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Bank competition and ECB's monetary policy ☆

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Abstract

In a model of oligopolistic competition in the banking sector, we analyse how the monetary policy rule chosen by the Central Bank can influence the incentive of banks to set high interest rates on loans over the business cycle. We exploit the basic model to investigate the potential impact of EMU implementation on collusion among banks. In particular, we consider the possible effects of the European Central Bank's policy criteria with regard to the cost of credit in national markets. © 2000 Elsevier Science B.V. All rights reserved.

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1. Introduction

The campaign on the benefits of the EMU emphasises the increase in consumer's surplus brought about by smaller transaction costs and, in general, increased competition in all markets. Also the banking sector will have to undergo formidable changes. Although the implications of the EMU on the banking system have been discussed exclusively at the microeconomic level (see e.g., Dornbusch et al., 1998), the likely consequences of the changed macroeconomic scenario on increasingly integrated financial markets have still to be investigated. The conduct of monetary policy is going to change under the EMU, even though the ultimate goal of the European Central Bank (ECB) remains price stability (European Central Bank, 1998). Sharing the same objective of the Bundesbank is not indeed a guarantee of unchanged policy for a number of reasons. Since voting participants outnumber the ECB's executive board (Kenen, 1995), monetary policy will no longer be aimed at achieving German domestic objectives (as in the EMS era), but will be geared to pursue the interests of all countries in the Union.

In this paper, we argue that the novelties brought about by the EMU in policy-making criteria may influence competition in the credit markets of member countries. We model inter-bank competition in national credit markets by using the oligopoly model developed by Rotemberg and Saloner (1986) (see also Bagwell and Staiger, 1997) and show that "implicit collusion" can arise without any overt cooperation among banks. [1] Thus, even when loans are priced following non-cooperative Nash strategies, lending rates may be set above their competitive level. The pricing behaviour of banks depends on the (current) gains and on the (future) losses of undercutting. When an oligopolistic bank undercuts on its loan rate, it manages to steal the current market share of its competitors. Then, banks will have an incentive to compete more aggressively when the loan market is buoyant. However, undercutting entails a cost, since the rival banks will punish aggressive behaviour by setting competitive loan rates in the future (trigger-strategy). A similar model has been used by Dutta and Madhavan (1997) to examine implicit collusion among securities dealers.

Although we abstract from many aspects that are frequently considered in modern banking theory (such as asymmetric information in the lender–borrower relation: see Freixas and Rochet, 1997), the adoption of the Rotemberg–Saloner framework presents several advantages. First, it can encompass

[1] Other papers have used non-competitive models of the banking sector to represent the credit market. For example, Hannan and Berger (1991) consider a monopolistic competition model of the loan market to justify "interest rate stickiness".

different types of competition, from perfect competition to monopoly pricing. [2] Second, it is well suited to capture the effects of entry on pricing policies. This has some relevance to our purposes, since the EMU is supposed to increase market integration and competition. Third, the Rotemberg–Saloner model provides an explicit analysis of pricing-behaviour over the business cycle. This feature is particularly important here, since monetary policy may well respond to cyclical fluctuations.

The model presented in this paper makes a general point. We show that monetary policy affects banks' incentives to collude in the credit market through its influence on the cost of raising funds (interest rates paid on deposits, etc.). For example, if the Central Bank raises market rates during booms, banks will have to bear higher costs on the funds they collect. Since the higher cost of funding reduces the gains that can be obtained by pricing loans more aggressively, a countercyclical monetary policy may favour implicit collusion among banks. Thus, the selection of the monetary policy rule tends to condition the competitive environment of the banking industry. This simple principle has interesting implications for the transition process to the EMU. Not only increasing integration will modify the market structure of credit markets in member-countries, but also the shift from national Central Banks to the ECB may have specific effects on banks' behaviour. This aspect may be particularly relevant in the comparison of Germany, where the Bundesbank enjoyed some degree of freedom in monetary policy decisions, with other EMS members, whose monetary policies had to adapt in order to keep exchange-rate stability.

The paper is organised as follows. Section 2 develops the implicit-collusion model of the banking sector and analyses the effects of entry and market-niches on banks' pricing policy. Section 3 shows how monetary policy rules can affect competition in the credit market and makes some conjectures on the possible impact of ECB's policy criteria. Section 4 briefly concludes the paper.

2. A simple model of implicit collusion in the banking sector

We begin by setting up the basic model of banking behaviour in the face of a stochastic loan demand. Our framework hinges on Rotemberg and Saloner (1986) implicit collusion model of oligopoly (see also Tirole, 1988).

[2] The empirical evidence in Berger and Hannan (1989) for US banks, and in Goldberg and Rai (1996) for European banks, provides some support for the structure-performance hypothesis: the setting of interest rates is less favourable to banks' clients in more concentrated markets as a result of collusion or other forms of non-competitive behaviour. Evidence of imperfect competition in European banking markets is also found by De Bandt and Davis (1998).

Let us consider N banks competing for loans in the market. Any individual bank j ($j = 1, \ldots, N$) issues deposits at an interest rate i and makes loans at an interest rate r_j. Deposits and alternative liquid assets (i.e., Treasury bills) are assumed to be perfect substitutes in the public's portfolios, so that i may be regarded as the market interest rate on short-term assets. At the market rate i the bank faces an infinitely elastic deposit supply $D_j(i)$. Reserve requirements imply that loans supplied to customers, L_j, are a fraction $1 - \rho$ (with $0 \leqslant \rho \leqslant 1$) of deposits: $L_j = (1 - \rho)D_j$.

When all banks charge the same interest rate on loans ($r_j = r$, $\forall j$), the market loan demand is given by $L(r)$. We assume that the loan demand can be either low, $L_L(r)$, or high, $L_H(r)$, with equal probabilities, and that $L_L(r) < L_H(r)$ holds for all values of the loan rate r. Loans are repaid to the bank with exogenously given probability p_L and p_H in the low and high demand cases, respectively ($0 < p_L \leqslant p_H < 1$). Even when setting identical loan rates, banks may get different shares of the market loan demand: as in Dutta and Madhavan (1997, Par. IIIB), this may reflect differences in banks' size, reputation, or relationships with the borrowers. Let ϕ_j denote bank's j share of total loan demand, with $\sum_{j=1}^{N} \phi_j = 1$. The possibility of different market shares among banks allows us to investigate how the number and the relative size of banks in the market affect the likelihood of collusive behaviour. When all market shares are equal ($\phi_1 = \phi_2 = \cdots = \phi_N = 1/N$), the price-setting problem reduces to a game among N symmetric players.

When all banks set the same loan rate in state S ($S = L, H$), bank j has the following per-period profit function:

$$\Pi_j^S(r_S) = \phi_j \left[p_S(1 + r_S) - \frac{1 + i}{1 - \rho} \right] L_S(r_S), \tag{2.1}$$

where r_S denotes the loan rate set by all banks in state S. Considering an infinite horizon and a discount factor β ($0 < \beta < 1$) the expected discounted profit function is

$$\begin{aligned} V_j &= \sum_{t=0}^{\infty} \beta^t \left(\frac{\Pi_j^H(r_H) + \Pi_j^L(r_L)}{2} \right) \\ &= \phi_j \frac{1}{1 - \beta} \left\{ \frac{1}{2} \left[p_H(1 + r_H) - \frac{1 + i}{1 - \rho} \right] L_H(r_H) \right. \\ &\qquad \left. + \frac{1}{2} \left[p_L(1 + r_L) - \frac{1 + i}{1 - \rho} \right] L_L(r_L) \right\}. \end{aligned} \tag{2.2}$$

If banks adopt a *fully collusive* behaviour, they set the interest rate on loans at the *monopoly* level r_S^m corresponding to each state S. The expected discounted monopoly profits become

$$V_j^m = \sum_{t=0}^{\infty} \beta^t \left(\frac{\Pi_j^H(r_H^m) + \Pi_j^L(r_L^m)}{2} \right)$$
$$= \phi_j \frac{1}{1-\beta} \left\{ \frac{1}{2} \left[p_H(1+r_H^m) - \frac{1+i}{1-\rho} \right] L_H(r_H^m) + \frac{1}{2} \left[p_L(1+r_L^m) - \frac{1+i}{1-\rho} \right] L_L(r_L^m) \right\}. \tag{2.3}$$

For the collusive outcome to be sustainable, the (future) losses from deviation must be larger than the (immediate) gains accruing to the deviating bank. If the rival banks adopt a trigger-strategy behaviour, a single deviation from the collusive, monopoly pricing in one period determines the reversion to the competitive, zero-profit, outcome in all future periods. Therefore, the *gains* from deviation last only one period and amount, for each individual bank, to the monopoly profits earned, in each state, by all other banks. Since the gains from deviation are larger for the bank with the smallest market share, we concentrate on the problem of bank i, with market share $\phi_i \equiv \min(\phi_1, \ldots, \phi_N)$. For bank i, the gain from deviation in state S is

$$\Pi_{-i}^S(r_S^m) = (1-\phi_i) \left[p_S(1+r_S^m) - \frac{1+i}{1-\rho} \right] L_S(r_S^m). \tag{2.4}$$

If a deviation occurs, from the following period onward zero profits are realized, with the *loss* for the deviating bank amounting to the present value of the infinite stream of monopoly profits in (2.3) discounted for one more period:

$$\beta V_i^m. \tag{2.5}$$

Fully collusive, monopoly pricing is sustainable in each state when $\beta V_i^m \geqslant \Pi_{-i}^S(r_S^m)$. Since, for each bank profits are higher in the high-demand state, we have $\Pi_{-i}^H(r_H^m) > \Pi_{-i}^L(r_L^m)$, and the condition for implicit collusion reduces to

$$\beta V_i^m \geqslant \Pi_{-i}^H(r_H^m). \tag{2.6}$$

From (2.3) and (2.4) we get the following condition on the discount factor β:

$$\beta \geqslant 1 \bigg/ \left(1 + \frac{\phi_i}{2(1-\phi_i)} \frac{\Pi^H(r_H^m) + \Pi^L(r_L^m)}{\Pi^H(r_H^m)} \right) \equiv \bar{\beta}, \tag{2.7}$$

where $\Pi^S(r_S^m) = \left[p_S(1+r_S^m) - ((1+i)/(1-\rho)) \right] L_S(r_S^m)$, with $S = \{H, L\}$, denote aggregate profits at monopoly rates. The value of $\bar{\beta}$ is critical for the following discussion. If the discount factor β is greater than $\bar{\beta}$, no bank will have an incentive to undercut on the monopoly loan rate r_H^m. Thus, high values of $\bar{\beta}$ make implicit collusion on monopoly loan rates less likely.

The following proposition characterizes the possible cases generated by the model.

Proposition 1. *According to the value of the discount factor* β, *it will hold that*:
(i) *for values of the discount factor* β *such that* $\beta < 1 - \phi_i$, *banks will set the loan rate at the competitive* (*zero-profit*) *level*;
(ii) *when* $\beta \geqslant \bar{\beta}$, *loan rates are set at the monopoly level*;
(iii) *The Rotemberg–Saloner case. When* $1 - \phi_i \leqslant \beta < \bar{\beta}$, *full collusion cannot be sustained in the high-demand state. In this case*, *it holds that* $r_L = r_L^m$ *and* $r_H = r_H^*$, *where* r_H^* *solves the following equation*:

$$\beta = 1 \bigg/ \left(1 + \frac{\phi_i}{2(1-\phi_i)} \frac{\Pi^H(r_H^*) + \Pi^L(r_L^m)}{\Pi^H(r_H^*)}\right) \equiv \beta^*. \tag{2.8}$$

Proof. See Appendix A.

In what follows, we concentrate on case (iii) of Proposition 1 above. In this case, in the low-demand situation the loan rate r_L is fixed at the corresponding monopoly level, r_L^m, whereas in the high-demand state, the chosen rate must be lower than the monopoly rate r_H^m, to reduce the potential gains from deviation and sustain collusion as an equilibrium outcome. Therefore the main conclusion of Rotemberg and Saloner (1986) and Tirole (1988) on the lesser degree of collusion (profits lower than the monopoly level) during periods of "booms" (captured here by a high loan demand) is re-established in our framework.

Note also that the lower ϕ_i (with $0 < \phi_i < \frac{1}{2}$) the higher $\bar{\beta}$: collusion is more difficult to sustain in equilibrium when (at least) one bank has a very small market share. In other words, the smallest bank (which is, the bank with the smallest market share when all banks set the same credit rate) tends to behave more aggressively, since it has much to gain from undercutting. This notion is particularly relevant when drawing inferences on the relation between market concentration and collusion. According to common wisdom, a high degree of concentration (as measured by the C4 or by the Herfindal Index) will make collusion easier to attain. Our analysis shows that this may not be the case: implicit collusion may be easier to sustain when banks are of roughly equal size, and the Herfindal Index tends to be quite low (see Dutta and Madhavan, 1997). Moreover, our model also suggests that the impact of greater competition might be particularly strong when important foreign institutions, such as the Deutsche Bank, or the AMRO, enter a local credit market, in which they possess a very small market share. [3]

[3] Our model does not consider forms of external finance other than bank loans. However, many observers (see, e.g., Dornbusch et al., 1998, p. 50, and De Bandt and Davis, 1998) argue that European banks will face increasing competition from non-bank specialised institutions and, in particular, from market-issued securities (such as commercial paper, bonds and equity), providing alternative forms of finance to an increasing number of agents. In our framework, the existence of non-bank external financing would set an upper limit to the loan rate on which banks may collude.

2.1. Entry and market-niches

Suppose that all banks have the same market share: $\phi_j = 1/N$ for all j. The effects of a larger number of competitors, N, may be shown as follows.

In the Rotemberg–Saloner case the loan rate prevailing in high-demand states, r_H^*, solves the following equation:

$$\beta = 1 \Big/ \left(1 + \frac{1}{2(N-1)} \frac{\Pi^H(r_H^*) + \Pi^L(r_L^m)}{\Pi^H(r_H^*)}\right). \tag{2.9}$$

Given $r_L = r_L^m$, a higher N implies a smaller value of the profits accruing to any individual bank in high-demand states. In order to offset the stronger incentive to deviate, a lower value of r_H^* is needed for an implicit collusion equilibrium. Thus, a larger number of competing banks will lower the equilibrium rate on loans in high-demand states.

Thus, our results support the view that the EMU – by boosting entry of foreign (e.g., German) banks in national (e.g., French or Italian) credit markets – is likely to reduce interest-rate margins across Europe. For example, De Bandt and Davis (1998) argue the EMU will generate increased inter-bank competition, making oligopolistic cartels more difficult to sustain. Thus, the EMU should reinforce the trend towards a more competitive environment in commercial banking that Hasan and Weill (1998) detect for France, Germany and Italy.

The higher levels of competition in the banking sector that are commonly associated to the EMU must however be confronted with the possible existence of barriers to entry. In this perspective, the model can be extended to analyse both the equilibrium number of banks in the credit market and the existence of market niches.

As observed by Dutta and Madhavan (1997), market niches exist in securities markets like the Nasdaq in the form of "preferencing", when some orders are directed by brokers to preferred dealers. Such behaviour reduces dealers' ability to attract customers through price competition. Mechanisms that restrict interest rate competition may also arise in the banking industry. This is the case, for example, when some banks have monopoly power in niches like local credit markets, or when they attract customers by offering services other than loans, such as auditing, consultancy, etc.

Suppose that a fraction $\theta > 0$ of the aggregate loan demand goes to a group of X banks ($X \leqslant N$). Each bank in this group gets a fraction $\theta_x > 0$, where $\sum_x \theta_x = \theta$, and will enjoy strictly positive profits on the share of the market, θ_x, it controls. The remaining portion of the loan demand, $1 - \theta$, is shared equally among all the N competitors. Of course, the case with $\theta = 0$ implies that no market niches exist and corresponds to the model analysed above.

If the number of banks in the market is given, it is straightforward to show that market niches have no implications on the equilibrium loan rates. However, the existence of niches can affect the price of loans when the number of banks is endogenously determined.

Suppose that each bank must incur a fixed cost $c > 0$ to enter the credit market. Entry will occur as long as the following zero-profit condition is fulfilled:

$$V_j^* \equiv V_j(r_L^m, r_H^*, N) = \sum_{t=0}^{\infty} \beta^t \left(\frac{\Pi_j^H(r_H^*) + \Pi_j^L(r_L^m)}{2} \right) = \frac{1}{1-\beta} \frac{1-\theta}{N} \left(\frac{\Pi^H(r_H^*) + \Pi^L(r_L^m)}{2} \right) = c, \tag{2.10}$$

where V_j^* is bank j's discounted stream of expected profits, calculated at the equilibrium loan rates. We claim the following proposition.

Proposition 2. *The higher the entry cost* c, *the lower the equilibrium number of banks in the market, and the higher the loan rate* r_H^* *on which banks implicitly collude in high-demand states.*

Proof. See Appendix A.

The importance of market niches, as measured by θ, has relevant effects on how banks price loans in the contestable share $(1 - \theta)$ of the market. In particular:

Proposition 3. *The larger* θ, *the higher the equilibrium market rate on loans in high-demand states,* r_H^*.

As for a higher N, an increase in θ *will reduce* V_j^*. Since it holds that $V_j^* = c$, a larger θ implies that N^* must be lower. Intuitively, the existence of market niches reduces the size of the market on which all banks can compete, making entry less attractive. For this reason, the existence of market niches in national credit markets may limit the competitive effects of the EMU.

We can now analyse the interactions between banks' pricing policy and monetary policy conduct.

3. The role of monetary policy

Competition in the credit market has a very special feature. The credit market environment is influenced by the actions undertaken by the Central

Bank. We provide a stylised analysis of how monetary policy decisions can influence banks' incentive to collude, [4] by explicitly considering the effect of the monetary policy rule, setting the short-term interest rate i, on banks' behaviour. Some possible implications for the effects of the ECB on national credit markets are then derived.

A general specification of monetary policy can be given by the following interest rate-setting rule:

$$i = \bar{i}\,(1 + \alpha D) + \varepsilon, \quad D = \begin{cases} -1 & \text{if} \quad S = L, \\ 1 & \text{if} \quad S = H. \end{cases} \tag{3.1}$$

According to (3.1) the monetary authorities may set the short-run interest rate countercyclically, raising the rate to $\bar{i}(1 + \alpha)$, with $\alpha \geqslant 0$, during periods of high loan demand, whereas if a low-demand state occurs the rate is lowered to $\bar{i}(1 - \alpha)$. Moreover, a random element ε (independently and identically distributed, with mean zero and variance σ_ε^2) is introduced in the determination of the interest rate, to account for unanticipated actions which deviate from the rule. We examine two polar cases: (i) a purely "random" monetary policy ($\alpha = 0$), and (ii) a non-stochastic countercyclical interest rate rule ($\alpha > 0$ and $\varepsilon \equiv 0$).

As we noted in Section 2, the EMU is likely to have strong effects on the competitive structure of national (i.e., local) credit markets. However, the consequences on competition in local credit markets following the switch from national Central Banks to ECB's monetary policy management are neglected in the literature.

As remarked by Dornbusch et al. (1998), "the model of the past decade was straightforward: Germany set its own monetary policy on the basis of German inflation and unemployment rates. The connection to the rest of Europe was provided by the EMS. The various partner countries within the context of the EMS had to translate German monetary policy rules into domestic monetary measures so as to be compatible with maintenance of the exchange rate margins". As a consequence, "Germany made its own policy and the rest scrambled along. By and large, in building a German reaction function, European (ex-Germany) conditions had no significance. By contrast, say in France, German variables would do better in explaining monetary policy than French conditions. Europe was on the Bundesbank standard. In an EMU setting, joint

[4] A similar idea has been advanced by Cottarelli and Kourelis (1994), who argue that the Central Bank can act as a leader in oligopolistic credit markets by signalling changes in the stance of monetary policy through the administered discount rate.

decision making with an eye on European targets changes the process dramatically'' (Dornbusch et al., 1998, pp. 20–21). [5]

We now look at the effects of alternative policy rules on bank collusion and draw some possible implications of the EMU.

3.1. Purely stochastic interest rate setting

Assuming $\alpha = 0$, the interest rate rule (3.1) reduces to: $i = \bar{i} + \varepsilon$. In every period, each bank chooses the profit-maximizing loan rate after observing both the state of loan demand *and* the realization of the policy rate $\bar{i} + \varepsilon$. Therefore, the gains from deviation, in a given period, depend upon the observed value of the short-term rate, whereas future losses depend upon the expected interest rate. When ε is independently distributed in each period, $E(i) = \bar{i}$. Since in our setup the incentive to deviate is stronger for the bank with the smallest market share ϕ_i, we can express the condition for sustainability of the implicit collusive equilibrium with reference to the ''smallest'' competitor in the market.

Proposition 4. *A deviation* $\varepsilon > 0$ *from the average policy rate* $\bar{i}$ *implies that*:
(i) *banks are more likely to collude on monopoly rates*, *which is* $\mathrm{d}\bar{\beta}(\varepsilon)/\mathrm{d}\varepsilon < 0$;
(ii) *in the Rotemberg–Saloner case*, *the implicit-collusion equilibrium rate* r_H^* *is higher*, *that is* $\mathrm{d}r_H^*/\mathrm{d}\varepsilon > 0$.

Proof. See Appendix A.

A random increase in the current policy rate reduces the bank's gain from setting a lower loan rate, leaving the future losses from deviation unaffected. This results in a lower critical value for β, making collusion at the monopoly rate more likely. In other words, a (transitory) increase in market rates will increase the cost of raising funds for the banks, and reduce credit-market profitability. In general, the gain from undercutting will decrease, and favour collusive behaviour on higher loan rates.

This conclusion implies that, under a fixed exchange rate regime, a country-specific disturbance may have spillovers on other member countries. Consider, for instance, what happened with the German Unification shock under the EMS (see Dornbusch et al., 1998), which forced an increase of French rates to defend the French Franc parity. Our model can represent the consequences of German Unification on the French credit market through a sudden increase of ε, which tends per se to increase collusion among banks. The standard effect

[5] This issue is also emphasised in Clarida et al. (1998). They show that under the ERM, the central banks of France, Italy and UK closely followed the moves of the Bundesbank.

of higher interest rates thus might have been made stronger by another effect on credit rates, induced by higher collusion. European countries should be more protected from German-specific disturbances with the introduction of the Euro.

3.2. A countercyclical interest rate rule

We now consider the case of a countercyclical interest rate rule, whereby the monetary authorities react to a high (low) loan demand with a high (low) policy rate. For analytical simplicity, we neglect the random component, setting $\varepsilon \equiv 0$.

We concentrate on the no-deviation constraint in the high-demand state since the level of profits in the high-demand state is assumed to be higher than that in the low-demand state, when a lower policy rate is set. Thus, $\Pi^H\left(r_H^m, \bar{i}(1+\alpha)\right) > \Pi^L\left(r_L^m, \bar{i}(1-\alpha)\right)$. Under this condition, the following holds:

Proposition 5. *An increase in the degree of monetary policy countercyclicality* α, *has the following implications*:

(i) *banks are more likely to collude on monopoly rates, which is* $\mathrm{d}\bar{\beta}(\alpha)/\mathrm{d}\alpha < 0$;

(ii) *in the Rotemberg–Saloner case, the implicit-collusion equilibrium rate* r_H^* *is higher, that is* $\mathrm{d}r_H^*/\mathrm{d}\alpha > 0$.

Proof. See Appendix A.

An increase in α reduces the gains from deviation since profits in the high-demand state are lower. The losses from deviation are also affected: profits are lower in the high-demand state but higher in the low-demand state. This combined effect implies that collusion at monopoly rates can be sustained for a smaller β. In other words, a larger feedback coefficient implies that the positive effect on banks' profits due to outward shifts in the loan demand during booms will be (partly) offset by higher costs of fund-raising. Hence, the Central Bank's policy reaction reduces the incentive to undercut on loan rates and facilitates collusion among banks.

The shift in the conduct of monetary policy in Europe before and after the EMU can bear relevant implications for banks' competition in local oligopolistic markets. Let us consider first the pre-EMU phase. If we look at the German credit market, banks faced a monetary policy rule which heavily reacted to German conditions. In terms of our stylised policy-rule (3.1), the feedback coefficient α for Germany was relatively high. This fact, per se, may have further encouraged collusion among banks. On the other side, the Banque de France (say) had to adapt to the Bundesbank's reactions to German shocks. Thus, French monetary policy was quite unrelated to French-specific shocks.

Put in another way, the coefficient α relative to the Banque de France's monetary rule was smaller than the German one. This, per se, might have favoured a more aggressive behaviour on behalf of banks operating in the French credit market.

The passage to the EMU is bound to have relevant consequences. As Dornbusch et al. put it: "A stylized view of the change from EMS to EMU is that it will leave the economic structure equations essentially unaltered, but will change the reaction functions, replacing the entire set of previous reaction functions with a single reaction function, describing how the single interest rate is (optimally) set given anticipated deviations of EMU inflation, EMU output and the (external) EMU exchange rate from their target levels. Both the expected levels and targets are expressed as EMU averages using GDP weights" (Dornbusch et al., 1998, p. 31). In this perspective, a German-specific shock under the EMU will induce a lesser impact on the ECB policy rate, while a non-German specific shock will generate an ECB reaction greater than under the EMS. Thus, the shift to the ECB policy management will not have a uniform effect on local credit market conditions. For Germany, the passage from the Bundesbank to the ECB entails, in our model, a lower feedback coefficient α: this is likely to reduce the ability to collude in the German credit market, reinforcing the microeconomic effects of a more competitive environment. For the other EMU members, the effects of the passage to ECB are more varied. On the one hand, countries such as France will suffer less interest rate variability from external conditions than before (smaller ε). Further, they will also experience a larger ECB responsiveness to their local shocks than under the EMS (α will be calibrated as to respond to "average" economic conditions of the Union), which, however, implies – according to Proposition 5 – greater ability to collude on local credit markets.

The possibility that the ECB will be slightly more tolerant towards inflation than the Bundesbank has been advanced by many Euro-skeptical observers. Under certain conditions, we can show that a permanent decrease in $\bar{i}$ for a given α can make collusion easier to sustain for European banks. A sufficient condition for a decrease in the average rate to make collusion easier to sustain, is the following:

$$\frac{1+r_H^m}{1+r_L^m} > \frac{1+\alpha}{1-\alpha}\frac{p_L}{p_H}.$$

When α is sufficiently low (in the limit, $\alpha = 0$) the above condition is satisfied, since $p_H > p_L$ and $r_H^m > r_L^m$: thus $\mathrm{d}\bar{\beta}/\mathrm{d}\bar{i} > 0$.

In conclusion, the choice of the monetary rule adopted by the Central Bank can have relevant consequences on the collusion in oligopolistic credit markets. Our approach shows that the policy criteria that will be chosen by the ECB are likely to have a relevant effect on the banking system. The design of an "optimal policy rule'' should perhaps be reconsidered to capture also the effects on banks' interest rate margins.

4. Conclusions

It is commonly believed that the introduction of the Euro will force an increase in competition in the banking sector. Domestic banks will lose the shelter of the national currency from international competition. The possible macroeconomic consequences have been neglected, probably under the presumption that the passage from the Bundesbank to the ECB would not affect the market structure.

In this paper, we have shown that the type of monetary policy rule chosen by the monetary authorities tends to affect the degree of competitiveness in oligopolistic banking sectors. For this reason, monetary policy criteria that are designed to achieve some desired macroeconomic target may results in a ``softer'', or ``tougher'', credit-market competition.

This simple idea may have relevant implication for the EMU. The shift from the EMS to the EMU is likely to have relevant- and varied-effects on the German and other European credit markets. There is a trade-off between conducting monetary policy and banking competition. The loss in the monetary leadership for Germany is ``compensated'' by increased competition of the German banking sector. A prediction of our model thus is that German banks might experience a comparatively larger increase in efficiency than their European counterparts.

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Appendix A

Proof of Proposition 1. The ratio $(\Pi^H(r_H^m) + \Pi^L(r_L^m)/\Pi^H(r_H^m))$ ranges in the interval $[1,2]$ and depends on all parameters of the model and on the shape of the loan demand function. Consequently, $\bar{\beta}$ can range from $1-\phi_i$ to $(2-2\phi_i)/(2-\phi_i)$. We have three cases:

(i) When $\beta < 1-\phi_i$ condition (2.6) can never be fulfilled and monopoly pricing cannot be sustained as an implicit collusion outcome in the high-demand state. Sustainable rates must satisfy the condition

$$\beta V_i \geqslant (1-\phi_i)\Pi^S \tag{A.1}$$

for $S = H, L$. This condition is always satisfied when the the loan rates r_L and r_H are set to their competitive levels, implying that $\Pi^H = \Pi^L = 0$.

In the high-demand state, the equilibrium loan rate solves the following equation:

$$\beta = 1 \Big/ \left(1 + \frac{1-\phi_i}{2(1-\phi_i)} \frac{\Pi^H + \Pi^L}{\Pi^H}\right),$$

which implies

$$\frac{\beta}{1-\phi_i}\left[1 - \frac{\phi_i}{2}\left(1 - \frac{\Pi^L}{\Pi^H}\right)\right] = 1.$$

Since $\beta/(1-\phi_i) < 1$, the equation above requires that the equilibrium rates are such that the condition $\Pi^L > \Pi^H$ holds. By contrast, in the low-demand states, the equilibrium rate solves the following:

$$\beta = 1 \Big/ \left(1 + \frac{1-\phi_i}{2(1-\phi_i)} \frac{\Pi^H + \Pi^L}{\Pi^L}\right),$$

which implies

$$\frac{\beta}{1-\phi_i}\left[1 - \frac{\phi_i}{2}\left(1 - \frac{\Pi^H}{\Pi^L}\right)\right] = 1,$$

that can be fulfilled only if the condition $\Pi^L < \Pi^H$ holds. Therefore, any couple of loan rates (r_L, r_H) such that $\Pi_L \neq \Pi_H$ implies a contradiction. Let us now consider the case of $\Pi^L = \Pi^H$. If $\Pi^L = \Pi^H > 0$, then $\beta = 1 - \phi_i$, contradicting our initial assumption. Therefore, only perfectly competitive pricing ($\Pi^L = \Pi^H = 0$) guarantees that the incentive constraints are met in both demand states.

(ii) When $\beta \geqslant \bar{\beta}$, condition (2.6) is always fulfilled, and loan rates are set at the monopoly level.

(iii) When $1 - \phi_i \leqslant \beta < \bar{\beta}$, condition (2.7) is not satisfied. Thus, the monopoly rate r_H^* cannot be sustained as an implicit-collusion outcome in the high-demand state. The equilibrium rate r_H^*, with $r_H^* < r_H^m$, will be the highest loan rate at which collusion can be sustained. Thus, r_H^* must be such to satisfy condition (A.1). The rate r_H^* implicitly solves the following:

$$\phi_i \frac{\beta}{1-\beta} \frac{\Pi^H(r_H^*) + \Pi^L(r_L^m)}{\Pi^H(r_H^*)} = (1-\phi_i)\Pi^H(r_H^*). \tag{A.2}$$

In the low-demand state, the condition to be met for collusion at the monopoly rate r_L^m to be sustainable is, given $r_H = r_H^*$:

$$\beta \geqslant 1 \Big/ \left(1 + \frac{1-\phi_i}{2(1-\phi_i)} \frac{\Pi^H(r_H^*) + \Pi^L(r_L^m)}{\Pi^L(r_L^m)}\right). \tag{A.3}$$

Combining (A.2) and (A.3) yields the following condition:

$$\frac{\beta}{1-\phi_i} \geqslant \frac{A}{A+B},$$

where $A \equiv 2(1-\phi_i) - \beta(2-\phi_i) > 0$ (since $\beta > \bar{\beta}$) and $B \equiv \phi_i(\beta - (1-\phi_i)) \geqslant 0$. This condition is satisfied since $\beta/(1-\phi_i) \geqslant 1$ and $A/(A+B) \leqslant 1$.

Proof of Proposition 2. The equilibrium rate in high-demand states, r_H^*, is determined by the following condition:

$$\beta = 1 \Big/ \left(1 + \frac{1-\theta}{2(N-1)} \left(1 + \frac{\Pi^L(r_L^m)}{\Pi^H(r_H^*)}\right)\right). \tag{A.4}$$

For any $r_H^* < r_H^m$, it holds that $(\partial \Pi(r_H^*))/(\partial r_H^*) > 0$. Thus, the respect of condition (A.4) above requires that an increase in N reduces r_H^*. Therefore, it holds that $(\partial r_H^*)/(\partial N) < 0$. This effect reduces aggregate profits in high-demand states. Moreover, with more banks in the market, the share of aggregate profit accruing to each individual bank is smaller in both states. Therefore, bank j's discounted value of expected profits depends negatively upon the number of banks: $\mathrm{d}V_j^*/\mathrm{d}N < 0$. Consequently, when the entry cost c increases, the respect of the no-entry condition (2.10) requires that the equilibrium number of banks N^* be smaller.

Proof of Proposition 4. (i) For the monopoly pricing strategy to be a sustainable equilibrium, the following constraint must hold in each state S:

$$(1-\phi_i)\,\Pi^S(r_S^m, \bar{i} + \varepsilon) \leqslant \frac{\beta}{1-\beta}\,\phi_i\,\frac{\Pi^H(r_H^m, \bar{i}) + \Pi^L(r_L^m, \bar{i})}{2}. \tag{A.5}$$

Since, for the observed policy rate, the bank's profits are higher in the high-demand state, we can concentrate on the case $S = H$ and derive the critical value of β in this case. Rearranging (A.5) with $S = H$ we find that collusion at the monopoly price is sustainable if:

$$\beta \geqslant 1 \Big/ \left(1 + \frac{\phi_i}{2(1-\phi_i)} \frac{\Pi^H(r_H^m, \bar{i}) + \Pi^L(r_L^m, \bar{i})}{\Pi^H(r_H^m, \bar{i} + \varepsilon)}\right) \equiv \bar{\beta}(\varepsilon). \tag{A.6}$$

The current level of the policy rate is now crucial in determining the range of β for which the collusive equilibrium is sustainable in the high-demand state. From (A.6) we have: $\mathrm{d}\bar{\beta}(\varepsilon)/\mathrm{d}\varepsilon < 0$.

(ii) When $\beta < \bar{\beta}(\varepsilon)$, the equilibrium loan rate in the high-demand state $\tilde{r}_H^*$ solves the following equation:

$$\beta = 1 \Bigg/ \left(1 + \frac{\phi_i}{2(1-\phi_i)} \frac{\Pi^H(r_H^*, \bar{i}) + \Pi^L(r_L^m, \bar{i})}{\Pi^H(\tilde{r}_H^*, \bar{i} + \varepsilon)}\right) \equiv \beta^*(\varepsilon), \tag{A.7}$$

where r_H^* denotes the highest sustainable rate when $E(\varepsilon) = 0$. Since $(\partial \Pi^H(\tilde{r}_H^*, \bar{i} + \varepsilon)/\partial\varepsilon) < 0$ and $(\partial \Pi^H(\tilde{r}_H^*, \bar{i} + \varepsilon)/\partial\tilde{r}_H^*) > 0$, an increase in ε requires an increase in $\tilde{r}_H^*$ in order to satisfy (A.7): $\mathrm{d}\tilde{r}_H^*/\mathrm{d}\varepsilon > 0$.

Proof of Proposition 5. (i) The relevant constraint in the high-demand state is

$$(1-\phi_i)\,\Pi^H\Big(r_H^m, \bar{i}(1+\alpha)\Big) \leqslant \frac{\beta}{1-\beta}\,\phi_i\,\frac{\Pi^H\Big(r_H^m, \bar{i}(1+\alpha)\Big) + \Pi^L\Big(r_L^m, \bar{i}(1-\alpha)\Big)}{2}$$

from which

$$\beta \geqslant 1 \Bigg/ \left(1 + \frac{\phi_i}{2(1-\phi_i)}\left(1 + \frac{\Pi^L\Big(r_L^m, \bar{i}(1-\alpha)\Big)}{\Pi^H\Big(r_H^m, \bar{i}(1+\alpha)\Big)}\right)\right) \equiv \bar{\beta}(\alpha). \tag{A.8}$$

By the envelope theorem, it holds that $(\mathrm{d}\,\Pi^L\big(r_L^m, \bar{i}(1-\alpha)\big)/\mathrm{d}\,\alpha) > 0$ and $(\mathrm{d}\,\Pi^H\big(r_H^m, \bar{i}(1+\alpha)\big)/\mathrm{d}\,\alpha) < 0$. It follows that $(\mathrm{d}\bar{\beta}(\alpha)/\mathrm{d}\alpha) < 0$.

(ii) When $\beta < \bar{\beta}(\varepsilon)$, the equilibrium loan rate in the high-demand state r_H^* solves the following equation:

$$\beta = 1 \Bigg/ \left(1 + \frac{\phi_i}{2(1-\phi_i)}\left(1 + \frac{\Pi^L\Big(r_L^m, \bar{i}(1-\alpha)\Big)}{\Pi^H\Big(r_H^*, \bar{i}(1+\alpha)\Big)}\right)\right) \equiv \beta^*(\alpha). \tag{A.9}$$

Since $(\mathrm{d}\,\Pi^L\big(r_L^m, \bar{i}(1-\alpha)\big)/\mathrm{d}\alpha) > 0$ (by the envelope theorem) and $(\partial\,\Pi^H\big(r_H^*, \bar{i}(1+\alpha)\big)/\partial\,\alpha) < 0$, an increase in α requires an increase in r_H^* in order to satisfy (A.9): $(\mathrm{d}r_H^*/\mathrm{d}\alpha) > 0$.

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