THE EFFECT OF FINANCIAL FRICTIONS ON ECONOMIC DEVELOPMENT*

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1. INTRODUCTION

Restrictions on financial markets vary greatly between countries. Many of them, such as explicit or implicit taxes on financial services, have an impact on the net margin of financial intermediation, this being a way to measure the difference between rates of interest on deposits and on lending. Demirgüç-Kunt *et al.* (2004) show that the level of financial repression is very high in countries such as Belarus, Burundi and Ghana, but very low in Switzerland or the Netherlands.

There is another kind of constraint on the credit markets, and this has to do with the quality of the legal system. The World Bank (2005) has documented very large differences between countries in terms of collateral requirements on loans and bankruptcy laws. La Porta *et al.* (1998) show that the quality of the institutions that enforce these laws is positively correlated with the level of economic development.

It would therefore be interesting to see to what extent these differences in financial frictions between countries explain the differences in economic development, measured by GDP *per capita* or the ratio of total credit to GDP.

This article studies the effect of these two types of credit market frictions on countries' economic development.[1] The two types of friction are the costs of financial intermediation and the capacity to enforce credit contracts. A general equilibrium model is used, with heterogeneous agents in terms of initial wealth and entrepreneurial talent, along with independent estimates for the two types of financial frictions. This provides us with a partial explanation of the differences observed between the American economy and other economies in different stages of development (advanced and developing in Europe; Latin-American; Asian).

An initial conclusion is that the real capacity to enforce credit contracts can explain to a considerable degree the differences observed between advanced European economies and the U.S. in a number of spheres (GDP *per capita*, ratio of total credit to GDP and so on). The differences can be explained in the most part by the varying capacity to enforce credit contracts. In the model, this corresponds to the fraction of credit that financial intermediaries seize if the debtor defaults. This financial friction also explains a significant part of the differences, in terms of GDP *per capita*, between Latin-American and developing European economies, on the one hand, and the U.S., on the other.

A second conclusion is that the quantitative implications of the model depend critically on the existence of a general equilibrium effect in wages and in the rate of return on capital. This effect varies depending on whether the return on capital is determined exogenously (*i.e.* it is given by international market values) or endogenously (*i.e.* it is determined as if the economy was completely closed). The effects of financial frictions on *per capita* GDP in the economy are typically more pronounced in the first than in the second case. This implies that changes in policy affecting the two forms of frictions - and above all the capacity to enforce credit contracts - will have effects that are especially relevant in the case of small

open economies like the Portuguese. Numerical simulations suggest that a significant part of the difference between *per capita* income in Portugal and the United States can be explained by differences in financial frictions, especially the level of creditor protection.

This article is structured in the following way: in the next section we outline the model used and make a short summary of the literature on the topic; Section 3 details various quantitative exercises; Section 4 concludes.

2. CREDIT MARKET FRICTIONS WITH HETEROGENEOUS AGENTS

We start by giving a qualitative description of the model used in the article. The interested reader will find a short review of the economic texts available on the topic in Section 2.2 and a more detailed description of the model in Section 2.3.

2.1. The Model: qualitative description

Let us postulate an economy where the agents reap benefits from consumption and from the resources their predecessors have left them. As life begins, each agent is characterized by the amount bequested (given here as b) and their entrepreneurial talent (x). On the basis of this and looking at wage (w) and interest (r) rates, the agent decides whether to become a worker or an employer.

If the option is to become worker, a salary will be earned, a fraction of the accumulated wealth will be consumed (including the initial bequest capitalised at the rate of r), with the remainder passed on to the next generation.

If the option is to become an employer, a business scheme will be set in motion, relying on a technology based on the number of workers and the amount of capital used. But more important than this, the quantity of goods that entrepreneurs manage to produce from a specific quantity of inputs depends directly on their entrepreneurial talent. The employer will have a credit market available to finance the business. The interest rate for employers in this market is $r + \tau$, where τ reflects implicit and explicit taxes, along with other market frictions.

Each agent decides on whether to b a worker or employer by comparing the two options in terms of wealth spread across a lifetime.

The financial intermediaries, whom we can call banks, receive funds from all the agents. They pay out at rate r on deposits and charge $r + \tau$ on loans to entrepreneurs. Financial intermediaries, however, only lend up to a point where the entrepreneurs have an interest in honouring their commitment at the end of the contract: the credit contracts must be compatible with the incentives of the borrower. In order to define this amount clearly, there must be some penalty in the case of default by the debtor. Let us designate as ϕ the fraction of the borrower's gains that the creditor could recoup if default occurs. This parameter measures the level at which the legal structure of the economy favours borrowing and the factors involved are the bankruptcy laws and the collateral pledged against credit. This measurement, focusing on the level of protection afforded to the creditors, is a convenient designation which will be used in this work. The bigger the value of ϕ the bigger the penalty for the borrower who defaults and the greater the amount of credit that a borrower with specific characteristics can obtain from a financial institution.

In this economy, the wage rate *w* is determined endogenously by the equilibrium between supply and demand for labour. Demand comes from agents who decide to become workers; supply is the aggregation generated by employers.

As for the interest rate, two situations will be detailed. In the first, the banks are considered as having access to a market of external credit, without frictions, at the exogenous rate *r*. They can therefore borrow enough to cover the demand for funds from entrepreneurs. This situation is that of a small economy open to capital flows.

In the second situation, the interest rate is determined by the equilibrium between the supply and demand for funds in the credit market. Supply is equal to the aggregate value of bequests at the beginning of the agents' life; demand comes from the capital which entrepreneurs are planning to invest. This model is closer to closed economies or to economies where size affects the international credit markets.

In this type of economy, it is possible to demonstrate that the distribution of wealth left as a bequest is constant across the generations. The same happens with the price of factors after a period of transition. It is this "steady state" of the economy that we are going to study.

2.2. Literature

The model described above is related to at least three facets of the economic literature. The first takes in occupational choices, the dynamics of economic development and inequality, in a tradition dating back to Lucas (1978) and Banerjee and Newman (1993).

The second group covers the issue of disparities in the average income of various countries, in a tradition going back to Solow (1957). More recent studies by Prescott (1998) and Hall and Jones (1999) looked at the contribution of capital accumulation and TFP in various countries to explain observed disparities. Other contributions of similar nature have attempted to explain TFP differences through friction differences in the markets, distortions caused by economic policies or barriers against new technologies (Parente and Prescott, 1999; Acemoglu and Ventura, 2002).

The third relevant focus is the research on financial market development and economic growth. Some studies approach this theme from a historical standpoint and look to explain the joint development of markets and economic progress (Greenwood and Jovanovic, 1990; Boyd and Smith, 1998). This article fits better in another branch of the literature – studies of the impact of changes in the parameters of the economy (related with contract policies or others) on the endogenous variables. The work of Castro *et al*. (2004), Amaral and Quintin (2007) and Erosa and Hidalgo-Cabrillana (2007), among others, fits in with this group.

2.3. The model: formalisation

There follows a more detailed description of the type of economy used in this article. Any reader less interested in the technical aspects of the model can go directly to Section 3.

2.3.1. Agents

Let us suppose that there is a continuum of agents measurable in linear fashion. Each agent, indexed by $i \in [0;1]$, lives for a fixed period, the same fro everybody, and leaves behind another individual.

Each generation has measure one. The connection between successive generations arises through bequests. Each agent gains from consumption and from the bequest left to their successor in line with the utility function:

$$U^i = \left(c_t^i \right)^\gamma \left(b_{t+1}^i \right)^{1-\gamma}, \gamma \in (0;1)$$

where c_t^i and b_{t+1}^i are respectively the amount consumed by agents through their life and the quantity of goods left as a bequest to the successor. The form of this utility function implies that the agent will consume fraction γ of his wealth at the end of the period and will leave $1-\gamma$ as a bequest. For the sake of simplicity, the individual indicator i is hereinafter dropped.

Each agent is given a "entrepreneurial talent" x. This variable is exogenous, independent and distributed identically across generations, with a cumulative distribution function $\Gamma(x)$ defined in the interval $[0;\bar{x}]$. We shall standardise $\bar{x}$ to 1. Each agent's talent for business is not hereditary, nor can it be manipulated by the agent.

2.3.2. Production

Production follows a technology of decreasing returns to scale given by:

$$y = xk^\alpha n^\beta$$

where $\alpha, \beta > 0$ and $\alpha + \beta < 1$. The good produced can be consumed, used as capital or left as a bequest. Capital depreciates totally during the production period.

2.3.3. The credit market

Every agent has two options for investing capital. The first is to lend risk-free to financial intermediaries at rate r. The second is to use their own resources to start a project and then, if necessary, use the credit market to raise additional capital, on which $r + \tau$ is paid. In this last case, let us assume that the agents are not able to commit to paying off the loan (capital plus interest) at maturity. In other words, if it is more advantageous for agents not to pay off the loan at maturity, in the light of the penalty for default, they will not do so. The bank, of course, factors this into its calculations and, knowing the profile of the borrower, it will only give a loan up to the point where the agent will always choose to pay off at maturity. The calculations underlying this specific amount will be detailed below.

2.3.4. The agents: optimal behaviour

All agents optimise their use of resources with a view to production of the final good. Let us first consider the problem of a businessman with entrepreneurial talent x for a fixed amount of capital k and given wage level w:

$$\pi(k,x;w) = \max_n \ xk^\alpha n^\beta - wn$$

This function gives us production net of wages, with the associated labour supply function $n(k,x;w)$. This is the part which can be seized by the authorities in the case of default, since the capital depreciates totally during the production period.

Let a be the investment made by the entrepreneur in question and l the borrowing needed from financial institutions. The optimization problem for an entrepreneur with talent x and bequest b is:

$$V(b,x;w) = \max_{a \geq 0, l \geq 0} \pi(a+l,x;w) - (1+r)a - (1+r+\tau)l$$

subject to:

$$\phi\pi(a+l,x;w) \geq (1+r+\tau)l$$

$$a \leq b.$$

The objective function is easy to understand. The first term represents output net of wages. The second term is the opportunity cost of capital financed by the entrepreneur. The third term is repayment of the loan, and includes principal, interest and the costs of intermediation.

The first constraint ensures that the loan is compatible with the incentives of the bank and the entrepreneur. The amount which the creditor manages to seize on default, $\phi\pi(a+l,x;w)$, is equal to or higher than the amount to be repaid by the debtor, $(1+r+\tau)l$. This constraint ensures that the entrepreneur prefers to pay the loan rather than default. The amount that the entrepreneur manages to retain if default occurs, $(1-\phi)\pi(a+l,x;w) - (1+r)a$, should not be more than what they get if the loan is paid off, $\pi(a+l,x;w) - (1+r)a - (1+r+\tau)l$. This restriction is clearly equivalent to the first. The parameter ϕ will therefore have a major influence on the maximum figure of the loans in question.

The second constraint means that the level of self-finance is determined by the agent's bequest.

There is an investment function $k(b,x;w,r)$ associated with this problem. It gives us the scale of investment for each entrepreneur, given type and prices.

2.3.5. The choice of occupation and consumption

Given their types, (b,x), and prices, (w,r), agents will choose the occupation that affords them most revenue: they will choose to be entrepreneurs if $V(b,x;w,r) > w$; they will choose paid employment if $V(b,x;w,r) < w$; they will have no specific feelings either way if $V(b,x;w,r) = w$. To simplify, let us suppose that in the third case above, they all decide to be entrepreneurs. Such a hypothesis is completely innocuous.

The agent's total income through life is given by:

$$Y = \max\{V(b,x;w,r),w\} + (1+r)b.$$

This amount will be spread between consumption and a bequest for the agent's successor, in accordance with the utility function detailed earlier.

2.3.6. Market equilibrium

If $Y(b)$ is defined as the measure (or if preferred, as the cumulative distribution function) of all bequests at the start of the period, there will be equilibrium in the labour market if:

$$\iint_{entrepreneurs} n(x;w,r)Y(db)\Gamma(dx) = \iint_{workers} Y(db)\Gamma(dx).$$

The integral on the left is calculated on the pairs (b,x) such that, given the prices (w,r), the agents prefer to be entrepreneurs. This corresponds to the demand for labour, and the integral on the right corresponds to the labour supply. The equilibrium wage rate is the one that makes the integrals equal.

As for the interest rate – in the case it is exogenous – the labour market equation determines economic equilibrium. If the interest rate is endogenous, we need an additional equation to characterize the credit market:

$$\iint_{\text{entrepreneurs}} k(b,x;w,r)\Upsilon(db)\Gamma(dx) = \iint_{\text{all agents}} \Upsilon(db)\Gamma(dx).$$

The left side of this equation is the demand for capital from entrepreneurs for investment. The right side translates the amount of resources existing at the start of the period, which will then be used in production. This is therefore the supply of capital. Antunes *et al.* (2007) show that this economy's steady state is characterised by a unique endogenous distribution of bequests $\Upsilon(b)$ and a pair of prices (w,r). The size clearly depends on the model's parameters, particularly those of most interest in this article, τ and ϕ.

3. QUANTITATIVE EXERCISES

For a quantitative analysis of the frictions in the credit market that interest us, we must first calibrate the model for a real economy. This will be our baseline. We then use independent estimates of the parameters of interest in our problem and compare the results with the baseline. In this way, we will be able to assess changes in the economic policies that affect the parameters in terms of their impact on different measures of economic performance such as *per capita* GDP or the total credit granted as a percentage of GDP.

3.1. Calibration

The calibration process consists in selecting specific measurements of the real economy that we consider important for this analysis, and then choose parameters in such a way that the measurements obtained in the model are "similar" to the real ones.

The American economy in a steady state was used as the baseline. This was taken as a long-term equilibrium where economic variables grow at a constant rate. The reasons for this choice are based on the availability of data, the relevance of this economy and above all that it is considered to be close to a steady state. If, for instance, we look at a graph of real GDP *per capita* for the United States over time in log terms, we can see (taking out the economic cycle component) something very similar straight line (with slope equal to the average American's income real rate of growth). In addition, the quotient between capital and output or between salaries and output, shows a clear stability over time, suggesting that the economy is indeed near a steady state.

Table 1 shows the value given to each parameter in the model by our calibration and the measurements in the real economy that we try to reproduce in our model. The duration of each period in this economy is 35 years. In terms of the parameters for the production function, we have used values that ensure that the fraction of salaries and remuneration of capital in GDP are equal to the amounts in fact observed. The fraction of income left as a bequest was chosen in such a way as to make the model's equilibrium interest rate r equal to the real rate of return on post-war U.S. T-bills, 2% according to the International Financial Statistics of the IMF.

Table 1

MODEL PARAMETERS – CALIBRATION FOR THE AMERICAN ECONOMY		
β	0.55	Fraction of wages in output
α	0.35	Fraction of capital returns in output
γ	0.94	Fraction of income consumed
ε	4.422	Distribution of entrepreneurial ability
τ	0.005	Intermediation cost
ϕ	0.26	Creditor protection

For the cumulative distribution function of entrepreneurial talent, we choose the parametric form $\Gamma(x) = x^{\frac{1}{\varepsilon}}$. The parameter ε was calibrated in such a way that the Gini index of entrepreneurial income was 45%, a figure reported by Quadrini (1999).

Intermediation costs were based on Demirgüç-Kunt and Huizinga (1999) and correspond to implicit or explicit taxes paid as a percentage of banks' assets.[2]

Finally, parameter ϕ is calibrated in such a way that the percentage of entrepreneurs in the total population is around 9 percent, a figure reported by Quadrini (1999).

Table 2 compares some of the measurements obtained from the model using this calibration with their real counterparts. The aims of the calibration are achieved in a sufficiently accurate way (annual interest rate, proportion of entrepreneurs, Gini index of entrepreneurs' income). Besides this, the capital-output ratio and the quotient between private credit and the product (variables not used to calibrate the model) are clearly near the figures for the U.S. economy. This gives us a certain comfort when comparing different economies in terms of these two entities.

Table 2

BASIC STATISTICS FOR THE AMERICAN ECONOMY AND THE MODEL ECONOMY	American economy	Model economy
Yearly real interest rate (%)	2	2
Taxes as a percentage of bank assets	0.5	0.5
Percentage of entrepreneurs	9	8.8
Gini index for entrepreneurs (%)	45	45.35
Capital to output ratio	2.5	2.24
Credit to output ratio	1.98	2.02

3.2. Impact of the parameters

There are changes in some of the endogenous variables of the model stemming from variations in the parameter of financial intermediation, τ, and creditor protection, ϕ. These variations are calculated by taking into account the exogenous or endogenous rate of interest.

3.2.1. Financial intermediation

Table 3 shows the variation in some of the endogenous entities in the model when we multiply by 4 the cost of financial intermediation relative to the baseline case. Let us look first at the case where the rate of interest is exogenous. Product *per capita* falls to 85.2 per cent of the baseline case and the equilibrium wage rate to 85.9 of the initial level. The percentage of entrepreneurs rises, while the quotient be-

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(2) The use of measurements such as the net margin of financial intermediation has some drawbacks (see Antunes *et al.*, 2008, for more details).

Table 3

	Base	Exogenous interest rate	Endogenous interest rate
IMPACT OF A FOUR-FOLD INCREASE IN THE COSTS OF INTERMEDIATION ON SOME OF THE MODEL'S VARIABLES			
Output (base = 100)	100.0	85.2	93.7
Wage rate (base = 100)	100.0	85.9	96.7
% of entrepreneurs	8.8	9.3	9.1
Credit to output ratio	2.0	1.5	2.0
Gini index for entrepreneurs (%)	45.4	44.8	46.1
Yearly real interest rate (%)	2.0	2.0	0.8

tween credit granted and product *per capita* falls from 2.02 to 1.46. The inequality among entrepreneurs, measured by the Gini index, falls from 45.35 to 44.83 per cent. How can these changes be explained when τ moves from 0.5 per cent to 2 per cent? This increase in the costs of intermediation has the effect of reducing the demand for loans from entrepreneurs for a specific rate of interest. This is a demand effect. The reduction in the amount of loans means that the investment in capital falls and this cuts the demand for labour. For there to be equilibrium in the labour market, there will have to be a combination of lower salaries and a larger number of small enterprises, offsetting the fall in demand. This means that there will be additional agents choosing to be entrepreneurs and self-financing their operations; at the margin, these agents are also less productive and will have smaller bequests. In this way there will be more entrepreneurs but with less productive projects and smaller enterprises. There is a tendency for entrepreneurs' incomes to be standardised.

When the rate of interest is endogenous, the effects of changes in τ in the endogenous variables that we have seen are much lower. Product *per capita* falls to 93.7 per cent of the baseline level. The wage rate becomes 96.7 of the initial level. The percentage of entrepreneurs goes up (although less than previously) while the quotient between total credit and the product remains virtually unchanged. The inequality in distribution of income among entrepreneurs now rises to 46.1 per cent and the real rate of interest falls to 0.82 per cent. How can these results be rationalised? The demand effect described earlier has now an added *general equilibrium effect*. As the rate of interest is endogenous, the fall in demand for funds, stemming from the rise in the costs of intermediation, causes the rate of interest to fall. A lower rate of interest implies a bigger level of capital, more productivity and bigger companies. The rise in inequality in distribution among entrepreneurs suggests that the fall in income already existing (which would reduce inequality) is more than offset by the lower productivity of the additional entrepreneurs. The general equilibrium effect is partial compensation for the demand effect in a variety of ways. The results set out in Table 3 suggest that the general equilibrium effect is quantitatively important.

3.2.2. Creditor protection

If the figure for creditor protection ϕ is reduced to a quarter of the baseline (Table 4), there are major effects when the rate of interest is exogenous. Product *per capita* falls to 57.6 per cent of the initial level, while salaries fall to 55.3 per cent of the baseline figure. The percentage of entrepreneurs rises considerably to 12.9 per cent of the active population, while the ratio of credit granted to product *per capita* falls from 2.02 to 0.46. The inequality of income among entrepreneurs narrows, although the average income is substantially lower. Again there are more entrepreneurs in the economy but they are less productive. The lower level of creditor protection reduces the incentive for credit contracts, and this

Table 4

IMPACT OF A FOUR-FOLD INCREASE IN CREDITOR PROTECTION ON SOME OF THE MODEL'S VARIABLES			
	Base	Exogenous interest rate	Endogenous interest rate
Output (base = 100)	100.0	57.6	96.9
Wage rate (base = 100)	100.0	55.3	98.7
% of entrepreneurs	8.8	12.9	10.2
Credit to output ratio	2.0	0.5	1.9
Gini index for entrepreneurs (%)	45.4	43.3	49.7
Yearly real interest rate (%)	2.0	2.0	-2.7

means a lower maximum amount available for each entrepreneur. The demand for funds for investment falls. The effects of this fall are similar to the demand effect described earlier.

When the rate of interest is endogenous, the effects are quantitatively identical to the previous case and again we see the importance of the general equilibrium effect. The real rate of interest falls to a negative figure (-2.6 per cent per year). This result is consistent with the observation of Calomiris and Beim (2000) that some financially repressed economies (closed economies with low levels of creditor protection and high intermediation costs) in Latin America, the Middle East and North Africa had negative real rates of interest (between -10 and 0 per cent per year) until the start of financial liberation in the 90s.

3.3. Counterfactual analysis

Having identified the main effects caused by variations in the parameters τ and ϕ, let us see how the model can be used to compare different economies. The exercise consists in collecting independent estimates of τ and ϕ for a number of countries and resolve the model using these figures, leaving all the other parameters equal to those in Table 1. The purpose of this exercise is to check what would be the product *per capita* in the U.S. if the costs of financial intermediation and the level of creditor protection were the same, for example, as Russia. In this way, an attempt is made to isolate the effects due solely to these two factors. The simulations will be made for both exogenous and endogenous interest rates.

The results for representative economies will be given – Brazil for Latin America, France and Portugal for Europe, Russia for transition economies and Singapore for high-growth Asian countries. The costs of intermediation are measured by explicit or implicit taxes on intermediation as a percentage of the total assets paid by banks (see Table 5). The level of creditor protection is based on the World Bank (2005) and Djankov *et al.* (2005). This consists of a scale of 1 to 10 measuring the extent to which access to credit is conditioned by bankruptcy laws and the laws applicable to the use of collateral. This amounts to *a de juris* measurement of ϕ. In order to construct *a de facto* measurement of ϕ, the previous figure is multiplied by a measure of the extent to which entrepreneurs consider that the laws are applied (Kaufmann *et al.*, 2003). This figure is then standardised using the level for the U.S. as the baseline ($\phi = 0.26$; see Table 5).[3]

When the rate of interest is exogenous, these two factors explain more than half of the differences in terms of product *per capita* between Brazil and the U.S. and the whole difference in terms of the ratio of credit to product. Looking at the impact of each parameter separately, it is clear that the costs of financial intermediation are not as important as creditor protection. When the rate of interest is endogenous,

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[3] The results obtained using the de juris figure for ϕ mentioned earlier do not change the conclusions obtained for a wider range of countries de facto. See Antunes *et al.* (2008).

Table 5

COUNTERFACTUAL ANALYSIS			Exogenous interest rate		Endogenous interest rate	
	ϕ	τ (in %)	Output	Credit to output ratio	Output	Credit to output ratio
United States (base)	**0.260**	**0.5**	**100.0**	**2.0**	**100.0**	**2.0**
Brazil (data)	**0.039**	**1.1**	**22.0**	**0.4**	**22.0**	**0.4**
Intermediation cost	0.260	1.1	94.2	1.8	97.8	2.0
Creditor protection	0.039	0.5	49.2	0.3	93.8	1.9
Both	0.039	1.1	47.6	0.3	93.5	1.9
France (data)	**0.100**	**0.2**	**77.0**	**0.9**	**77.0**	**0.9**
Intermediation cost	0.260	0.2	103.1	2.1	97.8	2.0
Creditor protection	0.100	0.5	68.4	0.7	97.7	1.9
Both	0.100	0.2	70.1	0.8	98.7	2.0
Portugal (data)	**0.136**	**0.3**	**53.0**	**1.3**	**53.0**	**1.3**
Intermediation cost	0.260	0.3	101.1	2.1	100.8	2.0
Creditor protection	0.136	0.5	76.9	1.0	98.4	2.0
Both	0.136	0.3	78.3	1.0	99.0	2.0
Russia (data)	**0.045**	**1.9**	**23.0**	**0.2**	**23.0**	**0.2**
Intermediation cost	0.260	1.9	86.3	1.5	93.9	2.0
Creditor protection	0.045	0.5	51.2	0.3	96.5	1.9
Both	0.045	1.9	46.9	0.2	87.7	1.9
Singapore (data)	**0.380**	**0.5**	**68.0**	**1.2**	**68.0**	**1.2**
Intermediation cost	0.260	0.5	100.0	2.0	100.0	2.0
Creditor protection	0.370	0.5	114.3	3.1	101.1	2.1
Both	0.370	0.5	114.3	3.1	101.1	2.1

these financial frictions only explain a small part of the difference in product *per capita* and the ratio of credit to product. The simulations for Russia give similar results, though the costs of intermediation would seem to have greater effects than for Brazil.

The case of Singapore is interesting because the parameter for creditor protection is larger than in the U.S. and the costs of intermediation are the same. The model anticipates a product *per capita* 14.7 per cent higher than the U.S., but the data actually point to a product *per capita* 32 per cent lower. In the context of the model, this discrepancy can be explained by two kinds of factor:

I.   Parameters such as those that govern the distribution of entrepreneurial talent (ε and $\bar{x}$) or the fraction left as bequest ($1-\gamma$). For example, if U.S. entrepreneurs were to have average qualifications different from Singapore, or if the institutional infrastructure which American entrepreneurs use (excluding whatever is related to credit markets, which are explicitly modelled) were to be different from Singapore, then parameters ε and $\bar{x}$ could be different in the two economies, contrary to what has been assumed here.

II. Creditor protection and access to credit may not have a monotone relationship, as assumed in this model. Dubey *et al.* (2005) show that when some agents default in equilibrium there may be an optimum creditor protection level.

When the interest rate is exogenous, the differences in financial frictions between Portugal and the U.S. explain around half the difference in terms of product *per capita*. This suggests that, as with Singapore, other factors (namely entrepreneurial talent) may explain part of the remaining difference. In the ratio of credit to product, the model undervalues the figure shown in the data: 1.03 against 1.27. In the context of the model, the Portuguese financial sector appears, however, to be more efficient than the creditor protection parameter would seem to show. Lower creditor protection may be partially offset, for example, through closer follow-up of those projects that are financed. When the rate of interest is endogenous, the results are in essence the same as for the baseline case.

France is similar to Portugal, except that the real data show greater similarity with the American economy than the model. The remarks made on Singapore are also applicable here.

In Antunes *et al.* (2008), it is demonstrated that the results above are valid for a wide range of countries: when the rate of interest is exogenous, variations in the two parameters explain a large proportion of the differences between countries in terms of product *per capita* and the ratio of credit to product. If the rate of interest is endogenous, these results are substantially lower through the general equilibrium effect. The results are also valid when there is a sector of large enterprises with no credit constraints.

The two paradigms analysed (exogenous and endogenous rates of interest) can be seen as two extremes in terms of the capacity of financial institutions to obtain outside resources at market rates of interest. This suggests that in a small open economy, the rate of interest is likely to be exogenous, while in a closed or large economy, the rates of interest are likely to be influenced by the economy's own parameters. The corollary of this is that *reforms leading to cuts in the costs of intermediation or to increases in effective creditor protection will have a bigger impact in small countries with financial markets open to the outside world*. These reforms may not be effective in closed economies (as happened in Latin America, the Middle East and North Africa before financial liberalisation in the 90s), since the general equilibrium effect tends to cancel out the looked-for demand effect.

It is worth noting that in small open economies, the foreign interest rate in fact paid by financial intermediaries may be affected by the state of these economies and is not therefore totally exogenous. There may exist, for example, a market, liquidity or operational risk premium or indeed other factors. This implies that the figures obtained for the exogenous rate of interest will be the upper limit of the effects of variations in the parameters which we have looked at. In a small open economy like Portugal's, where other frictions and uncertainty exist, the effects are likely to be found somewhere between the two cases analysed (exogenous and endogenous rates of interest).

4. CONCLUSION

In this article, a model has been structured for a qualitative and a quantitative study of the effects stemming from two financial frictions – costs of intermediation and creditor protection – on variables used to gauge economic development: product *per capita*, the ratio of credit to product, the proportion of entrepreneurs in the economy, and inequality in distribution of income.

With independent measurements used for the two frictions, it is possible to see that the model explains part of the differences observed between countries in terms of product *per capita* and the ratio of credit to product. The quantitative implications of the market depend critically on whether the rate of interest is exogenous or endogenous, with the effects on product *per capita* typically more pronounced when the rate of interest is exogenous.

The implications for economic policy are clear: when it is reasonable to assume that the rate of interest is exogenous, as happens if banks have access to finance abroad at market rates, there is a big impact on the improvements to the technologies of creditor protection and financial intermediation. If the rate of interest is endogenous, as when the banks cannot draw on finance from abroad at market rates, there is a big price effect on the factors that tend to hamper the impact of reforms.

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