



## CHAPTER 2

### ECONOMIC GROWTH AND DEVELOPMENT

*Once one starts to think about economic growth, it is hard to think about anything else*

(Robert Lucas)

#### 2.1 INTRODUCTION

The purpose of this chapter is to identify and describe the role of various macro-economic factors and their contribution to economic growth and development in an urban economic environment. The identification of these factors is important in evaluating their availability and quality in an economic system, be it national or local. The availability and quality of these factors, to a large extent, determine the potential opportunities for economic growth and development. As stated earlier, it is important to realise that economic growth is merely a necessary but not sufficient condition for economic development. Economic growth implies a quantitative change while economic development implies both a quantitative and qualitative change. In this study, both concepts will be seen as complementary to the enhancement and improvement of an urban environment.

Standards of living differ all around the world and the implications of this for the welfare and quality of life of its inhabitants are enormous. These differences can be associated with large discrepancies in literacy, nutrition, life expectancy and other related factors. It is thus of great importance for an economy to identify the factors that will influence its potential economic growth and prosperity. This will enable an area to enhance the quality of life of its residents and thus ensure a qualitative change or economic development. Various phases of interest in economic growth theory have activated thoughts on this very important issue. This progress in economic thought concerning



contributing factors to economic growth and development will now be analysed as a starting point for growth and development in urban economies.

## 2.2 THE HARROD-DOMAR THEORY

### 2.2.1 The growth model

The Harrod-Domar model involves the manipulation of two basic relationships, *viz.* the fixed output/capital ratio and the equality between savings and investment (Brown, 1988: 374). The rate of economic growth is the product of the investment-output ratio and the output-capital ratio. Net investment spending adds to the nation's stock of capital, increases the economy's productive capacity and raises its potential level of income. The change in productive capacity will depend on the level of investment and the potential social average productivity of new investment (Brue, 1994: 491). Suppose that the required labour input per unit of output is falling at rate  $m$ , the labour productivity is thus rising. If the labour force is increasing at rate  $n$ , the output must grow at  $m + n$  on average. If this does not happen the unemployment rate will rise indefinitely if output growth is too slow, or the economy will experience a shortage of labour if growth is too fast. The consequence may be that economies will for the most part experience continued periods either of increasing or falling unemployment rates.

On the other hand, they may experience continued periods of rising or falling capacity utilisation (Brown, 1988: 377). The first problem could be evaded by a developing country with a large pool of rural labour. Such an economy could merely improve its long-term rate of industrial growth by increasing its investment quota. If it were that simple, it would be hard to understand why poor countries have not followed that route to economic growth. To avoid these awkward conclusions is to recognise that at least one of the variables used is likely to be endogenous. The Harrod-Domar model doubts whether annual investment growth would automatically be sufficient to maintain full employment. If investment failed to grow at the required rate, the economy would recede. On the other hand, if the growth of investment spending exceeded the required

rate, demand-pull inflation would result. The essential result of this theory is that the economy will be prone to instability (Brown, 1988: 374).

### 2.2.2 Implications for urban economic development

The link between the Harrod-Domar growth model and its implications for urban economic development is that it relates more closely to problems faced by a developing economy. The emphasis in this growth model - to generate economic growth and development - is based on increased levels of savings and investment. Although these factors cannot be ignored by developed economies, they are seen as a given. However, in a developing economy, capacity building is the order of the day and high levels of savings and concomitant investment are still very important prerequisites for economic growth and development. The level of growth and development in a developing urban economy necessitates basic investment, which would not necessarily be required in a developed urban economy. Other than increasing levels of savings and investment, various related factors will also contribute to urban economic development.

## 2.3 THE SOLOW GROWTH MODEL

The model of Solow focuses on four variables *viz.*: output (Y), capital (K), labour (L) and knowledge or the effectiveness of labour (A). Certain amounts of capital, labour and knowledge are present at any stage in the economy. These are then combined to produce output. The production function takes the form:

$$Y(t) = F[K(t), L(t), A(t)],$$

where  $t$  denotes time (Solow, 1957: 312). The variable  $t$  for time appears to allow for technological change. Technological change refers to any kind of shift in the production function. Any economic slowdown or boom, better educated labour force, etc. will appear as technical change (Solow, 1957: 312). It is also important to note that time does not enter the production function directly but only through K, L and A. Output will



change over time if the inputs into the production process change.  $AL$  is seen as effective labour and any technological progress that enters through them is considered to be labour augmenting. The central assumption of this model concerns the production function and its three inputs into production (capital, labour and knowledge) over time, which will now be discussed.

### 2.3.1 Assumptions concerning the production function

A critical assumption is the fact that constant returns to scale are experienced. This implies that if the quantities of capital and labour are doubled, with  $A$  fixed, the amount of output ( $Y$ ) also doubles. Using this argument and multiplying it by any positive constant ( $c$ ) causes the output to change by the same factor:

$$F(cK, cAL) = cF(K, AL) \text{ for all } c \geq 0 \quad (2.1)$$

This is assumed to happen in an economy that is big enough for the gains from specialisation to have been exhausted. In a very small economy (e.g. urban economy) there is a possibility for specialisation which may lead to more than a doubling of the output with a doubling of inputs.

By assuming constant returns to scale, the production function can now be analysed further. Setting  $c = 1/AL$  in equation (2.1) yields

$$F(K/AL, 1) = (1/AL)F(K, AL) \quad (2.2)$$

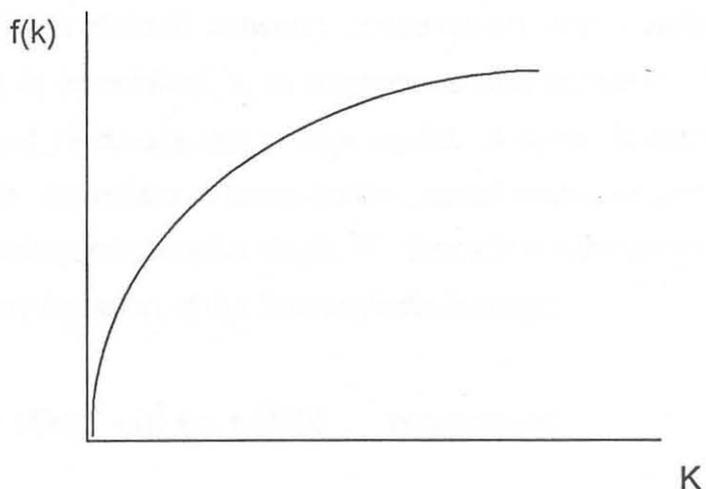
$K/AL$  is the amount of capital per unit of effective labour and  $F(K, AL)/AL$  is  $Y/AL$ , output per unit of effective labour. Define  $k = K/AL$  and  $f(k) = F(k, 1)$ . Now (2.2) can be rewritten as:

$$Y = f(k) \quad (2.3)$$

Output per unit of effective labour can be written as a function of capital per unit of effective labour. To understand (2.3) better, divide the economy into  $AL$  small economies (e.g. urban economies), each with 1 unit of effective labour and  $K/AL$  units of capital. With constant returns to scale, each of these small economies produces  $1/AL$  as much as it produced in the large, undivided economy. The amount of output per unit of effective labour thus depends only on the quantity of capital per unit of effective labour and not on the overall size of the economy. This is the mathematical meaning of equation (2.3). If the total amount of output is wanted, instead of the amount per unit of effective labour, it needs to be multiplied by the quantity of effective labour:  $Y = ALf(k)$ .

From the intensive-form production function,  $f(k)$ , it is assumed to satisfy  $f(0) = 0$ ,  $f'(k) > 0$ ,  $f''(k) < 0$  and thus it is possible to derive the marginal product of capital, viz.  $f'(k)$ . This implies that the marginal product of capital is positive, but it declines as capital (per unit of effective labour) rises. It also states that the marginal product of capital is very large when the capital stock is relatively small and that it becomes very small as the capital stock becomes large (Solow, 1991:397). A production function satisfying all of these conditions is shown below in Figure 2.1.

**Figure 2.1: A production function**





A specific example of this type of production function is the Cobb-Douglas function.

$$F(K, AL) = K^\alpha (AL)^{1-\alpha}, 0 < \alpha < 1 \quad (2.4)$$

Multiplying both inputs by c will give

$$\begin{aligned} F(cK, cAL) &= (cK)^\alpha (cAL)^{1-\alpha} \\ &= c^\alpha c^{1-\alpha} K^\alpha (AL)^{1-\alpha} \\ &= cF(K, AL) \end{aligned} \quad (2.5)$$

It is thus possible to see that the Cobb-Douglas function has constant returns to scale. This critical assumption of constant returns to scale can be seen as one of the major constraints of the Solow growth model.

### 2.3.2 Development of inputs into production

The remaining assumptions of this model are concerned with the change in the stocks of labour, capital and knowledge over time. To determine the behaviour of the economy, it is necessary to analyse the behaviour of capital, since labour and knowledge are exogenous. Solow's model shows that initial levels of labour, knowledge and capital are taken as given, with labour and knowledge growing at constant rates (Solow, 1987: 10). Output is divided between consumption and investment. The fraction of output devoted to investment, s, is exogenous and constant. One unit of output devoted to investment yields one unit of new capital. A dynamic economy grows over time and therefore it is convenient to focus on the capital stock per unit of effective labour, k, rather than the unadjusted capital stock, K. Since  $k = K/AL$  and the fact that  $Y/AL$  is given by  $f(k)$ , the key equation of the Solow model is found:

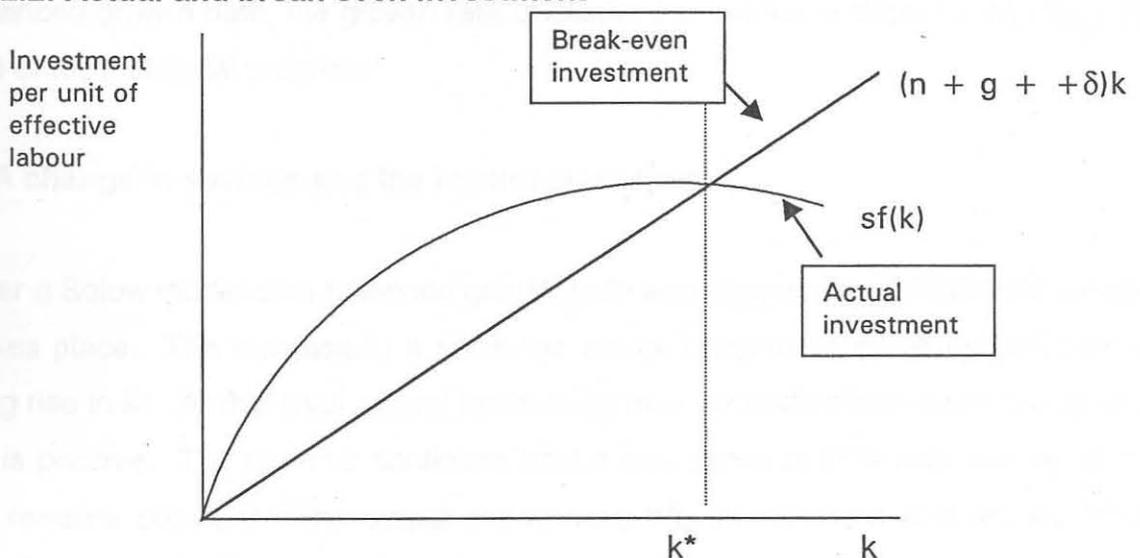
$$\bullet k(t) = sf[k(t)] - (n + g + \delta)k(t) \quad (\text{see footnote})^* \quad (2.6)$$

\* (The dot next to the variable denotes a derivative with respect to time, i.e.  $\bullet k(t)$  is a shorthand method for  $dk(t)/dt$ ).

This equation states that the rate of change of the capital stock per unit of effective labour is the difference between two terms. The first term,  $sf(k)$ , is the actual investment per unit of effective labour: output per unit of effective labour is  $f(k)$  and the fraction of that output that is invested is  $s$ . The second term,  $(n + g + \delta)k$ , is the break-even investment, meaning the amount of investment that must be done just to keep  $k$  at its existing level.

Two reasons explain why some investment is needed to prevent  $k$  from declining. Because existing capital is depreciating, it must be replaced to keep the capital stock ( $K$ ) from falling. This is denoted by the term  $\delta k$ . Secondly, the quantity of effective labour is growing and to keep the capital stock per unit of effective labour ( $k$ ) constant, some investment is needed to keep this relation constant. Since the quantity of effective labour is growing at rate  $n + g$ , the capital stock must grow at rate  $n + g$  to hold  $k$  steady. This is shown by the term  $(n + g)k$  in equation (2.6). If the actual investment per unit of effective labour exceeds the investment needed to break even,  $k$  will rise. When the investment is less than the break-even point,  $k$  is falling and when the two are equal,  $k$  is constant. Solow mentions that profitability is a determinant of investment but continues to argue that the meaning of profitability becomes unclear when the future is unclear (Solow, 1987: 18).

**Figure 2.2: Actual and break-even investment**





In Figure 2.2 the two terms from the expression for  $\dot{k}$  as functions of  $k$  are shown. The break-even investment,  $(n + g + \delta)k$ , is proportional to  $k$ . Actual investment  $sf(k)$ , is a constant times output per unit of effective labour. Since  $f(0) = 0$ , actual investment and break-even investment are equal at  $k = 0$ . The conditions imply that at  $k = 0$ ,  $f'(k)$  is large and this means that the  $sf(k)$  line is steeper than the  $(n + g + \delta)k$  line. Thus for small values of  $k$ , actual investment exceeds break-even investment. The conditions also imply that  $f'(k)$  moves closer to zero as  $k$  becomes large.

At some point the slope of the actual investment curve falls below the slope of the break-even investment curve. With the  $sf(k)$  curve flatter than the  $(n + g + \delta)k$  curve, it eventually crosses. The fact that  $f''(k) < 0$  implies that the two curves intersect only once for  $k > 0$ . Where the actual and break-even investment are equal,  $k$  is denoted by  $k^*$ . From this figure it is possible to see that if  $k$  is initially less than  $k^*$ , actual investment exceeds break-even investment and so  $\dot{k}$  is positive (rising). If  $k$  exceeds  $k^*$ ,  $\dot{k}$  is negative. If  $k$  equals  $k^*$ ,  $\dot{k}$  is zero. It can thus be concluded that regardless of where  $k$  starts, it converges to  $k^*$ .

Due to the convergence to  $k^*$ , the Solow model implies that, regardless of its starting point, the economy converges to a balanced growth path. This refers to a situation where each variable in the model is growing at a constant rate (Solow, 1987: 11). In this balanced growth path, the growth rate of output per worker is determined solely by the rate of technological progress.

### 2.3.3 A change in savings and the impact on output

Consider a Solow model on a balanced growth path and suppose a permanent increase in  $s$  takes place. The increase in  $s$  shifts the actual investment curve upward with a resulting rise in  $k^*$ . At this level, actual investment now exceeds break-even investment and  $\dot{k}$  is positive. The rise in  $k$  continues until a new value of  $k^*$  is reached, at which point it remains constant. The output per worker,  $Y/L$ , is important and equals  $Af(k)$ . When  $k$  is constant,  $Y/L$  grows at rate  $g$ , which is the same as the growth rate of  $A$ .



When  $k$  increases,  $Y/L$  grows not only because  $A$  is increasing but also because  $k$  is increasing. Its growth rate thus exceeds the rate of  $g$ . The moment that  $k$  reaches the new value of  $k^*$ , however, only the growth of  $A$  contributes to the growth of  $Y/L$ . The growth rate of  $Y/L$  now returns to  $g$ . A permanent increase in the saving rate thus produces a temporary increase in the growth rate of output per worker (Solow, 1987: 12). The rise in  $k$  takes place for some time but eventually increases to the point where the additional saving is devoted entirely to maintaining the higher level of  $k^*$ .

The output per worker begins to rise above the path it was on and then gradually settles into a higher path parallel to the first. A change in the saving rate has a level effect but not a growth effect. It changes the economy's balanced growth path and thus the level of output per worker but it does not effect the growth rate of output per worker on the balanced growth path. In the model of Solow no other change will lead to growth effects other than technological progress, which is exogenous.

#### 2.3.4 Central questions of the growth theory

The Solow model identifies two possible sources of variation in output per worker, *viz.* differences in capital per worker ( $K/L$ ) and differences in the effectiveness of labour ( $A$ ). Only growth in the effectiveness of labour can lead to permanent growth in output per worker. The changes in capital per worker on output per worker are modest. The differences in wealth between economies can to a certain extent be accounted for by differences in effectiveness of labour.

The effectiveness of labour is seen as exogenous and is not identified by the model. This residual, or portion of economic growth which cannot be attributed to growth in labour or capital is seen as "advances in knowledge and other miscellaneous factors that influence the growth rate" (Brown, 1988: 379). One possibility is that the effectiveness of labour corresponds to abstract knowledge. To understand differences between the growth rate of various countries, one needs to explain why certain firms have access to more knowledge than other firms and why knowledge is not rapidly



transferred to other firms. Another way of interpreting effectiveness of labour may be to consider the following: The education and skills of the labour force, the strength of property rights, the quality of infrastructure and cultural attitudes toward entrepreneurship and work in general. The effectiveness of labour may also reflect a combination of forces.

The central question remains that of how knowledge affects output, how it evolves over time and why it differs between different economies. The other possibility is that capital is more important than the Solow model implies. If capital encompasses more than just physical capital, or if physical capital has positive externalities, then the private return on physical capital is not an accurate guide to capital's importance in production. Solow's own estimates showed that the output per hour of work in the economy of the United States between 1909 and 1949 increased. Of this increase, seven-eighths could be attributed to technological change in the broadest sense and only the remaining eighth could be attributed to a conventional increase in capital intensity (Solow, 1987: 21). The work of Denison showed the similar results. For the period 1929 to 1982 he suggested that the single most important factor was the residual, which accounted for 55 per cent of the per capita income growth (Brown, 1988: 380).

It must be borne in mind that the Solow model is simplified in a number of ways: The model uses only a single good; government is absent; fluctuations in employment are ignored; the production function explains production, making use of only three inputs; and the rates of saving, depreciation, population growth and technological progress are constant. It is obvious that important features explaining growth are omitted. The limitations of Solow's model were first expressed by Abramowitz (1956: 11) who characterised the residual as "a measure of our own ignorance".

This conclusion leads to the work of the new growth theory, known as the Endogenous Growth Theory, where the role of knowledge was endogenised and seen as an explanatory factor for the residual in the Solow model.



### 2.3.5 Implications for urban economic development

It is important to determine the link between the Solow growth model and its implications for urban economic development. Solow identified three possible sources contributing to output, viz. capital, labour and knowledge or the effectiveness of labour. The only factor that could lead to permanent growth in output per worker, according to Solow, was knowledge, which was seen as exogenous and therefore not identified by the model. The three factors above are important building stones in generating economic growth and development in both developing and developed urban economies. The importance of the knowledge factor for the study is that the majority of knowledge is generated within urban areas. It is thus important to realise that Solow's residual, although not explained in detail, identified a most important factor contributing to economic growth and development within urban areas. In this way Solow paved the way for Romer to explore the factor of knowledge or effectiveness of labour in greater detail.

## 2.4 ENDOGENOUS GROWTH

Any increase in Gross National Product (GNP) that cannot be attributed to adjustments in the stock of capital or labour is ascribed to a third category, commonly referred to as the Solow residual (Todaro, 1994: 88). The residual, despite its name, is responsible for approximately 50 per cent of historical growth in developed countries. Solow credits the bulk of economic growth to an exogenous variable called technological progress. The Endogenous Growth Theory distinguishes itself from the Solow model by emphasising that economic growth is an endogenous result of an economic system and not the result of forces that impinge from outside.

An interesting aspect of the endogenous growth approach is that it helps to explain that the potentially high rates of return on investment are greatly eroded by lower levels of complementary investments in human capital, infrastructure or research and development (Meier, 1995: 103). In less developed economies individuals generally

receive fewer personal gain from the positive externalities created by their own investments and this leads to the accumulation of less than the optimal level of complementary capital.

Various economists have stressed increasing returns as an endogenous explanation for economic growth. Adam Smith (1776) referred to the growth in productivity due to the division of labour and the extent of the market. Alfred Marshall (1890) emphasised that the role of "nature" in production may be subject to diminishing returns, but the role of "man" is subject to increasing returns. JM Clark (1923) also observed that "knowledge" is the only instrument of production that is not subject to diminishing returns.

The Endogenous Growth Theory involves four variables, viz. labour (L), capital (K), technology (A) and output (Y). Two sectors are used in this model: A goods-producing sector where output is produced, and a research and development (R&D) sector where additions to stock of knowledge are made. A fraction ( $a_L$ ) of the labour force is used in the R&D sector and a fraction  $(1 - a_L)$  is used in the goods-producing sector. Similarly, fraction ( $a_K$ ) of the capital stock is used in the R&D sector and the rest in the production of goods. A piece of knowledge being used in one place does not prevent it from being used elsewhere; thus both sectors use the full stock of knowledge (A). The quantity of output produced at time t is thus:

$$Y(t) = [(1 - a_K)K(t)]^\alpha [A(t)(1 - a_L)L(t)]^{1-\alpha} \quad (2.7)$$

Equation (2.7) implies constant returns to capital and labour with a given amount of technology. The production of new ideas depends on the quantities of capital and labour engaged in research and the level of technology (Romer, 1996: 97):

$$\bullet A(t) = G[a_K K(t), a_L L(t), A(t)] \quad (2.8)$$

If a generalised Cobb-Douglas production function is assumed, equation (2.8) becomes:



$$\bullet A(t) = B[a_K K(t)]^\beta [a_L L(t)]^\gamma A(t)^\theta, \quad B > 0, \beta \geq 0, \gamma \geq 0 \quad (2.9)$$

where  $B$  is a shift parameter. The fact that the production function does not necessarily have constant returns to scale is the reason for referring to it as a generalised Cobb-Douglas function (Romer, 1996: 97). In the case of knowledge, constant returns to scale would cause the same set of discoveries to be made twice, thereby leaving  $\bullet A$  unchanged. Thus, diminishing returns are also possible in R&D. On the other hand, interaction among researchers may be so important in R&D that the doubling of labour and capital more than doubles output. There is also then a possibility of increasing returns to scale. There does not appear to be a restriction on how increases in the stock of knowledge affect the production of new knowledge. No restriction is thus placed on  $(\theta)$  in equation (2.9). If  $\theta = 1$ ,  $\bullet A$  is proportional to  $A$ ; the effect is stronger if  $\theta > 1$  and is weaker if  $\theta < 1$ . The saving rate is assumed to be exogenous and constant as in the Solow model and depreciation is set to zero for simplicity [ $\bullet K(t) = sY(t)$ ]. The growth rate of the population [ $\bullet L(t) = nL(t)$ ,  $n \geq 0$ ] is treated as exogenous.

### 2.4.1 The dynamics of knowledge accumulation

If no capital is used, the production function for output becomes:

$$Y(t) = A(t)(1 - a_L)L(t) \quad (2.10)$$

Similarly, the production function for new knowledge, equation (2.9), now becomes:

$$\bullet A(t) = B[a_L L(t)]^\gamma A(t)^\theta \quad (2.11)$$

The output per worker is proportional to  $A$ , as implied by equation (2.10), and thus the growth rate of output per worker equals the growth rate of  $A$ . The focus will now be on the dynamics of  $A$ , which are given by equation (2.11).

The growth rate of A, denoted by  $g_A$ , is:

$$\begin{aligned} g_A(t) &= \dot{A}(t)/A(t) \\ &= B a_L^\gamma L(t)^\gamma A(t)^{\theta-1} \end{aligned} \quad (2.12)$$

Since B and  $a_L$  are constant, whether  $g_A$  rises, falls or remains constant depends on the behaviour of  $L^\gamma A^{\theta-1}$ . Equation (2.12) implies that the growth rate of  $g_A$  is  $\gamma$  times the growth rate of L plus  $(\theta - 1)$  times the growth rate of A (Romer, 1996: 99). Thus

$$\dot{g}_A(t) = [\gamma n + (\theta - 1)g_A(t)]g_A(t) \quad (2.13)$$

Equation (2.12) determines the initial value of  $g_A$  and equation (2.13) then determines the subsequent behaviour of  $g_A$ . The production function for knowledge (2.11) implies that  $g_A$  is always positive. Thus  $g_A$  is rising if  $\gamma n + (\theta - 1)g_A$  is positive, falling if this quantity is negative, and constant if it is zero (Romer, 1996: 99). The term  $g_A$  is therefore constant when:

$$\begin{aligned} g_A &= \gamma n / (1 - \theta) \\ &= g_A^* \end{aligned} \quad (2.14)$$

To describe the growth rate of A further, three different cases should be investigated viz. if:  $(\theta < 1)$ ,  $(\theta > 1)$ , and  $(\theta = 1)$ .

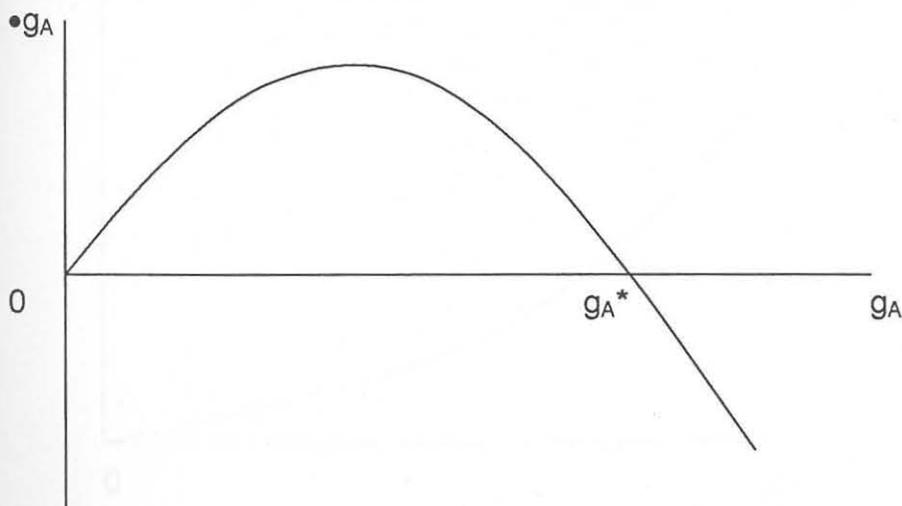
### Case 1: $\theta < 1$

According to equation (2.13),  $g_A$  is falling if it exceeds  $g_A^*$  and is rising if it is less than  $g_A^*$ . Regardless of the initial conditions,  $g_A$  thus converges to  $g_A^*$ .

In Figure 2.3 it is shown that once  $g_A$  reaches  $g_A^*$ , both A and  $Y/L$  grow steadily at this rate and the economy is on a balanced growth path. This is the first example of a model of endogenous growth. This model implies that the long-run growth rate of output per worker,  $g_A^*$ , is an increasing function of the rate of population growth,  $n$ . A

positive population growth is necessary for sustained growth of output per worker. It is, however, true that the growth rate of output per worker is not on average higher in countries with faster population growth. If the model is seen as a model of worldwide economic growth,  $A$  would then represent knowledge that can be used anywhere in the world. From this perspective the model does not imply that countries with greater population growth enjoy greater income growth, but only that higher worldwide population growth raises worldwide income growth. Higher population growth is thus beneficial to the growth of worldwide knowledge because the larger the population, the more people there are to make new discoveries. If adding to the stock of knowledge becomes more difficult as the stock of knowledge rises (that is, if  $\theta < 1$ ), economic growth would diminish in the absence of population growth (Romer, 1996: 100).

**Figure 2.3: Growth rate of knowledge when  $\theta < 1$**

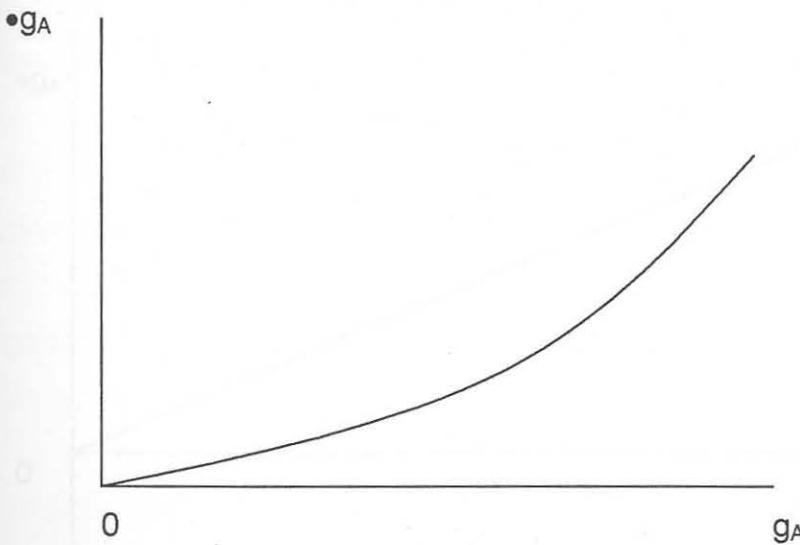


Although the rate of population growth affects long-term economic growth, equation (2.14) shows that the fraction of the labour force engaged in R&D ( $a_L$ ) does not. The reason for this is that  $\theta$  is less than one and the increase in  $a_L$  has a level effect and not a growth effect on the path of  $A$ . According to equation (2.12), the increase in  $a_L$  causes an immediate increase in  $g_A$ . However, the limited contribution of the additional knowledge to the production of new knowledge will result in this increase in the growth rate of knowledge being unsustainable (Romer, 1996: 100).

**Case 2:  $\theta > 1$**

The second case is considered where  $\theta$  is greater than one. According to equation (2.13),  $\bullet g_A$  is increasing in  $g_A$  and since  $g_A$  is positive it also implies that  $\bullet g_A$  must be positive. In Figure 2.4 this implication is manifested where the economy now exhibits ever-increasing growth rather than converging to a balanced growth path. Knowledge is so useful in the production of new knowledge that each marginal increase in its level results in increasing levels of new knowledge. As soon as the accumulation of knowledge begins, the economy thus embarks on a path of increasing economic growth.

**Figure 2.4: Growth rate of knowledge when  $\theta > 1$**



The impact of an increase in the fraction of the labour force engaged in R&D is now dramatic (Romer, 1996: 102). From equation (2.12) an increase in  $a_L$  causes an immediate increase in  $g_A$ , but because  $\bullet g_A$  is an increasing function of  $g_A$ ,  $\bullet g_A$  rises as well. The more rapidly  $g_A$  rises, the more rapidly its growth rate rises. The increase in  $a_L$  thus leads to an ever-increasing gap between the new path of A and the path it would otherwise have followed.

**Case 3:  $\theta = 1$** 

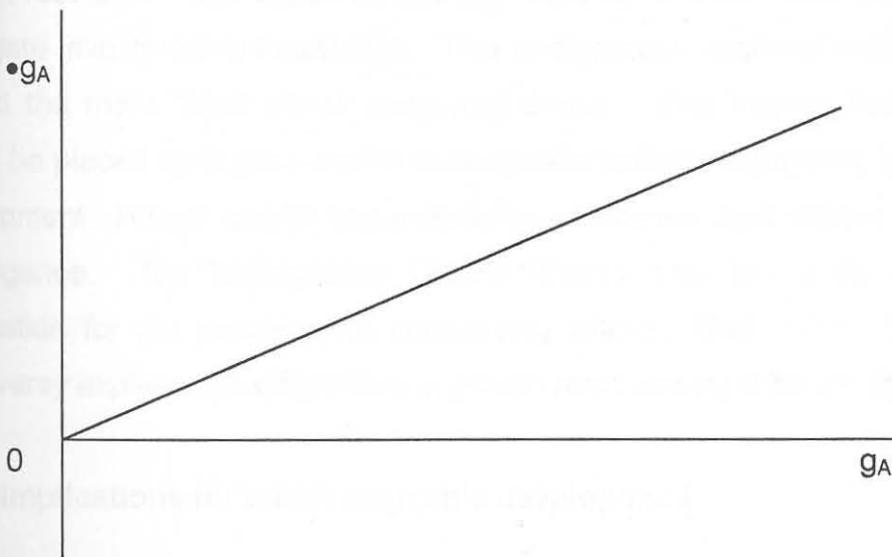
When  $\theta$  is equal to one, the expressions for  $g_A$  and  $\bullet g_A$  is simplified to:

$$g_A(t) = Ba_L^\gamma L(t)^\gamma \quad (2.15)$$

$$\bullet g_A(t) = \gamma n g_A(t) \quad (2.16)$$

If the population growth is positive,  $g_A$  will grow over time, and the dynamics of this model become similar to those where  $\theta > 1$ . The result in the case where  $\theta = 1$  is shown in Figure 2.5.

**Figure 2.5: Growth rate of knowledge when  $\theta = 1$  and  $n > 1$**



If the population growth is zero (or if  $\gamma$  is zero),  $g_A$  is constant regardless of its initial position. Knowledge is now just useful enough in producing new knowledge that the level of  $A$  has no impact on the growth rate (Romer, 1996: 103). No adjustment towards a balanced growth path occurs; the economy thus immediately exhibits steady growth. In this case equations (2.10) and (2.15) show that the growth rates of knowledge, output and output per worker are all equal to  $Ba_L^\gamma L(t)^\gamma$ . The long-term growth rate of the economy is thus affected by  $a_L$  in this case.



Each of the above three cases displayed different implications, which determined whether these were decreasing, increasing or constant returns to scale to produced factors of production. Capital was eliminated from the model and the growth of labour was considered exogenous. Knowledge was thus the only produced factor. Whether there are decreasing, increasing or constant returns to scale in this economy, is determined by the returns to scale to knowledge in knowledge production. This occurs whether  $\theta$  is less than one, greater than one or equal to one.

This Endogenous Growth Theory examines functions of production that show increasing returns because of investment in “knowledge” capital (Meier, 1995: 102). Technological progress and human capital formation is endogenised within general equilibrium growth models. Knowledge is treated as a public good and new knowledge can be generated through research. This allows for spillover benefits to other firms that may then allow aggregate investment in knowledge. This endogenous approach has a “growth effect” beyond the mere “level effect” explained earlier. This implies that more emphasis should be placed on human capital development rather than merely on physical capital development. Human capital and increasing returns are also related to the question of convergence. The Endogenous Growth Theory provides a far more acceptable explanation for the convergence controversy (Meier, 1995: 103). The convergence controversy explains the differences in growth rates among different economies.

#### **2.4.2 Implications for urban economic development**

It is important to determine the link between the endogenous growth model and its implications for urban economic development. This growth model uses a goods-producing sector where output is produced and an R&D sector where additions to stock of knowledge are made. Romer thus provided a solution to the unexplained exogenous Solow residual called knowledge, or the effectiveness of labour. Knowledge is now endogenised and the accumulation of knowledge is important for generating economic growth and development in both developed and developing urban economies. This



implies that urban areas are very well positioned to engage in R&D and to generate knowledge, which could improve the growth-enhancing urban environment.

The notion of knowledge thus means that local urban governments can promote growth by providing incentives to knowledge-enhancing human capital sectors. In an urban environment, due to their proximity, more individuals could engage in R&D with a greater potential spillover effect. It is thus important that local authorities follow an approach conducive to the contribution to and enhancement of economic growth and development.

Although conventional economic growth theory thus provides a theoretical base for urban growth and development, it still lacks an organisational and institutional system within which to realise its stature. The Economic System Approach provides such a framework, which will consequently be analysed.

## **2.5 ECONOMIC SYSTEM APPROACH**

The Economic System Approach (ESA) initially emerged in an effort to stress a sense of dissatisfaction and disagreement with the conventional neo-classical account of the economic development success in East Asia. The ESA represents an attempt to re-examine the methodological premises of the policy prescriptions by the neo-classical school (Yanagihara, 1997: 8). The approach aims to identify deficiencies in the neo-classical paradigm in its assumptions and interpretations of economic activities and changes. The term "economic system" is used to describe the way in which productive capacities exist, personified in co-operative relationships within and between firms and in relation to various factor markets. The economic system can further be seen as an interrelated and mutually reinforcing process comprising the improvement of organisational capabilities of firms and the expansion and deepening of inter-firm relationships.



The ESA accentuates the strengthening of organisational capacities of economic agents and views markets as interrelationships among these agents formed and shaped through their interactions. It also focuses its attention on the technological and managerial capabilities of economic subjects such as economic decision-makers or economic agents (Yanagihara, 1997: 11). Markets on the other hand, refer to the relational arrangements among these agents. The process of decision-making and actions taken by subjects to establish and change the interrelations between them leads to the creation and development of markets. The ESA therefore revolves around building and improving the productive capacity of economic subjects by focusing more on their personal capacities such as education, training, health, etc. It furthermore concerns the development of the institutional framework in which the subjects operate, which includes both the physical and social infrastructures and the natural environment surrounding these. The process of production and employment is enhanced in this way and the subjects therefore consider themselves active participants and not merely spectators or recipients.

ESA sees economic growth and development as a joint process driven by economic subjects. As regards the infrastructural framework, the economic process is also embedded in an institutional, physical and social framework surrounded by the natural environment. These are the building blocks of the process and should be of a good character and quality, requiring constant revision and adaptation to ensure sustained growth and development. The subjects responsible for driving the process also need to possess certain capabilities. It is therefore important that the productive capacities of the economic subjects and a production-enhancing process be developed within the supporting sphere of an institutional, physical, social and natural environment. The role of government is one of promoting and supporting, and also deals with any failures or breakdowns in the system and the capacity-generating process. The government should furthermore define and establish institutional environments that set the rules of the game for private economic agents, thus affecting the design and working of institutional arrangements (Yanagihara, 1997: 21).

A comparative assessment between the ESA and the conventional neo-classical approach to economic growth and development reveals a marked difference illustrated in Table 2.1.

**Table 2.1: Comparison of the Neo-Classical and Economic System Approach (ESA)**

<b>Neo-Classical Approach</b>	<b>Economic System Approach</b>
Economic functions	Economic relationships
Mechanical/Deterministic	Dynamic
Prescriptive	Accommodating
Narrow, specific development path	Broad playing-field - openness
Segregation of processes	Integration of processes
Abstracting	Focus on the real world
Analytical	Descriptive
People are instruments	People do matter
Policy	Capabilities
Markets are neutral	Markets are part of the development process

Source: Blignaut, 1997.

According to this comparative analysis, the neo-classic approach emphasises the role of economic functions that are deterministic and universal by nature. The approach can therefore be prescriptive and leads to a narrowly-defined development path using abstraction and assumptions, based on a segregation of processes. The ESA, on the other hand, focuses on economic relationships which acknowledge the dynamic nature of the real world. Theory and policy should therefore be accommodating with enough room for openness, based on the integration of processes.

The more analytical neo-classical approach regards people as objects (recipients or spectators) where policy-making and economic determinism are extremely important in



the achievement of the "prescribed" results. The ESA, on the other hand, is descriptive and concentrate on people and their capabilities in order to achieve progress.

Furthermore, since the neo-classical approach views markets as homogenous in nature, markets act neutrally according to a specific order. The diversity of the participants is however, acknowledged by the ESA and markets are regarded as an integral part of the diverse economic process. People and infrastructure will influence markets, their quality, volume, scope and nature. The ESA constitutes a decisive paradigm shift in that it postulates that people and dynamic relationships are essential to economic growth and development.

### **2.5.1 Implications for urban economic development**

The ESA has important implications for urban economic development as it provides an organisational and institutional framework. The institutional framework in which economic decision-makers and agents operate should be improved. This includes the physical and social infrastructures as well as the natural environment. In developing economies infrastructure development is an extremely important factor, and this usually takes place within urban areas. Another important contribution is the fact that the ESA views knowledge as implicit and it focuses on people, capabilities and economic agents. The enhancement of the technological and managerial capabilities of economic decision-makers or economic agents is vitally important. The acquisition and proliferation of knowledge is thus a prerequisite for improving the capabilities of these economic decision-makers and agents to enable them to improve the quality of life of the area's residents.

The ESA thus supplements the conventional economic growth theories and provides an institutional framework in which urban growth and development may be stimulated. Developing economies are under pressure, more so than developed economies, to develop and improve quality of life. Urban areas in developing economies are well-positioned in guiding and directing economic growth and development.



## 2.6 SUMMARY

Both Harrod and Domar developed models to explore the existence of a long-term growth path by increasing the levels of savings and investment. The models were very similar and have since been combined as the Harrod-Domar model. This model ultimately found that the economy was relatively unstable. The economy would therefore move in cycles of unemployment and stagnant growth followed by periods of inflation and shortages.

In the mid-1950's, Solow and others developed an alternative approach to modelling economic growth. This growth model assumed variable capital/labour and output/capital ratios and thus implied stable growth. Higher levels of investment and lower levels of population growth explained economic growth. This would allow countries to accumulate more capital per worker and increase labour productivity. The permanent rate of growth of output per unit of labour input was, however, independent of the saving (investment) rate and depended entirely on the rate of technological progress in the broadest sense. Technological progress could offset the tendency of the marginal product of capital to fall. The effectiveness of labour was seen as exogenous and was not identified by the model. The effectiveness of labour could also be seen as abstract knowledge or it may reflect a combination of forces.

Endogenous growth theory was able to identify and explain the Solow residual. Knowledge or the effectiveness of labour was no longer a mere residual but endogenously part of the process of growth. The importance of R&D was accentuated to enhance and proliferate knowledge. The endogenous growth theory examined functions that show increasing returns because of investment in human capital or knowledge. Technological progress and human capital formation was thus endogenised within the general equilibrium growth models.

The Economic System Approach (ESA) is mainly concerned with an analysis of technological and organisational or institutional innovations. The strength of this



approach lies in its ability to identify the determining factors for dynamism and sustainability of economic development at the level of an individual industry or industry cluster. It also provides a basis for formulating and evaluating the policies to foster industries. This will be harnessed in the ESA philosophy because the policy philosophy is complex and dynamic. Urban areas are interdisciplinary and interactive. As the neo-classical approach is linear it will therefore not contribute as much as the ESA.

The emphasis on knowledge by the endogenous growth theory as a main contributing factor to economic growth is an important factor in urban areas. It needs to be proliferated to the advantage of the total urban environment including the local authorities. The ESA also provides a structure according to which local authorities may enhance the economic capacity-building process. Further elaboration on the ESA will follow in Chapter 11. The concept of knowledge also needs further investigation in terms of this study.

The next chapter will be devoted to the analysis of knowledge and its contribution to urban economic growth and development and thus an improvement in quality of life.