Pricing and Dividend Policies in Open Credit Cooperatives

by

William R. Emmons and Frank A. Schmid *

This paper develops a model of pricing and dividend policies in open credit cooperatives (i.e., those doing member and nonmember business). For a fixed distribution of member preferences, the larger the fraction of business done by members, the smaller the optimal dividend and the larger the optimal pricing subsidy. For a fixed fraction of member business, the greater the skewness of member preferences toward loan (deposit) business with the credit cooperative, the larger the optimal dividend and the higher (lower) the optimal loan (deposit) interest rate. Aggregate empirical evidence from the German cooperative banking sector supports a version of the latter prediction. (JEL: G 21, G 32, L 31)

1 *Introduction*

A credit cooperative has three channels for allocating benefits to its members: (high) deposit interest rates, (low) loan interest rates, and dividends. This paper develops an integrated model of pricing and dividend policies in open credit cooperatives, those that do business with members and nonmembers alike on a nondiscriminatory basis. The model highlights two conflicting incentives inherent in an open cooperative's governance structure: pricing policy and dividend policy. First, as users of financial services (depositors or borrowers), members want to deal with the cooperative on favorable terms. However, lenders to and borrowers from the cooperative have diametrically opposed and irreconcileable pricing preferences. Second, as owners of the cooperative, members want to maximize profit in order to pay out dividends to themselves. However, higher profits require unfavorable prices for depositors or borrowers, or both.

Although some credit cooperatives, such as U.S. credit unions, exclude nonmembers, many other types, such as German cooperative banks, welcome nonmember business. Terms are identical for members and nonmembers in the latter case, because the cost of differentiating prices based on membership status is too high (Grosskopf [1990, p. 41]).

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This paper develops an integrated model of pricing and dividend policies in an open credit cooperative. We show that it is not sufficient to know the preferences of the median cooperative member; in fact, both the fraction of business that is done with nonmembers and the size of the controlling group of members turn out to be critical parameters.

Our first main result is that, the larger the proportion of the cooperative's business that is done with members, the stronger is the cooperative's incentive to provide favorable terms for financial services. This holds regardless of the distribution of member preferences (i.e., borrower dominance or depositor dominance). Our second main result is that, the larger the controlling member group's majority, the stronger is the cooperative's incentive to maximize profit, even though this means unfavorable prices for financial services. This holds regardless of the proportion of business that is done with nonmembers.

Empirical evidence supporting the model's predictions comes from the German cooperative banking sector during the period 1981–1997. Our model predicts that, in an increasingly depositor-dominated open credit cooperative, average deposit rates and dividend payout rates will be negatively correlated. This is precisely what we find for the German cooperative banking sector (primary banks only – that is, the lowest tier in the cooperative-banking sector, comprising retail institutions only). We provide some indirect evidence that German cooperative banks have became more depositor-dominated as time passed.

Section 2 provides a brief overview of the literature on credit cooperatives with special reference to German cooperative banks. Section 3 introduces the model and applies it to the case of a borrower-dominated membership, as was true of the early history of virtually all credit cooperatives. Moreover, it extends the analysis to the case of a depositor-dominated membership, as the German cooperative banking sector have become. Section 4 outlines our empirical strategy and discusses our results. Section 5 concludes.

2 *Theory and Practice of Open Credit Cooperatives*

Our review of the literature focuses on three strands of research related to open credit cooperatives: (1) the pure theory of credit cooperatives, (2) mutual depository institutions in the United States, and (3) the German cooperative banking sector.

2.1 The Pure Theory of Credit Cooperatives

A few recent papers explore the theoretical foundations of credit cooperatives. BESLEY, COATE, AND LOURY [1993] examine the sustainability and allocation rules in rotating saving and credit associations, a common form of rudimentary credit cooperative found all around the world. HART AND MOORE [1996], [1998] study decision-making in consumer cooperatives generally, but their analysis is relevant also for credit cooperatives. They highlight the possibility of cooperative decision-making resulting either in "inefficient inclusion" or "inefficient exclusion." HART AND MOORE [1998] also provide an analysis of dividend-paying cooperatives. Finally, CANNING, JEFFERSON, AND SPENCER [1999] examine optimal pricing policies in not-for-profit financial institutions.

The models in all of the papers noted above are kept simple in order to illuminate several basic tensions and trade-offs in cooperatives. Unfortunately, the range of testable hypotheses they generate is limited because the models abstract from a great deal of institutional detail such as differing levels of majority control, nonmember business activity, and payment of nontrivial dividends to members.

2.2 Research on Mutual Depository Institutions in the United States

Many different institutional types of depository institutions exist in the United States, including credit unions, mutual savings banks, and mutual savings and loan associations (SHAY [1992]). Research interest has been strongest in the credit-union movement. Indeed, the one-member, one-vote governance structure of credit unions makes them an interesting case. Much of the focus of academic research on credit unions, however, has aimed to show that in fact credit unions are *not* all that different from other banks. Similarities exist in terms of scale economies, managerial agency problems, and a nascent profit motive (TAYLOR [1971]; FLANNERY [1974]; SMITH, CARGILL, AND MEYER [1981]; SMITH [1984], [1986]; PATIN AND MCNEIL [1991]; EMMONS AND SCHMID [1999]).

An important distinguishing feature of credit unions for our purposes is their members-only business policy. As a consequence, very little of the research on credit unions can be applied directly to open credit cooperatives. Also in contrast to the German cooperative banks we highlight, U.S. credit unions pay only a trivial member dividend, if any, out of operating surplus. Instead, benefits are distributed primarily through the interest rates charged on loans and deposits. One implication of these differences is that, while a median-voter model is appropriate for credit unions because decisions about distributing surplus are relatively straightforward, it is not appropriate for open credit cooperatives that pay nontrivial dividends.

2.3 Studies of the German Cooperative Banking Sector

The cooperative banking sector in Germany has a long and rich history (BONUS AND SCHMIDT [1990], ASCHHOFF AND HENNINGSEN [1996]). The primary (that is, local retail) cooperative banks and their associated regional and national financial institutions are significant competitors in the German financial landscape, having demonstrated flexibility in adapting their business practices to competitive challenges and changing member preferences (SELBACH [1991], EMMONS AND MUELLER [1998]). Economic analysis of German cooperative banks has been primarily institutional in nature (BONUS [1986], GROSSKOPF [1990], PAAßEN [1991]), while only a few papers have been empirical (GORTON AND SCHMID [1999]).

Research papers focused on the pure theory of credit cooperatives or on U.S. mutual institutions are ill-suited for studying the German cooperative banking sector. In addition to doing nonmember business, German cooperative banks pay significant dividends to members. In 1997, for example, German cooperative banks paid an average of 75 percent of their after-tax income as dividends, an amount equivalent to a 4 percent return on the book value of equity (capital plus reserves) at the end of the previous year (OECD [1999]). Furthermore, their dividend payout as a fraction of the balance-sheet total was nearly as high as that of the large commercial banks in Germany over our sample period (OECD [1992], [1999]).

3 Pricing and Dividend Policy in a Model of Open Credit Cooperatives

The model we examine is an extension of SMITH, CARGILL, AND MEYER [1981], who studied U.S. credit unions. We focus on an open credit cooperative (henceforth, a cooperative bank) with some degree of local market power. That is, the bank faces a downward-sloping demand curve for loans as well as an upward-sloping supply curve of deposits. These demand and supply curves include both members and nonmembers. The cooperative bank makes no distinction between the two groups when accepting deposits or making loans; this corresponds to the practice of German cooperative banks today (GROSSKOPF [1990, p. 43]).

3.1 The Model

The cooperative bank has two types of members, lenders (depositors) and borrowers (loan customers). We assume for simplicity that a cooperative member is either a lender or a borrower but not both. A member who simultaneously (or over time) lends to and borrows from the cooperative bank would be treated as two separate people. Furthermore, all borrowers are identical and all lenders are identical, except that some borrowers and some lenders are members while others are not.

In equilibrium, all members do business with the cooperative. The number and identity of members is fixed and known in advance. We let $\alpha (0 \leq \alpha \leq 1)$ denote the fraction of the membership that would like to borrow from the cooperative bank. Hence, a fraction $1 - \alpha$ of the members want to deposit money at the bank. For convenience, we define $\beta \equiv 1 - \alpha$. The cooperative bank has unlimited access to an interbank market for loans and deposits, both at the interest rate r, to square up its balance sheet. Individuals do not have access to the interbank market. For simplicity, we assume the bank faces no noninterest variable costs. All other costs are assumed to be fixed (or quasi-fixed in the sense that they can be changed only over time).

The cooperative bank chooses its deposit and loan interest rates and its operating profit according to the one-member, one-vote principle. The cooperative distributes its operating profit to its members as dividends, E.[1] The 100% payout assumption is

[1] We assume dividends exert no wealth effect on members' supply and demand functions.

not as restrictive as it may seem because our interest is in the steady-state behavior of cooperative banks, not the transitional dynamics that occur in response to shocks. A bank in steady state at its target capital ratio obviously will distribute all of its earnings.

We let $\kappa (0 < \kappa \leq 1)$ denote the fraction of the bank's borrowers that are members, while $\lambda (0 < \lambda \leq 1)$ is the fraction of depositors that are members. The cooperative bank faces linear loan-demand and deposit-supply curves which are as follows in indirect form:

$$p(x) = a - b \cdot x, \quad a, b > 0, \quad p, \frac{a-p}{b} \geq 0\,, \tag{1a}$$

$$q(y) = c + d \cdot y, \quad c, d > 0, \quad q, \frac{q-c}{d} \geq 0\,, \tag{1b}$$

where p and q denote the borrowing (loan) rate and the lending (deposit) rate, respectively; x and y are the amount of loans made and deposits accepted by the bank, respectively. We assume that the maximum rate a borrower will pay for a loan, a, exceeds the interbank rate, r, whereas the minimum rate a depositor will accept on a deposit, c, lies below the interbank rate.

3.2 A Borrower-Dominated Cooperative Bank

First assume that $\alpha > 1/2$, that is, the bank is borrower-dominated. This corresponds to the historical situation of many credit cooperatives, including the German cooperative banks. The fraction of loan business done with members is $\kappa (0 < \kappa \leq 1)$. A borrower-dominated cooperative bank solves the following optimization problem:

$$\max_{p,q,E} \left\{ \kappa \cdot x(p) \left(\frac{a-p}{2} \right) + \alpha \cdot E \right\} \tag{2a}$$

subject to

$$E = p \cdot x(p) - q \cdot y(q) + r \cdot [y(q) - x(p)]\,, \tag{2b}$$

$$p \geq q\,, \tag{2c}$$

$$E \geq 0\,, \tag{2d}$$

where $\alpha > 1/2$. The objective function is the sum of the member borrowers' surplus from obtaining credit at the cooperative and their share of the cooperative's operating profit that is distributed as a dividend. The borrowers' surplus is the integral between the loan demand curve and the borrowing rate, calculated over the total amount of loans. Only a fraction κ of this benefit created by lending is captured by member borrowers, the remainder going to nonmember borrowers. Likewise, only the fraction α of the cooperative's operating profit is paid to borrowing members, the remainder going to depositor members.

Constraint (2b) relates the cooperative's pricing policies to its operating profit, and hence to its dividend payout. The borrowing rate cannot fall below the deposit rate to rule out arbitrage, as (2c) shows. Finally, dividends must be nonnegative.

3.2.1 Interior Solution

The interior solutions of the optimization problem presented above (i.e., for $p > q \wedge E > 0$) are as follows:

$$p^*(\alpha, \kappa) = \frac{\kappa \cdot a - \alpha(a + r)}{\kappa - 2\alpha}, \quad \kappa \neq 2\alpha ; \tag{3a}$$

$$q^*(\alpha, \kappa) = \frac{r + c}{2} . \tag{3b}$$

We highlight the dependence (respectively, independence) of the cooperative bank's optimal pricing policies on the parameters of the model in anticipation of the comparative statics that provide the most important insights of our model. It is easy to show that, at an interior equilibrium, the optimal loan rate, p^*, is strictly *increasing* in the fraction of votes controlled by the borrowers, α. On the other hand, the optimal loan rate is strictly decreasing in the fraction of borrowers that are members, κ.[2] The optimal deposit rate, q^*, is invariant with respect to α and κ because the loan and deposit pricing decisions are separable by virtue of the bank's access to the interbank market. Therefore, a borrower-dominated credit cooperative utilizes its market power in the deposit market precisely as a profit-maximizing bank would, paying less than the interbank rate.

Notice that, for $\alpha = 1$ (all members are borrowers), the borrowing rate takes on its maximum value. For $\kappa = 1$ (all borrowers are members), the maximum loan rate equals the interbank rate, r. When $\kappa < 1$, the maximum borrowing rate is above the interbank rate.

The optimal dividend, E^*, is a residual from equation (2b), replacing $x(p^*)$ and $y(q^*)$:

$$E^*(\alpha, \kappa) = \frac{-(a - r)^2 \alpha \cdot (\kappa - \alpha)}{(\kappa - 2\alpha)^2 b} + \frac{(r - c)^2}{4d}, \kappa \neq 2\alpha . \tag{3c}$$

Focusing first on the interior solution ($p > q \wedge E > 0$), note that the cooperative bank's optimal dividend is strictly increasing in the fraction of votes controlled by members who are borrowers, α, while it is strictly decreasing in the fraction of borrowers who are members, κ.[3] In the limiting case in which the borrowers have all the votes, the dividend payout of the cooperative is simply the operating profit made on deposits, $(r - q)y = (r - c)^2/4d$.

As α decreases from above toward $1/2$, the borrowers prefer dividends less and loan subsidies more. The optimal borrowing rate, p^*, decreases, which leads to an increase in the amount of loans made by the bank, $x(p^*)$. Because the deposit rate, q^*, and the quantity of deposits, $y(q^*)$, are unaffected by the level of α, the bank's profit decreases as α decreases. Hence, the dividend also decreases. Mean-

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[2] These two statements are true if (and only if) $a - r > 0$, as assumed.

[3] These two statements are true if (and only if) $2\alpha - \kappa > 0$, a condition that always holds.

while, the bank's net supply of funds to the interbank market decreases (i.e., $y - x$ decreases).

3.2.2 Corner Solutions

For a sufficiently low value of $\alpha(\alpha > 1/2)$, the bank might reach a corner solution with either the borrowing rate equaling the deposit rate, $p = q$ (at $E \geq 0$), or with the dividend equalling zero, $E = 0$ (at $p \geq q$), or both. If in the course of a decline of α the borrowing rate reaches the deposit rate at a dividend level greater than zero, the dividend will remain at this level for further decreases in α. We define $\hat{\alpha}$ to be the fraction of voting rights controlled by the borrowers at which the bank enters this corner solution.

The value $\hat{\alpha}$ is an empty set if, as α declines, the dividend decreases to zero before the borrowing rate falls to the deposit rate. We define $\tilde{\alpha}$ to be the fraction of votes controlled by the borrowers at which the bank enters the corner solution of a zero dividend, $E = 0$, at a borrowing rate that is greater than or equal to the deposit rate, $p \geq q$. Except for the limiting case in which $\hat{\alpha}$ equals $\tilde{\alpha}$, only one corner solution can apply for a given set of parameters.

3.2.3 Empirical Implications

We conclude that, for $1/2 < \alpha < \tilde{\alpha}$, the cooperative bank's optimal dividend does not vary with α, but remains constant at zero. Similarly, for $1/2 < \alpha < \tilde{\alpha}$, the borrowing rate is independent of α and equals the deposit rate. Together with equations (3a)–(3c), which apply to the interior equilibrium, these considerations prove the following lemma.

Lemma 1: For $1/2 < \alpha \leq 1$ (borrower domination), an open credit cooperative's loan rate and dividend are increasing in α in the range $\max\{\tilde{\alpha}, \hat{\alpha}\} < \alpha < 1$, and are constant in the range $1/2 < \alpha < \max\{\tilde{\alpha}, \hat{\alpha}\} \leq 1$.

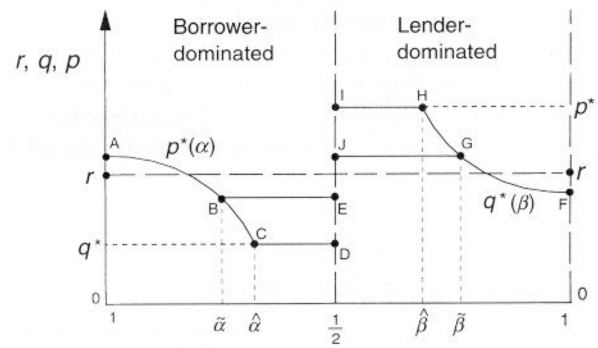
We now have the following testable proposition.

Proposition 1: For $1/2 < \alpha \leq 1$ (borrower domination), loan rates and dividends are positively correlated in the range $\max\{\tilde{\alpha}, \hat{\alpha}\} < \alpha < 1$, and are uncorrelated in the range $1/2 < \alpha < \max\{\tilde{\alpha}, \hat{\alpha}\} \leq 1$.

Proof: Follows immediately from Lemma 1.

Optimal borrowing and deposit rates set by a borrower-dominated cooperative bank are displayed in the left-hand side of Figure 1. The figure corresponds to parameter settings such that $\tilde{\alpha} > \hat{\alpha}, \kappa < 1$. If all members are borrowers ($\alpha = 1$; point A), the cooperative bank prices loans above the interbank rate ($p > r$) and pays a dividend ($E > 0$; not shown). As α decreases, the borrowing rate and the dividend decline. At point B ($\alpha = \tilde{\alpha}$), the dividend reaches zero and its nonnegativity constraint becomes binding. Further declines in α leave the borrowing rate unchanged because the nonnegativity constraint remains binding. If $\tilde{\alpha}$ were an empty set, i.e., if the nonnegativity constraint did not become binding before the decrease in α led the borrowing rate down to the deposit rate ($p = q$), the borrowing rate and the dividend would decline with α until point C is reached ($\alpha = \hat{\alpha}$).

Figure 1
Voting Distribution and Pricing of Financial Services



Note: The figure is a composite of two figures, each of which runs from 1/2 to 1 on the horizontal axis. The left half of the figure illustrates optimal loan (p) and deposit (q) rates when borrowers dominate the cooperative. The right half of the figure illustrates optimal loan (p) and deposit (q) rates when lenders dominate the cooperative. The interbank loan and deposit rate is r. The fraction of a cooperative bank's membership accounted for by borrowers is denoted α; this is shown on the horizontal axis in the left-hand side of the figure, where α runs from 1/2 at the dashed line in the center of the figure to 1 at the vertical axis at the left of the figure. The fraction of a cooperative bank's membership accounted for by lenders (depositors) is denoted β; this is shown on the horizontal axis in the right-hand side of the figure, where β runs from 1/2 at the dashed vertical line to 1 at the dashed vertical line at the right of the figure.

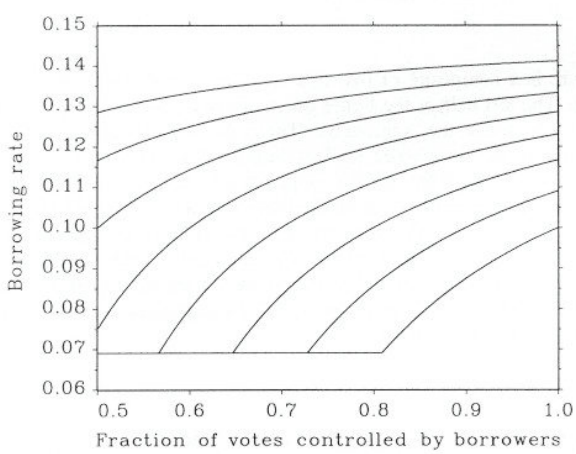
3.2.4 Output-Maximizing vs. Profit-Maximizing Incentives

Perhaps the most interesting – and counterintuitive – aspect of our discussion so far is that a borrower-dominated open credit cooperative optimally charges a higher loan rate, the larger is the borrowers' majority. There are two conflicting effects operating on the decision-making group, corresponding to the two parts of the borrowers' objective function. First, the output-maximizing incentive of the controlling group relates to the surplus they obtain in transacting with the cooperative; in this case, loans are more favorably priced than borrowers could obtain elsewhere. This would lead one to expect that a borrower majority might decrease the loan rate as the borrower majority increased. Pricing-related benefits are shared with nonmember borrowers, however, so there is an obvious inefficiency from the dominant group's perspective in delivering benefits this way.

The second incentive of the dominant group is to maximize the cooperative's operating profit so a larger dividend can be paid. This keeps benefits generated by the cooperative in the hands of members, but dividends must be shared with depositor members about whose welfare borrowers do not care. Yet, as the significance of depositor members dwindles, the profit-maximizing incentive of the dominant group at some point overpowers their output-maximizing incentive.

Holding the fraction of borrowers in the membership constant (α), variations in the fraction of the cooperative's lending business that is done with members (κ) also matter. Figure 2 shows the borrower-dominated open credit cooperative's optimal loan rate as a function of α for several values of κ. The uppermost line traces out, for increasing values of α, the optimal loan rate for the case in which only 30 percent of the borrowers are members ($\kappa = 0.3$). The line closest to the bottom of the figure shows the dependence of the optimal borrowing rate on a when all borrowers are members ($\kappa = 1$).

Figure 2
Nonmember Borrowers and Borrowing Rate

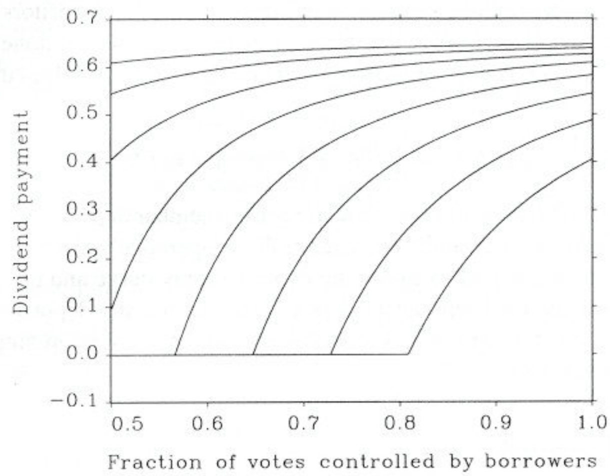


Note: The figure shows the cooperative's optimal loan (borrowing) rate for various combinations of α (fraction of members that are borrowers) and κ (fraction of lending business done with members) when the cooperative is controlled by borrowers $\alpha > 1/2$. The horizontal axis is α while the various curves in the figure correspond to different values of κ. The uppermost line in the figure is drawn for $\kappa = 0.3$. Moving downward in the figure, each subsequent curve is drawn for a value of κ that is 0.1 larger than in the previous curve, culminating with $\kappa = 1.0$. The lower bound at about 0.07 for the borrowing rate reflects the parameter combinations for which the nonnegativity constraint of the dividend becomes binding.

In general, as κ rises, the optimal borrowing rate decreases, holding all else constant. This is consistent with the intuition developed above that member borrowers

Figure 3

Nonmember Borrowers and Dividend Payment



Note: The figure shows the cooperative's optimal deposit payment for various combinations of α (fraction of members that are borrowers) and κ (fraction of lending business done with members) when the cooperative is controlled by borrowers ($\alpha > 1/2$). The horizontal axis is α while the various curves in the figure correspond to different values of κ. The uppermost line in the figure is drawn for $\kappa = 0.3$. Moving downward in the figure, each subsequent curve is drawn for a value of κ that is 0.1 larger than in the previous curve, culminating with $\kappa = 1.0$. The lower bound at zero reflects parameter combinations for which the nonnegativity constraint of the dividend becomes binding.

will channel an increasing proportion of the benefits they obtain from the cooperative bank into the form of borrowers' surplus, the less this leaks out to nonmembers. The higher κ, the more likely the cooperative will find itself in a corner solution in which the nonnegativity constraint of the dividend binds ($E = 0$; $\alpha = \tilde{\alpha}$). For the vector of values (a, b, c, d, r) chosen for Figure 2, the constraint $p \geq q$ never binds, which means that the floor under the borrowing rate exceeds the deposit rate.[4]

Figure 3 demonstrates how the optimal dividend is related to the fraction of votes held by borrowers, α, and to the fraction of borrowers that are members, κ. The same set of values for the vector (κ, a, b, c, d, r) was used to draw the figure. As in Figure 2, the uppermost line represents a case in which 30 percent of the borrowers are members ($\kappa = 0.3$), while the line nearest the bottom of the figure corresponds to the case in which all borrowers are members. As with the optimal loan rate in Figure 2, the optimal dividend decreases with an increase in κ.

[4] For Figure 2, we chose the following values: $\alpha = 0.2$; $b = c = 0.01$; $d = 0.005$; $r = 0.1$. Thus, the deposit rate, q, equals 0.055. The floor under the borrowing rate that results from the nonnegativity constraint of the dividend is approximately 0.069.

3.3 A Depositor-Dominated Cooperative Bank

This section examines a depositor-dominated cooperative bank ($\alpha < 1/2$). For notational simplicity, we replace the fraction of members that are depositors, $1-\alpha$, with the parameter $\beta (1/2 < \beta \leq 1)$. The fraction of deposit business done with members is $\lambda (0 < \lambda \leq 1)$. A depositor-dominated cooperative bank solves the following problem:

$$(4) \qquad \max_{p,q,E} \left\{ \lambda \cdot y(q) \left(\frac{q-c}{2} \right) + \beta \cdot E \right\} \quad \text{subject to (2b), (2c), (2d)},$$

where $\beta > 1/2$. The objective function comprises member depositors' surplus from lending to the cooperative and their share of the cooperative's dividend. The depositors' surplus is the integral between the deposit supply curve and the deposit rate, calculated over the total amount of deposits. As before, the depositor-dominated cooperative bank balances output-maximizing and profit-maximizing incentives subject to constraints.

3.3.1 Interior Solution

An interior solution to the depositor-dominated open credit cooperative's problem is:

$$(5a) \qquad p^*(\beta, \lambda) = \frac{a+r}{2},$$

$$(5b) \qquad q^*(\beta, \lambda) = \frac{\lambda c - \beta(c+r)}{\lambda - 2\beta}, \lambda \neq 2\beta.$$

The optimal borrowing rate, p^*, is independent of β and λ and lies above the interbank rate, r, because the depositor-dominated cooperative bank exercises its market power to the detriment of all borrowers, member and nonmember alike. Meanwhile, the optimal deposit rate, q^*, is strictly decreasing in the fraction of votes controlled by the lenders, β, and is strictly increasing in the fraction of lenders that are members, λ.[5] For $\beta = 1$ (all members are depositors), the deposit rate takes on its minimum value. For $\lambda = 1$ (all depositors are members), the minimum deposit rate equals the interbank rate r. For $\beta = 1$, the minimum deposit rate lies below the interbank rate.

As before, the optimal dividend, E^*, follows from equation (2b) for $x(p^*)$ and $y(q^*)$:[6]

$$(5c) \qquad E^*(\beta, \lambda) = \frac{-(c-r)^2 \beta(\lambda - \beta)}{(\lambda - 2\beta)^2 d} + \frac{(r-a)^2}{4b}, \lambda \neq 2\beta.$$

[5] These two statements are true if (and only if) $r - c > 0$, as assumed.

[6] As before, we assume the bank's choices of loan and deposit quantities follow directly from its choice of interest rates according to the demand and supply curves it faces. We rule out the possibility of separating the price- and quantity-setting decisions because this would introduce another level of complexity that does not add any insight to the problem analyzed here.

The dividend is strictly increasing in the fraction of depositors in the membership, β, and is strictly decreasing in the fraction of depositors that are members, λ.[7] In the limiting case in which all members are depositors, the optimal dividend is precisely the operating profit the credit cooperative earns on lending, $(p-r)x = (r-a)^2/4b$.

Depositors prefer dividends less, and they prefer mark-ups in the deposit rate more, as β decreases toward 1/2. As a consequence of optimally higher deposit rates, q^*, a larger amount of deposits are attracted, $y(q^*)$. With the borrowing rate, p^*, and the quantity of loans, $x(p^*)$, invariant with respect to β, the bank's operating profit – hence also its dividend – decreases as depositor dominance increases. At the same time, the bank's net supply of funds to the interbank market, $y-x$, increases.

3.3.2 Corner Solutions

One or two constraints may become binding as β falls toward 1/2, producing a corner solution. One type of corner solution has the deposit rate equal to the loan rate. Another corner solution is characterized by a zero dividend. We let $\hat{\beta}$ denote the fraction of depositor members at which the bank enters the corner solution with $q = p$ (at $E \geq 0$), and we let $\tilde{\beta}$ denote the fraction of depositor members at which the bank's dividend becomes zero, $E = 0$ (at $q \leq p$).

3.3.3 Empirical Implications

It is easy to see that the dividend does not vary with β in the range $1/2 < \beta < \tilde{\beta}$, while the deposit rate is independent of β. Together with equations (5a)–(5c), which describe the interior equilibrium, we have the following lemma.

Lemma 2: For $1/2 < \beta \leq 1$ (depositor domination), an open credit cooperative's deposit and dividend rates are increasing in β in the range $\max\{\tilde{\beta}, \hat{\beta}\} < \beta < 1$, and are constant in the range $1/2 < \beta < \max\{\tilde{\beta}, \hat{\beta}\}$.

We now have the following testable proposition.

Proposition 2: For $1/2 < \beta \leq 1$ (depositor domination), deposit rates and dividends are positively correlated in the range $\max\{\tilde{\beta}, \hat{\beta}\} < \beta < 1$, and are uncorrelated in the range $1/2 < \beta < \max\{\tilde{\beta}, \hat{\beta}\} = 1$.

Proof: Follows immediately from Lemma 2.

Optimal borrowing and deposit rates set by a depositor-dominated cooperative bank are displayed in the right-hand side of Figure 1. The figure corresponds to parameter settings such that $\tilde{\beta} > \hat{\beta}, \lambda < 1$. If all members are depositors ($\beta = 1$; point F), the cooperative bank prices deposits below the interbank rate ($q < r$) and pays a dividend ($E > 0$; not shown). As β decreases, the deposit rate increases and the dividend

[7] These two statements are true if (and only if) $2\beta - \lambda > 0$, a condition that always holds.

declines. At point G ($\beta = \tilde{\beta}$), the dividend reaches zero and its nonnegativity constraint becomes binding. Further declines in β leave the deposit rate unchanged because the nonnegativity constraint remains binding. If $\tilde{\beta}$ were an empty set, i.e., if the nonnegativity constraint did not become binding before the decrease in β led the deposit rate up to the loan rate ($q = p$), the deposit rate would continue to increase and the dividend would decrease with β until point H is reached ($\beta = \hat{\beta}$).

3.3.4 Output-Maximizing vs. Profit-Maximizing Incentives

A depositor-dominated open credit cooperative optimally offers a *lower* deposit rate, the larger is the depositors' majority. The output-maximizing incentive alone would lead one to expect that a depositor majority might increase the deposit rate as the depositor majority increased. Pricing-related benefits are shared with nonmember depositors, however, blunting this incentive.

The second incentive of the dominant group is to maximize the cooperative's operating profit so a larger dividend can be paid. Dividends avoid leakage of benefits to nonmembers, but they must be shared with borrower members who are not part of the majority group. Thus, as the depositors' majority increases, dividends become increasingly attractive and deposit interest rates are lowered in order to deliver benefits most efficiently.

Figure 4 shows the depositor-dominated open credit cooperative's optimal deposit rate as a function of β for several values of λ.[8] The lowest line traces out, for increasing values of β, the optimal deposit rate for the case in which only 30 percent of the depositors are members ($\lambda = 0.3$). The uppermost line in the figure shows the dependence of the optimal deposit rate on λ when all depositors are members ($\lambda = 1$).

In general, as λ rises, the optimal deposit rate increases, holding all else constant. The higher is λ, the more likely the cooperative will find itself in a corner solution in which the nonnegativity constraint of the dividend binds ($E = 0$; $\beta = \tilde{\beta}$). For the vector of values (a, b, c, d, r) chosen for Figure 4, the constraint $q \leq p$ never binds, which means that the ceiling over the deposit rate lies below the loan rate.[9] The behavior of the optimal dividend is analogous in a depositor-dominated cooperative to that of the borrower-dominated cooperative discussed above and shown in Figure 3, so it is not shown separately.

4 *Empirical Evidence*

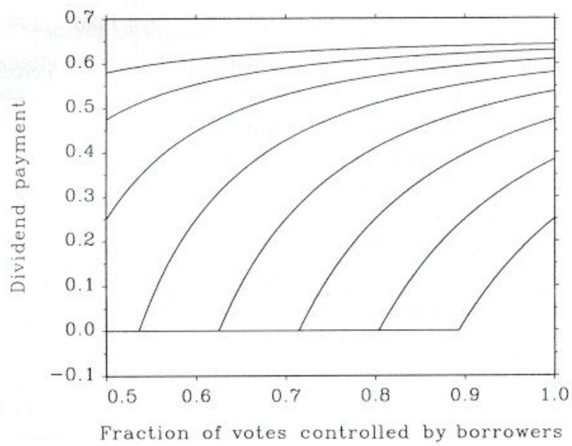
4.1 19th-Century German Cooperative Banks

German cooperative banks in the mid-1800s were borrower dominated (BONUS [1986], BONUS AND SCHMIDT [1990]). In fact, the sole purpose of the early cooper-

[8] The same parameter values were used for Figure 4 as in Figures 2 and 3.

[9] The borrowing rate, p, equals 0.150. The ceiling to the deposit rate that results from the nonnegativity constraint of the dividend approximately equals 0.112.

Figure 4
Nonmember Lenders and Deposit Rate



Note: The figure shows the cooperative's optimal deposit rate for various combinations of β (fraction of members that are lenders) and λ (fraction of deposit business done with members) when the cooperative is controlled by lenders ($\beta > 1/2$). The horizontal axis is β while the various curves in the figure correspond to different values of κ. The lowest line in the figure is drawn for $\kappa = 0.3$. Moving upward in the figure, each subsequent curve is drawn for a value of κ that is 0.1 larger than in the previous curve, culminating with $\kappa = 1.0$. The upper bound above 0.11 for the deposit rate reflects the parameter combinations for which the nonnegativity constraint of the dividend payment becomes binding.

atives was to borrow from city banks in order to lend to their members. These banks did no lending to nonmembers, so they were effectively closed credit cooperatives.[10]

Our model makes several predictions that can be compared to the operations of early cooperative banks. As noted, they did not generate any of their own loanable funds; nor did they pay dividends to members. All members wanted to borrow. Equation (4) of our model shows that, if the deposit-supply curve facing the bank intersects the vertical axis at the interbank rate ($c = r$) and if all members are borrowers, then no dividends are paid, as was the case.

4.2 *Late 20th-Century German Cooperative Banks*

The typical modern German cooperative bank pays dividends to its members (GROSSKOPF [1990, p. 43]).[11] Table 1 shows that the membership rolls of coopera-

[10] The German Cooperative Banking Act of 1889 disallowed lending to nonmembers.

[11] In terms of our model, the fact that cooperative banks typically pay dividends implies that the fraction of votes controlled by lenders must exceed the minimum level, $\bar{\beta}$, at which positive dividends are optimal.

Table 1
Membership Types

Type of member		1980	1990	1998
		Percent		
Entrepreneurs	Agriculture and forestry[12]	7.5	4.3	2.0
	Manufacturing and construction	4.1	3.3	2.2
	Wholesaling and retailing	3.1	2.2	1.6
	Services	4.4	3.3	2.0
	Other businesses	0.6	0.5	—
Self-employed		—	—	0.9
Subtotal		*19.7*	*13.6*	*8.7*
Employed persons		59.1	58.1	55.5
Retirees		11.2	13.6	14.3
Others		9.7	14.3	21.3
Subtotal		*80.0*	*86.0*	*91.1*
Public institutions		0.3	0.4	0.2
Total		100	100	100

Note: The table shows the distribution of primary occupations of members in German cooperative banks at various dates. The definition of entrepreneurial occupations and of self-employed persons changed in 1998. Employed persons are those who reported working for someone else. "Others" consists mainly of household members who were not employed by someone else, self-employed, or retired. Public institutions may own cooperative shares so they are included for completeness. The data were provided upon request by the *Bundesverband der Deutschen Volksbanken und Raiffeisenbanken.*

tive banks are dominated by employed persons, retirees, and other family members. These groups typically are net lenders to cooperative banks (which do not extend first-mortgage loans). In fact, over the period we analyze, the primary cooperative banks were net suppliers of funds to the interbank market (OECD [1992], [1999]).

4.2.1 Empirical Hypotheses

Proposition 2 states that (for a lender-dominated cooperative bank) the deposit rate varies inversely with the dividend rate in a depositor-dominated cooperative bank with $\beta > \tilde{\beta}$. We test this hypothesis with the following regression equation:[13]

$$\ln(q_t/q_{t-1}) = \gamma_0 + \gamma_1 \ln(r_t/r_{t-1}) + \gamma_2 \ln\left(e_t^j/e_{t-1}^j\right) + \varepsilon_t\,, \tag{6}$$

[12] For 1998 including fishing.

[13] We use log changes because rates of return typically are co-integrated. We did not employ an error-correction model because we have only a few annual observations (HAMILTON [1994]).

where e stands for the dividend rate (in contrast to E, which denoted the total dividend in the model). We distinguish two measures of the dividend rate, as indicated by the superscript $j(j = c, m)$. The first measure, e^c, looks at distributed profit relative to the capital and reserves of the bank. The second measure, c^m, defines the dividend rate as the quotient relating distributed profit and the number of members.

The loan rate, p, is independent of member preferences in a depositor-dominated, dividend-paying regime. The loan rate has a constant elasticity with respect to the interbank rate, r.[14] This allows us to substitute the interbank rate for the borrowing rate in the regression equation. While the model predicts that the elasticity of the latter with respect to the former is smaller than one (but greater than zero) in the assumed depositor-dominated, dividend-paying regime, the corresponding elasticity of the deposit rate with respect to the interbank rate is greater than one.[15] Thus, the parameter γ_1, which equals the elasticity of the ratio of the deposit rates, q_t/q_{t-1}, with respect to the ratio of the borrowing rates, p_t/p_{t-1}, must be greater than one. The parameter γ_0 controls for a possible (linear) time trend in the log deposit rate, $\ln(q)$.

4.2.2 Data

We use annual data on the aggregated German primary cooperative banking sector, which accounted for almost 12 percent of the balance-sheet total of the entire German banking system at the end of 1998 (OECD [1999]). These are local retail banks, constituting the bottom level in the three-tier cooperative banking sector. We use data from *Bank Profitability* (OECD [1992], [1999]), covering the period 1981–1997, and from the *Bundesverband der Deutschen Volksbanken und Raiffeisenbanken* (http://www.vrnet.de).

We measure deposit rates as the ratio of interest expenses to the sum of the following liabilities: nonbank deposits, interbank deposits, bonds, and borrowing from central bank. The borrowing rate is calculated as the ratio of interest income to the following categories of assets: loans, securities, and interbank deposits. Our empirical measures of the deposit and the borrowing rates include interbank market activity because the data do not allow us to disaggregate interest expenses and interest income. We measure the dividend payout as the ratio of distributed profit to capital and reserves or, alternatively, to the number of members. Table 2 provides descriptive statistics for these four rates of return and the interest-rate spread, $p - q$.

The descriptive statistics in Table 2 reveal that the deposit rate is more volatile than the lending rate. The coefficient of variation (the standard deviation normalized by the mean) of the deposit rate equals 0.174, versus 0.130 for the lending rate.

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14 The elasticity of the borrowing rate with respect to the interbank rate equals $r/(r + a) < 1$.

15 The elasticity of the deposit rate with respect to the interbank rate equals $\beta r/(\beta r - c \cdot (\gamma - \beta)) < 1$ in the interior solution of the depositor-dominated regime. For $r > c > 0$ (which we assumed), it is greater than zero.

Table 2
Descriptive Statistics

Variable	Minimum	Median	Mean	Maximum	Standard deviation	Variation coefficient[16]
Borrowing rate(p)	0.063	0.077	0.076	0.096	0.010	0.130
Deposit rate (q)	0.033	0.043	0.045	0.059	0.008	0.174
Spread ($p - q$)	0.024	0.031	0.032	0.038	0.004	0.111
Dividend rate (e^c)	0.036	0.046	0.049	0.066	0.008	0.163
Dividend rate (e^m) (DM per member)	67.09	76.90	93.98	133.50	25.68	0.273

Note: The borrowing or loan rate, p, is the ratio of interest income to loans, securities, and interbank deposits for all German cooperative banks in each year of the sample. The deposit rate, q, is the ratio of interest expenses to the sum of nonbank deposits, interbank deposits, bonds, and borrowing from the central bank for all German cooperative banks in each year of the sample. We examine two versions of the dividend payout rate. The first concept, e^c, is the ratio of distributed profit to capital and reserves of all German cooperative banks in each year of the sample. The second concept, c^m, is the ratio of the distributed profit to the number of members of all German cooperative banks in each year of the sample. The data are from the OECD [1992], [1999] and the *Bundesverband der Deutschen Volksbanken und Raiffeisenbanken* (http://www.vrnet.de).

4.2.3 Results

The empirical results are displayed in Table 3.[17] As predicted by Proposition 2, the deposit rate and the dividend rate vary inversely. The standard t-value shows that this regression coefficient is significantly different from zero at the 5% level. The regression coefficient of the lending rate is significantly greater than one, as predicted by the model.[18] The coefficient γ_0 is significantly greater than one, indicating a linear trend in the log deposit rate. This trend is small in economic terms, however, given that the mean log deposit rate equals -3.122.

4.2.4 Robustness Checks

We have only 16 observations for estimating regression equation (6) when employing a one-period lag. However, the Bera–Jarque value in Table 3 does not indicate a violation of the assumption that the errors are normally distributed.

[16] Mean divided by standard deviation.

[17] The t-values and the Wald statistic are WHITE [1980] corrected. We tested for serial correlation using the LJUNG–BOX [1978] test statistic with a standard lag length of $floor(4(T/100)^{2/9})$, where floor means rounded down to the nearest integer. The null hypothesis of no serial correlation could not be rejected.

[18] The test statistics are not shown. They were carried out within the regression framework presented in Table 3, using two bootstrapping procedures.

Table 3
Regression Results (e^c)

Dependent variable: deposit rate (q)

Independent variable	Coefficient	t-Statistic
Linear Trend	1.333×10^{-2}	2.269**
Borrowing rate (p)	1.715	18.744***
Dividend rate (e^c)	-1.926×10^{-1}	−2.186**
R^2	0.946	
$\overline{R}^2$	0.938	
Bera–Jarque value	2.940	
Wald statistic	472.4***	
Number of observations	16	

Key: **/*** Significant at the 5/1% level (t-tests are two-tailed).
Note: The table provides results of a regression of the deposit rate paid by German cooperative banks on a linear time trend, the average loan rate charged to borrowers, and the average dividend payout rate to members. The dividend rate is defined here as the ratio of distributed profit to the capital and reserves of all German cooperative banks. All variables are defined in Table 2.

The results of two bootstrapping procedures displayed in Table 4 reinforce the main regression results. The first bootstrapping method generates Student's-t intervals under the assumption of normally distributed errors. These intervals confirm the significance of the tests of the regression coefficients at the 5% level. The second bootstrapping procedure provides a bootstrap-t interval, which does not rely on the normality assumption.[19] These intervals also validate the significance tests at the 5% level.

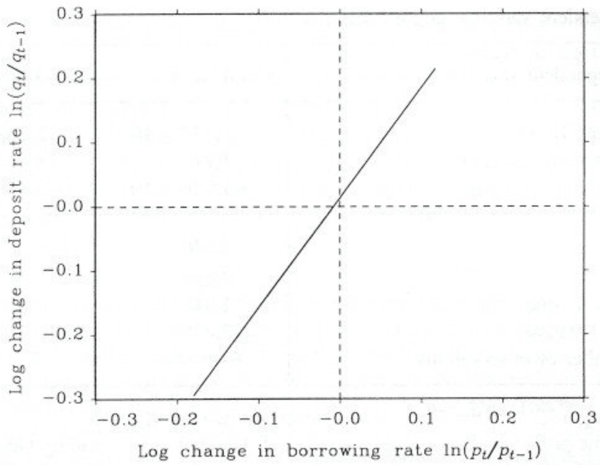
We applied the same statistical procedures to a member-based concept of the dividend ratio, e^m, as an additional sensitivity analysis. This concept of the dividend payout takes into account the fact that cooperative members do not have a claim on the cooperative's retained earnings (in contrast to traded shares in stock corporations).[20] Typically, a cooperative's shares are held in roughly equal proportions by all members; many cooperative banks have ceilings on the number of shares one individual may own.

The empirical analysis using the member-based dividend payout confirms our earlier findings using the capital-based dividend measure, e^c (Tables 5 and 6). The regression coefficient of the borrowing rate is again significantly greater than one,

[19] For details on these two bootstrapping procedures, see EFRON AND TIBSHIRANI [1993, pp. 158–162].

[20] The majority group could, of course, vote to pay out the accumulated earnings as a dividend.

Figure 5
Regression Equation at Zero Log Change in Dividend Rate



Note: Figure 5 displays the regression equation from Table 3 over the range of actual observations for a zero log change in the dividend payout. The regression line shows that the log change in the deposit rate, $\ln(q_t/q_{t-1})$, varies more than proportionately with the log change in the borrowing rate, $\ln(p_t/p_{t-1})$. The vertical difference between the regression line and the intersection of the dashed lines indicates a small positive linear trend in the log deposit rate.

while the regression coefficient of the dividend ratio is significantly negative. The positive linear trend in the log deposit rate is now more than twice as large as before, but it is still small in economic terms.

5 Conclusion

We show that both the distribution of member preferences and the amount of nonmember business a cooperative bank does influence its optimal pricing and dividend policies. The output-maximizing incentive varies positively with the proportion of member business. For a fixed fraction of member business, on the other hand, the greater the skewness of member preferences toward loan (deposit) business with the credit cooperative, the larger the optimal dividend and the *higher (lower)* the optimal loan (deposit) interest rate. Evidence from German cooperative banks supports a prediction of our model, that in a borrower-dominated cooperative bank, average deposit rates tend to fall as dividends rise. Thus, optimal pricing and dividend policies are closely interrelated, a connection not explored in earlier work on this topic.

Table 4
Bootstrapping Results (e^c)

Dependent variable: deposit rate (q)

Independent variable	Coefficient	Bootstrapped Student's-t 90% interval	Bootstrap-t 90% interval
Linear trend	-1.333×10^{-2}	$\pm 1.267 \times 10^{-2}$	-1.258×10^{-2}; 1.160×10^{-2}
Borrowing rate (p)	1.715	$\pm 1.987 \times 10^{-1}$	-1.786×10^{-1}; 1.970×10^{-1}
Dividend rate (e^c)	-1.926×10^{-1}	$\pm 1.830 \times 10^{-1}$	-1.908×10^{-1}; 1.677×10^{-1}
Number of draws		2,500	2,500

Note: The table provides results of a regression of the deposit rate paid by German cooperative banks on a linear time trend, the average loan rate charged to borrowers, and the average dividend payout rate to members. Standard errors were bootstrapped in two different ways. The first bootstrapping method generates Student's-t intervals under the assumption of normally distributed errors. The second bootstrapping procedure provides a bootstrap-t interval, which does not rely on the normality assumption. All variables are defined in Table 2.

Table 5
Regression Results (e^m)

Dependent variable: deposit rate (q)

Independent variable	Coefficient	t-Statistic
Linear trend	2.914×10^{-2}	2.845***
Borrowing rate (p)	1.726	19.032***
Dividend rate (e^m)	-2.514×10^{-1}	−2.372**
R^2	0.955	
$\overline{R}^2$	0.948	
Bera–Jarque value	1.690	
Wald statistic	483.4***	
Number of observations	16	

Key: **/*** Significant at the 5/1% level (t-tests are two-tailed).
Note: The table provides results of a regression of the deposit rate paid by German cooperative banks on a linear time trend, the average loan rate charged to borrowers, and the average dividend payout rate to members. The dividend rate is defined here as the ratio of distributed profit to the number of members of all German cooperative banks. All variables are defined in Table 2.

Table 6
Bootstrapping Results (e^m)

Dependent variable: deposit rate (q)

Independent variable	Coefficient	Bootstrapped Student's-t 90% Interval	Bootstrap-t 90% Interval
Linear trend	-2.914×10^{-2}	$\pm 1.991 \times 10^{-2}$	-2.202×10^{-2}; 1.759×10^{-2}
Borrowing rate (p)	1.726	$\pm 2.019 \times 10^{-1}$	-1.812×10^{-1}; 2.173×10^{-1}
Dividend rate (e^m)	-2.514×10^{-1}	$\pm 2.175 \times 10^{-1}$	-2.345×10^{-1}; 1.998×10^{-1}
Number of draws		2,500	2,500

Note: The table provides results of a regression of the deposit rate paid by German cooperative banks on a linear time trend, the average loan rate charged to borrowers, and the average dividend payout rate to members. Standard errors were bootstrapped in two different ways. The first bootstrapping method generates Student's-t intervals under the assumption of normally distributed errors. The second bootstrapping procedure provides a bootstrap-t interval, which does not rely on the normality assumption. All variables are defined in Table 2.

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William R. Emmons
Frank A. Schmid
Federal Reserve Bank of St. Louis
P.O. Box 442
St. Louis, MO 63166-0442
USA
E-mail:
emmons@stls.frb.org
frank.a.schmid@stls.frb.org