The Linear Theory of Economic Development

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Abstract

This article is a theory of economic development which shows that under development and civil wars in Africa comes mostly from ethnic divisions. Therefore, since development economics dynamics is linear, development take-off is reached at the locus on the space-time where all the ethnics take place inside the production sector without distinction of their origins. Thus, the article promotes incentives to invest in human capital accumulation and labour force participation in the society as a mechanics of economic development since it may fight ethnic division in least advanced economies.

Keywords : Ethnic divisions, Development, Growth, Complementarity Relation

1. Introduction

Almost, for four decades, Africa faced ethnics conflicts i.e Kikuyus aganist Luos in Kenya, Baoulés against Bétés in Ivory Coast, Hutus against Tutsis in Rwanda and in Burundi. Zulus against Xhosas in South Africa in the 1980s and Ibos against Haoussas during 1967 in Biafra which retards development. Many civil wars in Africa are due to ethnic divisions which finally may partly explain under development in the area until in this second decade of the 21th century. The problem began to be accurate after the years 1960s when those countries became independant from some Western countries' political power, therefore three views are presented in the concern of the origins of the problem in Africa. The first view assimilates the problem to colonialism (M'Bokolo, 1996), the second view located the problem far away before colonialism (Thual, 1995) and the third view is due to a kind of altruism where more powerful ethnics prevail for the direction of the country after colonialism done (Diouf, 2004). Figure 1 locates countries were civil wars caused by ethnic divisions are accurate. Indeed, this article aim is to show that development emergence comes from ethnic divisions cease in a given African country composed of multiple ethnics were wealth share is based on ethnic

power mostly given by the European country under which the country was politically kept. In order to prove that the unique equilibrium highlights by ethnic divisions convergence through one thought i.e national interest rather than community preferences is a mechanics of economic development.

The theory of economic development pioneer didn't study ethnic division impact on growth in least development economics, neither growth literature. Therefore, this article models a given society with ethnic multiplicity in order to look for growth occurrences in that context. We show that the linearity form of the society highlights growth and development take-off.

The scientific contribution of the article holds on three aspects, the first is ethnic division introduction in endogenous growth model with human capital accumulation. The second is the provision of a new mechanics of economic development i.e the linear function of the society organization since all the social classes take place in the labour force participation at the same time. Finally, development is highlighted by a unique equilibrium through a complemetarity relation among all the society composed of several ethnic groups. Therefore, a preference function should be national rather than local.

Two literatures are used in this article which are endogenous growth literature with human capital accumulation and development economics pioneer analysis[1]. One the one hand, growth literature is the field used for economic performance studies of the industrial countries in contrast to development economics literature which is the field used to study least advanced countries economic performance. But during 1970 and 1986 the both literatures faced a crisis which led them be gathered in one, therefore barriers among them were levy (Krugman, 1994) which allow to build a development economics model on the basis of growth theory. Still looking for mechanims able to explain under development in Africa, both growth and development economics were unable to introduce ethnic divisions' effect on economic performance that does this article to evidence the powerful of the complementarity

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[1] development economics, or more specifically the linked set of ideas that Krugman (1993) called "high development theory" is a set of ideas highly persuasive as at least a partial explanation of what development is about, and for a stretch of about 15 years in the 1940s and 1950s it was deeply influential among both economists and policymakers. Yet in the late 1950s high development theory rapidly unravelled, to the point where by the time in the 1970s it seemed not so much wrong as incomprehensible. Only in the 1980s and 1990s were economists able to look at high development theory with a fresh eye and see that it really does make a lot of sense, after all. The problem was due to the method in the social sciences. The crisis of high development theory in the late 1950s was neither empirical nor ideological: it was methodological. High development theorists were having a hard time expressing their ideas in the kind of tightly specified models that were increasingly becoming the unique language of discourse of economic analysis. They were faced with the choice of either adopting that increasingly dominant intellectual style, or finding themselves pushed into the intellectual periphery. They didn't make the transition, and as a result high development theory was largely purged from economics, even development economics.

relation among all the social classes which composed the society in the labour force participation to know how to enhance economy in the least advanced countries in the world where exist the society separability caused by ethnic division heterogeneity. Indeed, this article introduces civil war explanation through ethnic divisions in the literature of economic growth or economic development pioneer2 since the end of that aspect is able to geatly boost the economy from the poverty trap where the balanced growth is kept from development and later on to the long run growth. The article is presented like follow, section2 presents the theoretical model, section 3 and 4 study the equilibrium , section5 displays the results and conclude on the analysis

Figure1 : Africa and ethnic divisions
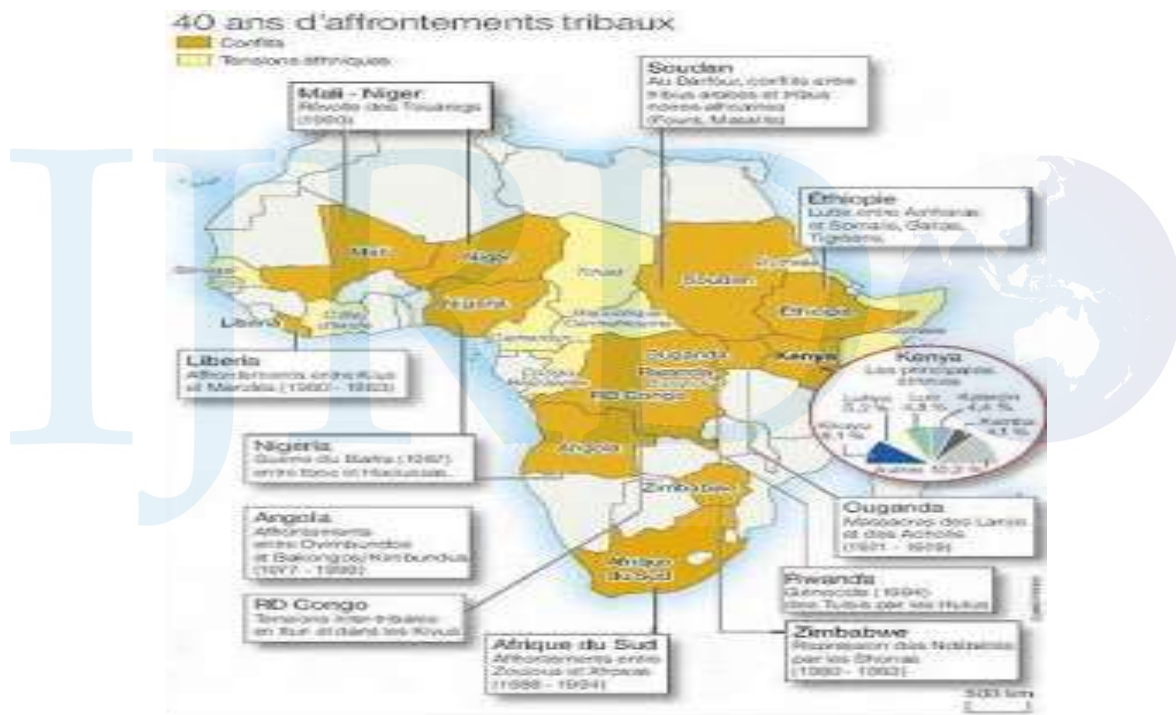
2. The Model

Consider an overlapping generations model in a developing country located in Africa where the society is divided into three ethnic groups. Agents live for two periods of time and the interest rate is endogenously determinated. The first ethnic group is called « skilled » denoted,

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2 There were also disputes over the nature of the policies that might be required to break a country out of a low-level trap. Rosenstein Rodan and others appeared to imply that a coordinated, broadly based investment program -- the Big Push -- would be required. Hirschman disagreed, arguing that a policy of promoting a few key sectors with strong linkages, then moving on to other sectors to correct the disequilibrium generated by these investments, and so on, was actually the right approach. Indeed, Hirschman structured his book as an argument with what he called the "balanced growth" school. He did not acknowledge that he had far more in common with Rosenstein Rodan and other "balanced growth" advocates like Nurkse (1953) than any of them had with the way that mainstream economics was going.

S_t^S who live from skilled labour income. This ethnic group possess the high tech sector of production and is interested by the social status of his children. Indeed, each child inherited a bequest or a money gift in order to accumulate human capital in the first period and work as a skilled labour next period. The second ethnic group is called « hybrid » who hold low tech production sectors. Their wage rate income doesn't necessitate a significant human capital level holding, this etnic group is denoted, S_t^U inside which exist a fraction of agents who accumulate human capital denoted, S_t^{US} and other who don't accumulate human capital and thus denoted, $S_t^{\bar{S}}$. Therefore we have equation (1) such that

$$S_t^U = S_t^{US} + S_t^{\bar{S}} \tag{1}$$

The third ethnic group is the one composed of poor people who don't hold neither skilled nor assets and denoted, U_t who are unable to invest in human capital accumulation because it is too costly. Those agents work in the low tech production sector and choose the number of children to have in considering that they represent a wealth for the future resting income. Thus, each child gives a fraction of his income to his old parent, indeed increases with the number of doners. In contrast to Dahan-Tsiddon (1996) where each child receives a bequest from his parents to accumulate human capital, here parents prepare their resting income upon the children they choose to have. The choice is driven by quantity since the more children they have, the higher probability they have to win a lot of money to protect themself from poverty due to aging without income precarity. Dahan-Tsiddon (1996) bequest exist for the skilled agent who belongs to the skilled ethnic evocated above

The assumptions of the model are : agents who belong to the hybrid ethnic group and who are willing to accumulate human capital go to the capital market to ask for a loan and if given, the credit comes from the poor agents' savings. The poor and the unskilled give money to their parents during their resting period at a rate τ_t of their wage rate income. The skilled agent has few children than the other ethnic groups because he wants quality for his offspring in allowing him accumulate human capital where the direct cost of education is denoted, ϕ_t. The skilled agent is thus altruist.

In this model, the decision variables of each agent are, the first and the second period consumption, as well as the fecundity choice variable. The last choice variable is made in the first period for the poor and the other unskilled agents who have low tech production business and in the second period in the concern of the skilled labour from the skilled ethnic group as well as from the hybrid ethnic group.

2.1 The community organization

Because of the uncertainty faced by the resting income in that poor country, families must support their old parent themself and ensure their income through money gift per-child. But that thinking applied only for the poors and the unskilled of the hybrid ethnic group. Therefore, the parents' number of children is given by equation (2) which help determinate future resting income later on such that :

$$U_t = U_{t-1} m_{t-1}^U \tag{2}$$

$$S_t^{\bar{S}} = S_{t-1}^{\bar{S}} m_{t-1}^{\bar{S}} \tag{3}$$

Those equations highlight the number of children of a given poor agent where the first applied to the case of the poor agent and the second to the case of the unskilled from the hybrid ethnic group. Finally, total stock of old people in the economic system is given such that :

$$U_t w_t^U \tau_t^U = U_{t-1} m_{t-1}^U w_t^U \tau_t^U = U_{t-1} \theta_t^U$$

Therefore, per-capita income of the old agent of the poor ethnic group is given by

$$\theta_t^U = w_t^U m_{t-1}^U \tau_t^U \tag{4}$$

Threfore, we have

$S_t^{\bar{S}} w_t^U \tau_t^{\bar{S}} = S_{t-1}^{\bar{S}} m_{t-1}^{\bar{S}} w_t^U \tau_t^{\bar{S}} \theta_t^{\bar{S}}$ since the income of the old unskilled of the hybrid ethnic is thus provided by equation (5) i.e

$$\theta_t^{\bar{S}} = m_{t-1}^{\bar{S}} w_t^U \tau_t^{\bar{S}} \tag{5}$$

Those equations mean that the resting income revenue depends on the number of children hold.

2.2 The production

The supply side has a 3X3 structure, meaning two manufactured production sectors of an homogenous good differentiated by their technological sophistication and skill intensity.

The high tech production sector employs skilled labour for the tasks which consist on the absorption of the high technology in the good production expressed by equation (6) i.e

$$Y_t^H = \delta_t^H A \left(S_t^S + S_t^{US} \right) \tag{6}$$

Where $\delta_t^H \succ 0$ is the labour productivity parameter and $0 < A$ is the productivity parameter of the high tech sector of production.

The low tech sector of production employs non skilled labour for routine tasks and its production function is expressed such that equation (7) i.e

$$Y_t^L = \delta_t^L B\left(S_t^{\bar{s}} + U_t\right) \tag{7}$$

Where $\delta_t^L \succ 0$ is the productivity of the unskilled labour and $B>0$ is the productivity parameter of the low tech sector of production.

Note that $B<A$ *which* mean that, the productivity of the high tech sector is higher than that of the low tech sector.

Good production establishes in perfect competition, thus profit maximization yields the following equations :

$$w_t^S = \delta_t^H A \tag{8}$$

$$w_t^U = \delta_t^L B \tag{9}$$

2.3 The utility optimization

The demand determinates the first period consumption: c_t^j where j is the number of social classes inside the country, the second period consumption is d_{t+1}^j and the number of children denoted : m_{t+1}^j.

The utility function of the agents is expressed such that eqution (10) i.e

$$U\left(c_t^j, d_{t+1}^j, m_{t+1}^j\right) = \alpha \ln\left(c_t^j\right) + \beta \ln\left(d_{t+1}^j\right) + \gamma \ln(m_{t+1}^j) \tag{10}$$

$\alpha + \beta + \gamma = 1$

$\alpha \succ 0\ \beta \succ 0$ and $\gamma \succ 0$

The unskilled wage rate income finance the resting income of the old parents, the savings for human capital accumulation, the first period concumption whereas the parent's income only support the second period consumption. Therefore, the poor agent's budget constraint is expressed such that equation (11) i.e

$$w_t^U\left(1 - \tau_t^U\right) = c_t^U + s_t^U \tag{11}$$

$$\theta_{t+1}^U + \left(1 + r_t\right)s_t^U = d_{t+1}^U \tag{12}$$

Each young of the skilled ethnic group receives a monetary bequest, b_t from his parents that he uses to finance human capital accumulation at a direct cost z_t as well as both the first period consumption and savings. In the second period, the agent becomes skilled, chooses the number of children to have and wins a skilled wage rate income that he spends to his second

period consumption as well as the bequest to leave to his children. The budget constraint of the skilled agent is thus expressed such that equations (13) and (14) i.e

$$b_t = c_t^S + s_t^S + z_t \tag{13}$$

$$w_{t+1}^S + (1+r_t)s_t^S = d_{t+1}^S + \phi_{t+1}w_{t+1}^S m_{t+1}^S \tag{14}$$

The agents from the hybrid ethnic group who is willing to accumulate human capital borrow e_t at the capital market to support the education direct cost, the first period consumption and works in the second period where he also pays his debt as well as chooses the number of children to have. Therefore, his budget constraint is such that :

$$e_t = c_t^{US} + z_t \tag{15}$$

$$w_{t+1}^S = (1+r_t)e_t + d_{t+1}^{US} + \phi_{t+1}w_{t+1}^{US} m_{t+1}^{US} \tag{16}$$

The budget constraint of the unskilled of the hybrid ethnic can be written such that :

$$w_t^U(1-\tau_t^{\bar{s}}) = c_t^{\bar{s}} + s_t^{\bar{s}} \tag{17}$$

$$\theta_{t+1}^{\bar{s}} + (1+r_t)s_t^{\bar{s}} = d_{t+1}^{\bar{s}} \tag{18}$$

The first order conditions of the maximization problem yield :

For the poor agent we have :

$$c_t^U = \left(\frac{\alpha}{1-\gamma}\right)(1-\tau_t^U)w_t^U \tag{19}$$

$$d_{t+1}^U = \left(\frac{\beta}{1-\gamma}\right)(1-\tau_t^U)w_t^U \tag{20}$$

$$\theta_t^U = \left(\frac{\gamma}{1-\gamma}\right)(1-\tau_t^U)w_t^U \tag{21}$$

For the unskilled of the hybrid ethnic group we have

$$c_t^{\bar{s}} = \left(\frac{\alpha}{1-\gamma}\right)(1-\tau_t^{\bar{s}})w_t^U \tag{22}$$

$$d_{t+1}^{\bar{s}} = \left(\frac{\beta}{1-\gamma}\right)(1-\tau_t^{\bar{s}})w_t^U \tag{23}$$

$$\theta_t^{\bar{s}} = \left(\frac{\gamma}{1-\gamma}\right)(1-\tau_t^{\bar{s}})w_t^U \tag{24}$$

For the skilled agent of the skilled ethnic group we have :

$$c_t^S = \alpha\left[(b_t - z_t) + \frac{w_{t+1}^S}{1+r_t}\right] \tag{25}$$

$$\frac{d_{t+1}^S}{1+r_t} = \beta \left[(b_t - z_t) + \frac{w_{t+1}^S}{1+r_t} \right] \tag{26}$$

$$m_{t+1}^S = \gamma (b_t - z_t) \left[1 + \frac{1}{\frac{w_{t+1}^S}{1+r_t}} \right] \tag{27}$$

Finally, for the skilled agent of the hybrid ethnic group we have :

$$c_t^{US} = \left(\frac{\alpha}{1-\gamma} \right) \frac{w_{t+1}^S}{1+r_t} \tag{28}$$

$$\frac{d_{t+1}^{US}}{1+r_t} = \left(\frac{\beta}{1-\gamma} \right) \frac{w_{t+1}^S}{1+r_t} \tag{29}$$

$$\theta_{t+1}^{US} = \frac{1}{\phi_{t+1}} \left(\frac{\gamma}{1-\gamma} \right) w_{t+1}^S \tag{30}$$

It can be seen that skilled wage rate incomes are higher than the unskilled wage rate incomes

2.4 The labour market constraints

Since the labour market size is N_t therefore, the labour market constraints are at a time t expressed such that following

$$S_{t-1}^S + S_{t-1}^{US} = H_t \tag{31}$$
$$S_t^{\bar{S}} + U_t = L_t \tag{32}$$
$$H_t + L_t = N_t \tag{33}$$

The first equation means that the skilled labour stock is composed of the agents from the skilled ethnic as well as those from the hybrid ethnic group. The second equation means that the unskilled labour stock is composed of agents from the ethnic of the poor and from the hybrid ethnic. The third equation means that totale active population is composed of skilled and unskilled labour.

Therefore, in terms of dynastic links we have

$$S_{t-1}^{US} + S_t^{\bar{S}} = \overline{N_t} \tag{34}$$

Equation (34) means that the hybrid ethincs is composed of skilled and unskilled labour

$$S_{t-1}^S + U_t + \overline{N_t} = N_t \tag{35}$$

Equation (35) means that the whole active population is respectively composed of three different ethnic groups, thus all spend time in the production process.

2.5 The dynamics

The fecundity choice dynamics

At each period of time, the respective fecundity choices dynamics of the poor, the hybrid as well as the skilled labour and the skilled ethnic and of the hybrid ethnic are expressed such that following :

$$\frac{U_{t+1}}{U_t} = m_t^U , \frac{S_{t+1}^{\bar{S}}}{S_t^{\bar{S}}} = m_t^{\bar{S}} , \frac{S_{t+1}^S}{S_t^S} = m_{t+1}^S , \frac{S_{t+1}^{US}}{S_t^{US}} = m_{t+1}^{US} \qquad (36)$$

The respective fecundity choices dynamics of the poor as well as the unskilled of the hybrid ethnic are expressed such that :

$$m_t^U = \left(\frac{\gamma}{1-\gamma}\right)\left(1 - \tau_{t+1}^U\right) \qquad (37)$$

$$m_t^{\bar{S}} = \left(\frac{\gamma}{1-\gamma}\right)\left(1 - \tau_{t+1}^{\bar{S}}\right) \qquad (38)$$

Note that income level as well as poverty, are independant of the fecundity choices of the both previous categories.

$$m_{t+1}^S = \gamma\left(b_t - z_t\right)\left(1 + \frac{1+r_t}{w_{t+1}^S}\right) \qquad (39)$$

In contrast to the above previous cases, now fecundity decisions are linked to the wage rate income such that the highest the wage rate income is, the lower the number of children is i.e

$$m_{t+1}^{US} = \gamma\left(\frac{1}{\phi_t\left(1-\gamma\right)}\right) \qquad (40)$$

According to the skilled agent from the hybrid ethnic, the direct cost of eduction is the determinant of the number of children because he intends to allow his children accumulate human capital.

2.6 The demographic stock dynamics

The fecundity choices and the demographic stocks are expressed from the initial conditions at time t_0 such that :

$$U_t = U_0\left[\frac{\gamma\left(1 - \tau_0^U\right)}{1-\gamma}\right]^t \qquad (41)$$

$$S_t^{\bar{S}} = S_0^{\bar{S}}\left[\frac{\gamma\left(1 - \tau_0^{\bar{S}}\right)}{1-\gamma}\right]^t \qquad (42)$$

$$S_{t+1}^S = S_0^S \left[\gamma \left(b_0 - z_0 \right) \left(1 + \frac{1+r_0}{\delta_0^H A} \right) \right]^t \tag{43}$$

$$S_{t+1}^{US} = S_0^{US} \left[\gamma \left(\frac{1}{\phi_0 (1-\gamma)} \right) \right]^t \tag{44}$$

3. The capital market equilibrium

At each time, incentives to invest in human capital accumulation of the skilled from the hybrid ethnic are supported by the savings of the poor i.e

$$e_t S_t^{US} = s_t^U U_t \tag{45}$$

The supply and the demand determinate the endogenous interest rate such that :

$$R_t = \frac{\alpha \delta_t^H F \left(S_0^{US} + K \right)}{F S_0^{US} z_t + \left(b_t - z_t \right)(1-\alpha) K F} \tag{46}$$

Where

$$F = \left[\gamma \left(\frac{1}{\phi_0 (1-\gamma)} \right) \right]^{t-1} \quad \text{and} \quad K = U_0 \left(1 - \tau_0^U \right)^t$$

4 The general equilibrium

4.1 The perfect foresight dynamics

At each period, the savings of the skilled of the skilled ethnic as well as of the hybrid ethnic finance total human capital of the nation. Where we can find the low tech and the high tech sectors of productions. Physical capital depreciates fully at each time period and agregate investment is thus expressed such that :

$$K_{t+1} = s_t^{\bar{s}} S_t^{\bar{S}} + s_s^S S_t^S \tag{47}$$

Proposition1 *: the complementarity relation*

The unskilled labour participation in the production sector for wealth creation is the preliminary state of economic development measured by the complementarity relation among social classes in the process of economic development define by the relation (44) such that :

$$k_{t+1} = \theta_t^1 l_t + \theta_t^2 h_t \tag{48}$$

Proof :

From $S_t^{\bar{S}} = \dfrac{S_{t+1}^{\bar{S}}}{m_t^{\bar{S}}}$ and $S_t^S = \dfrac{S_{t+1}^S}{m_{t+1}^S}$, setting $k_{t+1} = \dfrac{K_{t+1}}{N_{t+1}}$ and $h_t = \dfrac{S_{t+1}^S}{S_t^S}$ as well as $l_{t+1} = \dfrac{S_{t+1}^{\bar{S}}}{S_t^{\bar{s}}}$

substituting each variable by its equilibrium value yields the complementarity economic development relation i.e :

$$k_{t+1} = \theta_t^1 l_t + \theta_t^2 h_t$$

Where

$$\theta_t^1 = \frac{(1-\gamma-\alpha)(1-\tau_t^{\bar{S}})\delta_t^L B}{(1+\dfrac{R_t}{\delta_t^H A})(b_t - z_t)\gamma}$$

$$\theta_t^2 = \frac{(1-\alpha)(b_t - z_t)+\alpha\delta_t^H A / R_t}{(1+\dfrac{R_t}{\delta_t^H A})(b_t - z_t)\gamma}$$

For the relation to be stable, both skilled and unskilled labour productivities must move at the same constant rate. The complemetarity relation summarizes the intertemporal behavior of the economy and show off that, in the wealth creation activity, all the social classes all ethnic groups are beneficial for the economic development process of the country.

4.2 The stationary state equilibrium

Définition1 : the stationary state equilibrium is the locus on the space where per-capita physical capital and per-capita human capital move at the same constant rate through the time

Proposition2 : *according to definition1, along the balanced growth path, the linear economic development relation is the locus on the space where economy moves such that equation (49) i.e:*

$$k = \theta^1 l + \theta^2 h \tag{49}$$

Where

$$\theta^1 = \frac{(1-\gamma-\alpha)(1-\tau^{\bar{S}})\delta^L B}{(1+\dfrac{R}{\delta^H A})(b - z)\gamma}$$

$$\theta^2 = \frac{(1-\alpha)(b-z)+\alpha\delta^H A / R}{(1+\dfrac{R}{\delta^H A})(b-z)\gamma}$$

Because the two previous parameters are inside the range [0,1], the system is locally stable

Proposition3 *: the impact of physical capital on human capital depends on θ^2 through the time. Therefore the following results are satisfied :the borrowing level decreases per-capita human capital, too much first period consumption decreases incentives to invest in human capital, fecundity rate parameter decreases with per-capita capital.*

Proof : differentiating the above equations by the parameters of interest, yields the sign of the derivative, thus the conclusion suggested.

5 Conclusion

This model shows that development is highlighted by a linear expression since conflicts are not included inside, thus labor market and labor force participation are the mechanics of economic development. Since wealth creation is fully shared among all the social classes composing the society, conflicts no more hold.

REFERENCES

Diouf, Mamadou, « Between Ethnic Memories and Colonial History in Senegal : The MFDC & the Struggle for Independance in Casamance », dans Bruce Berman et *al.*, *Ethnicity and Democracy in Africa*, Oxford, Ohio University Press, 2004, pp. 218-239.

Fleming, J.M. 1955. "External Economies and the Doctrine of Balanced Growth." Economic Journal. June.

Hirschman, A. 1958. The Strategy of Economic Development. New Haven, Conn.: Yale University press.

Leibenstein, H. 1957. Economic Backwardness and Economic Growth. New York: Wiley.

Lewis, W.A. 1954. Economic Development with Unlimited Supplies of Labor. The Manchester School. May.

----------. 1955. The Theory of Economic Growth. London: Allen and Unwin.

M'bokolo, Elikia et Amselle, J.-L., *AU CŒUR DE L'ETHNIE : ETHNIE, TRIBALISME ET ÉTAT EN AFRIQUE,* PARIS, LA DÉCOUVERTE, 1999 ET BAYART, J.-F., *L'ILLUSION IDENTITAIRE*, PARIS, FAYARD, 1996.

Murphy, R., A. Shleifer, and R. Vishny. 1989. Industrialization and the Big Push. Journal of Political Economy.

Myrdal, G. 1957. Economic Theory and Under-developed Regions. London: Duckworth.

Nelson, R. 1956. A Theory of the Low Level Equilibrium Trap in Underdeveloped Economies. American Economic Review. May.

Rosenstein-Rodan, P. 1943. Problems of Industrialization of Eastern and South-Eastern Europe. Economic Journal. June-September.

Scitovsky, T. 1954. Two Concepts of External Economies." Journal of Political Economy. April.

Thual, François, *Les conflits identitaires,* Paris, Ellipses/Marketing, 1995.
Young, A. 1928. Increasing Returns and Economic Progress. Economic Journal. December