

CORPORATE FINANCIAL STRUCTURE UNDER INFLATION AND FINANCIAL REPRESSION: A COMPARATIVE STUDY OF NORTH AMERICAN AND EMERGING MARKETS FIRMS

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INTRODUCTION

The prevailing financial markets environment of western industrialized countries differs from that found in many emerging markets. The form and intensity of government controls over price-setting mechanisms in the markets is one important difference. Another is the relative role of financial intermediaries (e.g., banks) and securities markets (e.g., stock and bond markets) in financing the business sector. A third difference is the level of inflation rate.¹ One should expect that these differences introduce distinct incentives that influence financing decisions by managers.

The control by governments of credit supply and price-setting mechanisms in financial markets, common to many emerging markets, is conventionally called *financial repression*.² The reason is that this form of government intervention discourages the development of financial institutions and instruments. Beyond that, by modifying the price structure and allocation mechanisms of real and financial resources, this form of government intervention transforms the decision making process on almost every level of the economy. Financial repression also influences financial decision making by firms. For example, managers shape a firm's financial structure under the influence of a complex set of factors that include riskiness of cash flows, growth potential, tax shields, agency costs, and the state of financial

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markets among other factors.³ Researchers generally assume that managers, in selecting a particular financial policy, maximize a function of the value of the firm. That is, managers decide on a particular capital structure for the firm by combining financial resources up to the point where the marginal utility of using an additional unit of each resource equals the competitively set price of that resource. The pecking-order theory of Myers and Majluf (1984) is an exception only in the sense that the decision is based on a comparison of the marginal impact of the financing choice on the value of the firm to old shareholders given the current financial structure and the investment opportunity set available. The general approach to setting a firm's capital structure supposes that the choice set is not subject to binding quantity constraints. If such constraints exist, the firm's capital structure must adjust to these constraints. Without constraints, firms choose the mix of financing sources based on competitively set market prices (market rates). With constraints present, firms are prevented from attaining the desired financial structure due to restrictions on the amount of financial resources available. In the latter case, the firm is operating under conditions of *non-price credit rationing*, *disequilibrium credit rationing*, or *quantity rationing*.⁴ Financial repression induces this form of credit rationing.⁵

This paper studies the effect of a particularly common phenomenon in emerging markets, *the presence of government controls* on lending rates and quotas (a form of financial repression) on financial structure in an inflationary environment. Building on conventional credit-rationing theory, a model is developed that allows to predict testable hypotheses regarding firm financial structure choices resulting from the response of banks and non-financial commercial enterprises to changes in inflation. As a benchmark of comparison, firm financial structure predictions are developed and tested when banks and industrial firms operate in markets without government control on lending rates and credit allocation. The statistical model uses data of firms operating in the repressed markets of Greece and Turkey and of firms operating in Canada and the United States, two markets which can be considered relatively "free" of financial repression. Since control of lending rates is usually part of a package of other controls, the two types of markets will be referred to as repressed markets (RM) and un-repressed markets (UM).

More specifically, for firms operating in repressed markets the model suggests the following hypotheses: With controlled interest rates, increases in inflation result in an aggravation of credit rationing to the business sector and thus in decreased corporate leverage. Simultaneously, the financial sector shifts risks and losses associated with uncertain and high inflation to the business sector through changes in the maturity of loans. This results in a drop in the maturity structure of corporate debt. The decisions on leverage and maturity of debt are joint decisions and a function of both the changes in real interest rates and inflation. Details of the hypothesis for the UM case will be given below.

The organization of the paper is as follows. Section I reviews the main findings in the literature regarding financial structure decisions in the presence of inflation and absence of financial repression upon the financial system. Section II presents

the discussion of the constraints forced upon decision makers of both firms and financial intermediaries in the presence of financial repression. Sections III and IV present the statistical model and the data respectively. Section V reports the results of the statistical test; and, finally, Section VI summarizes the major findings of the study.

I. INFLATION AND CAPITAL STRUCTURE IN UN-REPRESSED MARKETS

Conventional wisdom and financial economists suggest, for different reasons, that as inflation increases, firms have incentives to raise financial leverage. The argument behind this prediction is that, as the unanticipated inflation rate increases, lending rates do not keep pace. This results in low or even negative real rates and a transfer of wealth from lenders to borrowers. This wealth transfer effect obviously favors a policy of increasing leverage with rising inflation.⁶ This argument is, of course, difficult to defend from a rational expectations point of view. With equal access to information by both lenders and borrowers, when lenders correctly anticipate inflation rates, nominal rates will adjust in step. Therefore, no transfer of wealth will occur.

Firms may also favor debt over equity as inflation increases for completely different reasons. Regardless of inflation, firms enjoy shields against income taxation generated by deductible items other than debt. These "non-debt shields" include depreciation and depletion allowances. If these shields are large enough relative to the income of the firm, interest deductions could be redundant as tax shields. In the presence of non-debt-related tax shields, Miller's (1977) individual firm may no longer be indifferent toward financial structure (DeAngelo & Masulis, 1980). Given a maximum potential shield limited by taxable income, firms will select the most efficient shield at a minimum risk.

The efficiency of these shields changes with price inflation. As a corporation is exposed to inflation, nominal income increases and the effectiveness of depreciation shields declines. In contrast, as inflation increases, so does the efficiency of debt-related tax shields. As Cohn and Modigliani (C&M) (1985) have shown, the early principal repayments implied in inflation-adjusted higher nominal rates become tax deductible. More specifically, in the presence of deductible interest, C&M show that the *effective real cost of unit of debt*, κ , can be expressed as

$$\kappa = (1 - \tau)k - i - (1 - \tau)k^* - \tau i \quad (1)$$

where k represents the *nominal* interest rate; k^* the *real* interest rate; i the *inflation* rate, and τ the marginal *corporate tax rate*. That is, through inflation, non-deductible principal payments become "tax-deductible." Thus, even if redistribution of wealth from creditors to debtors does not occur, the incentive for using debt increases with inflation.

Increases in the real rate, k^* , will increase the effective cost of borrowing, κ . But, the optimal response of firms to increases in real rate is ambiguous for at least three reasons. First, according to C&M, an increase in the effective cost of unit of debt, κ , increases the tax-shelter effect of debt versus equity. Second, if the increase in the real rate is accompanied by an increase in inflation, then whether it is beneficial to increase or reduce leverage depends on the relative value of the shifts of both k^* and i . Third, increases in the real borrowing rate may affect the relative market value of debt and equity, forcing a shift in either direction.

Inflation also can influence management's choice of the maturity structure of liabilities. Assets can be financed either through long-term borrowing or a sequence of short-term borrowings. Insight about the choices available to managers can be obtained by extending the analysis of C&M. Equation (1) can be written in terms of cost of long-term and short-term borrowing:

$$\tilde{\kappa}_{t,l} = (1 - \tau)k_t - \tilde{i}_t = (1 - \tau)(k_t^* + i_t) - \tilde{i}_t \quad (2)$$

$$\tilde{\kappa}_{t,s} = (1 - \tau)\tilde{k}_{t,s} - \tilde{i}_t = (1 - \tau)\tilde{k}_{t,s}^* - \tau\tilde{i}_t \quad (3)$$

where the tilde indicates a stochastic variable and a subscript has been added to denote short (*s*) and long (*l*) term rates. At any time t the *ex-post* effective cost of debt, κ_t , will depend upon whether long-term or short-term debt is used. If long-term debt has been used, the *ex-post* effective cost of debt, $\kappa_{t,l}$, will be a function of the non-stochastic long-term real rates, k_t^* , the non-stochastic long-term inflation premium, i_t , both implicit in the long-term nominal rates, k_t , and the *ex-post* inflation rate at time t , \tilde{i}_t . In equation (2) the real interest and inflation rates are implicitly fixed in the long-term nominal rates and, therefore, are non-stochastic. In contrast, in the short-term borrowing equation (3), all rates become random. The incremental cost of borrowing long term over short term, $\Delta\kappa_t$, is

$$\Delta\kappa_t = (1 - \tau)[(\tilde{k}_t^* - k_{t,s}^*) + (i_t - \tilde{i}_t)] \quad (4)$$

Equation (4) suggests that the *ex-post* incremental cost of borrowing long term over short term (excluding the maturity premium, $k_t^* - k_{t,s}^*$) is a function of the expected difference between the real rate and inflation implicit in the current long-term nominal rates and the inflation rate realized in the short-term nominal rates. The real maturity premium is generally small while size and variability of the second term can be expected to be larger. Whether a firm will prefer to borrow short term or long term will depend on the firm's own forecast of future inflation rates. If Leuthold's (1981) observations are correct, then firms have an incentive to borrow long term in periods of rising inflation and short term in periods of declining inflation.

Summarizing, the analysis of the impact of changes in inflation on capital structure and debt maturity under conditions of unrepressed markets suggests the following predictions. With rising inflation, firms are expected to increase both

their financial leverage and maturity of debt. With respect to changes in the real rate, k^* , the direction of the shift in capital structure is undetermined.

II. INFLATION AND CAPITAL STRUCTURE IN REPRESSED MARKETS

Whether the firm is able to implement a financing policy consistent with the incentive structure introduced by inflation depends upon the existence and/or severity of non-price credit rationing. Capital-rationing literature in the bank loan (second tier) market dates from the time of usury laws and regulated interest rates. Blitz and Long (1965) show that the existence of interest-rate ceilings can lead to non-price or disequilibrium credit rationing. This will occur if, at the ceiling, loan demand exceeds supply.⁷ Not only are these restrictions less ubiquitous today, but also most of the larger firms in un-repressed markets have the choice to issue securitized debt (first-tier market). Thus, even if rationing in the second-tier market exists, firms are able to seek a suitable capital structure.

Financial repression leads to a characteristic structure in financial markets, namely⁸ emphasis on indirect intermediation with heavy reliance on bank loans for firm financing associated with under-development of primary and secondary securities markets,⁹ and persistence of below-equilibrium real interest rates. Since the possibilities to access securities markets are limited if not absent, non-price credit rationing can promptly become a binding constraint. This may alter decisively the choice of financial structure.¹⁰

Under these conditions, how does the interaction between banks and commercial firms change when expectations on price inflation change? Under controlled interest rates, as expected inflation rates increase the real cost of debt capital falls. Bank expected losses (profits) increase (decrease) accordingly, raising the intermediaries' incentive to stiffen non-price credit rationing and shift the maturity of the loan portfolio toward short-term credit. This shift of loan maturity has two concomitant effects: first, it reduces the need to carry loans with negative real rates for many years; and, second, if an inverted yield curve persists, it converts lower-rate long-term loans into higher-rate short-term loans. If this rationing process becomes binding, as inflation rises, firms will display a simultaneous reduction in the maturity structure of debt and a reduction in overall leverage ratios as they are forced to increase the use of equity financing or contract asset balances. If firms, due to the severity of rationing, tap the usually large informal credit markets to raise funds or rely increasingly on suppliers' credit,¹¹ this will also cause a shift toward lower maturity debt. We will now develop this scenario more formally.

Credit Rationing with Regulated Interest Rates and Credit Floors

Assume a two-period framework in which banks $i = \{1, \dots, n\}$, and candidate commercial borrowers/firms $j = \{1, \dots, m\}$ exist. Two types of loans are offered by the banks, short-term loans (STL) with maturity of one period and long-term

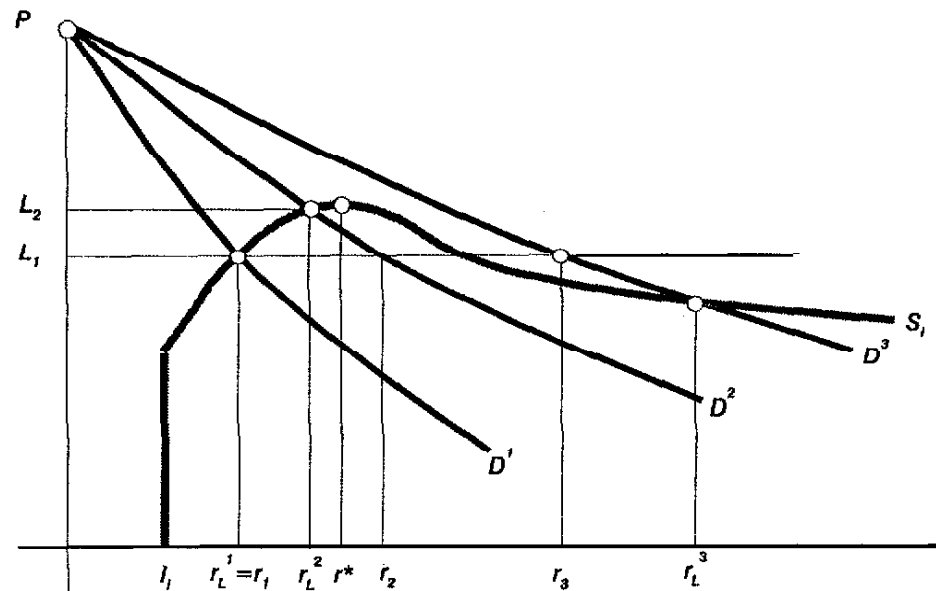


Figure 1. Equilibrium Credit Rationing

loans (LTL) with maturity of two periods. Assume also that LTL are regulated while STL are not.¹² We assume that the regulation on LTL consists of *preferential rediscount rates* and *credit floors* (minimum fraction of deposits that must be lent to specific priority borrowers).¹³ To keep the model simple, we assume absence of a liquidity premium in the yield curve and firms' preferences to finance short and long-term assets with liabilities of the same maturity. That is, firms prefer not to perform maturity transformation unless profitable opportunities exist in doing so or they are quantity rationed. Banks, on the other hand, perform maturity transformation. That is, banks bear the interest rate risk of the financial intermediation process. Although the banks are indistinguishable, the borrowing firms are distinguishable by the interest rate they are willing to pay but not by the size of their borrowing preferences (size of projects to be financed).

In the absence of controls, the equilibrium attained with lenders i and borrowers j can be represented by the classical graph of equilibrium credit rationing reproduced in Figure 1.¹⁴ The vertical axis represents quantities (loans) supplied (S) and demanded (D) at *real* rates of return (r) scaled on the horizontal axis. We observe a representative lender with a supply curve, S_i , and three loan applicants with demand curves D^j , $j = 1, 2, 3$. They represent three "types" of firms sampled from a continuum of firms of different quality types. The common origin at point P of the three demand curves simply means that the borrowers hold projects of similar size but are willing to pay different interest rates. The supply curve drawn reflects the fact that no loan will be extended at rates below the deposit rate l_i , which is

assumed to be regulated and equal for all banks, $i = 1, \dots, n$. It also reflects the standard assumption that real expected returns, r , by the bank increase less rapidly than real interest rates, k^* , and, beyond a "bank-optimal" point, r^* , actually decrease. The demand curves reflect the fact that the demand for loans is negatively related to the bank's expected return, r^* ; that is, for a given loan size, say L_1 , the three types of firms are willing to pay different costs of borrowing, $r_L^1 = r^1 < r^2 < r^3$; and that firms will borrow at most the cost of the project, P .¹⁵ In the equilibrium rationing represented by Figure 1, firms Types 1 and 2 borrow at r_{L1} and r_{L2} respectively, while firms Type 3 are rationed. Although firms Type 3 are willing to pay r_{L3} , at which the demand for loanable funds equals the supply of loanable funds, this is not an equilibrium rate. A bank can increase its profit by charging the (lower) rate, r^* . At this lower rate, the bank would attract all the firms it attracted at r_{L3} and obtain higher returns from each loan. It should be clear that the returns in Figure 1 are expected returns from bank lending. In the absence of uncertainty, the bank would act as a discriminating monopolist.¹⁶ An excess demand of Z exists and firms Type 3 will be equilibrium-rationed. Given the assumption of financing policy and structure of interest rates, firms Types 1 and 2 will borrow short term and long term according to the maturity structure of their assets.

Assume now that credit floor and rate controls on long-term funds are imposed by the government, while short-term funds are unrestricted. That is, financial repression is introduced. This situation is presented in Figure 2. With a flat equilibrium yield curve, long-term and short-term supply curves are superposed

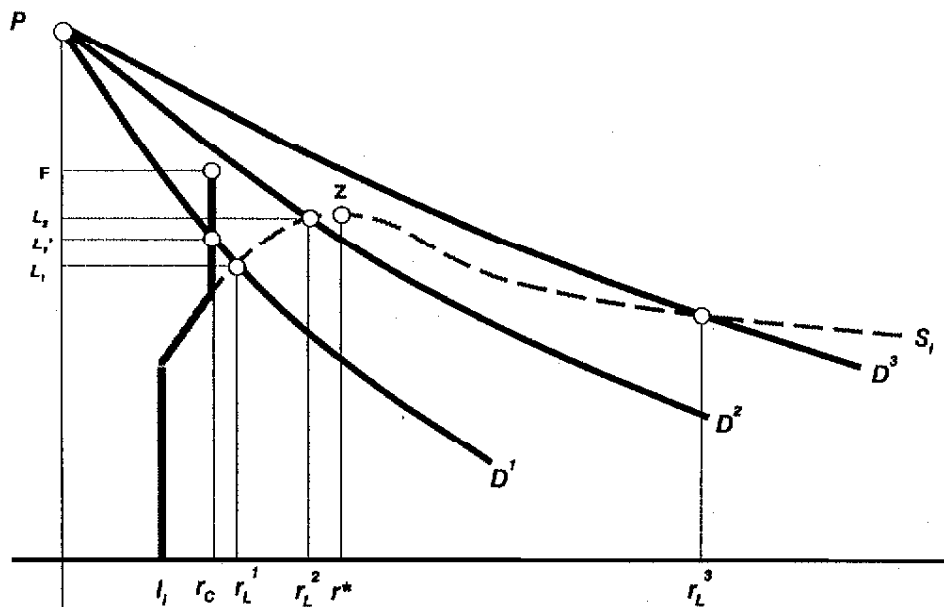


Figure 2. Equilibrium and Quantity Credit Rationing

up to the regulated rate. From this point on, the supply function for STL—represented by the broken line—will have the standard shape with an upward sloping and a downward sloping portion. The supply curve for LTL will be vertical at the point of regulated rate, r_c , up to the credit floor, F_i , set for bank i . Thus we observe the distinctive *inverted yield curve* characteristic of many developing countries. The difference, $r_c - I_i$, represents the spread guaranteed to the bank to cover intermediation costs. There are still three types of firms with demand curves D^j , $j = 1, 2, 3$. For firms Type 1, the equilibrium rate is r_1^j . But, in the presence of credit floors and regulated rates, it is able to borrow $L_1' > L_1$ at rates $r_c < r_1^j$. Firms Type 2 will be quantity rationed on LTL—a situation they would not have encountered in the absence of controls—but they will have L_2 units of short-term funds available. Firms Type 3 will be quantity-rationed on long-term funds and, as in the standard case of equilibrium rationing, equilibrium-rationed on short-term funds.

The equilibrium condition is $F = \sum_i F_i = \sum_j L_{j(k)}$, where $L_{j(k)}$ represents the loan demanded by borrower type k , j . That is, the total regulated supply of regulated-rate loans by all banks must be equal to the total demand of these loans by firms. It is possible that the government-set combined floor F may exceed or fall short of the total demand of loans by firms Type 1. If $F = \sum_i F_i > \sum_j L_{j(1)}$, banks will be forced to lend to borrowers of lower category—Type 2 in the discrete world of the model—at rates $r_c < L_2^j$. If instead $F = \sum_i F_i < \sum_j L_{j(1)}$, banks will be forced to ration some firms Type 1 of LTL. Whether the selection is made via a first-come first-serve basis or, more likely, by means of a selection procedure that allows banks to reclassify some borrowers as Type 2 and ration them has little bearing on the result. In either case some borrowers Type 1 will be rationed.

Note also another important point that arises in the earlier case, that is, when $F = \sum_i F_i > \sum_j L_{j(1)}$. When this is the case, banks may face increased potential losses from lending to lower-quality borrowers (Type 2). Then, rational bank managers are likely to engage in costly schemes foreordained to circumvent the credit floor. Penalties by the regulating authority could be one of these costs. Banks will engage in these schemes as long as the marginal costs of engaging in avoidance schemes does not exceed the marginal expected losses of lending to lower-quality borrowers.

A few other interesting implications result from this analysis. First, most likely, firms Type 1 will bias the maturity structure of their liabilities toward a higher proportion of long-term financing, irrespective of the maturity structure of their assets. On the other hand, firms Type 2 will be forced to either curtail borrowing altogether or bias the maturity structure of their liability toward a heavy reliance on short term funds, also irrespective of the maturity structure of their assets. This is far from being an uncommon result. These types of situations are frequently reported in developing countries. Clearly, this bias in the maturity structure of firms' liabilities in either direction is a secondary effect of financial repression largely ignored in the literature.

The Impact of Inflation on Credit Rationing

Changing conditions in the market can lead to situations in which firms shift status, say between Types 1 and 2. It was shown above that a Type 2 firm will be quantity rationed on LTL but will have L_2 of short-term funds available. If this firm at some earlier time has been a borrower of Type 1 and, for a particular reason, has changed status to borrower Type 2, two effects will be observable in the firm's balance sheet: a shift in total leverage ratios and a shift in the maturity structure of the debt toward ST funding. Similarly, the balance sheet of a firm that changes from Type 2 to Type 1 status will display opposite shifts. Changes in inflation under financial repression is one circumstance that could lead to a change of status between Type 1 and Type 2. Again, this situation is quite common in many developing countries with an inflationary environment.

In Section I, it was shown that the ex-post cost of STL and LTL are different when actual inflation rates are considered. In particular, the ex-post cost of long-term rates had a fixed component—the interest rate costs as a function of ex-ante expected inflation rates—and a stochastic component—the ex-post inflation rate. Stickiness of any type in lending rates will lead to delayed adjustments of these rates to new levels of inflation, and will influence the short-term and long-term credit granting/rationing decisions of banks.

The responses of banks largely depend on the rules employed in setting regulated interest rates. The standard policy is to set the long term regulated rates as to guarantee the banks a spread that covers the costs of intermediation. As noted before, this is achieved by regulating simultaneously both the lending and deposit rates. This spread can, however, be guaranteed on short term funds only. If banks perform any maturity intermediation (receive short-term deposits and grant long-term loans), the guarantee of a spread breaks down for long term assets, for which the rates have been set in reference to earlier inflation rates.

Assume that a bank has expectations of rising inflation that are not matched by adjustment in the base deposit and lending rates set by the government. This can also take the form of a systematic lag by government in adjusting the base rates. In either case, a drop in the expected real long-term lending rate results. For simplicity, assume that the short-term rate-setting process is efficient.¹⁷ In a graph that depicts conditions of credit rationing, a drop in real lending rates implies a shift of the long-term funds supply curve to the left, closer to or below I_t . In Figure 3, this is shown by the curve S'_L to the left of I_t . This would be representative of a situation in which the bank is forced to lend long term up to F at rates that are expected to be below future deposit rates. This does not need to be the case. A shift of the long-term loan supply curve to the left of S_L but at rates higher than I_t would produce exactly the same analytical result. Curve S_L represents the supply of loanable funds that would exist at current levels of inflation rate and government spread guarantees. In Figure 3, D^1 and D^2 represent borrowers of Type 1 with respect to supply curve S_L . D^3 is the demand curve for a borrower Type 3 that is rationed in a quantity and equilibrium sense. A shift of the supply curve from S_L to S'_L that results from rising inflationary expectations will shift the status of

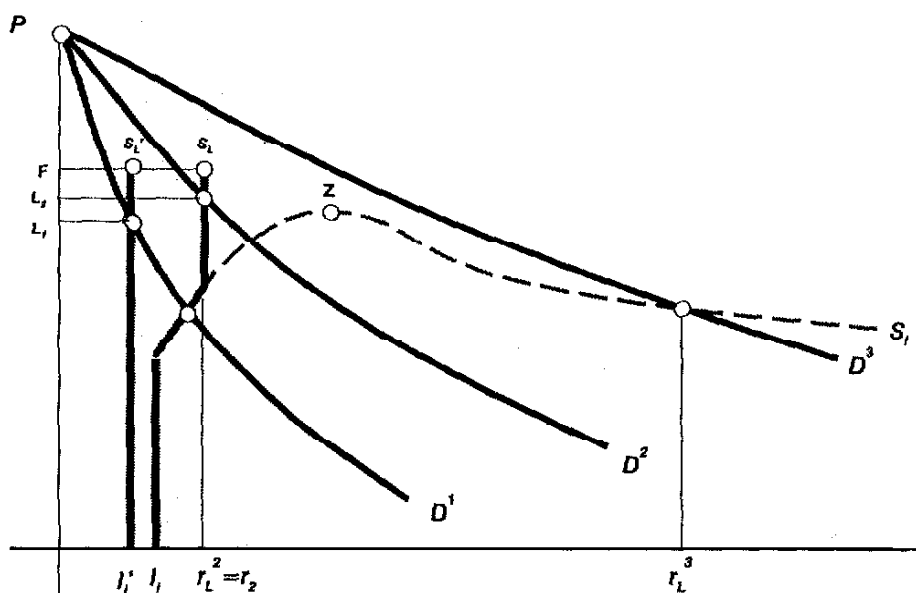


Figure 3. Equilibrium and Quantity Credit Rationing with Expectation of Rising Inflation

borrower D^1 from Type 1 to Type 2. Borrower D^2 , with the expected rise in inflation, will now be quantity-rationed of long-term funds. This, in turn, will force the readjustment of total leverage and debt maturity structure described above.

The consequence on the aggregated firms' balance sheet is ambiguous. As the long-term funds supply curve shifts to the left, borrowers that originally were entitled to funds with regulated rates (Type 1) and have not lost their status will increase the size of the loans demanded. This follows the upward shift along the supply curve of the intersection of demand and supply curves. If the shift to the left of the supply curve is not accompanied by a rising of the credit floor, F , it will be more likely that $F = \sum_i F_i < \sum_j L_{j(1)}$. Thus banks will discriminate further between candidate borrowers Type 1, most likely reclassifying some as Type 2 and rationing them. The result is that leverage ratios and the maturity structure of liabilities of some firms Type 1 will tend to increase while those of others will fall. Also, as the supply curve shifts to the left, banks face a higher expected net loss on loans at l_i . Thus, it is likely that banks will increasingly find incentives to engage in costly schemes to circumvent credit controls by government. A priori, the combined effect should be a fall of the aggregate firms' leverage and maturity structure.

Summarizing, under repressed markets an increase (decrease) in price inflation will, as a result of non-price credit rationing, have the simultaneous effect of reducing (increasing) corporate leverage and reducing (increasing) the maturity structure of debt. This prediction is exactly opposite of that made for firms in unrepressed

markets. The shift in maturity structure will be reinforced by the firms' efforts to ease severity of the credit rationing through shifting from long term to short term debt. Thus, there should exist a positive interdependence between the maturity structure of debt and total leverage. This prediction is a direct result of the mechanism of credit rationing under financial repression. Without financial repression, the prediction should not hold, thus, resulting in the absence of a relationship between these two dependent variables.

The prediction of lower financial leverage and shorter maturity structure of debt due to credit rationing under inflationary conditions may not hold though when large corporations and banks have developed symbiotic relationships (Leff, 1975). Ex-ante bank losses from inflation are further minimized in credit systems where the central bank and/or the government budget subsidizes individual bank profitability. This allows banks to socialize their lending risks (Monti & Porta, 1981).

III. THE STATISTICAL MODEL

The statistical analysis that follows focuses on the impact of inflation on two specific financial ratios under un-repressed and repressed markets: the ratio of total debt to total assets (δ), and the maturity structure of debt; that is, the ratio of current liabilities to long-term debt (γ). The goal of the statistical test is to obtain parameter estimates of statistical equations using data from Greece and Turkey, two repressed markets with a highly inflationary environment and from the U.S. and Canada, two countries with un-repressed markets and relatively low inflation. As was indicated above, the determination of these two ratios in the financing decision process is not independent, and the value one ratio takes influences the value of the other. There are strong theoretical reasons to expect that the value of γ is influenced by the size of the firm as well as by the maturity structure of assets. An appropriate proxy of firm size is the value of total assets. However, to avoid multi-collinearity with other variables, a different proxy of size is used, namely, total sales. The formulation of the *structural equations* representing the simultaneous equations model is as follows:

$$\delta_t = A_0 + A_1\gamma_t + \sum_m A_{2,m}k_{t-m}^* + \sum_n A_{3,n}i_{t-n} + \varepsilon_{1t} \quad (5)$$

$$\gamma_t = B_0 + B_1\delta_t + B_2\phi_t + B_3S_t + \sum_m B_{4,m}i_{t-m} + \varepsilon_{2t} \quad (6)$$

where the endogenous variables are

δ_t the ratio of total debt (current liabilities plus long-term debt) to total assets at time t ;

γ_t the ratio of current liabilities to total debt (as defined above) at time t ;

and the predetermined variables are

- i_{t-i} the inflation rate lagged for times $t-i$, $i = 1 \dots n$;
 S_t net sales at time t . This is a proxy for firm size;
 k_t^* the real rate of interest (nominal rate minus inflation rate) at time t ¹⁸;
 ϕ_t the ratio of current-to-fixed assets;

whereas ε_{jt} with ($j = 1, 2$) are random disturbance error terms;
 and A_k, B_k are regression parameters of the structural equations.

Changes in the maturity structure of assets should lead to parallel changes in the maturity structure of liabilities, given certain working capital management policy. To take this relationship into account, the equation (6), reflecting the maturity structure of liabilities, includes as an independent variable the ratio of current-to-fixed assets, ϕ .

In this system, equation (5) is identified while equation (6) is overidentified. Thus, the functional mapping from the regression coefficients of the reduced-form equation to the structural equations using a three-stage least squares (3SLS)

Table 1
SIGN OF COEFFICIENTS MEASURING THE EFFECTS OF INFLATION
ON CAPITAL STRUCTURE FOR A SAMPLE OF FIRMS IN CONTROLLED
AND UNCONTROLLED FINANCIAL MARKETS

Dependent Variable	Instrumental Variables	Controlled Markets			Uncontrolled Markets		
		H_1	TURKEY	GREECE	H_1	U.S.A.	CANADA
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Leverage (δ)	γ	(+)	(+)	(-)*	(0)	(-)*	(-)
	k^*_{t0}	(+)	(+)*	(-)*	(+/-)	(+)*	(+)*
	k^*_{t1}	(+)	(+)*	(+)*	(+/-)	(+)*	(+)*
	i_0	(-)	NA ¹	(-)*	(+)	(-)*	(-)*
	i_1	(-)	NA	(-)*	(+)	(+)*	(+)*
Maturity (γ)	δ	(+)	(+)	(+)	(0)	(+)	(+)
	ϕ	(+)	(+)*	(+)*	(+)	(+)*	(+)
	S	(-)	(-)	(-)	(-)	(+)	(-)
	i_0	(+)	(-)	(+)	(-)	(-)	(-)
	i_1	(+)	(-)	(+)*	(-)	(-)	(-)

Notes: This table reports the predicted sign of the coefficients under the alternative hypothesis H_1 (columns 3 and 6) and the actual signs of coefficients obtained from a 3SLS simultaneous estimation of equations (7) and (8). The estimated coefficient values and the F -values to test whether the coefficients differ from zero in the hypothesized direction are given in Table 2. The significance of the coefficients is indicated by an asterisk next to the F -value.

*significantly different from zero at the five percent level.

¹These coefficients were not estimated for the subsample reported in this table.

regression procedure is well defined. The reduced-form equations are obtained by solving the system (Equations 5–6) for the two endogenous variables δ_t and γ_t . This transformation yields,

$$\delta_t = a_0 + \sum_m \alpha_{1,m} k_{t-m}^* + \sum_n \alpha_{2,n} i_{t-n} + v_{1t} \quad (7)$$

$$\gamma_t = \beta_0 + \beta_1 \phi_t + \beta_2 S_t + \sum_m B_{3,m} i_{t-m} + v_{2t} \quad (8)$$

where,

$$\alpha_0 = \frac{A_0 + A_1 B_0}{1 - A_1 B_1} \quad \beta_0 = \frac{B_0 + B_1 A_0}{1 - B_1 A_1} \quad (9)$$

$$v_{1t} = A_1 \varepsilon_{2t} + \varepsilon_{1t} \quad v_{2t} = B_1 \varepsilon_{1t} + \varepsilon_{2t} \quad (10)$$

The hypotheses to be tested are summarized in Table 1, Columns 3 and 6. These hypotheses are consistent with the theoretical analysis of the previous two sections. The standard F statistic is used to test whether the coefficients generated by the 3SLS estimation are individually consistent with the hypotheses summarized in Table 1.

DATA

The model was tested using samples of firms from Greece, Turkey, the U.S. and Canada. The Greek firms sample consist of financial data over the 1972–1983 period from all listed non-financial companies in the *Athens Stock Exchange* (approx. 140 companies when delisted firms are included with their partial series). This resulted in a data set of 1520 observations. For Turkey, the sample includes financial data over the period 1979–1986 from 59 companies listed in the Istanbul Stock Exchange. This sample yields 470 observations. The data for the Greek sample have been obtained from the *Yearbook of the Athens Stock Exchange* (1973–1984) published by the Government Supervision Office. The Turkish data have been obtained from the Capital Markets Board, Turkey. The U.S. and Canadian data refer to samples of industrial companies for the period 1972–1986. This data set was retrieved from the COMPUSTAT tapes. The number of observations available for the U.S. and Canadian firms are 1400 and 2397 respectively. Inflation and real rates were computed from the yearly values of the wholesale price index of the respective countries published in the IMF's *International Financial Statistics*. The complete data set used in the study is available from the authors upon request.

STATISTICAL RESULTS

The discussion of findings refers to the summary results reported in Table 1. Columns (1) and (2) of Table 1 list respectively the dependent and instrumental variables used in the estimation procedure. Columns (3)–(5) present the predicted signs of the coefficients derived from the theoretical discussion and the actual signs of the coefficients estimated by the 3SLS regression procedure for Turkish and Greek firms.¹⁹ Columns (6)–(8) present the same type of information for firms in the U.S. and Canada.

The sign and significance of the regression coefficients for the U.S. and Canadian samples tend to support the theoretical predictions. The most serious inconsistency appears in the case of the inflation rate variable i_0 in the leverage equation with dependent variable δ . The negative sign for both U.S. and Canadian firms indicates that total debt ratio and current inflation rates move inversely to each other, contrary to the prediction of a positive relationship. Since lagged variables are used, the signs may reflect an autocorrelation effect of the inflation-time series.²⁰ In the debt maturity structure equation, although insignificant, the inflation rates coefficients have the predicted negative sign. For the U.S. and Canadian regression equations, the estimated values of the regression coefficients, the computed F-values and the critical F-values at a five percent confidence level are reported in Table 2.²¹

The results from the regression of the Turkish and Greek sample are somewhat less consistent. However, the findings suggest that the response of the financial ratios of Greek and Turkish firms to changes in inflation rates was rather different from that observed for U.S. and Canadian firms, and consistent, in general, with the predictions. The response of the dependent financial variables, debt ratio and maturity, appears to have been slightly more consistent with predictions in the case of Turkish than Greek firms. With respect to the first equation, with dependent variable δ (leverage), the predictions are partially supported. In the case of Turkey, the signs of all estimated coefficients are as predicted. In the case of Greece, all coefficients are highly significant, but the signs are not always consistent with predictions.²² Interestingly, the negative relationship between debt ratio and debt maturity found for Greek firms is in line with the evidence reported for U.S. firms, contrary to the prediction of a positive relationship. Most notably, however, the coefficients of the inflation rate variables are significant and with the predicted negative sign. Compared to the mixed findings for the same coefficients for U.S. and Canadian firms, the evidence from Greek data suggests that, under financial repression, increases in inflation rates force firms to curtail their overall financial leverage. In Equation 2, with dependent variable γ (maturity structure of debt), all signs are as predicted, with the only exception being the coefficients for the inflation rates variables of the Turkish sample. However, given the F-values (reported along with coefficient values in Table 2), the hypothesis that the coefficients are equal to zero can be rejected only for the ratio of current-to-fixed assets and for the lagged inflation rate. Finally, the negative coefficient sign of the size (S) variable, for both Greek and Turkish firms, although not statistically significant, is consistent with the prediction, and could be interpreted as weak evidence that smaller firms are more likely to be credit rationed than larger firms.

Table 2
VALUE OF COEFFICIENTS MEASURING THE EFFECT OF INFLATION
ON CAPITAL STRUCTURE FOR A SAMPLE OF FIRMS IN CONTROLLED
AND UNCONTROLLED FINANCIAL MARKETS

Dependent Variable	Instrumental Variables	Controlled Markets		Uncontrolled Markets	
		TURKEY	GREECE	U.S.A.	CANADA
Leverage (δ)	Intercept	0.6198 ^a	2.8311 ^a	1.3696 ^a	1.4396 ^a
	γ	0.0344 (0.045)	-1.0272 (15.80) ^c	-0.3945 (3.33) ^c	-0.3087 (0.99)
	k^*_0	0.0042 (3.42) ^b	-0.1219 (20.88) ^c	0.0168 (3.94) ^c	0.0514 (8.01) ^c
	k^*_1	0.0039 (2.85) ^b	0.1248 (21.92) ^c	0.1926 (5.01) ^c	0.0806 (6.16) ^c
	i_0	NA ^d	-0.0716 (23.69) ^c	-0.1464 (4.84) ^c	-0.1213 (5.35) ^c
	i_1	NA	-0.0053 (3.18) ^c	0.0496 (4.85) ^a	0.0205 (4.63) ^c
	Maturity (γ)	Intercept	-0.8313	0.5879	0.2473
δ		2.5164 (0.687)	0.0875 (0.009)	0.6336 (0.005)	5.6356 (0.223)
ϕ		0.0393 (11.80) ^b	0.0360 (2.31) ^c	0.0959 (4.36) ^c	0.0013 (0.529)
S		-0.0000 ^e (0.21)	-0.0000 ^e (0.86)	0.0000 ^e (0.05)	0.0003 (0.295)
i_0		-0.0017 (0.71)	0.0016 (0.71)	-0.0017 (0.005)	-0.0125 (0.061)
i_1		-0.0033 (0.81)	0.0035 (15.04) ^c	-0.0002 (0.01)	-0.0026 (0.033)

Notes: This table reports the values of the coefficients derived from a 3SLS simultaneous estimation of equations (7) and (8). Values in parentheses report the computed F -values for each coefficient that test whether the $H_0: \beta_i = 0$ can be rejected in favor of the predictions presented in Table 1. Critical F -values and degrees of freedom, $F(\alpha, \nu_1, \nu_2)$, are reported at the bottom of the table.

^a t -value significant at the five percent level.

^b $F \geq F_{0.05,3} = 2.60$.

^c $F \geq F_{0.05,5} = 2.21$.

^dThese coefficients were not estimated for the subsample reported in this table.

^eSmaller than 0.0001 in absolute value.

VI. SUMMARY AND CONCLUSIONS

This paper examines the impact of government controls on lending rates on the financial structure of firms operating in emerging markets under inflationary conditions. A model based on conventional credit-rationing theory is used to derive specific testable hypotheses about the lending and borrowing responses of banks and non-financial enterprises, to changes in several relevant variables, particularly inflation. As a benchmark of comparison, the analysis also develops

predictions regarding the credit behavior of banks and firms in the absence of control on lending rates.

Government control of lending rates is usually part of a system of controls commonly labeled financial repression. For firms operating in financially repressed markets the model suggests the following hypotheses: Under controlled interest rates, increases in inflation result in an aggravation of credit rationing to the business sector and thus in decreasing corporate financial leverage. Simultaneously, risks and losses associated with uncertain and high inflation are shifted from the financial to the industrial sector through reduced long-term lending and increased short-term lending. This results in a drop in the maturity structure of corporate debt. The decisions on leverage and maturity of debt are joint decisions and a function of both the changes in real interest rates and inflation.

The statistical model is tested with data of firms operating in the controlled markets of Greece and Turkey and of firms operating in the relatively control-free markets of the U.S. and Canada. Overall, the statistical results lend support to the main hypothesis of the paper regarding the impact of inflation on the financial structure of firms.

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NOTES

1. In 1990, the average inflation rate was 213% for 28 developing countries (up from an average 1985–89 rate of 64.9) and 4.7% for the major seven western economies. For the four countries included in this study inflation rates in 1990 were as follows: Canada, 5.0%; Greece, 20.4%; Turkey, 60%; and the United States, 5.4%.
2. Financial repression was first defined by Gurley and Shaw (1960). Since 1960, many researchers have studied the impact of financial repression on the economy, for example, McKinnon (1973), Shaw (1973), Fry (1982, 1987), Tybout (1984). The impact of relaxation of these constraints, that is, financial liberalization, has been described by DeMelo and Tybout (1986), Bolnick (1987), Dolley and Mathieson (1987) among others.
3. See Pozdena (1987) and more recently Titman and Wessels (1988) and Harris and Raviv (1991) for a review of the various arguments supporting relative shifts in capital structure of firms.
4. See Allen (1987) for a comprehensive review of the literature on credit rationing. Allen makes the distinction between *disequilibrium credit rationing*, which

results from institutionally (e.g., government) imposed interest rate ceilings, and equilibrium credit rationing, resulting from voluntary limits imposed by lenders when increases in lending rates no longer suffice to compensate for increased borrower default probability. This paper makes use primarily of an extension of the first concept. For the U.S.A. case, this type of rationing was studied by Blitz and Long (1965) and Koskela (1976).

5. Surprisingly little research has been published on the subject of financial decision making at the micro-economic level under financial repression. A study by Tybout (1984) is a noteworthy exception. Tybout suggests that, under financial repression, banks discriminate against small firms in allocating loans in the presence of interest rate controls. This prediction is supported by Colombian data. See also Monti and Porta (1981) for a study on the Italian market.
6. This argument has recently received empirical support in a historical analysis of the relationship between inflation and interest rates. Leuthold (1981) has shown that real rates of long-term instruments tend to lag inflation and often are negative.
7. In its most general sense, disequilibrium credit rationing exists when some type of institutional constraint results in some amount of interest rate stickiness that affects credit allocation to the set of potential borrowers. Jaffee and Modigliani (1969) studied another form of institutional constraints, namely, restrictions on perfect-price discrimination on the part of lenders.
8. See references in Note 2 for an extensive treatment of this subject.
9. Consider, for example, Greece. Molho (1986) reports that over the 1968–1983 period, bank credit provided 98.6 percent of funds raised in the open market by the non-financial private sector. The balance was raised through public share and bond (0.7% each) issues. Similarly, from 1970 to 1988 in Mexico, banks provided around 98 percent of credits to the corporate sector while the capital markets provided the rest. Total new funds channelled to the Mexican private sector in 1987 neared only \$ 1.6 billion, 1.19 percent of total gross domestic investment (Ortiz & Bueno, 1992).
10. Note, however, that firms may and do access foreign-currency debt and domestic informal loan markets.
11. A study of Argentine firms—which operate in a typical environment of financial repression—shows that, over the years 1955–1966, under conditions of high inflation, firms financed nearly 35 percent of total debt through trade accounts payable; another 35 percent was funded through other debts (likely informal sources) and accruals (mostly taxes), and only 22 percent through (controlled rate) bank debt. The balance was raised through *Financieras* for which equilibrium—that is, positive real—rates were paid (Eiteman, 1970).
12. This assumption is realistic for two reasons. First, it is typical that long-term rates are regulated for the purpose of promoting capital investment, while short-term rates are not. Second, even if short-term rates are regulated, non-in-

- terest charges can boost bank yields on short-term instruments more than yields on long-term instruments.
13. These are among the most common forms, together with the control of deposit rates, of financial repression in many emerging markets. See Dooley and Mathieson (1987) for a survey of these policies.
 14. See Jaffee and Modigliani (1969), Stiglitz and Weiss (1981) and Sealey (1979) for details not covered here on background information for this framework of analysis. For the purpose of the arguments in this paper, the somewhat more detailed structure of the loan supply curve of Jaffee and Modigliani (1969) is condensed to its most essential points.
 15. The distinction between the three types of firms made here is not essential. Alternatively, firms can be distinguished by the size of the loans demanded but be indistinguishable otherwise. In either case, it remains true that borrowers with different reservation prices for money or different sizes of loans demanded will be willing to pay different rates.
 16. We thank the anonymous referee for calling attention to this point.
 17. This assumption will not affect the analysis since governments will *always* be more efficient in guaranteeing a spread to banks on ST rates than on LT rates.
 18. Nominal interest rates minus actual inflation rate may not be a very good proxy of the expected real interest rate. However, in the absence of a model that is consistent with the market participants' formation of expectations or inflation survey data (see, e.g., Hardouvelis (1988) for the U.S.), it is assumed that today's observed inflation is the best estimate of tomorrow's expected inflation. Note also the commentary given in footnote 21 with respect to the sign of the inflation coefficients.
 19. Beginning in July 1980, the government of Turkey started a modest process of liberalization policy that culminated in 1982 in a major shift in monetary and credit policy. In particular, interest rates charged by the banking sector were allowed to "float" and take market equilibrium values. In effect this meant that the institutional framework of "financial repression" was largely lifted. Furthermore, during the period 1980–1982, Turkey was under control of a military junta which undertook social and economic policies with deep impact on the society. It is not clear what effect such policies could have had on the behavior of business. To take into account these developments, the sample was partitioned and the 3SLS regression run for three different cases. First, the regression was run including the whole sample. Two more regressions were run using the sub periods 1979–1982 and 1983–1986 respectively. In Table 2 only the results of the regression using the 1979–1982 sub sample—a period with a regime of financial repression—are presented.
 20. An analysis of the inflation time series revealed that ARMA(2, 1) would fit the series quite well with at least one of the autoregressive parameters being consistently negative across all series. This reveals a cyclical in the inflation time series, which could explain the alternate signs of the coefficients yielded by the 3SLS regression. This also implies that monetary authorities tend to

manage inflation by reaction. That is, when inflation rates are high, authorities introduce policies aimed at reducing inflation in the next period. When inflation rate is low, authorities relax monetary and credit policy, which results in higher inflation in the next period. If this is the case, it would only be rational for business (and banks) to interpret today's lower inflation as meaning higher inflation next period.

21. Results for Turkey for the complete period and for the subperiod of liberalization are as follows:

Complete period:

$$\delta = 0.679 - 0.014\gamma + 0.00175k_0 - 0.00228k_1 - 0.00077i_0 + 0.00058i_1$$

(8.18) (0.005) (0.778) (0.863) (0.386) (0.286)

$$\gamma = 0.989 - 0.6662\delta + 0.0411\phi + 0.32 \times 10^{-8}S - 0.98 \times 10^5 i_0 + 0.0002i_1$$

(3.849) (0.378) (24.42) (1.284) (0.000) 0.005

Period of liberalization:

$$\delta = 0.376 + 0.2917\gamma + 0.00199k_0 - 0.00041k_1$$

(4.58) (1.608) (0.511) (0.018)

$$\gamma = 0.693 - 0.2884\delta + 0.0549\phi + 0.17 \times 10^{-8}S + 0.00059i_0 + 0.00138i_1$$

(3.147) (0.212) (30.26) (1.196) (0.076) (0.416)

The figures in parentheses are the computed F values. Critical F values at the five percent level are 2.60 and 2.21 for the first and second pair of equations respectively. One should not expect to find any consistency with the theoretical predictions in the first pair of equation. The sign of coefficients in the second pair of equations should, in turn, be consistent with the unrepressed markets scenario. However, the period of transition that followed the liberalization and the resistance of the banking system to the liberalization measures makes the results understandably inconsistent with either set of predictions.

22. The alternative signs for the real rate can be explained by a similar line of arguments as presented in Note 20.

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