Chapter 1. Statement of Problem and Review of Theory

I.1 The Problem

The Jamaican economy has not performed well over the past twenty-five years (see figure II.1). Since 1975, the growth rate of real gross domestic product (GDP) has not surpassed the low single digits and has been negative at times. Rather than being on a long-run growth path, Jamaica appears to be stuck in a long recession. Even in periods of global economic expansion, like the one experienced from 1993-1998, the Jamaican economy seems unaffected. The composition of the economy today is almost identical to what it was forty years ago, save for the addition of garment assembly to the manufacturing sector. Perhaps partially at fault is the slow rate of change in the general skill level of the labor force. While the number of persons receiving secondary training has increased since 1960, it is not clear that this has resulted to an improvement in skill. Neither is it clear that the population is acquiring skill at a rate that makes it competitive in the global labor market. Chapter 2 will show that illiteracy, for example, is still an important problem. There, it will also be revealed that a large portion of the labor force has had very little training and that employers consider many secondary-school graduates untrainable. These observations are simultaneous with substantial expenditure on public education by every governments since 1962, and it leads one to ask why is Jamaica having such a difficult time catching up.

It is universally accepted that the rate of economic growth depends positively on the stock of human capital in a country. Economic theory (eg. Romer (1987), Lucas (1988)) emphasize that human capital is as important to economic development as physical capital. In particular, there may be complementarities between human and physical capital that only economies with well-trained individuals will be able to exploit. Recent empirical work by Robert Barro (1991) and Gregory Mankiw et. al. (1992) provide considerable evidence in favor of the hypothesis that those countries that grew fastest between 1960 and 1990 were those countries with higher than average levels of investment in human capital in 1960. There is also recognition that education plays an important role in changing the welfare of people by affecting their ability to absorb information about health, family planning, and child rearing practices.

If it is the case that the quantity of human capital a country possesses is crucial in determining its potential for economic growth, then it is important to understand the mechanisms that determine the quantity and quality of education the population receives. The amount of human capital one receives depends on a number of factors including the level of public investment in education, the level of investment at the level of the household, and the environment for learning that is created at school and at home. It is important to understand the manner in which each of these institutions may influence a child’s ability and desire to get an education and the relative importance of each of these influences.
The central hypothesis of this dissertation is that one of the reasons for the slow pace of human capital acquisition, and hence of economic growth and transformation, is that the majority of Jamaican children are born within a family structure that does not produce human capital efficiently. More than ¾ of the children born in Jamaica are born to parents who are unmarried. A substantial minority of children is born to parents who do not have even a short-term commitment to each other. Others are born to parents whose attachment lasts for less than two years. Many children spend a good portion of their schooling years with only one or none of their parents present. These children are possibly disadvantaged both from the willingness and the ability of their households to invest in their education. On the one hand, the child could be disadvantaged from an unwillingness to invest in his education because the child was not desired at this point in the parents’ life (the so-called “unwanted children”). These children are perhaps often regarded as temporary setbacks to the mother’s own life-plan, and responsibility for them is shifted to other persons (or they are abandoned) as soon as possible. On the other hand, some children could suffer a disadvantage because their mothers are too poor to invest time and money into their education.

The structure of the households in Jamaica could be a serious constraint on the effectiveness of government investment in education. It is well recognized that household behavior is an important determinant of the educational success of children. Households determine educational attainment of children through the fertility decisions of adults, the allocation of resources between goods that enhance the human capital of children and goods that do not, and by its use of the household members’ time. For the past thirty years, the family planning programs of the Jamaican government consist mainly of providing information about and access to modern contraception methods. They also tried to persuade adults (and teens) that a small family size (delayed fertility) was an economically superior choice. These programs have had their biggest impact on the fertility of married women (see chapter 2) and limited impact on the fertility of unmarried women. If family structure does constrain the pace of human capital acquisition then the government needs to develop a more active policy toward family formation and provide incentives to ensure that the fertility and investment choices of adults are more conducive to the production of human capital.

The remainder of this chapter gives a brief review of the main theoretical and empirical literature that links household behavior, human capital acquisition, and economic growth.

I.2 The Role of Human Capital in Economic Growth - The Theory

I.2.1 Introduction

The role of human capital in economic growth was not always explicitly recognized in formal economic models of growth. The neoclassical model of growth outlines by Solow (1956) and Swan (1956) related the total output of goods and services
to the stock of capital that is available in the economy and the available labor force. In this model, the rate of change of the per capita capital stock depends on the exogenously determined rate of savings, rate of growth of the population and the depreciation rate of capital. The neoclassical nature of the model guarantees a steady state in which per capita output, capital and consumption each ceases to grow. Even though changes in technology, the savings rate, the rate of depreciation, and the population growth rate may affect the level of the per capita values in the steady state, they do not affect the rate at which the economy grows. The model predicts that countries with the same values for the savings rate, the rate of population increase, and rate of depreciation will converge in per capita output over time even if they have different starting values for capital per person. The idea is that where capital is scarce the marginal product of capital is high so per capita output grows relatively faster than places where capital is abundant.

This model came under criticism for two main reasons. First, it fails to account for trends in the growth rate of individual countries and for differences in the growth rates of different countries (see Lucas (1988)). For example, some countries appear to be growing without bound while other have remained stagnant for over 30 years, and not all in the manner the theory predicts. Second, the model fails as a theory of growth because it provides no explanation of the process that generates economic growth. In other words, while the model can account for growth, it does not say what countries can do to encourage growth. The shortcomings of the model have encouraged economists to entertain the consequences of new assumptions in formal models of economic growth. A new model of growth would need to account for the inter-country differences in growth rates and at the same time outline an internal engine of growth. There have been a number of responses to this challenge among which the three most well known are Romer (1986), Lucas (1988), and Becker, Murphy and Tamura, (1990) BMT. These models suggest that it is possible to achieve long-term, continuous economic growth because the accumulation of human capital is not subject to diminishing returns. Lucas and BMT stress that the crucial determinant of the level of human capital in the economy is the allocation of resources and time by individuals and households.

I.2.2 Brief Theoretical Review

In Romer’s model, long-run growth occurs primarily as a result of the accumulation of knowledge by profit-maximizing firms. The three fundamental assumptions are (1) the production function for consumption goods exhibits increasing returns in the stock of knowledge, (2) the production of knowledge by one firm produces a positive external effect on the production function of other firms and (3) there is decreasing returns to the production of new knowledge. Increasing marginal productivity of knowledge ensures that the production of consumption goods will grow without bound, while assumption (3) constrains the pace of growth and helps guarantee the existence of a competitive equilibrium. Assumption (2) suggests that a firm’s output depend not just on the firm- specific stock of knowledge, but also on the aggregate stock of knowledge in the economy. Hence, in this model, public investment in education is justified on the grounds that social returns to education exceed private returns.
Knowledge is produced according to the production function $\dot{h} = G(I, h)$, where $h$ is the current stock of knowledge and $\dot{h}$ is the time derivative of $h$. Firms can augment knowledge by investing an amount $I$ into research. So the accumulation of knowledge depends on the existing stock in the firm, and the amount the firm invests in knowledge. Romer derives conditions under which the socially feasible production function (the production function that would be maximized by a social planner) will be globally convex in $h$ with marginal and average social product of knowledge that never decreases.

Lucas’ model is designed to show that an individual’s allocation of his/her time not only affects current productivity but also productivity in future periods (individually, and economywide). Like Romer, Lucas stresses that an individual’s acquisition of human capital has both internal and external effects on the individual’s productivity. Human capital is accumulated according to the production function $\dot{h}(t) = h(t)\delta(1 - u(t))$. The growth of one’s human capital depends on the existing stock $h(t)$, and the amount of time that is devoted to further acquisition, $1-u(t)$, where $u(t)$ is the proportion of time spent working. $\delta$ is the effectiveness of investment in human capital. Clearly, the production of human capital exhibits non-diminishing returns to $h(t)$. Also, the rate of growth of the stock of human capital is a positive function of the amount of time spent studying. In both the socially optimal and competitive solutions, continuous growth occurs even if the external impact of human capital is removed, because the assumption of non-diminishing returns to human capital ensures that $\frac{\dot{h}(t)}{h(t)} = \delta(1 - u)$ is always positive and, as long as human capital is allowed to grow, so too will output.

The analysis of Becker, Murphy and Tamura establishes a relationship between the returns to human capital, $h$, and economic growth and between the amount of human capital acquired by children and the allocation of time and other resources in the household. Returns to human capital are higher when the existing stock is already high, so households find it more profitable to invest in fewer high human-capital children than in many low human-capital children. The converse is also true. This result rests on the assumption that there is a positive relationship between the fertility of the present generation and the rate at which it discounts the consumption of future generations in the intertemporal utility function.

In this model, each person lives for two periods, childhood and adulthood. All childhood is spent acquiring human capital and $T$ hours are spent working as an adult. At the beginning of adulthood, each person bears $n$ children with a plan to spend some of her time and food rearing each child. Each child is endowed with a minimum amount of productive capacity. The human capital that is produced in each child, $h(t+1)$, depends on the time spent by the parent teaching the child and on the parent’s own human capital, $h(t)$. Again, an important assumption is that the accumulation of human capital is not subject to diminishing returns.

This model yields two steady states; one in which fertility is high, human capital and investment in human capital are both zero and there is little growth; and another in
which human capital is high, investment in human capital is high and consumption and human capital grow at a constant rate. In the steady state with $h=0$, the rate of return on increasing the number of children strictly dominates the returns from investment in their human capital. If children are naturally well endowed and their maintenance cost low, then it pays to have many children and give each little education. This equilibrium is stable for small changes in $h$ around zero.

It is not difficult to imagine the mechanism that would generate the other steady state. First, if $h(t)$ is sufficiently large the opportunity cost of parent’s time spent in child rearing will be high and will rise with $h$. Eventually the cost of time rises enough to induce a shift away from large $n$. As $n$ falls, the rate of return on human capital increases and it becomes more attractive to invest in child quality rather than quantity. Second, as $h$ rises so does the rate of return on its accumulation. Eventually $h$ will become large enough such that a given amount of parental time invested in human capital produces an $h(t+1)$ than exceeds $h(t)$. From this point onwards, human capital continues to grow until the economy converges to a steady state with constant fertility, constant time input and a constant (positive) growth rate of consumption and human capital.

These models have three very clear themes. The first is that the acquisition of human capital by individuals is the primary source of long-run economic growth. The mobilization of factors of production can act as a source of growth, but growth stops when the limits of the supply of factors are reached. On the other hand, continual expansion of knowledge can act as a source of continuous growth. The second theme is that the level of human capital in the future is a function of the amount of time and financial resources allocated to its production today. This is where the behavior of households is crucial to this story, because it is at the household level that the allocation decisions are made. If households decide to use the time of children for purposes other than the acquisition of human capital then the society will acquire human capital at a slow rate. The final major theme is that the production of human capital depends positively on the existing stock. Where the stock is already high, the society will acquire human capital faster than where the stock is low.

I.3 The Role of Human Capital in Economic Growth – Empirical Evidence

There is some (perhaps mixed) evidence that the level of human capital a country possesses plays an important role in its rate of economic growth. In general, the approach to this sort of research has been to attempt to discover whether a relationship exists between initial levels of human capital (measured by literacy rates, or school

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1 The poor attendance rate of Jamaican students in primary school is possibly one of the factors which constraint educational attainment. Possibly some households prefer to use the time of its children for immediate income generating projects than for long-term human capital acquisition.

2 Three of the studies reviewed here are based on cross-country regressions. One important criticism of these studies is that heterogeneity across countries is likely to be an important source of differences in economic growth over time and should be taken into account. Some authors used regional dummy variables under the assumption that countries within a region are fairly homogeneous. It is likely that this does not take care of the entire problem.
enrollment for example) and the subsequent rate of growth of the economy. Some of these studies are summarized here. The first three studies used cross-country data and excluded oil producing and (formerly) centrally planned economies while the last study uses micro data on individual countries.

In a 1990 paper, Paul Romer presented regression results which related the average annual rate of growth of real per capita income between 1960 and 1985 to real per capita income in 1960, the average share of GDP which goes to investment (averaged over the period 1960 to 1985), the average share of GDP that goes to government spending (net of government investment), dummy variables for Africa and Latin America and the percentage of the population (multiplied by 100) that was literate in a year close to 1960. His least squares results indicated a positive and slightly significant (p=0.063) relationship between average growth rates and literacy. The effect disappears, however, when he estimated instrumental variable regression to control for possible measurement error in initial GDP and literacy. The instrumental variable result, he demonstrated, was probably due to the strong correlation between the (error-corrected) literacy rate and the level of investment. When the rate of investment was regressed on the (error free) 1960 literacy rate and the change in literacy between 1960 and 1980 (along with the other variables named above) both had positive and strongly significant coefficients. The results in this paper are therefore not conclusive, at best they can be called encouraging.

Robert Barro (1990) attempted a study similar to the one described above. He used the same dependent variable but measured human capital by the primary and secondary school enrollment rates in 1960. Other control variables were real per capita income in 1960, the average (1970-1985) ratio of real government consumption (net of defense and education) to real GDP, the number of revolutions and coups per year, the number of assassinations per million population per year, and the deviation of the 1960 PPP value for the investment deflator from the sample mean. The model suggested a strong positive role for human capital in 1960 in the subsequent average rate of growth of the economy. This result was generally insensitive to several respecifications of the model, including the inclusion of the 1950 (1970) primary and secondary enrollment rates, teacher/pupil ratios in 1960 (to control for the quality of education), the 1960 literacy rate and dummy variables for sub-Saharan Africa and Latin America.

Consistent with the theory of Becker, Murphy and Tamura, Barro found that the average (between 1965 and 1985) total fertility rate (the projected average number of live birth for a typical woman over her lifetime), the net fertility rate (net of mortality for 0 to 4 year olds), and the growth rate of the population were all inversely related to the 1960 primary and secondary enrollment rates. He also found significant positive associations between the human capital proxies and the average rate of investment over the survey period. The two measures of investment were the average of the ratio of real private domestic investment to real GDP and the ratio of real private and public investment to real GDP. Both of the latter models had roughly the same control variables as the ones used in the GDP growth equation.

\[^3\] Of course, revolutions and coups are themselves related to (the absence of) economic prosperity.
Gregory Mankiw, David Romer and David Weil provided further evidence on the role of human capital in (at least accounting for) economic growth in 1992. The intent of their study was to show that the neoclassical growth model could still account for economic growth over time by simply updating the model to include human capital. They regressed the logarithm of GDP per working person in 1985 on the average share of real investment (including government investment) in real GDP for 1960 to 1985, the sum of the population growth rate, the rate of depreciation of capital and the rate of technical change (the sum of the latter two were taken to be 0.05) and a measure of human capital. Their measure of human capital was constructed as the product of the fraction of 12 to 17 year olds enrolled in secondary school and the fraction of the working age population who are of school age (15 to 19). This variable was intended to measure the rate at which the economy acquires human capital. This variable was found to have a large positive and significant effect on GDP per working person in 1985.

Rosenzweig (1990) used household-level data for India, Indonesia and the Philippines. The results provided fairly strong support for the Becker, Murphy and Tamura model. He reported that fertility is higher and school enrollment lower the higher the district level child wage rate, though the point estimates and elasticities (with respect the child’s wage) were small. These results support the idea that where the financial rate of return on children are high fertility is high and schooling is low. The female wage rate had a negative relationship with the fertility rate (children ever born) which supports the idea that women will shift away from large \( n \) as the opportunity cost of time increases. One other interesting finding was that regions of India that experienced exogenous technological change also experienced greater decreases in children ever born, bigger reductions in the percentage of males with no primary schooling and bigger increases in the real agricultural wage rate.

I.4 The Importance of Growth

This dissertation is not interested on the effect of out-of-wedlock child bearing and rearing on human capital formation for its own sake. Rather, these issues are of interest because there appears to be a strong connection between the human capital stock that a country has and its economic prosperity over time (see Sections I.2 and I.3). But why is growth important?

Barro and Sala-i-Martin (1995) report that the US real per capita gross domestic product (GDP) grew by an average of 1.75 percent per year between 1870 and 1990. As a result, real per capita GDP increased from $2,244 in 1870 to $18,258 in 1990. To demonstrate the importance of growth, they showed that had real per capita GDP increased at a rate which is a mere one percent less than the actual rate (i.e. 0.75 percent) then the US would only have achieved a real per capita GDP of $5,519 in 1990. This is only thirty percent of the actual GDP achieved and, in 120 years, per capita income

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4 Working age is defined as age 15 to 64. One problem with defining per capita GDP in this way is that by focussing only on the working-age population, the relative position of countries with high dependency ratios is improved.
would only have increased 2.5 times. In other words, the US would be a lot like many of today’s developing countries. So from the mere standpoint of the wealth people are able to achieve, it is important that the economy grows, and small differences in the rate of growth, when compounded, are important.

But it is possible to argue that money is not equivalent to welfare and that consumption rather than income should measure welfare. For most of the past sixty years the Japanese economy has been recording substantial rates of growth in both GDP and GDP per person. Per capita GDP in 1991 was about 5 times what it was in 1960. How has this affected the wellbeing of the average Japanese? According to Yasukichi Yasuba (1996), in the 1980s consumption was buoyant, households significantly increased their spending on consumer durable goods, meals away from home and designer clothing and the popularity of other recreational activities like golf, tennis and visits to museums increased. Bronfenbrenner and Yasuba (1996) report that working hours per month in Japanese manufacturing industries fell from 207 hours in 1960 to 178 in 1980. Between 1990 and 1992 the annual average hours for a manufacturing worker fell by 150 hours, and this trend was expected to continue. Improvements in health and housing conditions were also noted.

Economic growth is also important because poverty still threatens the lives of many people. The World Development Report (1990) indicates that, through its phenomenal growth, it took Indonesia less than a generation to reduce poverty from 60 percent to less than 20 percent. There is also evidence that general welfare is improving in China. Over the past twenty years the number of persons in poverty fell rapidly in places where economic growth was strong but either stagnated or increased in places where economic growth was weak. So economic growth is crucial in the alleviation of poverty, which is now estimated to affect more than one billion people. Growth also helps reduce the population growth rate by increasing the value of time, thus changing the opportunity cost of high fertility.

Another major global concern in recent decades is the environment. Especially in the 1970s, it was believed that economic growth and the maintenance of a healthy environment were conflicting goals. Yet it is now clear that environmental quality is better in most advanced countries because they can afford to keep the environment clean, and because the demand for environmental quality is strongly related to income level. For example, The World Development Report (1992) indicates that the concentration of suspended particulate matter in the air has improved in middle- and high-income countries between the decade of the seventies and the middle of the 1980s. At the same time it worsened in low-income countries and is now in the region regarded as unacceptable. Several other sources of pollution such as lead, sulfur oxides and nitrogen oxides show strong negative relationships with the level of wealth.

Chapter 2 provides background information on Jamaica, including recent economic trends, the school system and family structure. In chapter 3 I hope to find an answer to the question: Do children whose mothers are married have higher educational attainment than children whose mothers are not married? To do this, it is first assumed
that the marital status of the child’s mother is exogenous to the child’s educational attainment. Under this assumption, a simple model of child cognitive achievement is estimated, using tests in mathematics and reading comprehension as observable measures of cognitive achievement. In chapter 4, the investigation centers on whether the revelation of a child’s ability (quality as an asset) affects the probability that an unmarried mother will receive and accept an offer of marriage. The child’s performance on the national common-entrance exam is used as the measure of child ability because of the importance of this exam to future labor market success. Chapter 5 gives a brief discussion of the implications of the results. A description of the data used for the study is provided in Appendix A.