DUALISM, UNEMPLOYMENT AND GROWTH

by

Patrice Borda
and
Fréderic Gavrel
Université des Antilles et de la Guyane

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Patrice Borda
(Lead and Université des Antilles et de la Guyane)
Fréderic Gavrel
(Lead, Université des Antilles et de la Guyane Université du Havre)

Abstract

Using a dual representation of the economy, we develop a model that attempts to explain economic take-off. The model takes into account two kinds of externalities that spread from the modern sector into the traditional one. On the one hand a static externality (Marshall type economy scale) and on the other hand, a dynamic technology externality. We show that the economy can be characterised by two configurations : an underdevelopment equilibrium and a biaised-development equilibrium with a higher level of unemployment. If the development of the modern sector decreases employment, then the take-off is accompanied by an increase in unemployment.

Résumé

En nous appuyant sur une représentation duale de l'économie, nous proposons un modèle qui tente de traduire le phénomène de décollage économique (take-off). Le modèle intègre deux types d'externalités prenant leur source dans le secteur moderne et se propageant dans le secteur traditionnel. Nous montrons alors que l'économie pourrait être caractérisée par deux configurations : un équilibre de sous-développement et un équilibre de développement-biaisé. Le take-off, passage de l'équilibre de sous-développement à l'équilibre de développement-biaisé, peut alors imposer l'augmenta-tion du chômage.

Introduction

The seminal work of Arthur Lewis (1954) placed at the heart of the debate on development the ideas of classical economists about the process of industrial transformation in the early stages of capitalist development. This model is based on the agriculture/industry relationships in a two-sector economy and the sustained growth is driven by industrial expansion (industrial investment). Harris and Todaro (1970) extended the Lewis model. Building on that model, they contend that an increase in employment in the modern sector impacts negatively on employment in the economy at large. This analytical framework gave rise to various explanations and reformulations most of which focusing on the wages setting in the modern sector. Calvo (1978) for one, claimed that the pressure of trade unions in the modern sector widen the wage gap between the latter and the traditional sector, while Perrot and Zylberberg (1989) and Bulow et Summers (1986) contend that the link between wage and duality favors the emergence of an internal labour market. The ideas developed is that in the primary sector wages are basically determined by interplay between learning and productivity whereas such an interplay can hardly be formed in the secondary sector.

The aim of this paper is to reexamine the consequences of dualism in the perspective of economic take-off. Our argument is simple. If the development of the modern sector decreases employment, then the take-off is unavoidably accompanied by a sudden increase in unemployment. The economic take-off is represented by a dual model in which the production in the modern sector generates two technological externalities : on the one hand a static externality (Marshall type economy of scale) and on the other hand, a dynamic technology externality (*learning-by-doing*) that benefits the entire economy. Wage disparities and unemployment are the results of the bargaining power of workers in the modern sector. It is shown that when economies of scale are important, the economy admits two growth regimes : the underdevelopment equilibrium (*UED*) and the biased development equilibrium (*BDE*). Economic take-off, which is the transition from *UED* to *BDE*, combines expansion of the modern sector and increase in unemployment.

The rest of this paper is organized as follows. In section 2 we present a theoretical model. The stationary equilibrium is analysed in section 3. It is shown that a rise in the modern sector employment increases the unemployment. In section 4, we present a modified model in which we take into account dynamic externalities.

The model

Consider an economy with two production sectors, a modern sector and a traditional one. Both sectors produce the same good. There are N workers in the economy. Workers are identical and risks neutral.

The modern sector

The production function in the modern sector exhibits non-increasing returns to scale in modern employment, $L_{1,t}$. Given the capital stocks, output Y_{1t} is produced using labour according to the function :

$$Y_{1,t} = A_{1,t}F_1(L_{1,t}) \qquad F_1' > 0, \quad F_1'' < 0 \qquad (1)$$

Where the state of technology at time t is represented by the variable $A_{1,t}$. Following Marshall, we assume that the modern sector benefits from economies of scale external to the firm :

$$A_{1,t} = B_1 G(L_{1,t}) \qquad (2)$$

$G(L_1)$ is represented by a threshold function, which is similar to Azariadis and Drazen (1990), D'Autume and Michel (1994), hence :

$$G(L_1) = \begin{cases} L_1^{\epsilon_0} & 0 < \epsilon_0 < 1-\alpha_1 \quad \text{if } L_1 \le L_1^a \\ L_1^{a\epsilon_0}\left(\frac{L_1}{L_1^a}\right)^{\epsilon_1} & 1-\alpha_1 < \epsilon_1 < 1 \quad \text{if } L_1 \ge L_1^a \end{cases} \qquad (3)$$

It is often assumed that externalities are weak during the first stages of development and very strong during the take-off. Then, the higher $L_{1,t}$ the stronger the externality. The threshold effect will unavoidably open the possibility of multiple steady state.
The expected intertemporal profit of the firm at the current period is equal to :

$$E_{1,t} = A_{1,t}F(L_{1,t}) - L_{1,t}w_{1,t} + R^{-1}(1-\lambda)E_{1,t+1} \qquad (4)$$

where $E_{1,t}$, R^{-1}, λ and $w_{1,t}$ denote the profit of the modern sector, the discount factor, the destruction rate and the real wage. In this sector, wage is bargained at the first stage and the firm sets employment given the wage in the second stage. The trade union's objective is to maximize the intertemporal expected utility of every worker of the modern sector :

$$V_{1,t} = w_{1,t} + R^{-1}(\lambda V_{t+1}^u + (1-\lambda)V_{1,t+1}) \qquad (5)$$

where V_t^u denotes the expected utility when unemployed :

$$V_t^u = R^{-1}(hV_{1,t+1} + (1-h)V_{t+1}^u) \qquad (6)$$

h is the endogenous hiring rate of an unemployed at the next period. The wage in the modern sector is negotiated for a given level of employment L_1, which has been previously decided by the employers. The wage is given by maximizing :

$$\underset{w_{1,t}}{Max}\ (V_{1,t} - V_t^u)^\beta E_{1,t}^{1-\beta} \qquad (7)$$

The first order condition becomes :

$$\frac{\beta}{V_{1,t} - V_t^u} - \frac{1-\beta}{E_{1,t}}L_{1,t} = 0 \qquad (8)$$

The traditional sector

Workers getting a job in this sector earn an income $w_{2,t}$. To get this job is costless and fast. There is only one input, $L_{2,t}$:

$$Y_{2,t} = F_2(L_{2,t}) \qquad ,F_2' > 0 \quad F_2'' < 0 \qquad (9)$$

We assume that there is no technological externality. Profit maximization yields the familiar equality between marginal revenue and marginal cost:

$$F_2'(L_{2,t}) = w_{2,t} \qquad (10)$$

Since workers in this sector can obtain a job costlessly, the workers' expected utility denoted by $V_{2,t}$, is given by :

$$V_{2,t} = w_{2,t} + R^{-1}V_{2,t+1} \qquad (11)$$

Stationary equilibrium

The wage relation in the two sectors

In a steady state, the expected utility of workers holding a job in the traditional sector must be equal to that of unemployed workers, $V_{2,t} = V_t^u$, hence the relation (5) becomes :

$$rV_{1,t} = Rw_{1,t} - \lambda(V_{1,t} - V_{2,t}) \tag{12}$$

Moreover, in stationary equilibrium, (4) and (11) become :

$$E_{1,t} = \frac{R(A_{1,t}F_1(L_1) - L_1 w_{1,t})}{r+\lambda} \tag{13}$$

$$rV_{2,t} = Rw_{2,t} \tag{14}$$

Substituting (14) into (12) and using the migration condition, we get :

$$V_{1,t} - V_{2,t} = \frac{R(w_{1,t} - w_{2,t})}{r+\lambda} = V_{1,t} - V_t^u \tag{15}$$

Using (15) and (4), equation (8) can be used to determine the modern wage :

$$\beta(A_{1,t}F_1(L_1) - w_{1,t}L_1) = (1-\beta)L_1(w_{1,t} - w_{2,t}) \tag{16}$$

Consequently

$$w_{1,t} = \frac{\beta A_1 F_1(L_1)}{L_1} + (1-\beta)w_{2,t} \tag{17}$$

By using (17), it is then easy to show that maximum profit satisfies :

$$A_{1,t}F_1(L_1) - w_{1,t}L_1 = (1-\beta)(A_{1,t}F_1(L_1) - L_1 w_{2,t}) \tag{18}$$

and hence, the level of employment that maximizes the firm's profit in the modern sector is given by :

$$A_{1,t}F_1'(L_1) = w_{2,t} \tag{19}$$

Since $w_{2,t} = F_2'(L_2)$, it follows from (19) that :

$$A_{1,t}F_1'(L_1) = F_2'(L_2) \tag{20}$$

Finally, we get :

$$B_1 G(L_1)F_1'(L_1) = F_2'(L_2) \tag{21}$$

This relation means that labour allocation in the two sectors determined by competition between them until equilibrium is reached. We now specify the production function in order to solve for the market equilibrium. A simple way of specification is to use a Cobb-Douglas representation. Output is given by equations (1) and (9), which now have the form :

$$F_i(L_i) = L_i^{\alpha_i} \qquad 0 < \alpha_i < 1 \qquad i = 1,2 \tag{22}$$

The derivative of the production function and equation (21) allow us to rewrite employment relation (21) :

$$L_2 = \begin{cases} \left(\frac{\alpha_2}{B_1\alpha_1}\right)^{\frac{1}{1-\alpha_2}} L_1^{\frac{1-\varepsilon_0-\alpha_1}{1-\alpha_2}} & \text{if } L_1 \le L_1^a \\ \\ \left(\frac{\alpha_2}{B_1\alpha_1}\right)^{\frac{1}{1-\alpha_2}} L_1^{a\frac{\varepsilon_1-\varepsilon_0}{1-\alpha_1}} L_1^{\frac{1-\alpha_1-\varepsilon_1}{1-\alpha_1}} & \text{if } L_1 \ge L_1^a \end{cases} \tag{23}$$

That equation allows to distinguish between two cases according to whether the expansion of the modern sector increases or decreases employment in the traditional sector. On the one hand, with increasing return to scale, a rise in employment in the modern sector brings about a higher employment in the traditional sector. On the other hand, with decreasing return to scale, the expansion of the modern sector results in a decrease of the employment level in traditional sector.

Unemployment and jobs in the modern sector

This section assesses the effect of the expansion of the modern sector on the labor market equilibrium. Similarly to relation (9), we can represent an unemployed expected utility as follows :

$$rV_t^u = h(V_{1t} - V_t^u) \tag{24}$$

Substituting (15) into (24) we get the net expected value of a wage earner in the modern sector :

$$V_{1,t} - V_t^u = \frac{Rw_{1,t}}{r+\lambda+h} \tag{25}$$

The above relation is another condition that is useful below. Combining (24) and (25) gives the expected utility of an unemployed worker as a function of modern wage :

$$rV_t^u = h\frac{Rw_{1,t}}{r+\lambda+h} \tag{26}$$

By turning to the migration equilibrium condition and taking into account equation (14), we then get :

$$h\frac{w_{1t}}{r+\lambda+h} = w_{2,t} \tag{27}$$

We can notice that the modern wage is a constant multiple of traditional wage. This is similar to the assumption used in the literature (Harris and Todaro (1970), Blomqvist (1978), Calvo (1978)). Relation (27) represents also an implicit function between L_1 and L_2. On can use (1), (10), (17) and (27) to find (Equation (28) can be obtained by using the following relation : $F_1(L_{1t}) = F_1'(L_1)\frac{L_1}{\alpha}$). :

$$r + \lambda + \beta h = \beta h \frac{1}{\alpha_1} \tag{28}$$

In a steady state, the labor market equilibrium must be such that the flow out of unemployment be equal to the flow into unemployment, $\lambda L_1 = h(N - L_1 - L_2)$. Thus we get :

$$h = \frac{\lambda L_1}{N - L_1 - L_2} \tag{29}$$

Substituting (29) to (28), we finally get :

$$\beta\frac{1-\alpha_1}{\alpha_1}\frac{\lambda L_1}{N - L_1 - L_2} = r + \lambda \tag{30}$$

Equation (23) and (30) determine the labor market equilibrium. The equilibrium as depicted in figure 1 is characterised by tree steady-state equilibrium : an underdevelopment equilibrium (*UDE*) represented by *A*, an unstable equilibrium represented by B, and a biased development equilibrium (*BDE*) given by *C*. Steady-state equilibrium *A* and *C* are locally stable, whereas the steady-state equilibrium *B* is instable. The transition from a traditional regime through the modern regime emerges from the externality effect due to the modern sector expansion. The reason for the multiple steady-state equilibrium is that firms in the modern sector have two behaviours. First, by hiring more workers, modern employment raises and so does productivity increase (*EDB*). Second, when workers are fired, productivity decreases and so unemployment increases.

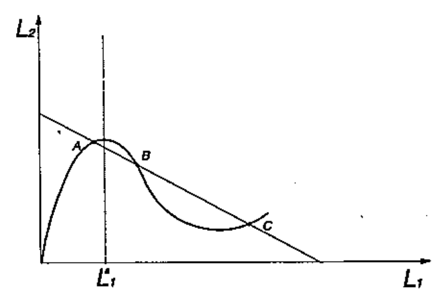

Figure 1. Labor market equilibrium

Extension : the dynamic externalities

Keeping the same framework as in previous section, we now introduce a learning-by-doing as source of externalities.

A learning-by-doing process

Following Arrow (1962) and Romer (1986), we assume that the economy benefits from the experience accumulated by workers in the modern sector. The technology of the modern sector given by (1) remains unchanged. The state of technology in the modern sector at time $t+1$ becomes now :

$$A_{1,t+1} = A_{1,t}(1+g_t) \qquad (31)$$

where $A_{1,t}$ denotes the state of the technology at time t. Changes in $A_{1,t}$ reflect the changes in the technology. The state of technology at time 0 is historically given at a level $A_{1,0}$ so that :

$$A_{1,0} = B_1 G(L_{1,0}) \qquad G'(L_{1,0}) > 0 \qquad (32)$$

$A_{1,0}$ is then a static externality. Furthermore, we assume that the technological progress g that takes place at time t depends upon the flow of labour $L_{1,t}$:

$$g_t = g_t(L_{1,t}) \qquad g'(L_{1,t}) > 0 \qquad (33)$$

The worker's behavior in the modern sector remains unchanged. Production in the traditional sector occurs according to returns-to-scale, which is subject to endogenous technological progress :

$$Y_{2,t} = A_{2,t}F_2(L_{2,t}) \qquad (34)$$

A_{2t} is the state of technology. As indicated above, the knowledge accumulated in the modern sector spreads to the traditional sector :

$$A_{2,t+1} = A_{2,t}(1+g_t) \qquad (35)$$

Further notice that the static technologic externality is independent from $L_{1,t}$:

$$A_{2,0} = B_2 \qquad (36)$$

Given the structure of the production technology, the return to a unit of labor is :

$$A_{2t}F_2'(L_{2t}) = w_{2t} \qquad (37)$$

Equilibrium

Labour productivity in both sectors grows at a constant rate denoted by g. Expected utility of wage-earners in the modern and traditional sectors, the unemployed and the expected intertemporal profit also grow at the same rate :

Using the definition of the growth rate, expected utility and the expected intertemporal profit is now written :

$$V_{1t+1} = (1+g)V_{1t}$$
$$V_{t+1}^{u} = (1+g)V_t^{u}$$
$$V_{2t+1} = (1+g)V_{2t}$$
$$E_{1t+1} = (1+g)E_{1t}$$

Given the migration equilibrium and the previous relations, equation (12) can be rewritten as follows (we assume : $r \equiv R-1 > g$) :

$$(r-g)V_{1,t} = Rw_{1,t} - \lambda(1+g)(V_{1,t} - V_{2,t}) \qquad (38)$$

In the same way, (2) and (7) become :

$$E_{1,t} = \frac{R(A_{1,t}F_1(L_1) - L_1 w_{1,t})}{r-g+\lambda(1+g)} \qquad (39)$$

$$(r-g)V_{2,t} = Rw_{2,t} \qquad (40)$$

Combining (37) and (39) yields :

$$V_{1,t} - V_t^{u} = \frac{R(w_{1,t} - w_{2,t})}{r-g+\lambda(1+g)} = V_{1,t} - V_{2,t} \qquad (41)$$

According to the Nash bargaining maximand (see equation (7)), it is easy to check that the following condition must be fulfilled :

$$A_{1,t}F_1'(L_1) = A_{2,t}F_2'(L_2) \qquad (42)$$

Using (32) and (36), we derive an equation similar to (21) :

$$B_1 G(L_{1,0})F_1'(L_1) = B_2 F_2'(L_2) \qquad (43)$$

The condition given by given by (23) becomes :

$$L_2 = \begin{cases} \left(\frac{B_2\alpha_2}{B_1\alpha_1}\right)^{\frac{1}{1-\alpha_2}} L_1^{\frac{1-\varepsilon_0-\alpha_1}{1-\alpha_2}} & \text{if } L_1 \le L_1^{a} \\ \left(\frac{B_2\alpha_2}{B_1\alpha_1}\right)^{\frac{1}{1-\alpha_2}} L_1^{a\frac{\varepsilon_1-\varepsilon_0}{1-\alpha_1}} L_1^{\frac{1-\alpha_1-\varepsilon_1}{1-\alpha_1}} & \text{if } L_1 \ge L_1^{a} \end{cases} \qquad (43')$$

The migration condition and relation (40) can be used to find equation (48) :

$$h(1+g)\frac{w_{1t}}{r-g+(\lambda+h)(r+g)} = w_{2,t} \qquad (48)$$

Using equations (37), (22) and (48) we have :

$$\frac{r-g}{1+g} + \lambda + \beta h = \beta h \frac{1}{\alpha_1} \qquad (49)$$

If we let $g = \gamma L_1$ where γ is postif constant, then equation (49) becomes (one can use the migration condition given by (29) to simplify) :

$$\beta\frac{1-\alpha_1}{\alpha_1}\frac{\lambda L_1}{N-L_1-L_2} = \frac{R}{1+\gamma L_1} + \lambda - 1 \qquad (50)$$

This expression reveals that unemployment is positively related to jobs in the modern sector according to a *Todaro effect*. An increase in the modern sector employment leads to a rise of unemployment. Unemployment increases because there are more jobs in the modern sector so that high-paid jobs becomes more attractive. This result correspond with the findings of Cahuc and Celimene, Blomqvist (1978), Takagi (1984).

Notice that the equilibrium rate of growth does depend on the size of employment in the modern sector. The solution is depicted in figure (2). Hence, take-off is the change from *UDE* to *BDE*. There is a break in the level of output in the modern sector. This break is unavoidably accompanied by an unemployment *jump* (see figure 3).

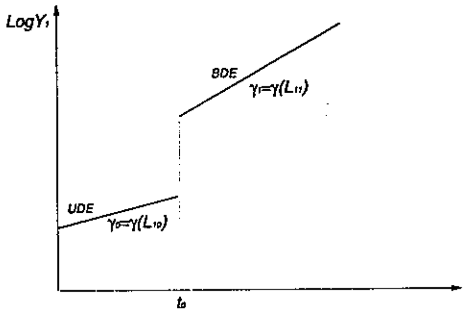

Figure 2. Output jump

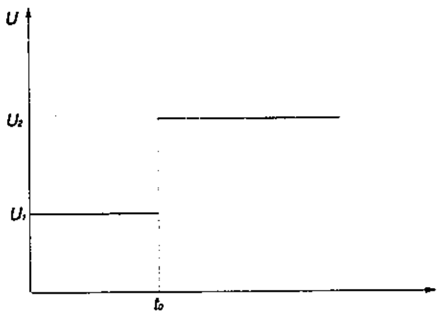

Figure 3. Unemployment Jump

Conclusion

In this paper, we have developed a model which characterizes the growth rate regimes of a developing economy. The theoretical framework is similar to Harris and Todaro's model. In this study, externality is the major source of growth, therefore the relation between jobs in the modern sector and jobs in the traditional sector depends on the importance of returns to scale in the development process. The model shows that the development process is characterized by a trade-off between *unemployment* and *transformation*.

In the early stages of development, the economy characterized by a large traditional sector and a low unemployment rate. Conversely, during take-off, growth increases due to the development of the modern sector, while in its turn brings about a rise in unemployment. It would be interesting to confront the theoretical results to an empirical analysis. The opportunity offered by models with regimes changes would enlighten us to the take-off process.

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