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ABSTRACT

This paper develops an endogenous growth model with overlapping generations displaying the importance of the banking sector for economic growth in developing countries in an environment where authorities resort to money creation in order to finance public expenditures. The main results are: (*i*) the growth rate of the economy with financial intermediaries is higher than that of the financial autarky; (*ii*) credit constraints on households' borrowing have negative effects on long run growth; (*iii*) a fiscal policy financed by money creation entails a positive correlation between inflation and economic growth (another version of the Tobin effect). In addition, a monetary policy does not entail a proportional increase in the price level, but it entails a positive variation of the real output. This result is *original* since it is different from the main conclusion of *the quantitative theory of money*, where inflation is only a monetary phenomenon.

Keywords: financial intermediation, growth, credit constraints, monetary policy, quantitative theory of money

I- Introduction

The recent decade has seen a renewed interest in the analysis of the finance and growth nexus. Yet, the topic is not new and can be traced back at least to Schumpeter (1912) who argued that the services provided by the financial intermediaries are paramount for innovation and consequently for economic growth. More later, Cameron (1967) and Goldsmith (1969 argued that the actual success in development strategies in developed countries was due to the presence of efficient financial institutions in their early development stage.

The debate was also marked by the seminal contributions of Mckinnon (1973), Shaw (1973), Mathieson (1980) and Fry (1988) where financial development is seen to play a key role. More specifically, and according to this neoliberal school, liberalised financial system help to mobilise more financial savings and to allocate more productive capital to its best uses, which is likely to improve both the volume and productivity of physical capital and contribute finally to economic growth.

Since the pioneering contributions of Greenwood and Jovanovic (1990), Bencivenga and Smith (1991), the literature on financial intermediation and growth has seen a resurrection especially with endogenous growth models. Greenwood and Jovanovic (1990) have constructed a model in which the causal relationship between finance and growth is acting in two ways where financial institutions assure a rating activity based on the collected and analysed information permeating to place funds in sectors corresponding to their most profitable use.

For Bencivenga and Smith (1991) the banking sector tend to alter the fraction of saving held in the form of productive assets since banks give the opportunity to liquidity holders which are averse to risk to get deposit returns rather than to hold unproductive assets. Doing so banks provide more saving resources to capital accumulation which is likely to faster economic growth. In Greenwood and Smith (1997) more emphasis is put on the role that financial markets play in supporting specialisation in economic activity and in allocating funds to the highest value use in the economic system.

Recent efforts in analysing the theoretical finance and growth nexus are more focused on *the importance of financial intermediation costs* (Khan (1999), Harrisson, Sussman and Zeira (1999)). For example, Khan (1999), based on the empirical approach of Rajan and Zingales (1998), has developed a dynamic general equilibrium model in which financial development reduces the cost of financial intermediation. According to the author, this cost increases the informational asymmetries between borrowers and financial institutions. When credit is limited, the agents who have access to borrowing will have a higher return with respect to other investors. Over time, more producers will be interested in this external finance which is likely to rise the borrower's net worth with respect to debt. This reduces financial intermediation cost and raises the investment return and economic growth.

The present paper develops a model in which we underline the importance of the banking sector in *developing countries* where public authorities proceed to money creation in order to finance their expenditures. Accordingly, we use an overlapping generations model with endogenous growth where money is an argument of the utility function besides private consumption.

In fact, this paper is considered to be an attempt to reconcile between two approaches (the first is initiated by Bencivenga and Smith (1991) and the second is due to Roubini and Sala-I-Martin (1992)) in order to analyse the impact of financial intermediation on long run growth in developing countries. The objective is to prove that even with financial distortions represented by a public intervention in the financial system, financial intermediation has always a positive effect on the long run growth. For these reasons, the developed model is an extension of Bencivenga and Smith (1991) in which we add the government as an agent capable to create money to finance its expenditures. Nevertheless, the model presents the following differences with respect to the basic model:

- The agents are supposed to live only two periods.
- Money holdings provide satisfaction to individuals
- Financial institutions appear exogenously in the households' constraint
- Two types of economies are supposed, where the first is in a financial autarky situation and the second with a financial system composed exclusively of banks. The government is always present in the economy and may intervene using fiscal and monetary policies (seigniorage).

This latter hypothesis is very important since it allows the analysis of the effect of fiscal and monetary policy interactions and their effects on inflation and long run growth. The main conclusions of the paper are the following:

- The equilibrium growth rate of the economy with banking institutions is higher than that of the economy without financial intermediaries, that is to say, the development of the banking sector has a positive impact on long run growth.
- Financial distortions, such as represented by borrowing constraints have a negative impact on long run growth since they reduce the access for credit, considered the only engine of investment and growth in this economy.

- A fiscal policy financed by money creation entails a positive correlation between inflation and growth with and without banking intermediaries: this result is another version of the Tobin effect in an endogenous growth model.
- Finally, any monetary policy does not entail a proportional increase in the price level but also a positive variation of the real output. This result is *original* since it is different from the main conclusion of *the quantitative theory of money*, where inflation is only a monetary phenomenon.

The rest of the paper is organised as follows: section II presents the model with and without banking institutions and determine the equilibrium growth rates for this economy. Section III analyses the effect of financial distortions, such as measured by credit constraints, on lung run growth. Section IV deals with the impact of a fiscal policy financed by money creation, on inflation and growth in the long run. Finally section V concludes the paper.

II- The model

II-1- The E*conomy without financial intermediaries*

We consider an economy with three agents, households, firms and the government. The absence of financial intermediaries does not mean absence of money. In fact, the latter is introduced in the model through the government which, exclusively, supplies money. The demand of money comes from households.

II-1-1- *Households*

We consider an overlapping generation's model in which the economy is composed of young and old people. The representative individual maximises a utility function in which money is present as an argument together with consumption as in Sidrauski (1967): $U = U(c_{t+1}, m_t)$, where c_{t+1} and m_t denote the consumption at the period $t+1$ and *real money detention* at the period t, respectively.

During their youth, the individuals work and earn a nominal wage W_t, which is allocated to savings s_t and to liquid money detention m_t. By retirement, they use real money detention $R_t^m m_t = (P_t/P_{t+1})m_t$ and the accumulated savings $(1+r_{t+1})\, s_t$ to finance consumption in the next period c_{t+1}.

The individuals are supposed to have no consumption during the first period *t*. This hypothesis does not alter the conclusions of the model and even if we suppose the presence of consumption in that period the results are similar. Because of these reasons and for the sake of simplicity we preferred the first hypothesis. Finally, we suppose an inelastic supply of labour and equal to unity with an absence of leisure.

The resulting maximisation issue of the individual is:

$$\begin{cases} MaxU(c_{t+1}, m_t) \\ \quad s_t + m_t = w_t \\ \quad c_{t+1} = R_t^m m_t + (1 + r_{t+1}) \dfrac{p_t}{p_{t+1}} s_t \end{cases} \tag{1}$$

where c_t is the real individual consumption in the period *t*, s_t is the real saving destined to finance the real capital acquisition during the period *t*, m_t are the real monetary assets. R_t^m is the real return of money detention, which equal to the ratio of price levels in the economy in the period *t* and *t+1* respectively, (p_t/p_{t+1}). r_{t+1} is the nominal interest rate for the nominal saving $p_t s_t$ and w_t is the real income of labour.

Taking account of saving remuneration and the evolution of price levels, the maximisation problem may be rewritten as follows:

$$\begin{cases} MaxU(c_{t+1}, m_t) \\ \quad s_t + m_t = w_t \\ \quad c_{t+1} = R_t^m m_t + \rho_{t+1} s_t \end{cases} \tag{2}$$

By substituting the constraints in a logarithmic utility function, the program is reduced to free optimisation of the following function:

$$U = log(R_t^m w_t + (\rho_{t+1} - R_t^m) s_t) + log(w_t - s_t) \tag{3}$$

The optimisation of equation (3) with respect to the level of saving gives the optimal saving s_t^*:

$$s_t^* = \frac{\phi}{1+\phi} w_t \tag{4}$$

With $\phi = 1 - 2\frac{R_t^m}{\rho_{t+1}}$

The optimal saving s_t^* is a fraction of the real income (wage) w_t and this fraction is less than unity ($\phi/1+\phi$) : the marginal propensity to save is a function of the inflation rate (money return) and the saving remuneration ρ_{t+1}.

A marginal propensity to consume less than unity supposes that ϕ must be positive ($\phi>0$) or $R^m{}_t < \rho_{t+1}/2$. *In the absence of financial intermediaries, the saving is totally invested by agents in physical capital acquisition.*

The optimal money detention m_t^* linked to the optimisation problem is given by the following equation:

$$m_t^* = \frac{1}{1+\phi} w_t \tag{5}$$

Equation (5) represents the demand for real money detention by the agents, which is a function of the inflation rate (money return) and saving remuneration.

II-1-2- *Firms*

The economy is made up of firms producing one consumption good using labour L, supposed to be constant and equal to unity, and physical capital K_t. The representative firm produces, as in Romer (1986), according to the following technology:

$$Y_t = AK^{\alpha} L_t^{1-\alpha} \overline{K}_t^{1-\alpha} \tag{6}$$

Where $\overline{K}_t$ is the average stock of physical capital. Profit maximisation for these enterprises implies that factors are remunerated to the marginal productivity criteria:

$$w_t = (1-\alpha)A\overline{K}_t^{1-\alpha} K_t^{\alpha} L^{-\alpha}$$

$$\rho_t = \alpha A\overline{K}_t^{1-\alpha} K_t^{\alpha-1} L^{1-\alpha}$$

However since we have in the equilibrium state $\overline{K}_t = K_t$, the equilibrium conditions become:

$$w_t = (1-\alpha)Ak_t \tag{7}$$

$$\rho_t = \alpha A \tag{8}$$

II-1-3- The *Government*

Public expenditures are financed in the model exclusively by money creation or seigniorage, defined as $(M_t - M_{t-1})/P_t$. The public budget constraint is, therefore, formulated as follows:

$$G_t = (M_t - M_{t-1})/P_t \tag{9}$$

Without intermediaries, the government is the unique source of money creation and consequently of money supply. In other words, money is introduced and fixed, in this section, only by the government and is considered as an outside money.

II-2- *The equilibrium analysis*

II-2-1- *Market of goods and services*

The equilibrium of this market implies the equality of saving s_t and physical capital accumulation $(k_{t+1}-k_t)$. However since the physical capital is supposed to depreciate during one period, the equilibrium condition becomes:

$$s_t = k_{t+1} \tag{10}$$

The substitution of equations (4) and (7) in equation (10) gives the growth rate of per capita capital stock:

$$\theta_{BS} = \frac{(1-\alpha)A\phi}{1+\phi} \tag{11}$$

II-2-2- *Money market equilibrium*

The money market equilibrium is deduced from the public budget constraint represented by equation (9). Yet to derive this equilibrium, we suppose, following Roubini and Sala-I-Martin (1992), Espinosa and Yip (1995, 1996, 1999) and Haslag and Young (1998), that public expenditures represent a *constant fraction* μ of the aggregate production Y_t ($\mu = G_t/Y_t$).

Given this hypothesis, the public constraint becomes:

$$\mu y_t = \frac{M_t}{p_t} - \frac{M_{t-1}}{p_t} \tag{12}$$

However, since in the equilibrium state the production function is reduced to a more simple form as in Rebelo (1991) ($Y_t = AK_t$), then the growth rate of per capita capital stock (θ_{BS}) is equal, along the balanced growth path, to which of per capita production y_t. Moreover, along the equilibrium path the growth rate of the money stock is equal to that of the capital stock per capita (*according to equations* (5) *and* (7)). Consequently, the growth rate of the money stock (θ_{MM}) is stated as follows:

$$\theta_{MM} = \frac{(1-\alpha)R_t^m}{(1-\alpha) - \mu(1+\phi)} \tag{13}$$

wtih $\quad \phi = 1 - 2\dfrac{R_t^m}{\rho_{t+1}}$

(A proof of this equation is provided in appendix (1)).

Determining the growth rate of this economy implies the equality of growth rates in *goods* and *money* markets given, by equations (11) and (13), respectively. Equating these latter equations gives:

$$\frac{(1-\alpha)A\phi}{1+\phi} = \frac{(1-\alpha)R_t^m}{(1-\alpha) - \mu(1+\phi)}$$

With few transformations and the elimination of time [4] this equality becomes:

$$\underbrace{\frac{\alpha A - 2R^m}{2\alpha A - 2R^m}}_{f(R^m)} = \frac{\alpha R^m}{\underbrace{\alpha A\left[(1-\alpha) - 2\mu\right] + 2\mu R^m}_{g(R^m)}} \tag{14}$$

Equation (14) gives the *equilibrium money return* and consequently the equilibrium growth rate of the economy. In the absence of financial intermediaries *this equilibrium is unique* as it is shown by the following proposition:

PROPOSITION 1*:*

With logarithmic preferences and in the absence of financial intermediaries, the growth rate of the economy is unique if and only if $(1-\alpha)>2\mu$..

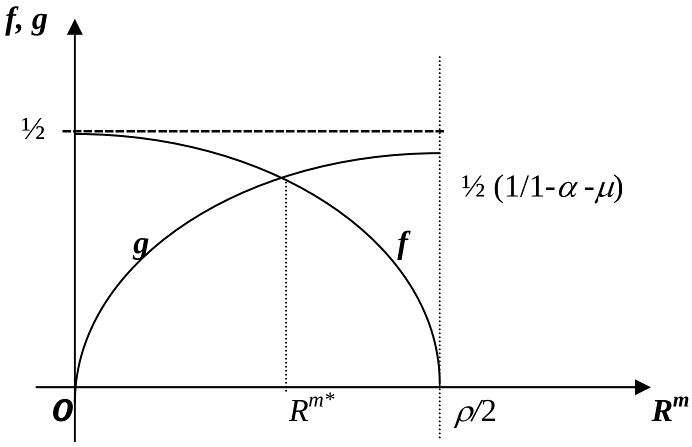
(The proof of this proposition is provided in appendix (2)).

The condition $(1-\alpha)>2\mu$ guarantee the unique equilibrium since the first derivative of the $g(R^m)$ (appendix (2)) shows that its sign depends on the sign of $[(1-\alpha)-2\mu]$. If it is negative, $g(R^m)$ will be a decreasing function and the equilibrium will not exist. When this difference is equal to $[(1-\alpha)-2\mu = 0]$, the function $g(R^m)$ will be reduced to a constant ($g(R^m) = \alpha/2\mu$) and to have an equilibrium in this case we must have $\alpha<\mu$.

Figure (1) displays the equilibrium of this economy with the mentioned condition above in proposition (1):

[4] In the equilibrium, control variables do not vary and we suppress, consequently, the time subscript for these variables.

Figure (1): *Equilibrium without financial intermediaries*



The form of the functions shows that their intersection takes place only in one point in the interval [0, $\rho/2$] and that the equilibrium money return is also unique. This fact implies that the equilibrium growth rate of this economy is also *unique and positive*.

II-3- An economy with financial intermediaries

II-3-1- financial *intermediaries*

We consider now financial intermediaries and we suppose for the sake of simplicity that there is only *one bank* in the economy. The latter creates money and allocates credits to agents during the activity period (with a level b_t and it is a real credit). Credits are destined to finance physical capital acquisition and entail a repayment of interests r_{t+1} during the retirement activity. However, the behaviour of the government does not change with respect to the precedent section.

With this new hypothesis regarding the behaviour of financial intermediaries, the individual maximisation problem becomes:

$$\begin{cases} MaxU(c_{t+1}, m_t) \\ \qquad s_t + m_t = w_t + b_t \\ \qquad c_{t+1} + (1+r_{t+1})\dfrac{p_t}{p_{t+1}} b_t = R_t^m m_t + (1+r_{t+1})\dfrac{p_t}{p_{t+1}} s_t \end{cases} \tag{15}$$

Where (1+ r_{t+1})$p_t b_t$ represents the total (nominal) reimbursement amount during the retirement period and we adjust this amount by p_{t+1} to take into account the evolution of prices. Yet, the presence of credit in the new constraints has no effect on consumption and money holding and credits simply increase physical capital acquisition in the economy since individual resources are, henceforth, composed of savings and credits.

To have a solution for the maximisation program represented by equation (15), we suppose also that the credits allocated to households represent a constant fraction of money supply (b_t=βm_t). The intuition behind this hypothesis is that credit is one counterpart of money supply together with gold and foreign currencies. The solution of the optimisation problem with this new hypothesis gives the optimal saving and money holdings $s_t^*(IF)$ and $m_t^*(IF)$ as follows:

$$s_t^*(IF) = \frac{\beta + \phi}{1+\phi} w_t \tag{16}$$

$$m_t^*(IF) = \frac{1-\beta}{1+\beta}\frac{1}{1+\phi} w_t \tag{17}$$

(A proof of these equations is provided in appendix (3)).

The saving rate in this economy (with financial intermediaries) is higher than that of the financial autarky economy (equation (4)) since the propensity to save (ϕ/1+ϕ) is augmented by the fraction (β/1+ϕ). However, the demand for money with financial intermediation diminishes with respect to the first type of economy (equation (5)). With financial intermediaries, agents hold less liquid assets and more saving deposits in banking institutions. These deposits serve as a basis for credit grants in the whole economy.

Indeed, combining equations (16) and (17) and taking into account the hypothesis on credits (b_t =β m_t), the relationship between granted credit and saving can be formulated as follows:

$$b_t^* = \frac{1-\beta}{1+\beta}\frac{1}{\beta+\phi}s_t^*$$

The credit is, therefore, less than saving: banking intermediaries do not grant the whole amount of savings as credits but only a fraction.

II-3-2- *The market of goods and services*

Equation (16) gives the equilibrium of this market using equations (7) and (10). The resulting growth rate of the capital stock is:

$$\theta_{BS}^*(IF) = \frac{(1-\alpha)A(\beta+\phi)}{1+\phi} \tag{18}$$

With $\phi = 1 - 2\dfrac{R_t^m}{\rho_{t+1}}$

(The proof is provided in appendix (4)).

II-3-3- *Money market equilibrium*

To determine the equilibrium of this market and the growth rate of the capital stock, we use the public budget constraint, the same hypotheses formulated previously and the equilibrium demand for money with banking institutions represented by the equation (17). The resulting growth rate of the capital stock is:

$$\theta_{MM}(IF) = \frac{(1-\alpha)(1-\beta)R_t^m}{(1-\alpha)(1-\beta)-(1+\beta)(1+\phi)\mu} \tag{19}$$

Avec $\phi = 1 - 2\dfrac{R_t^m}{\rho_{t+1}}$

(The proof of this equation is provided in appendix (5)).

Equating the growth rate of the capital stock in the two markets, represented by equations (18) and (19), respectively provides equilibrium growth rate of this economy:

$$\frac{(1-\alpha)A(\beta+\phi)}{(1+\phi)}=\frac{(1-\alpha)(1-\beta)R_t^m}{(1-\alpha)(1-\beta)-(1+\beta)(1+\phi)\mu}$$

After replacing ϕ by its value, arranging terms and eliminating the time subscript, we find:

$$\underbrace{\frac{(1+\beta)\alpha A-2R^m}{2\alpha A-2R^m}}_{f_\beta(R^m)}=\underbrace{\frac{(1-\beta)\alpha R^m}{\alpha A\left[(1-\alpha)(1-\beta)-2(1+\beta)\mu\right]+2\mu(1+\beta)R^m}}_{g_\beta(R^m)} \tag{20}$$

Equation (20) gives, in presence of financial intermediaries, a *unique money return* and, then, a *unique* growth rate of the capital stock.

PROPOSITION 2:

In presence of financial intermediaries, the economy maintains a unique equilibrium if and only if $(1-\alpha)(1-\beta)>2(1+\beta)\mu$..

(The proof of proposition (2) is provided in appendix (6))

The condition $(1-\alpha)(1-\beta)>2(1+\beta)\mu$ maintains the function $g_\beta(R^m)$ decreasing, since the sign of its derivative depends, directly, on the sign of $[(1-\alpha)(1-\beta)-2(1+\beta)\mu]$. If the latter expression is negative, the function $g_\beta(R^m)$ will be decreasing and the long run equilibrium will not exist. Finally, if $(1-\alpha)(1-\beta)=2(1+\beta)\mu$, the function $g_\beta(R^m)$ will be reduced to a constant $[\alpha(1-\beta)/2(1+\beta)\mu]$ but in order to have an equilibrium we must have $[\alpha(1-\beta)<(1+\beta)^2\mu]$.

With the mentioned conditions of proposition (2), the equilibrium of this economy is presented as follows:

Figure (2): *Equilibrium with financial intermediaries*

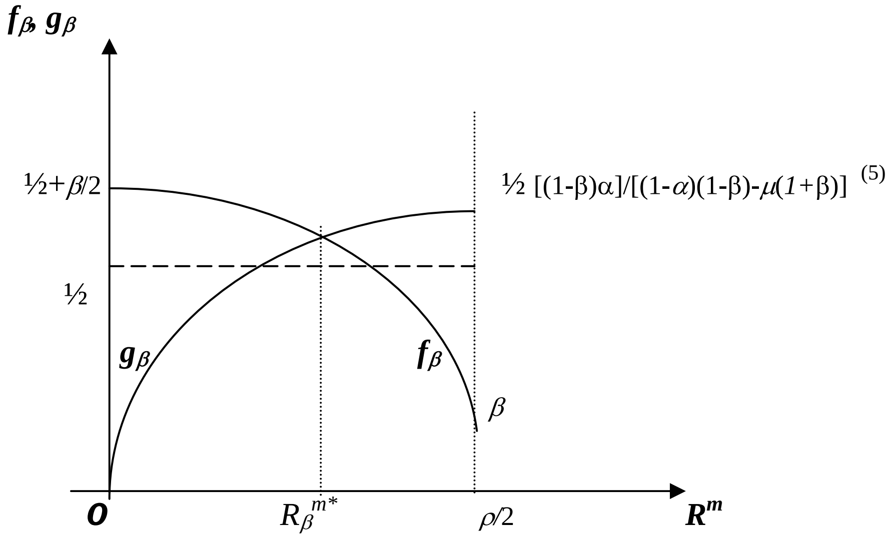


Figure (2) shows that the equilibrium of this economy is *unique* since the *money return* resulting from the intersection of the functions f_β and g_β in the interval $[0, \rho/2]$ is also unique. Yet, the features of this equilibrium are different from those of the economy without financial intermediaries. Moreover, the growth rate of the physical capital stock of this economy is higher than that of the financial autarky under certain conditions.

PROPOSITION 3:

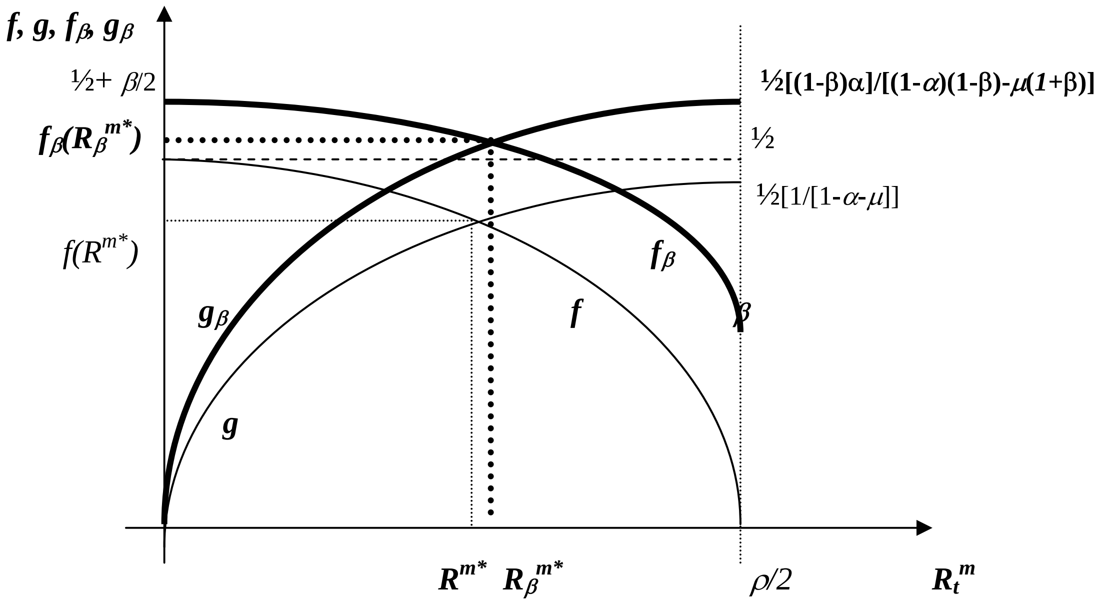
The presence of financial intermediaries in the economy entails a higher economic growth in the equilibrium state if $(1-\alpha) > 2\mu$ *and* $(1-\alpha)(1-\beta) > 2(1+\beta)\mu$.

(The proof is provided in appendix (7)).

Figure (3) displays the two equilibria of this economy (without and with financial intermediaries). The presence of financial intermediaries in the economy gives a higher money return as shown in the following figure:

[5] La valeur de cette expression est supérieure à ½ pour différentes valeurs α, β et μ

Figure (3): The effect of financial intermediation on economic growth

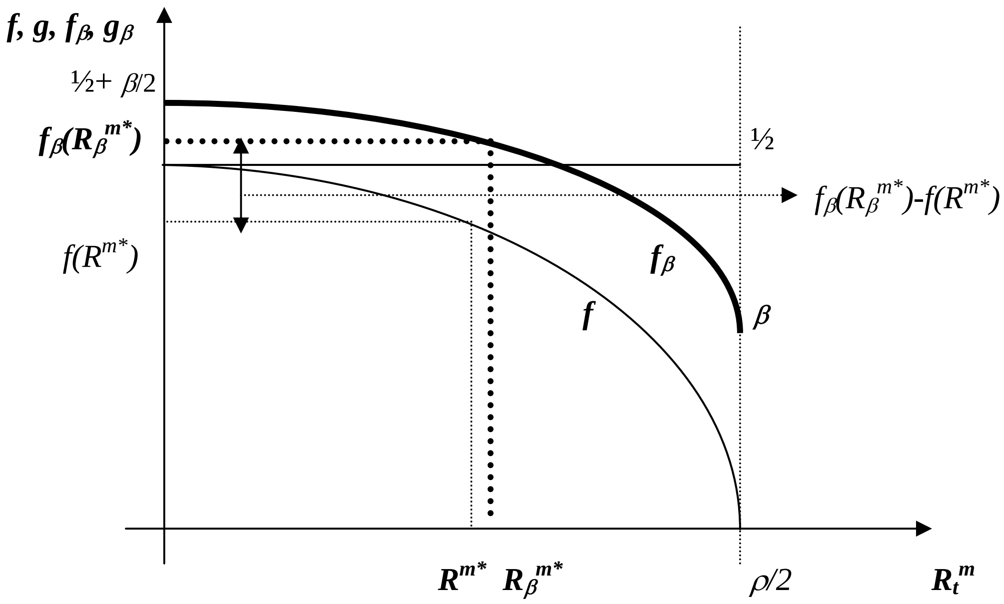


It appears then, as it is demonstrated in appendix (7), that the difference (D) between the equilibrium growth rates of the two types of the economy is positive:

$$D = \theta^*_\beta(IF)\text{-}\,\theta^* = (1-\alpha)A\underbrace{\left[f_\beta(R_\beta^{m^*}) - f(R^{m^*})\right]}_{\succ 0} \succ 0$$

According to the representations, the function $f_\beta(R_t^m)$ is superior to $f(R_t^m)$ and for different equilibrium money returns R_β^{m*}, R^{m*} the difference between the functions is positive as it is shown by the following figure (4) :

Figure (4): The positive effect of financial intermediation on economic growth



The latter three propositions show the necessary and sufficient conditions for a positive effect of financial intermediation on economic growth in this model. This positive effect depends on the availability of credits for households in banking institutions. To finance capital accumulation, the agents use their savings as well as the allocated credits by the banks. As a consequence, when the economy is in financial autarky, the agents are constrained to self-finance their projects and capital accumulation will be less important with respect to the first type economy. Economic growth is, therefore, more important in an economy with banking intermediaries.

In developing countries, where financial systems are featured by a quasi dominance of banking activity, the economic growth will remain totally dependent on the presence of credits as a source of financing investments, other things being equal. In this context, the experience of south-east asian countries in the field of investment financing and the importance of banking intervention in capital accumulation can be cited s an example.

IV- The role of financial distortions

So far, the endogenous growth literature has not devoted much attention to the effect of distortions on resource allocation and on capital accumulation. Easterly (1993), in an endogenous growth model, has shown that distortions i.e. higher taxes and tariffs, black market exchange rates and controlled prices, have notables effects on long run growth. Japelli and Pagano (1994) have shown that credit constraints on households' borrowing increase precautionary saving and, consequently, economic growth. De Gregorio (1996), on the other hand, has found that borrowing constraints reduce long run growth if private agents face constraints to finance their education and consequently the human capital accumulation.

In this paper, we will study the effect of any constraint on credit allocation by financial institutions. In other words, when households face borrowing constraints, they will borrow only a fraction φ of the credit volume available in the bank. In this case, the maximisation issue of the individual is stated as follows:

$$\begin{cases} Max U(c_{t+1}, m_t) \\ \qquad s_t + m_t = w_t + \varphi b_t \\ \qquad c_{t+1} + (1+r_{t+1})\dfrac{p_t}{p_{t+1}}\varphi b_t = R_t^m m_t + (1+r_{t+1})\dfrac{p_t}{p_{t+1}} s_t \end{cases} \tag{21}$$

The resulting saving and money detention from this maximisation problem are provided in the following equations:

$$s_t^*(IF) = \frac{\varphi\beta + \phi}{1+\phi} w_t \tag{22}$$

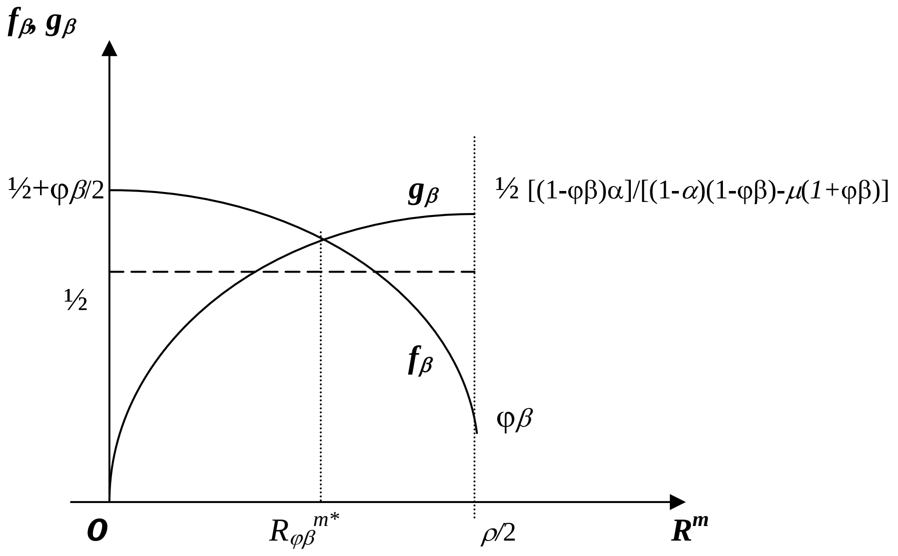
$$m_t^*(IF) = \frac{1-\varphi\beta}{1+\varphi\beta}\frac{1}{1+\phi} w_t \tag{23}$$

Equating the growth rates of the capital stock in the goods and money market gives:

$$\underbrace{\frac{(1+\varphi\beta)\alpha A - 2R^m}{2\alpha A - 2R^m}}_{f_{\varphi\beta}(R^m)} = \underbrace{\frac{(1-\varphi\beta)\alpha R^m}{\alpha A\left[(1-\alpha)(1-\varphi\beta) - 2(1+\varphi\beta)\mu\right] + 2\mu(1+\varphi\beta)R^m}}_{g_{\varphi\beta}(R^m)} \tag{24}$$

Equation (24) gives the unique equilibrium money return, as displayed in the following figure (5):

Figure (5): *Equilibrium analysis with credit constraints*



(The proof of the properties of the two functions $f_{\varphi\beta}$ and $g_{\varphi\beta}$ is provided in appendix (8)).

The equilibrium of this constrained economy is *unique* since the equilibrium money return resulting from the intersection of the functions *f* and *g* is unique in the interval [0, $\rho/2$].

Consequently, the equilibrium growth rate of the capital stock is:

$$\theta = (1-\alpha)A\frac{\alpha A(1+\varphi\beta) - 2R_{\varphi\beta}^{m^*}}{2\alpha A - 2R_{\varphi\beta}^{m^*}} \tag{25}$$

The effect of borrowing constraints appears when φ decreases, in this case the equilibrium growth rate will decrease and less capital accumulation will happen.

PROPOSITION 4:

Financial distortions, such as represented by the presence of borrowing constraints on the credit allocated by financial institutions, have a negative impact on long run growth.

The proof is provided in appendix (9)

The presence of borrowing constraints corresponds, therefore, to a lower value of φ which reduces the access to credit and, consequently, to capital accumulation and economic growth in the economy. As opposed to this, a higher value of φ traduces more allocation of credit agents and higher volume of investment. Finally, when φ is equal to unity (φ =1), credit constraints will disappear and we will come back to the precedent case.

IV- Seigniorage, inflation and growth

The presented model permits, also, to study the effects of monetary policy (Seigniorage) on inflation and growth. Indeed, with or without financial intermediaries, the effect of an increase in money creation by the government is always positive on inflation and growth.

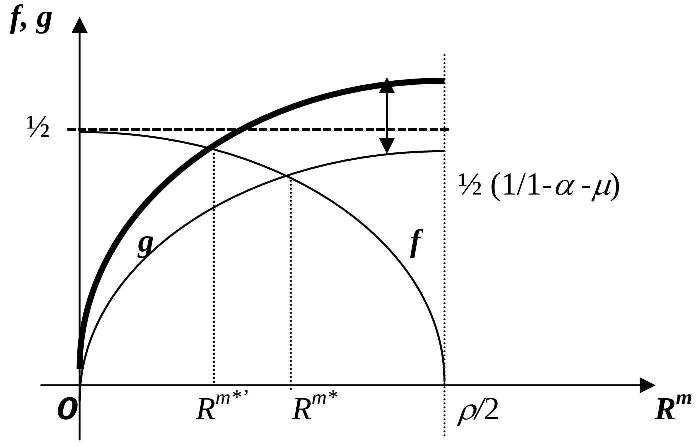
PROPOSITION 5

A budgetary policy, financed by money creation has a positive effect on inflation and growth with or without financial intermediaries

(The proof is provided in appendix (10))

In figure (6), the effect of a monetary policy, in a financial autarky situation, is represented by a movement of the curve $g(R^m)$ to the left:

Figure (6) : The effect of a money creation policy on inflation and growth in financial autarky

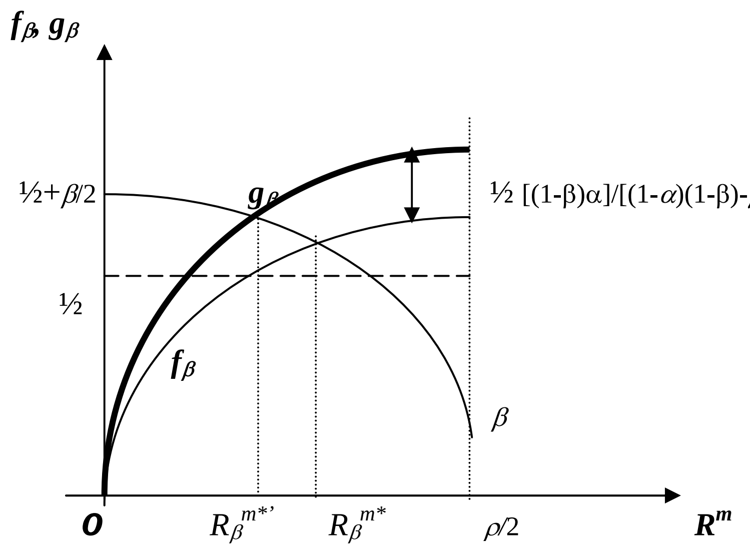


The movement of the curve $g(R^m)$ entails a reduction of the money return and consequently, an increase in the inflation rate and in the growth rate of the *equilibrium* *capital stock*. The same result is also obtained in an economy with financial intermediaries as it is displayed in figure (7).

This result of proposition 5 is not as strange as it seems, since the abundant literature on monetary policy, inflation and growth do not exclude such correlation between prices and production growth. In this paper, the positive correlation traduces the Tobin effect in an endogenous growth model. Indeed, in an inflationary economy, private agents seek to face bad effects of inflation by acquiring more real (capital) goods.

Tobin (1965), in a neoclassical growth model, concluded that any increase in the inflation rate (or an equivalent decrease in money return) is likely to entail a substitution of monetary assets by capital in the agents' portfolio with an increase of the saving rate. In the steady state, a permanent increase of inflation increases the level of output but in a transitory way resulting from the change from one equilibrium state to another[6]. *Inflation and growth are positively correlated in the Tobin's model*.

Figure (7) : The effect of money creation on inflation and growth in an economy with financial intermediaries



Tobin's finding is different from the money *superneutrality* principle of Sidrauski (1967) where any growth of the inflation rate does not affect the capital stock in the steady state. However, for Stockman (1981) Inflation and growth are negatively correlated since

[6] In the neoclassical model, the level of output increases permanently only with technical progress and not with inflation.

inflation increases the cost of capital acquisition and, consequently, reduces the accumulation of physical capital.

In *endogenous growth models*, the analysis of the inflation and growth nexus is not frequent. Espinosa and Yip (1995, 1999) have found that the effect of inflation and seigniorage on economic growth depends on the risk aversion degree of depositors. In other words, if the agents are fairly risk averse (with a positive coefficient of risk aversion in a CRRA utility function), then a fiscal policy financed by money creation will be harmful for economic growth. Indeed, when agents are fairly risk averse, a higher inflation entails more detention of real money assets, which is likely to decease the available resources for capital accumulation and consequently economic growth.

In the opposite, if the agents display low degree of risk aversion (with a negative coefficient of risk aversion in a CRRA utility function), the effect of a seigniorage financed expansionary fiscal policy will depend on the initial equilibrium situation. In fact, if the original equilibrium corresponds to a low inflation situation, then an increase in money creation will lead to a flight from real money holdings into capital and higher economic growth (a version of the Tobin effect). However, if the initial equilibrium is a high inflation one, a fiscal expansionary policy financed by money creation has negative effects on economic growth.

The positive correlation between inflation and growth remains theoretically possible in neoclassical and endogenous growth frameworks. Nevertheless, what is more important in this positive correlation is that money creation not only entails a *proportional increase* of prices but also a positive variation of real production in the presence as in the absence of financial intermediaries. This result is original since it is different from the main conclusion of *the quantitative theory of money,* where inflation is necessarily a monetary phenomenon.

This positive correlation between inflation and growth may be considered as an argument in favour of the fiscal aspect of inflation as well. Indeed, one of the determinants of inflation is the implemented fiscal policy: inflation is not only a matter of monetary authorities but also of fiscal authorities that founds the *fiscal theory of price level*. According to this hypothesis, fiscal authorities, looking for a balanced public budget, may force the Central Bank to generate seigniorage by creating current or future money, which gives inflation. Yet, the fiscal aspect of inflation is relevant only when fiscal authorities dominate the Central Bank's decisions.

As an example, we can recall the hyperinflation crisis that Germany has witnessed between 1921 and 1923. Such crisis was explained, to a large extent, by the public budget needs to finance the post-war reconstruction. The result was an hyperinflation phenomenon in 1923 (1 000 000 %) that was destructive for the German economy.

V- Conclusion

In this paper, we tried to underline the positive effect of financial intermediation on economic growth using an overlapping generations model with endogenous growth. In the model, the financial sector is made up by banking institutions and government reliance on money creation to finance public expenditures. These hypotheses are supposed to take into account, to a certain extent, the features of developing countries. The main finding is that an economy with banking institutions is growing faster than an economy in financial autarky.

The extensions of the model has shown a positive correlation between inflation and economic growth which may be interpreted as a Tobin effect in an endogenous growth model where agents seek to substitute money holdings by capital and real goods. Another result ensuing from these extensions is that any money creation policy does not entail a proportional increase in the price level but a positive variation of real production. This result is original since it is different from the main conclusion of *the quantitative theory of money*, where inflation has, necessarily, a monetary origin.

Appendices

Appendix (1): proof of equation (13)

According to equation (12) we have: $\mu y_t = \frac{M_t}{p_t} - \frac{M_{t-1}}{p_t}$. The substitution of equations (5) and (7) in this equation gives:

$$\mu y_{t+1} = \frac{1-\alpha}{1+\phi} y_t(\theta_{MM} - R_t^m)$$

Where θ_{MM} represents the money growth rate. However, since this rate is equal to which of the capital stock along the balanced growth path, the latter equation, with simple transformations following Espinosa and Yip (1995, 1999), gives the growth rate of money in equation (13):

$$\theta_{MM} = \frac{(1-\alpha)R_t^m}{(1-\alpha)-\mu(1+\phi)}$$

Appendix (2): proof of proposition 1

We have, first, two functions displaying the following features: $f(R^m) = \frac{\alpha A - 2R^m}{2\alpha A - 2R^m}$,

$f'(R^m) = \frac{-2\alpha A}{(2\alpha A - 2R^m)^2} \prec 0$, $f''(R^m) = \frac{-8\alpha A}{(2\alpha A - 2R^m)^3} \prec 0$,

Then the function $f(R^m)$ *is decreasing and concave.*

$g(R^m) = \frac{\alpha R^m}{\alpha A[(1-\alpha)-2\mu]+2\mu R^m}$, $g'(R^m) = \frac{\alpha^2 A[(1-\alpha)-2\mu]}{[\alpha A[\,(1-\alpha)-2\mu]+2\mu R^m]^2} \succ 0$, if and only if $(1-\alpha)>2\mu$. *This hypothesis is important since for lack of it the function will be decreasing and the equilibrium will not take place.*

$g''(R^m) = \frac{-4\alpha^2 A[(1-\alpha)-2\mu]\mu}{[\alpha A[(1-\alpha)-2\mu]+2\mu R^m]^3} \prec 0$, the function $g(R^m)$ *is increasing and concave.*

According to equation (8) we have $\rho = \alpha A$ and knowing that $f(0) = 1/2$, $f(\rho/2)=0$, $g(0) = 0$ et $g(\frac{\rho}{2}) = \frac{1}{2}\frac{\alpha}{(1-\alpha)-\mu}$. Figure (1) displays the functions f and g and the unique equilibrium of this economy.

Appendix (3): proof of equations (16) and (17)

From program (15), the constraints may be rewritten as follows:

$$\begin{cases} MaxU(c_{t+1}, m_t) \\ \qquad s_t + m_t = w_t + b_t \\ \qquad c_{t+1} = R_t^m m_t - \rho_{t+1} b_t + \rho_{t+1} s_t \end{cases}$$

With $\rho_{t+1} = (1 + r_{t+1})\frac{p_t}{p_{t+1}}$. Taking account the hypothesis on (b_t = βm_t) and substituting the constraints in the utility function we obtain:

$$U = log\left[\frac{R_t^m - \beta\rho_{t+1}}{1-\beta}w_t + \left(\rho_{t+1} - \frac{R_t^m - \beta\rho_{t+1}}{1-\beta}\right)s_t\right] + log\left[\frac{w_t - s_t}{1-\beta}\right]$$

The optimisation of this function with respect to saving s_t gives the individual optimal saving:

$$\frac{\partial U}{\partial s_t} = 0 \Leftrightarrow \frac{\rho_{t+1} - \frac{R_t^m - \beta\rho_{t+1}}{1-\beta}}{\frac{R_t^m - \beta\rho_{t+1}}{1-\beta}w_t + \left[\rho_{t+1} - \frac{R_t^m - \beta\rho_{t+1}}{1-\beta}\right]s_t} - \frac{\frac{1}{1-\beta}}{\frac{w_t - s_t}{1-\beta}} = 0$$

$$\Leftrightarrow s_t^*(IF) = \frac{\beta + 1 - 2\frac{R_t^m}{\rho_{t+1}}}{1 + 1 - 2\frac{R_t^m}{\rho_{t+1}}}w_t = \frac{\beta + \phi}{1+\phi}w_t,\ avec\ \phi = 1 - 2\frac{R_t^m}{\rho_{t+1}}$$

With the first constraint of the agent, we can easily deduce the optimal money holdings:

$$m_t^*(IF) = \frac{1-\beta}{1+\beta}\frac{1}{1+\phi}w_t,\ avec\ \phi = 1 - 2\frac{R_t^m}{\rho_{t+1}}$$

Appendix (4): proof of equation (18).

The equation (10) represents the equilibrium in the market of goods and services, which with equation (16) gives:

$$k_{t+1} = \frac{\beta + \phi}{1+\phi} w_t$$

The substitution of the real wage rate by its value in (7), we have:

$$k_{t+1} = \frac{\beta + \phi}{1+\phi}(1-\alpha)Ak_t$$

The growth rate of per capita capital stock *with financial institutions (IF)* is directly obtained:

$$\theta^{*}_{BS}(IF) = \frac{(1-\alpha)A(\beta+\phi)}{1+\phi}, \quad \text{with} \quad \phi = 1 - 2\frac{R_t^m}{\rho_{t+1}}$$

Appendix (5): proof of equation (19)

The substitution of equation (17) in the public constraint equation (12), with few transformations gives:

$$\mu y_t = (\theta_{MM} - R_t^m)\frac{1-\beta}{1+\beta}\frac{1}{1+\phi} w_t$$

Since in the equilibrium the production function is reduced to which of Rebelo (1991), taking account also of equation (7), this latter equation is rewritten as follows:

$$\mu y_t = (\theta_{MM} - R_t^m)\frac{1-\beta}{1+\beta}\frac{1}{1+\phi}(1-\alpha)y_t$$

Also, along the balanced growth equilibrium we have equality of growth rates of capital per head and money (equations (17) et (7)), the growth rate of per capital stock int he money market:

$$\theta_{MM}(IF) = \frac{(1-\alpha)(1-\beta)R_t^m}{(1-\alpha)(1-\beta)-(1+\beta)(1+\phi)\mu}, \quad \text{with} \quad \phi = 1-2\frac{R_t^m}{\rho_{t+1}}$$

Appendix (6): proof of proposition 2.

The properties of the functions f_β and g_β are:

$$f_\beta(R^m) = \frac{(1+\beta)\alpha A - 2R^m}{2\alpha A - 2R^m},$$

$$f'_\beta(R^m) = \frac{\alpha A[2(1+\beta)-4]}{(2\alpha A - 2R^m)^2} \prec 0, \quad \text{since } [2(1+\beta)-4] \prec 0 \text{ because } (0 \prec \beta \prec 1),$$

$$f''_\beta(R^m) = \frac{\alpha A[2(1+\beta)-4]}{(2\alpha A - 2R^m)^3} \prec 0, \ \Rightarrow \ f_\beta(R^m) \textit{ is decreasing and concave.}$$

$$g_\beta(R^m) = \frac{(1-\beta)\alpha R^m}{\alpha A[(1-\alpha)(1-\beta)-2(1+\beta)\mu]+2\mu(1+\beta)R^m},$$

$$g'_\beta(R^m) = \frac{(1-\beta)\alpha^2 A[(1-\alpha)(1-\beta)-2(1+\beta)\mu]}{\left[\alpha A[(1-\alpha)(1-\beta)-2(1+\beta)\mu]+2\mu(1+\beta)R^m\right]^2} \succ 0,$$ if and only if $(1-\alpha)(1-\beta) > 2(1+\beta)$. This hypothesis *is important since in the lack of it the function will be decreasing and the equilibrium will not exist.*

$$g''_\beta(R^m) = \frac{-4\alpha^2 A(1-\beta)(1+\beta)[(1-\alpha)(1-\beta)-2(1+\beta)\mu]\mu}{\left[\alpha A[(1-\alpha)(1-\beta)-2(1+\beta)\mu]+2\mu(1+\beta)R^m\right]^3} \prec 0, \Rightarrow g_\beta(R^m) \textit{ is}$$ *increasing and concave.*

Since we have $\rho \approx \alpha A$ and $f_\beta(0) = (1+\beta)/2$, $f_\beta(\rho/2) = \beta$, $g_\beta(0) = 0$

and $g_\beta(\frac{\rho}{2}) = \frac{1}{2}\left[\frac{\alpha(1-\beta)}{(1-\alpha)(1-\beta)-\mu(1+\beta)}\right]$. The resulting equilibrium for this economy with *financial intermediaries* is unique as displayed in the figure of the text.

Appendix (7): proof of proposition 3.

The proof is based upon a comparison of equilibrium growth rates of capital per head in economies with and without financial intermediaries. For that, we compute the difference between these rates. However to guarantee the unique equilibrium the conditions (1-α)>2μ and (1-α) (1-β)>2(1+β)μ. must be verified simultaneously.

The difference D is equal to:

$$D = \theta^*_\beta(IF) - \theta^* = \frac{(1-\alpha)A\left[\alpha A + \beta\alpha A - 2R^{m^*}_\beta\right]}{2\alpha A - 2R^{m^*}_\beta} - \frac{(1-\alpha)A\left[\alpha A - 2R^{m^*}\right]}{2\alpha A - 2R^{m^*}}$$

$$= (1-\alpha)A\left[\frac{\left[\alpha A + \beta\alpha A - 2R^{m^*}_\beta\right]}{2\alpha A - 2R^{m^*}_\beta} - \frac{\left[\alpha A - 2R^{m^*}\right]}{2\alpha A - 2R^{m^*}}\right]$$

$$= (1-\alpha)A\underbrace{\left[f_\beta(R^{m^*}_\beta) - f(R^{m^*})\right]}_{\succ 0} \succ 0$$

The difference D is positive since $f_\beta(R_\beta^{m^*})-f(R^{m^*})$ is positive as displayed in the figure (3) in the text.

Appendix (8): Proof of the properties of the functions $f_{\varphi\beta}$ *et* $g_{\varphi\beta}$ in equation (24)

The reached equilibrium in the economy is unique since the functions $f_{\varphi\beta}$ and $g_{\varphi\beta}$ have the following features:

$$f_{\varphi\beta}(R^m) = \frac{(1+\varphi\beta)\alpha A - 2R^m}{2\alpha A - 2R^m},$$

$$f'_{\varphi\beta}(R^m) = \frac{\alpha A[2(1+\varphi\beta)-4]}{(2\alpha A - 2R^m)^2} \prec 0, \quad \text{since } [2(1+\varphi\beta)-4] \prec 0 \text{ because } (0 \prec \varphi\beta \prec\prec 1),$$

$$f''_{\varphi\beta}(R^m) = \frac{\alpha A[2(1+\varphi\beta)-4]}{(2\alpha A - 2R^m)^3} \prec 0, \Rightarrow f_{\varphi\beta}(R^m) \textit{ is decreasing and concave.}$$

$$g_{\varphi\beta}(R^m) = \frac{(1-\varphi\beta)\alpha R^m}{\alpha A\left[(1-\alpha)(1-\varphi\beta) - 2(1+\varphi\beta)\mu\right] + 2\mu(1+\varphi\beta)R^m},$$

$$g'_{\varphi\beta}(R^m) = \frac{(1-\varphi\beta)\alpha^2 A\left[(1-\alpha)(1-\varphi\beta) - 2(1+\varphi\beta)\mu\right]}{\left[\alpha A\left[(1-\alpha)(1-\varphi\beta) - 2(1+\varphi\beta)\mu\right] + 2\mu(1+\varphi\beta)R^m\right]^2} \succ 0,$$ if and only if (1-α)(1-$\varphi\beta$)>2(1+$\varphi\beta$). This *hypothesis is important since in the lack of it the function will be decreasing the equilibrium will not exist.*

$$g''_{\beta}(R^m)=\frac{-4\alpha^2A(1-\varphi\beta)(1+\varphi\beta)\left[(1-\alpha)(1-\varphi\beta)-2(1+\varphi\beta)\mu\right]\mu}{\left[\alpha A\left[(1-\alpha)(1-\varphi\beta)-2(1+\varphi\beta)\mu\right]+2\mu(1+\varphi\beta)R^m\right]^3}\prec 0\,,\Rightarrow g_{\varphi\beta}(R^m)\ \textit{is}$$

increasing and concave.

According to equation (8) we have $\rho\approx\alpha A$ and knowing that $f_{\varphi\beta}(0)=(1+\varphi\beta)/2$, $f_{\varphi\beta}(\rho/2)=\varphi\beta$, $g_{\varphi\beta}(0)=0$ and $g_{\varphi\beta}(\frac{\rho}{2})=\frac{1}{2}\left[\frac{\alpha(1-\varphi\beta)}{(1-\alpha)(1-\varphi\beta)-\mu(1+\varphi\beta)}\right]$.

The functions are in figure (5) in the text.

Appendix (9): proof of proposition 4

The derivative of θ with respect φ is:

$$\frac{\partial\theta}{\partial\varphi}=(1-\alpha)A\frac{\alpha\beta A}{2\alpha A-2R^{m\,*}_{\varphi\beta}}\succ 0$$

This positive derivative indicates that an increase (decrease) of φ has a positive (negative) effect on economic growth. In other words, the more easy (difficult) is the access for banking credit for households, the more important (weak) is the investment for the economy.

Appendix (10): proof of proposition 5

A fiscal policy financed by money creation entails, in the model, an increase of the ratio μ.. The consequence is a decrease of the money return and an increase of inflation and economic growth.

With the absence of financial intermediaries, a rise of μ has no effect on $f(R_t^m)$ but the function $g(R_t^m)$ shifts to the left since

$$\frac{\partial g(R^m)}{\partial\mu}=\frac{-\alpha R^m\left[-2\alpha A+2R^m\right]}{\left[\alpha A\left[(1-\alpha)-2\mu\right]+2\mu R^m\right]^2}=\frac{2\alpha R^m\left[\alpha A-R^m\right]}{\left[\alpha A\left[(1-\alpha)-2\mu\right]+2\mu R^m\right]^2}\succ 0$$

The result is a decrease in the money return and an increase in the inflation rate as it is displayed in figure (6) in the text. The effect on economic growth is positive since:

$$\frac{d\theta_{BS}}{dR^m} = -\frac{2\alpha(1-\alpha)A^2}{\left[2\alpha A - 2R^m\right]^2} < 0$$

With financial intermediaries the effect is similar and the monetary policy entails a shift of $g_\beta(R_t^m)$ to the left since:

$$\frac{\partial g_\beta(R^m)}{\partial\mu} = \frac{2\alpha(1-\beta)(1+\beta)R^m\left[\alpha A - R^m\right]}{\left[\alpha A\left[(1-\alpha)(1-\beta)-2(1+\beta)\mu\right]+2\mu(1+\beta)R^m\right]^2} \succ 0$$

The consequence is a decrease in the money return and an increase of the inflation rate and economic growth as it is displayed in figure (7) in the text.

$$\frac{d\theta_{BS}(IF)}{dR^m} = -\frac{2\alpha(1-\alpha)(1+\beta)A^2}{\left[2\alpha A - 2R^m\right]^2} < 0$$

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