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Loan interest rates under risk-based capital requirements: The impact of banking market structure

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ABSTRACT

This paper analyzes how the effects of the introduction of risk-based bank capital requirements on bank loan rates depend on the market structure of the banking industry. We show that, when granting loans to borrowers under Basel II or Basel III capital requirements, banks with market power internalize an additional cost, in terms of regulatory capital, associated with the increase of borrowers' risk of default. As a result, the intermediation margin on bank loans increases with the changeover from non-risk to risk-based capital requirements, thereby making lending more expensive.

1. Introduction

The introduction of risk-based bank capital requirements, under both Basel II and Basel III, should be welcomed as it improves the adequacy of capital held by banks to the risk of their asset portfolios. Under these rules, the level of capital that a bank has to hold against a given exposure became a positive function of the credit risk of that exposure.[3] These developments in banking regulation have motivated additional research in this area. Nevertheless, the analysis of the effects of the implementation of risk-based capital requirements on bank loan rates under different banking industry structures has been overlooked.

Conventional economic theory on pricing under imperfect competition states that prices are set as a markup over marginal costs. By developing a partial equilibrium model with oligopolistic banks, this paper shows that the Basel II and Basel III bank capital regulation adds another link to the conventional relationship between prices and quantities: a bank is aware that extending a new loan to a borrower increases the borrower's leverage and, thus, his risk of default; accordingly, that same bank is also aware that it will have to raise more costly bank capital under risk-based capital requirements and will account for this effect when setting loan interest rates. As a result, the intermediation margin on bank loans increases with risk-based capital requirements. We also show that borrowers with a level of risk such that the interest rate on their loans would not adjust with the changeover from non-risk to risk-based capital requirements under perfect competition, face a higher cost of funds with an oligopolistic banking system.

1.1. The implications of banking market structure

The theoretical literature has identified two major effects of banking market structure on bank behavior. On the one hand, the fewer the number of banks, the larger is their market power and the smaller the total quantity of credit available to entrepreneurs. On the other hand, the fewer the number of banks, the higher the incentive to produce information, and therefore the larger the proportion of funds allocated to screened, high quality entrepreneurs.[4] The empirical evidence suggests the existence of multiple effects of banking market structure for loan behavior and it does not provide definite answers regarding the sign and size of the information production effects. Yet, the market power approach is broadly validated in most studies.

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[3] Under the Basel Accord of 1988 (Basel I) only the borrowers' institutional category was taken into account.

[4] Many theories stressing the role of production of information continue to rely on the existence of market power effects in the banking sector. For example, Gorton and He (2008), present a model in which banks collude in setting interest rates while competing in the production of information.

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Since the focus of this paper is not on the microfoundations of bank lending, we do not model explicitly the bank-firm relationship and the information channel and we choose the standard industrial organization (IO) approach to evaluate the Basel Accords. The new link presented in this paper exists whenever a bank with market power extends a loan to a firm and, therefore, the results are still valid in more general setups.

The links and results presented in this paper are relevant for economic activity as long as two conditions are met. First, bank credit supply must affect economic activity; multiple studies support this assumption showing that banks play a specific role in the economy, as it is also evident in the recent financial crisis. Second, credit supply is inversely related to capital requirements (the so-called "bank capital channel"). Using the *Call Reports*, Hancock et al. (1995) apply a VAR methodology and find a strong relationship between bank capital and loan growth. The authors report that, after a shock to capital, larger banks adjust each component of their portfolio faster than smaller banks. Kishan and Opiela (2000) study the relationship between bank capital and monetary policy in the United States. They find that undercapitalized banks have the largest response of loans to monetary policy shocks, but the smallest response of time deposits, indicating that small, poorly capitalized banks are unable to raise alternative funds to sustain lending levels when monetary policy tightens. Other studies on European countries also corroborate these findings (see, for example, Jiménez et al., 2007, for the Spanish case). Studies estimating the medium-term impact of Basel III implementation on GDP growth show that economic output is mainly affected by an increase in bank lending spreads, as banks pass a rise in funding costs, due to higher capital requirements, to their customers (see, for example, Slovik and Cournède, 2011).

Still, these studies do not account for the impact of regulation on intermediation margins and thus underestimate the full impact of new capital rules. Moreover, the Basel Committee is considering a surcharge on big systemically important financial institutions, forcing them to hold extra capital on top of the global minimums set last year. To the extent that many of these institutions have market power, the final impact of additional capital needs depends on the links described in this paper.

The traditional approach to competition in financial intermediation derives largely from applying standard IO economics to the banking industry. Mandelman (2011) provides empirical evidence that economic expansions attract competitors to the banking industry and, as a result, established banks react by lowering interest rates, while during recessions few competitors enter and incumbents are able to sustain high profit margins. Countercyclical bank markups create a bank-supply channel that propagates and amplifies shocks to the economy and contribute to macroeconomic volatility. Dynamic macroeconomic models with sticky interest rates apply results in IO to understand the pass-through of monetary policy, namely Scharler (2008) considers financial intermediaries which operate in a fully competitive environment, and Hülsewig et al. (2009) and Güntner (2011) assume that banks extend loans to firms in an environment of monopolistic competition. Verona et al. (forthcoming) use a monopolistically competitive shadow banking system to explain countercyclical bank markups and to investigate whether monetary policy was responsible for the US boom-bust cycle of the 2000s.

Van den Heuvel (2006) analyzed the impact of regulatory capital requirements when the bank faces a downward sloping demand curve for its loanable funds, thus laying the groundwork for a bank capital channel (Drumond, 2009, undertakes a survey of the existing literature on the bank capital channel). Gerali et al. (2010) analyze a DSGE model in which wholesale banks behave competitively and retail banks are monopolistic competitors, and in which banks have a target for their capital-to-asset ratio which the authors use as a shortcut for studying the implications and costs of regulatory capital constraints. Other authors introduced explicitly these constraints in dynamic macroeconomic models with a competitive banking sector, namely Jorge (2009) and Liu and Seeiso (2012). Yet, the literature is missing an integrated analysis of the pricing of loans under different banking structures *and risk-based capital requirements*. Our work fills this gap, thus providing the microeconomic foundations for dynamic macroeconomic models which aim at fully understanding the aggregate impact of bank capital regulation.

In the next section we study the implementation of risk-based capital requirements under perfect competition, Bertrand competition and the Cournot oligopoly. We propose a proof of the existence and uniqueness of the Bertrand equilibrium which we believe to be of independent interest. Section 3 presents the empirical evidence on banking market structure, and the final section concludes with the implications for regulatory policy.

2. The model

Our model economy consists of a set of M homogeneous banks and a set of J perfectly competitive firms, which borrow from those banks to buy physical capital. Both types of agents are risk neutral and the model is static.[5] Banks raise funds from depositors and bank capital holders to finance the loans granted to firms.

Let D_m and S_m be, respectively, the total amount of deposits and bank capital held by bank m. The gross return on deposits is given by R^D, and R^S represents the opportunity cost for the equity capital investment. We consider that the market for bank deposits is perfectly competitive, with R^D identical across banks. The cost of funds R^S is also identical for all banks.[6] We further assume that the opportunity cost of bank capital is higher than the cost of bank deposits — there is a sizable theoretical and empirical literature to support this assumption (see, for instance, Stein, 1998, Gorton and Winton, 2000, and Bolton and Freixas, 2006).

Let L_{jm} represent loans granted by bank m to firm j and $L_j = \sum_{m=1}^{M} L_{jm}$ be the total amount of loans granted by all banks in the economy to firm j. Expected marginal productivity of physical capital is decreasing so that, the more a firm borrows in a given period, the lower the average expected return on borrowed funds. Under very general conditions, firm j's demand curve for loanable funds is downward sloping. Formally, we represent the demand function for loans by firm j by $L_j = L_j(R_j)$ with $dL_j/dR_j < 0$ and $d^2L_j/dR_j^2 \leq 0$. Given these regularity conditions, the inverse-demand function for funds by firm j is given by $R_j = R_j\ (L_j)$ with $dR_j/dL_j < 0$ and $d^2R_j/dL_j^2 \leq 0$, and represents the firm's willingness-to-pay for an amount of loans L_j.

We assume that firms' risk of default on loans depends positively on firms' leverage ratio. We also consider that firms cannot issue equity — a reasonable hypothesis for small firms in the short run, which is the case we are interested in — implying that their net worth is fixed. Without loss of generality, we assume that firms' net worth is identical across firms and is standardized to one. Under these assumptions the level of risk of firm j depends only on L_j which, in turn, equals its leverage ratio.

The minimum amount of regulatory capital that each bank has to raise under Basel II and III depends on the estimated credit risk of its portfolio. Let $\alpha(L_j)$ be the credit risk weight assigned to firm j and used to compute bank capital requirements.[7] Under Basel I, bank capital requirements are not sensitive to loan risk and $\alpha(L_j)$ equals 1 for all L_j. We consider that under Basel II and III, $\alpha(L_j)$ is continuous with $d\alpha/dL_j > 0$ if $Lj > 0$, and $\alpha(L_j) = 0$ otherwise. We further assume that $d\alpha/dL_j + d^2\alpha/dL_j^2 > 0$ for $L_j > 0$, which amounts to saying that function α cannot be *too* concave. There is one single value L^* such that $\alpha(L^*) = 1$. Note that a bank

[5] Instead of the static model, we could have considered a dynamic setup but, for a preliminary regulatory analysis, intertemporal incentives to maintain a collusive arrangement may not be of first-order importance.

[6] For our purposes, considering a different setup would not bring additional insights.

[7] Under Basel II and III, function $\alpha(L_j)$ is determined either by the regulator, under the Standardized Approach, or by the bank, under the Internal Rating Based Approach.