10. DEVELOPMENT OF DUAL ECONOMY

10.1 - INTRODUCTION

Most of the developing economies are dual in character. One segment of them is quite comparable to the western capitalistic economies, where economic principles that have been developed are more or less applicable. The other segment of these economies is such that economic principles have limited applicability as the productive activity rests largely on traditions. We shall call this sector the traditional sector. The main distinguish feature of these two sectors, on which the following discussion rests, is that while the output attributable to the last worker in the industrial sector is equal to the wage rate, it is not necessarily so in the traditional sector. The latter is a fair discussion of the situation since most of the productive activity in the traditional sector is conducted in form of household enterprises, where any equality between the earnings and the contribution of worker is only accidental. In the industrial sector, however, the assumption of the equality between the wage rate and the marginal productivity of labour is quite reasonable. We shall assume that the average wage rate is the same in both the sectors, the familiar assumption that all the wages are consumed is implied. The rate of interest is suppressed on the assumption that a developing economy in its early stages is very short of capital
and has abundant profit opportunities, so that all savings are automatically invested. These assumptions are common to those used by Ramis and Fei [13]* in their article, which have served as the starting point for the following study. The two crucial assumptions made by Ramis and Fei, which are mainly responsible for the elegant and simple result they desire, are that the marginal physical productivity changes at a constant rate as employment in agriculture sector varies, i.e., MPP (Marginal Physical Productivity) Curve is a falling straight line and that an increase in agricultural productivity shifts the entire TPP (Total Physical Productivity) Curve 'upward' proportionally, i.e., the new TPP Curve is obtained by multiplying the initial TPP Curve by a constant. The major short coming of this model is that it discusses the disposition of agricultural output, but ignores industrial output. The process of capital formation which is a center to any dynamic growth theory is conspicuously absent. The opportunity of determining the marginal productivity of factors in the two sectors through the reallocation of growing labour and capital in the balanced way with which they are mainly concerned is simply forgotten. The result is that their approach can best be described as partial comparative static. Their article does little to alter this view. Since it simply demonstrates

that variations in the rate of labour employment over what is employed in proportion to growth of capital is due to technological changes and innovation.

In the structure of model, the main balanced growth model is given the weight and its solution under the assumption of a given rate of growth of employment in the industrial sector has been studied. It also deals with optional allocation factors of production.

10.2 - Structure of Model

Structure of model is mainly based upon 13 equations. The model assumes full utilization of all capital. The productive activity in both the sectors is assumed to be characterized by a homogeneous production function of degree one. The demand pattern does not change. Discontinuity in the production function due to innovation, etc., does not occur. The thirteen equations of the model are:

\[ P = P_1 + P_2 \]  \hspace{1cm} (1)
\[ P_1 = P_1(L_1, K_{01}) \]  \hspace{1cm} (2)
\[ P_2 = P_2(L_2, K_{02}) \]  \hspace{1cm} (3)
\[ P_1 = C_1 L + K_1 \]  \hspace{1cm} (4)
\[ P_2 = C_2 L + K_2 \]  \hspace{1cm} (5)
\[ K_0 = K_0^0 + \int K_1 dt + \int K_2 dt \]  \hspace{1cm} (6)
\[ K_0 = K_{01} + K_{02} \]  \hspace{1cm} (7)
\[ L = L_1 + L_2 \]  \hspace{1cm} (8)
\[ L_0 = L_0^0 \text{ ent} \]  
\[ L = L_2^0 \text{ en}_2 t \]  
\[ W = \frac{YP}{YL} < 1 \]  
\[ w = C_1 + C_2 \]  
\[ C_2 = C_2^3 \text{ ent} \]  

The description of these equations are as follows:

**EQUATION # 1**

Total output in the economy \( P \) is equal to the sum of the outputs in traditional sector \( P_1 \) and of industrial sector \( P_2 \). All the symbols with subscript 1 is of traditional sector whereas subscript 2 denotes industrial sector.

**EQUATION # 2**

The production possibilities in the traditional sector where \( L \) is the amount of labour employed and \( K_0 \) is the amount of capital utilized (capital includes land) is represented by the Cobb-Douglas Production function

\[ P_1 = u_1 L_1^{a_1} K_0^{b_1} \]

both the elasticities \( a_1 \) and \( b_1 \) are greater than zero.

**EQUATION # 3**

The production function is given here also by the Cobb-Douglas type

\[ P_2 = u_2 L_2^{a_2} K_0^{b_2} \]
where the elasticities $a_2$ and $b_2$ are both positive and $L_2$ is the amount of labour employed in the industrial sector and $K_{02}$ is the amount of capital utilized.

**EQUATION # 4**

Out of the traditional sector production a quantity related to the total population as $C_1L$ is consumed and remaining part $\bar{K}$ is invested.

**EQUATION # 5**

Here also, the output of the industrial sector $P_2$ is partly consumed at the average rate of $C_2$ and the rest $K_2$ goes to capital formation.

**EQUATION # 6**

Total capital stock is equal to the initial capital plus the sum of additions to it from both sectors.

**EQUATION # 7**

The total capital stock is then fully utilized in both of the sectors.

**EQUATION # 8**

The sum of $L_1, L_2$ is the total labour force $L$.

**EQUATION # 9**

The total labour force is growing with a rate $n$ with an initial value $L^0$. 
EQUATION # 10

The labour absorption in the industrial sector has a rate of growth $n_2$. The employment in the initial period is $L_2^0$.

EQUATION # 11

The average wage rate $W$, which equals the average per capita consumption is supposed to be the same in the two sectors.

EQUATION # 12

The average wage rate is the sum of the average consumption for worker of the traditional output and industrial output.

EQUATION # 13

The trend of the average per capita consumption is given an exponential shape with the rate, $m$.

We have 13 unknowns, namely:

\[ P = P_t, \quad P_1 = P_{1t}, \quad P_2 = P_{2t}, \]
\[ L = L_t, \quad L_1 = L_{1t}, \quad L_2 = L_{2t}, \]
\[ K_0 = K^t_0, \quad K_{01} = K^t_{01}, \quad K_{02} = K^t_{02}, \]
\[ K_1 = K^t_1, \quad K_2 = K^t_2, \quad W = W^t, \]
\[ C_2 = C^t_2. \]

If suppose investment is initiated only in the individual sector, i.e., $K_1 = 0$, considering $C$ as constant, we
have \( \delta = 1 \) throughout the processing.

\[ \therefore C_1 = \frac{P_1}{L} \]

i.e.,

\[ W \left( \frac{P_1}{L} + C_2 - u_2 a_2 L_2 - (1 - a_2) k_{02}^{b_2} \right) \]

also we have:

\[ K_{02} = K - K_0 - \left( \frac{P_1}{\mu_1 L_1 t_{a_1}} \right)^{1/b_1} \]

\[ K = \left( \frac{P_2}{\mu_2 L_2 a_2} \right)^{1/b_2} = \left( \frac{K_0 + C_2 L}{\mu_2 L_2 a_2} \right)^{1/b_2} \]

This gives the both of \( K_0^t \) by the differential equation

\[ K_0 = \frac{(K_0 + C_2 L)^{1/b_2}}{\mu_2 L_2 a_2} + \left( \frac{L}{\mu_1 (L_1 - L_2) a_1} - \left( \frac{a_2}{L_2} - (K_0 + C_2 L) \right) \right)^{1/b_2} \]

where \( L = \bar{L}_0 e^{nt} \), \( L_2 = \bar{L}_2 e^{n_2 t} \), \( C_2 = C_2^0 e^{mt} \).

Another modification can be made that the traditional sector provides the industrial sector with a technically determined portion as raw material, i.e., replacing \( \bar{K}_1 \) in our original by \( \theta P_2 \) where \( \theta \) is a given technical parameter we have considering \( C_1 \) as a constant:

\[ P_1 = C_1 L + \theta P_2 \]

\[ W = \left( \frac{P_1 - \theta P_2}{L} + C_2 = \mu_2 a_2 L_2 \left( 1 - \mu_2 \right) k_{02}^{b_2} \right) \]

also
\[ K_{02} = K_0 - \left( \frac{P_1}{u_1L_1} \right)^{1/b_1} \]

\[ K_{02} = \left( \frac{P_2}{u_2L_2} \right)^{1/b_2} = \left( \frac{K_0 + C_2L_2}{u_2L_2} \right)^{1/b_2} \]

and this gives the differential equation:

\[ K = \left( \frac{K_0 + C_2L_2}{u_2L_2} \right)^{1/b_2} + \left[ \frac{L}{u_1(1-L_2)a_1} \left\{ \left( \frac{\theta}{2} + \frac{a_2}{L_2} \right)(K_0 + C_2L) - C_2 \right\} \right]^{1/b} \]

where \( L = L_0e^{nt} \), \( L_2 = L_2e^{nt} \), \( C_2 = C_2e^{nt} \).

It is well known phenomenon that efficiency of production increases over the year due to technological progress and increasing experience.

This simple way to represent technical progress is to multiply the function by an exponential factor. This can be allowed by substituting \( \mu = \mu_0e^{v_1t} \) where \( v_1 \) is annual rate of growth of efficiency in production.