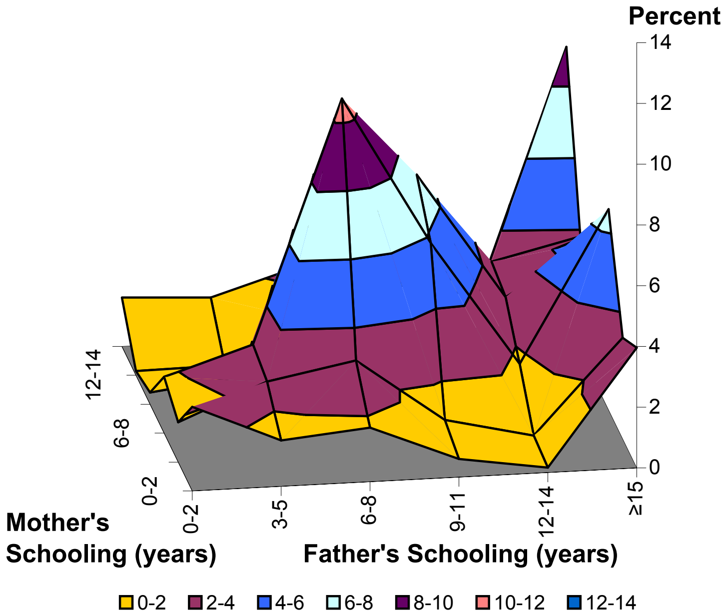
Table V. Ratio of Z-score (Stature) to Mother's Schooling Coefficients

	Present Study*			**Glewwe and Jacoby (1995)**	
	Stature not instrumented	Stature instrumented		Full Instrument Set	Reduced Instrument Set
		Parent's Stature and Weight not Included as Controls	Parent's Stature and Weight Included as Controls		
Lower to Higher Primary	0.48	10.16	**9.67**	**8.87**	7.18
Primary to Lower Secondary	1.88	11.97	**9.13**	-	-
Lower to Higher Secondary	3.26	73.25	**30.49**	-	-

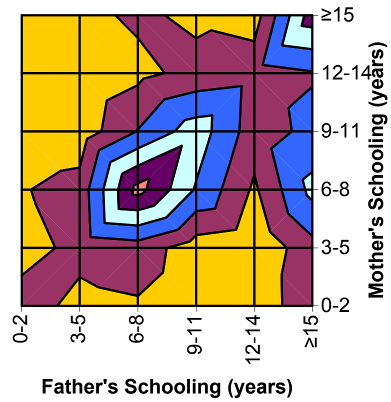
*Results converted to Z-score units for comparability. Prefered results in bold.

Figure V. Distribution of Households According to Female and Male Spouses' Schooling

Figure V.1 Data from ENSA 2000



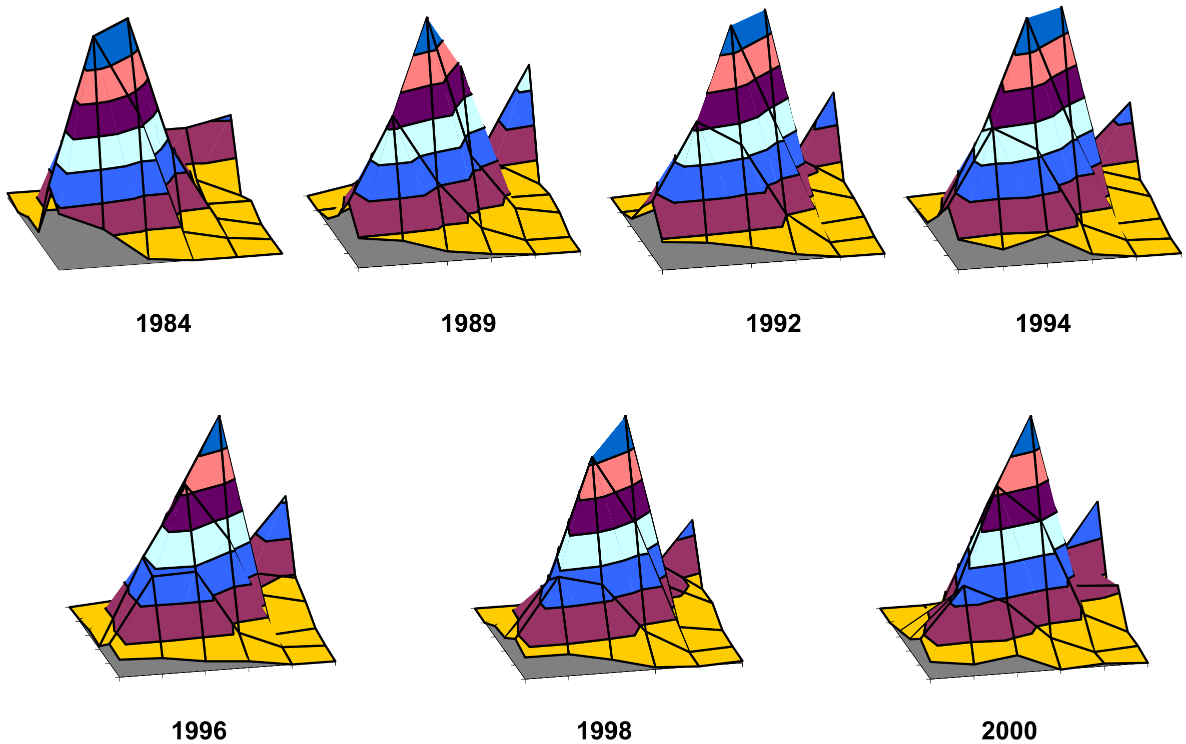
Three Dimensional Graph



Two Dimensional Graph

Households restricted to two spouses of opposite sex ages 25 to 40

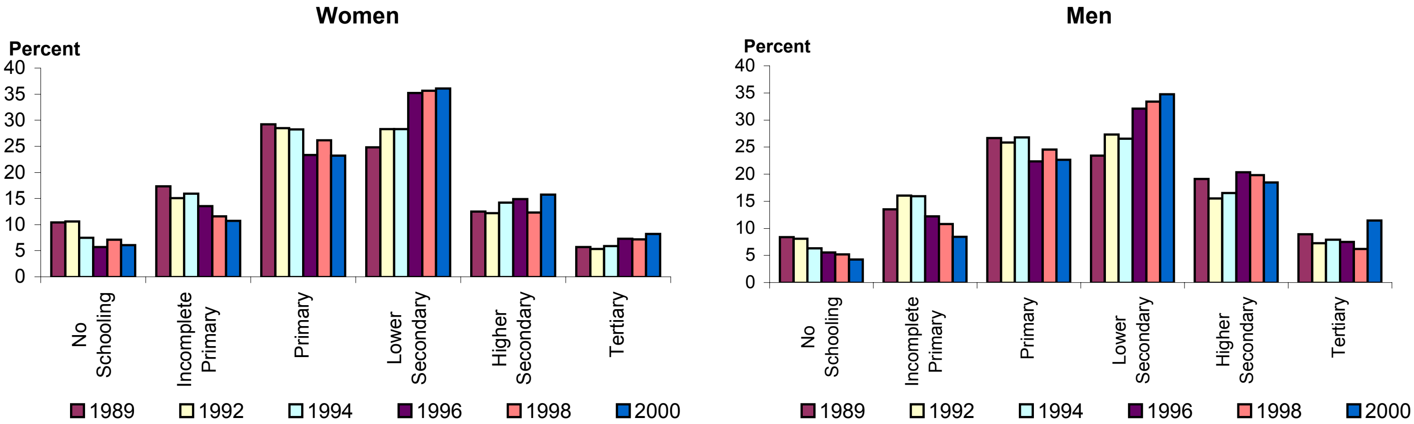
Figure V.2 Data from several ENIGH surveys.



Coloring and Orientation as in Figure V.1

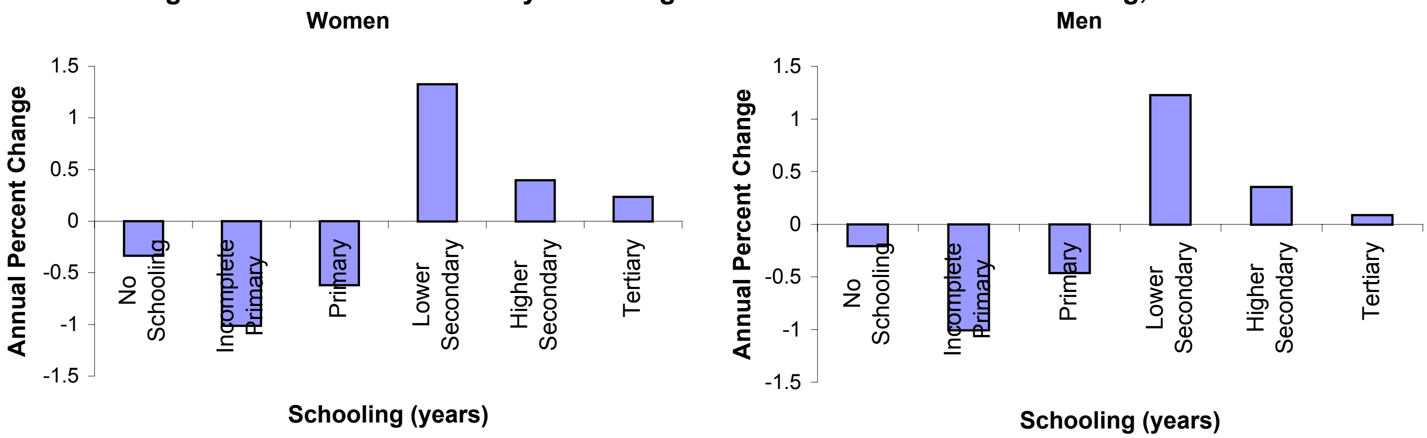
Households restricted to two spouses of opposite sex ages 25 to 30

Figure VI. Distribution of Schooling for Adults 25 to 30



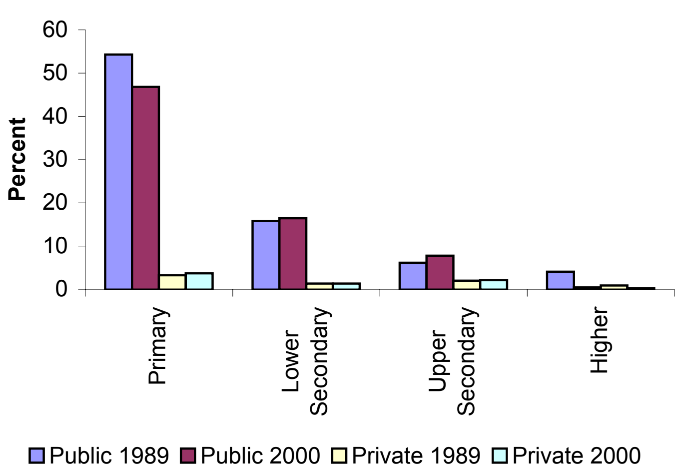
Based on ENIGH 1989, 1992, 1994, 1996, 1998, 2000 data for adults aged 25 to 30

Figure VII. Profile of Tendency for Change in Distribution of Adult Schooling, 1989-2000



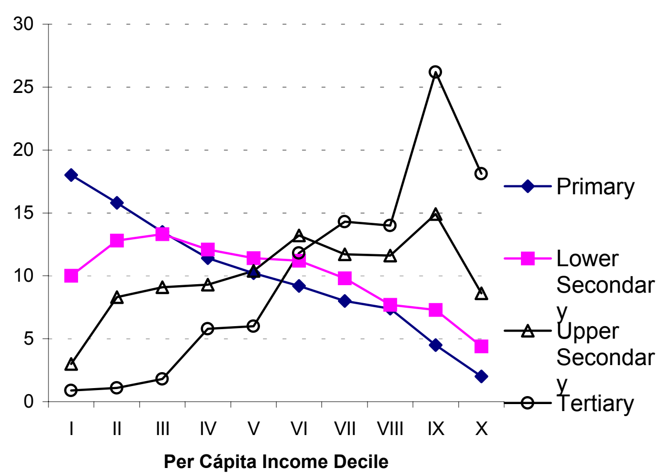
Based on ENIGH 1989, 1992, 1994, 1996, 1998, 2000 data for adults aged 25 to 30

Figure VIII. Students in Public and Private Schools, by Level of Schooling



Based on "Estadística Histórica del Sistema Educativo de la Nación",

Figure IX. Distribution of Public Education Expenditure in 2000



Source: Scott (2003b)