Banking, Credit Market Imperfection and Growth

Mahmoud Sami Nabi and Taoufik Rajhi

LEGI - Tunisia Polytechnic School and IHEC Sousse, African Development Bank

2005

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Mahmoud Sami Nabi

LEGI, Tunisia Polytechnic School

and

University of Sousse, IHEC, Tunisia

Taoufik Rajhi

African Development Bank

We develop a new model that links capital market imperfection to banking emergence and economic growth. It is shown that the banking system emerges endogenously after a first stage of slow economic growth. Interestingly, economic growth increases after the emergence of banking but remains under its potential level. This is due to a credit rationing brake which decreases progressively as the economy develops. Another finding is that a reduction of credit market imperfection reduces the credit rationing stage.

JEL Codes: G21, O16, O41,.
Keywords: endogenous growth, banking emergence, credit rationing, credit market imperfection.

1. Introduction

This paper investigates the relationship between banking and growth in the presence of an inefficient judicial system. With regards to banks, the legal framework is particularly important. For example, in case of borrower's default the bank often has the right to seize collateral. However, in practice the enforcement of this right depends on the efficiency of the judicial system. A number of empirical studies (Stulz, 2001; Levine, 1998 and Beck et al., 2001) have shown that the legal framework is crucial for the development of a financial system. Figure 1 shows two financial depth indicators (Private Credit/GDP and Liquid liability/GDP) in the period 2000-04 versus the judicial efficiency (JE) for 76 countries [1] divided in quartiles according to their "level" of judicial efficiency. It is clear that the two indicators of financial development increase with the judicial efficiency. This positive relationship suggests that the emergence of a banking system at the early stage of economic development may be influenced by the level of judicial efficiency.

The existence of a banking system is expected to lead to higher economic growth by providing more finance for productive projects. However, the judicial efficiency may in turn affect the intensity of this positive relationship. That is, when the judicial system is weak, banks will finance only those entrepreneurs providing sufficient collateral. Figure 2 outlines the entrepreneurship density in the period between 2002-04 versus the judicial efficiency for 56 countries [2]. The solid curve traces the regression line which has a positive and highly significant coefficient (*t*-statistic, 5.18) and an R^2 of 0.20. An increase of the judicial efficiency of 1 is associated, on average, with 18.83 percent increase in the entrepreneurship density. This is a large quantitative effect which suggests that even if a banking system has already emerged, an economy may suffer from low entrepreneurship due to the weakness of its judicial system.

Motivated by these empirical facts this paper proposes a theoretical model that focuses on two issues. First, the model seeks to provide a new explanation of the emergence of banking based on capital accumulation and credit market imperfection (judicial inefficiency). This is an issue that is rarely analyzed in the theoretical literature. To our knowledge the only exception is Tressel (2003), whose model analyses the emergence of banks after a first stage of development where the economy is endowed with an informal credit market. However, his analysis does not include the role of the credit market imperfection. In our model, credit market imperfection (judicial inefficency) is defined as in Matsuyama (2000, 2004) in relation to an enforcement problem: the borrowers are willing to honor their payment obligations vis-à-vis the bank only if they are inferior to the cost of default. This cost of default increases with the judicial inefficiency. Also, contrary to Tressel (2003), in our model the economy develops due to self-financed projects before the emergence of the banking system. This model shows that the banking system emerges once the economy reaches a particular stage of development. The higher the credit market imperfection (judicial inefficiency) the later this emergence occurs.

[1] The countries are presented in table 1 of the Appendix.

[2] The countries are presented in the table 2 of the Appendix.

The second issue concerns the evolution of the effect of banking on growth when the credit market is imperfect. It is related to the theoretical studies analyzing the relationship between financial development and economic growth which began with Gurley and Shaw (1955), Goldsmith (1969) and McKinnon (1973). After the emergence of the endogenous growth theory more convincing models were constructed (Greenwood and Jovanovic, 1990; Bencivenga and Smith, 1993; Boyd and Smith, 1996; Blackburn and Hung, 1998). Their common approach consists in the integration of a micro-economic model of financial contract theory in a dynamics general equilibrium model. These studies demonstrate the importance of financial development for economic growth. However, few theoretical models were developed to explain the weak impact of the banking system on growth in many countries where although a modern banking system has always emerged, it is far from playing its role in enhancing economic growth (Demetriades and Hussein, 1996). Nabi and Suliman (2009) showed that the intensity of causal effect from banking to economic growth is higher when the institutional environment improves. This is due to the reduction in the defaulting loans and the diminishing of the interest rate spread.

In this paper we propose a model which explains the countries' discrepancies in terms of the banking effect on economic growth by their different credit market imperfections' levels. Indeed, its shows that after the banking emergence, the economy develops more quickly but remains under its growth potential level along a second stage of development. This is due to a credit rationing brake caused by the credit market imperfection. This credit rationing loosens progressively as the economy develops and disappears in the third stage of development. The lower the credit market imperfection is the faster the economy reaches the third stage of development. Hence, the removal of credit market imperfection should be a part of financial reforms since it increases the enforceability of credit contracts and reduces the credit rationing phase.

To simplify the analysis, this work considers identical agents who can be borrowers (entrepreneurs of modern projects) or depositors. In previous studies, they correspond to the "potentially dishonest" individuals of Jaffee and Russel (1976) who default only if it is in their interest to do so. The first stage of development is characterized by the undertaking of "primitive" projects. These projects are self-financed and less productive than the modern projects which need an indivisible investment superior to the agents' wealth. Hence, for the modern projects to be undertaken, entrepreneurs need to borrow from banks when they exist. The emergence of a banking system is related to its ability to attract depositors with the alternative to invest their wealth in primitive projects. This is the case if the interest rate is superior to the return of "primitive" projects.

After the emergence of the banking sector which is assumed to be perfectly competitive and having no operational or entry cost, the interest rate is endogenously determined by the interplay between the supply and demand of capital. However, in the second stage of development, the potential of entrepreneurs to default sets the pace for a banking behavior that enforces the credit contract by fixing an interest rate ceiling. In this stage, all agents request bank loans but only a proportion effectively receive them. The remainder one is credit rationed and become depositors. The interest rate ceiling deprives the economy of additional saving capital that would finance more modern projects: the economy grows below its potential. In the third stage of the development, there is no need for the banking sector to fix an interest rate ceiling since the entrepreneurs' own capital invested in the modern project is so important that the cost of default is higher than the payment obligations. The competitiveness between agents to get a loan raises the interest rate to a threshold that makes them indifferent between undertaking a project or depositing their wealth in the bank: there is no credit rationing and the economy grows without any break.

Two main economic insights come out of this analysis. Firstly, the economy may be trapped in the first phase unless the "primitive" projects are sufficiently productive. Secondly, the higher credit market imperfection is, the later the emergence of a banking system and the exit from the credit rationing stage will happen. The rest of the paper is organized as follows: Section 2 develops the theoretical model. Section 3 exposes some concluding remarks.

2. Endogenous growth model

The basic framework is Diamond (1965) overlapping generations. The model integrates some features of Matsuyama (2000, 2004) namely the modelling of credit market imperfection and the indivisibility of the investment projects. However, it is different from it in many aspects. First, we use an endogenous growth specification of the capital accumulation technology, and second we include a banking system that emerges endogenously. Finally, while saving is not considered in Matsuyama (2000, 2004), in our model it plays an important role in the dynamics of capital accumulation.

2.1 Economic environment

We consider a closed economy with an infinite, discrete time horizon, t= 0, 1, 2,… The economy is endowed with two production technologies; one for the production of a consumption (final) good and another one for the production of an investment good. The final good is used for consumption and for the production of the investment good. The investment good, in turn, is used as an input (in addition to labor) in the final good production technology. It could be produced by two types of projects ("primitive" projects or modern ones) which are undertaken by individual entrepreneurs of different generations. Indeed, at each date a new generation of two-period living and identical agents of mass 1 is born. An initial generation of old agents coexists with young agents at date t = 0. All agents are endowed with one unit of labor during their first-period of life. They supply it to the final good sector inelastically at no disutility cost. In compensation for their work, they earn a wage that they split between consumption and saving/investment in order to maximize their intertemporal utility. For agents becoming entrepreneurs, the investment part will finance totally (respectively partially) the undertaking of “primitive” (respectively modern projects). After the emergence of a baking system, some agents will simply deposit their saving in a bank.

2.1 Production technologies

Consumption good technology

The consumption (final) good is obtained instantaneously from the combination of two substitutable factors: capital (good) K and labor L. The technology which is assumed to be of Cobb-Douglas type exhibits constant returns to factors but includes an aggregate level of "knowledge" A which enables the endogenous growth of the aggregate production: $Y_t = A_t K_t^{\alpha} L_t^{1-\alpha}$. We associate A_t to the aggregate stock of capital $A_t = \bar{k}_t^{1-\alpha} = (K_t/L_t)^{1-\alpha}$. This choice enables the endogenous growth of the aggregate production. Hence, the per capita output is given by $y_t = A_t k_t^{\alpha}$. Finally, capital depreciates fully after production and the factors' prices of capital and labor, respectively ρ_t and w_t, are equal to their marginal productivities:

$$\rho_t = \alpha A_t k_t^{\alpha-1}$$
$$w_t = (1-\alpha) A_t k_t^{\alpha}$$

Therefore, a share $1-\alpha$ of the output is distributed to the workers (via wages $w_t L_t$ with $L_t = 1$ by assumption). Whereas a share α of the output is distributed to the entrepreneurs (via the remuneration of capital $\rho_t k_t$). In the equilibrium the aggregate stock of capital is also the capital stock per capita: $\bar{k}_t = k_t$. Hence, we obtain

$$\rho_t = \alpha < 1 \quad (1)$$
$$w_t = (1-\alpha) k_t \quad (2)$$

Note that the price of the capital is constant and this will simplify the financial structure of the model. Since each generation contains a mass 1 of identical agents, the aggregate wage of young agents is w_t. It also represents the aggregate wealth of the young agents which finances their consumption and their saving or investment projects (depending on their occupational choice). For simplification, in the remaining of the paper we call w_t the economy wealth.

Investment good technology

The investment good (capital) is obtained from a one-period conversion of the final good through two possible technologies. The first is a primitive technology that converts linearly any quantity q of the final good to mq units of the investment good. The second is a modern technology which is more productive ($a > m$) but requires a fixed initial quantity[3] $\bar{w}$ of the final good to produce $a\bar{w}$ units of the investment good. In the two cases, each produced unit of the investment good is sold to the final good sector at the price $\rho_t = \alpha$ in terms of the final good. Hence, an agent who undertakes a primitive project will obtain $\alpha m q$ units of the final good from an initial investment of quantity q. Whereas after undertaking a modern project, an agent will obtain $\alpha a \bar{w}$ units of the final good from an initial investment of $\bar{w}$. Therefore, the gross return of the modern technology is αa whereas that of the primitive technology is αm. In order for these technologies to be profitable we should assume that $a > m > 1/\alpha$.

[3] A similar assumption is considered in Aghion and Bolton (1997). MacKinnon (1973) notes the importance of indivisible investment for the emerging countries.

2.3 Banks

Banks exist to assist young agents in starting a modern project. Therefore, it shall be assumed that the individual wealth of each young agent at date t=0 denoted w_0 is not high enough for the agents to self-finance a modern project.

Assumption 1

$$w_0 = (1-\alpha)k_0 < \overline{w}$$

Thus, in the region $[w_0, \overline{w}[$, the young agent's wage is inferior to the amount $\overline{w}$ required for the setting-up of the modern investment project. Hence, if he does not consume during its first period of life, the agent needs to borrow $\overline{w} - w_t$ from the bank. The banking system is assumed to be perfectly competitive but it faces a moral risk due to the imperfection of the credit market. An entrepreneur who wishes to set-up a modern investment project asks for a bank loan of $(\overline{w} - \widetilde{w}_t)$ where $\widetilde{w}_t$ represents its own capital. Having obtained this loan, the entrepreneur has an incentive to default whenever its utility is increased by doing so. Jaffee and Russel (1976) consider a similar behavior for their "dishonest" borrowers. In their model, there is asymmetric information about the likelihood of default between lenders and borrowers and the default may actually occur. However, in our model the borrowers (entrepreneurs) are of the same type, the bank knows perfectly what incentives make them default and acts to deter this potentiality. The cost of default for a borrower is $\lambda a\overline{w}$ where $a\overline{w}$ is the modern project output and $0 < \lambda \leq 1$ is the fraction that the bank can potentially seize. It is clear that for λ equal to one there is no incentive to default since the bank seizes all the modern project output. As in Matsuyama (2000), the parameter λ is a structural characteristic of the economy which measures the credit market imperfection. In Barro (2000) the credit market imperfection reflects among others the weakness of the judicial institutions. For $0 < \lambda < 1$, the bank must ensure that the default costs less than the loan repayment.

Let us specify how the bank guarantees the borrowers' solvency. An entrepreneur who contracted a loan of $(\overline{w} - \widetilde{w}_t)$ has to repay the bank $r_t(\overline{w} - \widetilde{w}_t)$ where r_t is the gross interest rate during period $t+1$. He is willing to do so if this repayment is less than the default cost $\lambda \alpha a\overline{w}$ (in terms of the final good)

$$r_t(\overline{w} - \widetilde{w}_t) \leq \lambda \alpha a\overline{w} \qquad (3)$$

Under the assumption that the banking system is perfectly competitive (which implies that the bank's profit is zero), the bank is willing to remunerate the deposits at the gross interest rate r_t if and only if the enforcement condition (3) holds for period $t+1$. Finally, it is clear that the banking emergence is conditioned by the attractiveness of deposits compared to primitive projects. In other words, banks exist if and only if the deposit remuneration is superior to the return of the primitive project.

2.4 Agents

Each agent inelastically supplies one unit of labor during his first period of life. Therefore, the total labor supply (for the final good sector) at each date is $L = 1$. An agent of generation t (born at date $t-1$) earns a wage w_t at date t and uses it in order to maximize the homothetic utility $U(c_t, c_{t+1})$ defined over his consumption in the two-period living

$$U(c_t, c_{t+1}) = c_t^{1-\gamma} c_{t+1}^{\gamma} \tag{4}$$

under the budget constraint that depends on his occupation during period t.

<u>Depositors</u>

The depositor consumes c_t and saves s_t in the bank in return of the gross deposit interest rate r_t^d. Hence, the budget constraint is the following

$$\begin{cases} c_t = w_t - s_t \\ c_{t+1} = r_t s_t \end{cases}$$

The saving that maximizes the agent's utility is a constant fraction of its wage and is given by

$$s_t = \gamma w_t \tag{5}$$

The maximum utility U_t^d of the depositor can therefore be derived and we obtain

$$U_t^d = (1-\gamma)^{1-\gamma}(\gamma r_t)^{\gamma} w_t \tag{6}$$

<u>Modern entrepreneur</u>

An agent who undertakes a modern project has to determine how to finance it optimally. He should determine his self-financing $\widetilde{w}_t$ and the loan $(\overline{w} - \widetilde{w}_t)$ taking in account his utility and the following budget constraint

$$\begin{cases} c_t = w_t - \widetilde{w}_t \\ c_{t+1} = \alpha a \overline{w} - r_t(\overline{w} - \widetilde{w}_t) \end{cases} \tag{7}$$

The second equation explains that the entrepreneur's consumption at the second period is equal to the modern project output (in term of the final good) net of the debt repayment. The self-financing $\widetilde{w}_t$ that maximizes the agent's utility is given by

$$\widetilde{w}_t = \gamma w_t - (1-\gamma)\left(\frac{\alpha a}{r_t} - 1\right)\overline{w} \tag{8}$$

We observe in equation (8) that an increase of the capital cost increases the self-financing which is carried out by a decrease of the first period consumption. The maximum utility U_t^e of this agent is given by

$$U_t^e = (\gamma)^\gamma (1-\gamma)^{1-\gamma} (r_t)^{\gamma-1} \left(\alpha a \overline{w} - r_t^l(\overline{w} - w_t)\right) \tag{9}$$

Primitive entrepreneur

An agent who undertakes a primitive project does not need a bank loan. He should simply determine $\widehat{w}_t$ the amount to invest that maximizes his utility under the following budget constraint

$$\begin{cases} c_t = w_t - \widehat{w}_t \\ c_{t+1} = \alpha m \widehat{w}_t \end{cases} \tag{10}$$

We obtain

$$\widehat{w}_t = \gamma w_t \tag{11}$$

The maximum utility U_t^p of this agent can therefore be derived

$$U_t^p = (1-\gamma)^{1-\gamma} (\gamma \alpha m)^\gamma w_t$$

Occupational choices

In this subsection, we analyze the agent's decision to become either a primitive entrepreneur or a saver, and then to become a modern entrepreneur or a depositor.

Proposition 1

- *The agents prefer to become a depositor rather than a primitive entrepreneur if the interest rate is greater than the return of the primitive project*

$$r_t > \alpha m \tag{12}$$

- *The agents prefer to become a modern entrepreneur rather than a depositor if the interest rate is lower than the return of the modern project*

$$r_t < \alpha a \tag{13}$$

Proof. The agents prefer the occupation that secures the highest utility. Hence, the proof follows straightforwardly from the comparison between the maximum utility (previously determined) that the agent can obtain from each occupation ■

2.5 Credit Market Equilibrium

First let us analyze the interaction between the enforcement condition (3) and the profitability condition (13).

Enforcement vis-à-vis Profitability Dominance

Definition 1

We say that condition A dominates condition B if the fulfilling of A implies that B is fulfilled.

Proposition 2

Let's define $w_\lambda = (1-\lambda)\overline{w}/\gamma$ *then we have*

- *The enforcement condition (3) dominates the profitability condition (13) if* $w_0 \le w_t \le w_\lambda$.
- *The profitability condition (13) dominates the enforcement condition (3) if* $w_\lambda \le w_t \le \overline{w}$.

Proof. Replacing $\tilde{w}_t$ by its expression (8), the enforcement condition (3) becomes

$$r_t \le \frac{\gamma-(1-\lambda)}{\gamma}\frac{\alpha a\overline{w}}{\overline{w}-w_t} \tag{14}$$

The rest of the proof is developed in the Appendix ■ From equation (14) that we shall assume that the credit market imperfection measured by $1-\lambda$ is inferior to γ (the utility partial elasticity to the second period consumption). Otherwise, the right term of (14) is negative which implies that the enforcement condition is never satisfied and that the banking system never emerges.

Assumption 2

$$1-\lambda < \gamma$$

As can be seen from figure 3, in region $]0, w_\lambda]$ any interest rate level that fulfills the enforcement condition satisfies also the profitability condition. However, when the economy reaches an advanced stage of development (the wealth level more than or equal to w_λ), the profitability condition dominates the enforcement one. In the wealth interval $[w_0, w_\lambda]$, the entrepreneur's contribution to the project financing is not sufficiently high to guarantee the debt repayment. Even if the project is profitable the entrepreneur may increase its final wealth by defaulting.

Hence, there is a need for the enforcement condition. However, this moral hazard problem disappears in the interval $[w_\lambda, \overline{w}]$ where the entrepreneur's contribution is sufficiently high that the incentive to default disappears.

Interest Rate and Development Regions

Let's w_m denotes the wealth threshold which marks the banking emergence.

Corollary 1

- At the equilibrium of the credit market the interest rate is r_t^* given by

$$r_t^* = \begin{cases} \frac{\gamma-(1-\lambda)}{\gamma}\frac{\alpha a\overline{w}}{\overline{w}-w_t} & \text{if } w_m \le w_t \le w_\lambda \\ \alpha a & \text{if } w_\lambda \le w_t \le \overline{w} \end{cases} \tag{15}$$

- The wealth interval $[w_m, w_\lambda]$ is characterized by credit rationing.
- The wealth interval $[w_\lambda, \overline{w}]$ is characterized by the agents' indifference between becoming depositors or modern entrepreneurs.

Proof. Let's consider that the wealth of the economy has reached the threshold w_m so that the banking system has emerged. From proposition 1 it is clear that unless the interest rate is equal or superior to the modern project return αa, all young agents prefer to become modern entrepreneurs rather than depositors. However, since the loanable funds arise from the young agent saving, it is obvious that only a proportion of them can effectively undertake a modern project. Hence, as far as the interest rate is less than the modern project return, the agents will compete with each other to obtain a loan. This competition increases the interest rate. When the wealth of the economy is less than w_λ, proposition 2 describes that banks limit the gross interest rate to the threshold $\frac{\gamma-(1-\lambda)}{\gamma}\frac{\alpha a\overline{w}}{\overline{w}-w_t}$ in order to exclude the default possibility. Hence, the credit market equilibrium in the interval $[w_m, w_\lambda]$ is such that the gross interest rate is equal to the maximum level $\frac{\gamma-(1-\lambda)}{\gamma}\frac{\alpha a\overline{w}}{\overline{w}-w_t}$. This level is lower than the gross return of modern projects αa. Therefore, at the equilibrium, all agents prefer becoming modern entrepreneurs (proposition 1). However, as we explained previously only a proportion of the agents become entrepreneurs. The remainder proportion is credit rationed and become depositors. When the economy wealth exceeds w_λ, proposition 2 proves that the profitability of the modern project in comparison to the bank deposit guarantees the debt repayment. Hence, the only restriction to the interest rate is the profitability condition. Therefore, the agent competitiveness raises the gross interest rate to the threshold αa which is reached at the equilibrium. At this interest rate level the modern project yields the same return as the deposit contract. Thus, the agents do not compete to obtain a loan; they are indifferent to the decision of becoming depositors or entrepreneurs ■

We call the wealth interval $[w_m, w_\lambda]$ the credit rationing region. Figure 4 plots the evolution of the gross interest rate with the economy wealth.

2.6 The Banking Emergence and Dynamics of capital accumulation

The banking emergence is conditioned by the attractiveness of deposits compared to primitive projects. Indeed, banks exist if they are able to transform the saving of depositors to loans for the modern entrepreneurs. In order to collect the young agents' saving the remuneration of deposits should be superior to the primitive project return: $r_t^* > \alpha m$.

Corollary 2

The banking system emerges when the wealth of the economy reaches the threshold w_m defined by

$$w_m = \overline{w}\left(1 - \frac{(\gamma + \lambda - 1)a}{\gamma m}\right) < w_\lambda \quad (16)$$

Proof. Using the gross interest rate expression (15), the threshold w_m is defined by $\frac{\gamma-(1-\lambda)}{\gamma}\frac{\alpha a\overline{w}}{\overline{w}-w_m} = \alpha m$ which gives the equation (16). Using the fact that $a > m$ and assumption 2, it is easy to show that $w_m < w_\lambda$ ■ When the wealth of the economy is smaller than w_m the only available occupation for the young agents during their second period of life is the undertaking of primitive projects. We classify the economy in the region $[w_0, w_m[$ as a primitive economy.

Corollary 3

After the emergence of the banking system ($w_t > w_m$) the proportion p_t^* of modern entrepreneurs is given by

$$p_t^* = \frac{w_t}{\overline{w}}\left(1 + \frac{1-\gamma}{\gamma}\frac{\alpha a}{r_t^*}\right)^{-1} \quad (17)$$

Proof. After the emergence of the banking system, the proportion p_t^* of modern entrepreneurs (and therefore the proportion $1 - p_t^*$ of depositors) is determined by the equality between deposits and loans (since the banking system is perfectly competitive and the bank's profit is nil). Denoting s_t^* the saving of a depositor at the equilibrium of the credit market and $\widetilde{w}_t^*$ the contribution of a modern entrepreneur to the financing of the project, the proportion p_t^* is given by

$$(1 - p_t^*)s_t^* = p_t^*(\overline{w} - \widetilde{w}_t^*)$$

which implies

$$p_t^* = s_t^*/(\overline{w} + s_t^* - \widetilde{w}_t^*)$$

Using the equations (5) and (8) that define s_t^* and $\widetilde{w}_t^*$ we find the solution (17) ■

Note that for a given the wealth of the economy w_t, the proportion of entrepreneurs increases with the interest rate $\partial(p_t^*)/\partial r_t^* > 0$. To explain the reason behind this increase, we should take into consideration that the saving of a rationed agent is $s_t^* = \gamma w_t$ and that the self-financing of an entrepreneur increases with the interest rate. Therefore, the financing need for an entrepreneur decreases which raises the proportion of financed projects (8). The dynamics of wealth accumulation depends on the quantity of investment good produced. From equation (2) we see that the economy wealth at the end of period $t+1$ is given by $w_{t+1} = (1-\alpha)k_{t+1}$. Besides, the capital accumulation level k_{t+1} is equal to the proportion of undertaken projects multiplied by the production of each one. Before the banking emergence, each young agent undertakes a primitive project which transforms $\widehat{w}_t$ final good to $m\widehat{w}_t$ capital good. Therefore, in the primitive region of development $[w_0, w_m[$ the dynamics of wealth accumulation is given by $w_{t+1} = (1-\alpha)m\widehat{w}_t$. When banks emerge, the capital accumulation level becomes equal to the proportion of modern projects p_t^* multiplied by the production $a\overline{w}$ of each one. Hence, the dynamics of wealth accumulation in the region $[w_m, \overline{w}]$ is given by $w_{t+1} = (1-\alpha)p_t^* a\overline{w}$. Using the expression (11) of $\widehat{w}_t$ and (17) of p_t^* we obtain the following wealth dynamics:

$$w_{t+1} = \begin{cases} m\gamma w_t & \text{for } w_t \in [w_0, w_m[\\ a\overline{w}/(1 + \frac{1-\gamma}{\gamma}\frac{\alpha a}{r_t^*}) & \text{for } w_t \in [w_m, \overline{w}] \end{cases} \qquad (18)$$

<u>Corollary 4</u>

- If the productivity m of primitive projects is superior to the threshold $\underline{m} = [\gamma(1-\alpha)]^{-1}$ then the economy grows and exits the primitive region $[w_0, w_m[$. Otherwise, it never develops.
- After the banking emergence, the economy grows less than its potential in the region of credit rationing $[w_m, w_\lambda]$.

Proof. The economy grows before of the emergence of banking if and only if $k_{t+1}/k_t = m\widehat{w}_t/k_t > 1$ which is equivalent using (11) and (2) to $m\gamma(1-\alpha) > 1$. Hence, the condition for the growth in the primitive region is that the productivity of primitive projects exceeds the threshold $\underline{m} = [\gamma(1-\alpha)]^{-1}$. After the emergence of banking, the dynamics of capital accumulation is given by $k_{t+1} = p_t^* a\overline{w}$ which is given using the expression (17) of p_t^*:

$$k_{t+1} = aw_t/\left(1 + \frac{1-\gamma}{\gamma}\frac{\alpha a}{r_t^*}\right)$$
$$= (1-\alpha)ak_t/\left(1 + \frac{1-\gamma}{\gamma}\frac{\alpha a}{r_t^*}\right)$$

Hence, we obtain the gross growth level

$$\frac{k_{t+1}}{k_t} = \frac{w_{t+1}}{w_t} = (1-\alpha)a/\left(1 + \frac{1-\gamma}{\gamma}\frac{\alpha a}{r_t^*}\right)$$

It is clear that the higher the interest rate is the higher the economic growth will be $\partial\left(\frac{k_{t+1}}{k_t}\right)/\partial r_t^* > 0$. Therefore, proving that the economy grows below its potential growth in the region of credit rationing is equivalent to proving that the interest rate would be higher without credit rationing. This is immediately noticed as the credit rationing results provokes banks intervention to enforce the entrepreneur's repayment. Without the enforcement condition, the competitiveness between young agents raises the interest rate to the level αa which is superior to r_t^* in the region $[w_m, w_\lambda[$■. Figure 5 shows the dynamics of wealth accumulation when the productivity of primitive projects is sufficiently high $(m > \underline{m})$ to enable the economy to exit the primitive region $[w_0, w_m[$.

2.7 Impact of the Credit Market Imperfection

Impact on the Development Regions and the Interest Rate

Proposition 3

If the credit market imperfection decreases then the emergence of banking and the exit from the credit rationing region are accelerated. Besides, the interest rate increases in the initial region of credit rationing.

Proof. See Appendix ■

This result is depicted by figure 6 for an economy with a credit market imperfection that passes from $1-\lambda_1 = 0,3$ to $1-\lambda_2 = 0,2$. Why do the wealth threshold w_m which marks the banking emergence decrease with the credit market imperfection (i.e. when λ increases)? Assume that the initial credit market imperfection is $1-\lambda_1$. Therefore, banking emerges when the economy wealth reaches $w_m(\lambda_1)$ or equivalently when the young agents' potential self-financing of the modern project reaches the minimum threshold $\widetilde{w}_m(\lambda_1)$. Let's now assume that credit market imperfection decreases and passes to $1-\lambda_2$. In this case, banks can seize a greater fraction of the output produced by a defaulting entrepreneur. As a result, the constraint on interest rate imposed by the enforcement condition is loosened. Or equivalently the minimum contribution to the modern project financing is lowered to $\widetilde{w}_m(\lambda_2)$. Consequently, banking emerges when the economy wealth reaches $w_m(\lambda_2) < w_m(\lambda_1)$.

The same reasoning enables us to explain why the exit from the credit rationing region is accelerated. Indeed, initially the enforcement condition dominates the profitability one in the region $[w_{\lambda_2}, w_{\lambda_1}]$. However, the default cost in this region becomes higher than the debt repayment after the decrease of the credit market imperfection. This dissuades modern entrepreneurs to default. As a result, there is no more need for the enforcement condition in this region where the only constraint to the interest rate becomes the profitability condition. At the credit market equilibrium, the latter is saturated and young agents are indifferent to the depositing occupation as well as the modern entrepreneurial condition.

Impact on the capital accumulation dynamics

Proposition 4

A decrease of the credit market imperfection accelerates the economy's dynamics through an earlier emergence of the banking system and an increase of the modern project proportion in the initial region of credit rationing.

Proof. Let's consider that the credit market imperfection decreases from $1-\lambda_1$ to $1-\lambda_2$. According to proposition 3, the wealth threshold that marks the banking emergence passes from $w_m(\lambda_1)$ to $w_m(\lambda_2) < w_m(\lambda_1)$. As a consequence of the earlier banking emergence, a proportion of the young agents can undertake a modern project even when the economy wealth belongs to the interval $[w_m(\lambda_2), w_m(\lambda_1)]$. Initially, the only option available to young agents in this region was the setting-up of primitive projects. Since, modern projects are more productive than primitive ones, it is clear that the earlier banking emergence accelerates the wealth accumulation dynamics. The second source that accelerates this dynamics is the increasing of the modern projects proportion in the initial region of credit rationing $[w_m(\lambda_1), w_{\lambda_1}]$. Indeed, using expression (17) and proposition 3 we observe that the proportion of modern projects increases when the credit market imperfection decreases (λ increases):

$$\frac{\partial p_t^*}{\partial \lambda} = \underbrace{\frac{\partial p_t^*}{\partial r_t^*}}_{>0} \underbrace{\frac{\partial r_t^*}{\partial \lambda}}_{>0}$$

■

This finding can be explained as mentioned hereafter. When the interest rate increases a modern entrepreneur becomes willing to decrease his first period consumption and to increase his contribution to the project financing ($\partial \tilde{w}_t^* / \partial r_t^* > 0$) in order to maximize its intertemporal utility. Meanwhile, the depositor increases his utility by decreasing his first-period consumption and increasing his saving ($\partial s_t^* / \partial r_t^* > 0$). Therefore, banks collect more savings and finance more projects since the project external financing decreases. Figure 7 illustrates the effect of a diminution in the credit market imperfection on the wealth accumulation dynamics.

Conclusion

In this paper we presented a model of development that links capital accumulation to the extent of capital market imperfection, and which yields a number of new insights. Indeed, in a simple endogenous growth model, the development process seems to be composed by three stages. In the first stage, the banking system does not exist and the economy develops slowly due to a primitive technology of capital accumulation. The second stage marks the emergence of banking and the substitution of the primitive technology by a more productive modern technology which enhances growth. But this paper has shown that the credit market imperfection creates a potential incentive for bank's borrower to default. This sets the place for a banking intervention to fix an interest rate ceiling in order to enforce the debt repayment. However, this intervention generates a situation of credit rationing which prevents the economy from reaching its potential growth. Finally in the third stage, the credit rationing constraint on growth disappears. These findings match the stylized facts reported in the introduction. Namely, the persistence of credit market imperfection (judicial inefficiency) in many developing countries could be a factor that has prevented the banking system from fully playing its enhancing economic growth role.

Appendix

Proof of proposition 2

The profitability condition (13) and the enforcement condition (3) are given by

$$r_t < \alpha a$$

$$r_t \leq \left(1 - \frac{1-\lambda}{\gamma}\right)\frac{\alpha a \overline{w}}{\overline{w} - w_t}$$

Let's denote w_λ the wealth level such that

$$\alpha a = \left(1 - \frac{1-\lambda}{\gamma}\right)\frac{\alpha a \overline{w}}{\overline{w} - w_\lambda}$$

Therefore, w_λ is equal to $(1-\lambda)\overline{w}/\gamma$. Hence,

$$\alpha a > \left(1 - \frac{1-\lambda}{\gamma}\right)\frac{\alpha a \overline{w}}{\overline{w} - w_t} \quad \text{if } w_\lambda > w_t \tag{19}$$

$$\alpha a \leq \left(1 - \frac{1-\lambda}{\gamma}\right)\frac{\alpha a \overline{w}}{\overline{w} - w_t} \quad \text{if } w_\lambda \leq w_t \tag{20}$$

Using the "dominance" definition, (19) and (20) imply that the enforcement condition dominates the profitability condition in $[w_0, w_\lambda]$ and the opposite is true in the wealth interval $[w_\lambda, \overline{w}]$.

Proof of proposition 3

Let's assume that the credit market imperfection decreases and passes from $1-\lambda_1$ to $1-\lambda_2$. From corollary 2 it follows that the economy wealth threshold that marks the banking emergence decreases and passes from w_{m1} to w_{m2} defined by

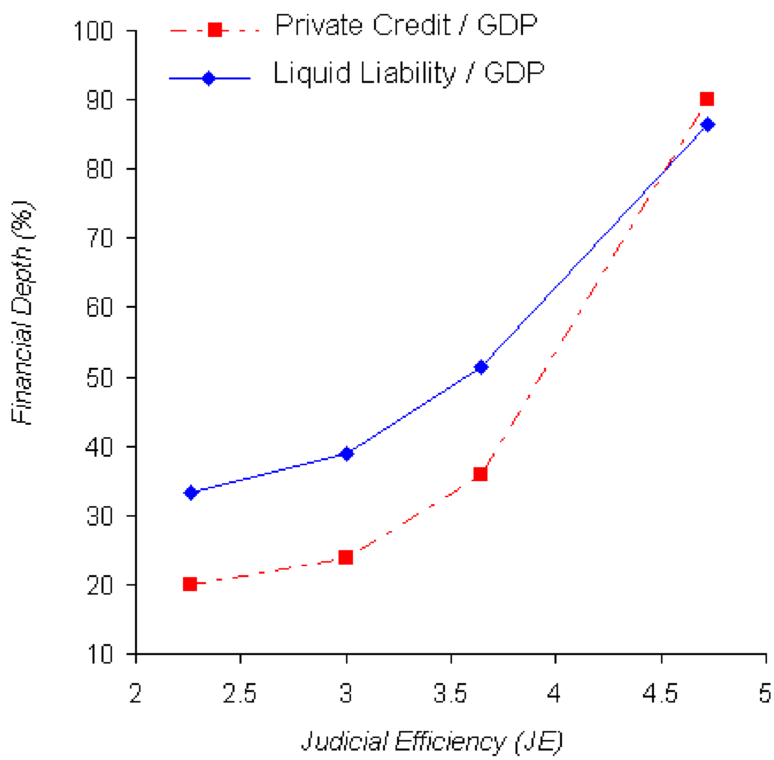
$$w_{m_1} = \overline{w}\left(1 - \frac{(\gamma + \lambda_1 - 1)a}{\gamma m}\right)$$
$$w_{m_2} = \overline{w}\left(1 - \frac{(\gamma + \lambda_2 - 1)a}{\gamma m}\right)$$

It is clear that $w_{m_2} < w_{m_1}$ which implies that the decrease of the credit market imperfection accelerates the banking emergence. From corollary 1, it follows that the threshold that marks the exit from the credit rationing region passes from $w_{\lambda_1} = (1 - \lambda_1)\overline{w}/\gamma$ to $w_{\lambda_2} = (1 - \lambda_2)\overline{w}/\gamma$. Hence, the exit from the credit rationing region is accelerated. Again, from corollary 1, we conclude that the interest rate passes from r_{t1}^* to r_{t2}^* when the economy wealth is w_t and we have for $j = 1, 2$.

$$r_{tj}^* = \begin{cases} \frac{\gamma-(1-\lambda_j)}{\gamma}\frac{\alpha a\overline{w}}{\overline{w}-w_t} & \text{if } w_m \le w_t \le w_{\lambda_j} \\ \alpha a & \text{if } w_{\lambda_j} \le w_t \le \overline{w} \end{cases} \tag{21}$$

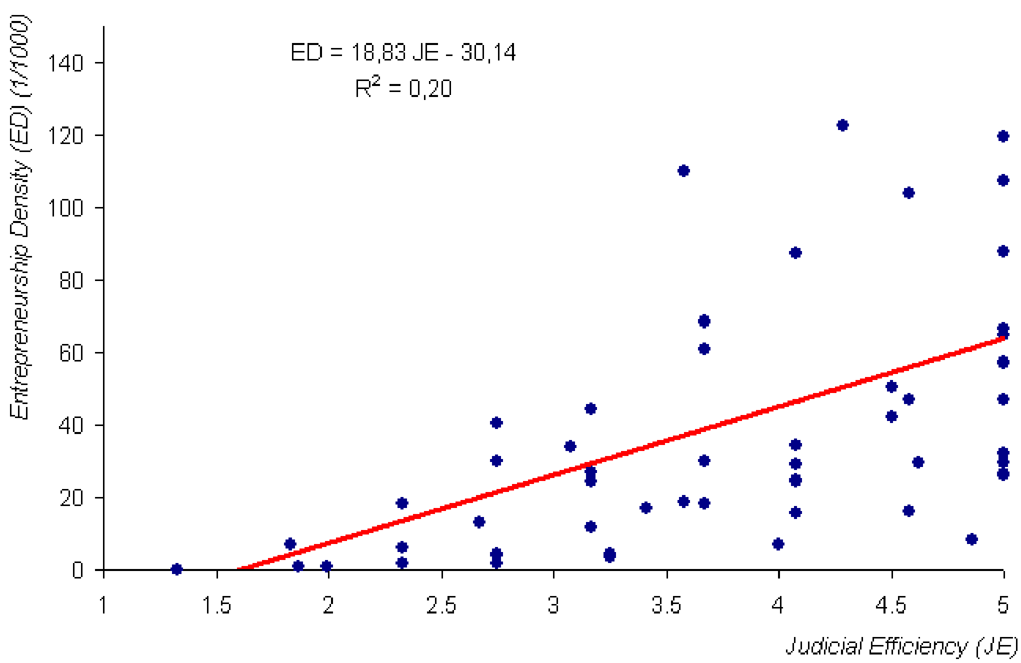
It follows that r_{t2}^* is superior to r_{t1}^* in the initial region of credit rationing $[w_{m_1}, w_{\lambda_1}]$.

Figure 1. *Financial Depth and Judicial Efficiency for 76 countries per quartile over 2000-2004*



Source: The authors' calculus based on Laeven and Majnoni (2005) and Beck et al. (rev. 2006)

Figure 2. *Entrepreneurship density and Judicial Efficiency*



Source: The authors' calculus based on Laeven and Majnoni (2005) and World Bank Group Entrepreneurship Database (2007)

Figure 3. *The frontiers of the enforcement and profitability conditions*

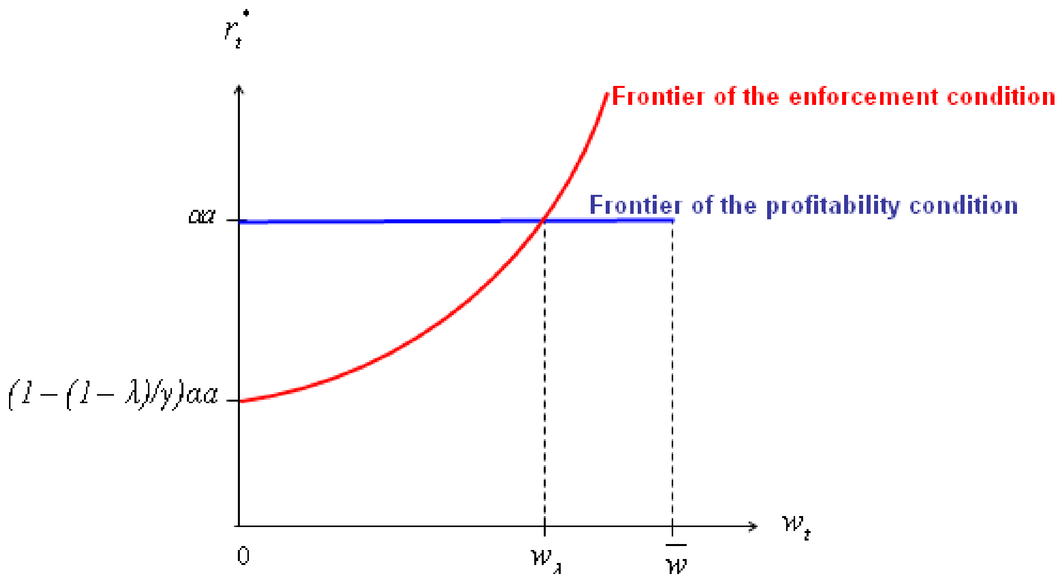


Figure 4. *The equilibrium gross interest rate*

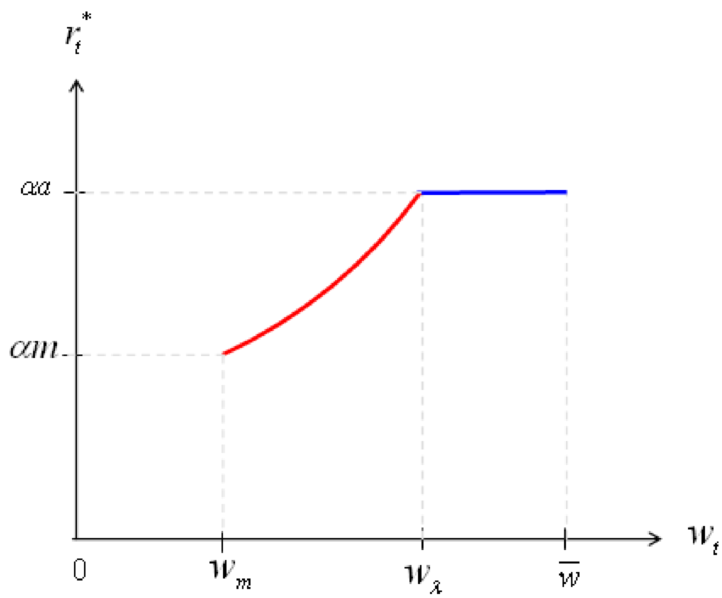


Figure 5. *The dynamics of wealth accumulation*

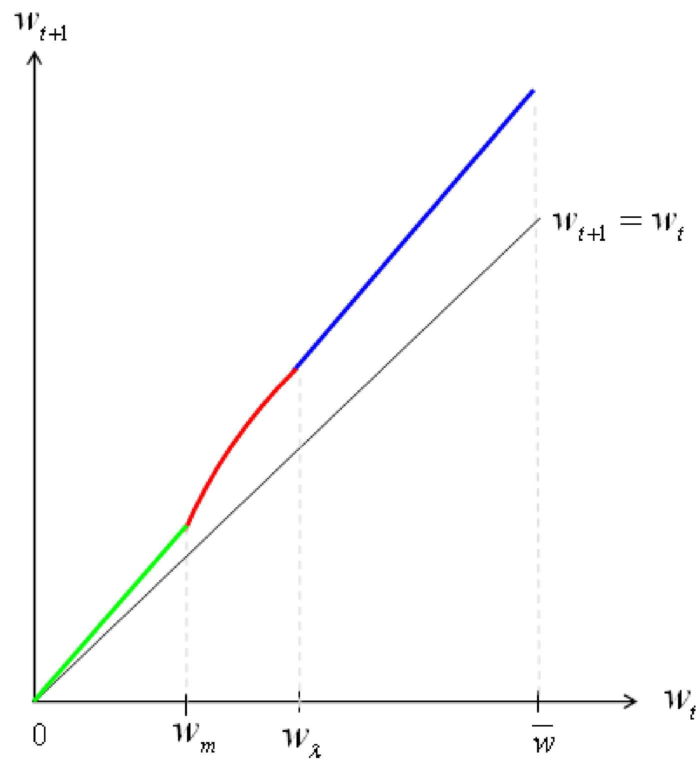


Figure 6. *Impact of the credit market imperfection on the interest rate and the development regions*

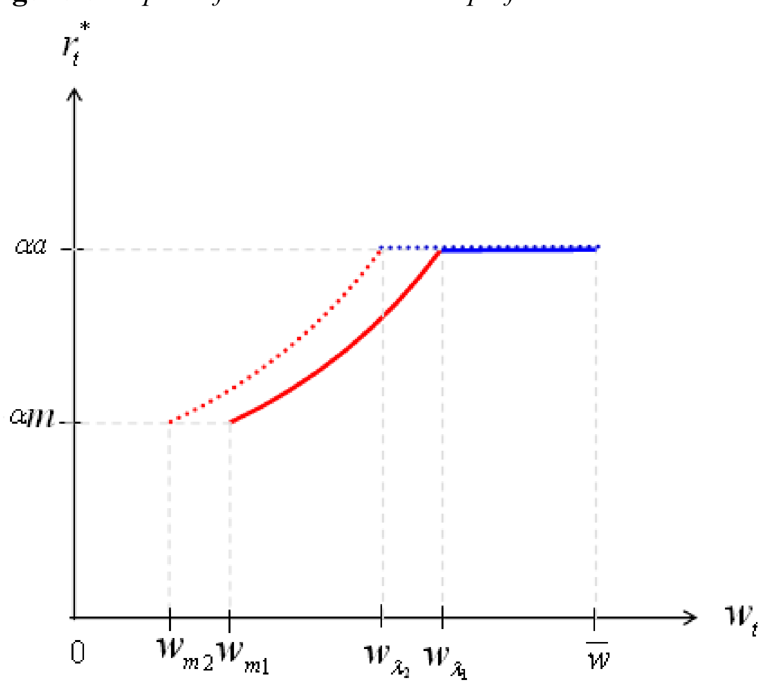


Figure 7. *Impact of the credit market imperfection on the dynamics of wealth accumulation*

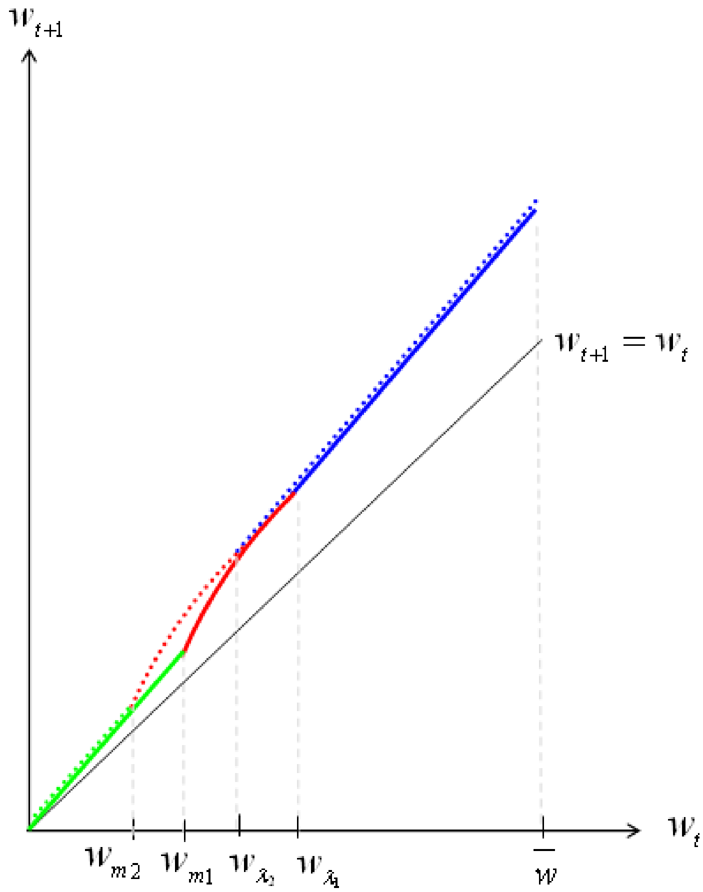


Table 1. *Country list according to their "level" of judicial efficiency*

Quartile 1	Quartile 2	Quartile 3	Quartile 4
Haiti	Gabon	Zambia	Thailand
Albania	Madagascar	El Salvador	Republic of Korea
Bangladesh	Panama	Malaysia	Trinidad & Tob
Cameroon	Peru	Uruguay	Namibia
Colombia	Russia	Slovak Republic	Sweden
Zimbabwe	Sri Lanka	Gambia	Chile
Mozambique	Jamaica	Latvia	Hong Kong
Nigeria	China	Moldova	Kuwait
Brazil	Croatia	Oman	Japan
Guatemala	Ethiopia	Tanzania	Australia
Honduras	Bulgaria	Botswana	Canada
Indonesia	Costa Rica	Estonia	Denmark
Kenya	Egypt	Jordan	Iceland
Mexico	Guyana	Poland	New Zealand
Vietnam	Lithuania	Morocco	Norway
Dominican Republic	Malawi	Argentina	Singapore
Armenia	Mongolia	Czech Republic	Switzerland
Bolivia	Uganda	Israel	United Kingdom
Ecuador	Venezuela	Slovenia	United States

Table 2. *Country List according to their "level" of GDP per capita*

Quartile 1	Quartile 2	Quartile 3	Quartile 4
Madagascar	El Salvador	Poland	Finland
Zambia	Peru	Slovak Republic	Sweden
Kenya	Ukraine	Czech Republic	France
Haiti	Colombia	Malta	United Kingdom
Moldova	Russia	Slovenia	Belgium
Germany	Costa Rica	Greece	Canada
Bangladesh	South Africa	Portugal	Australia
Bolivia	Botswana	Cyprus	Austria
Indonesia	Latvia	New Zealand	Denmark
Sri Lanka	Chile	Israel	Iceland
Morocco	Croatia	Spain	Netherlands
Albania	Lithuania	Japan	Switzerland
Jordan	Estonia	Italy	Ireland
Lebanon	Argentina	Hong Kong	United States

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