

# The Lerner Index as a Measure of Market Power of U.S. Credit Unions in the Absence of Profit Maximization

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## ABSTRACT

This paper explores the theoretical implications of a change in the behavioral assumptions of the Lerner index in the case of U.S. credit unions which do not operate under profit maximization. Despite the finding that the Lerner index underestimates the actual degree of market power in this non standard case, the value found for credit unions is considerably higher than for commercial banks. In other words, credit unions behave relatively monopolistically.

## Keywords

Lerner Index, Credit Unions, Revenue Maximization.

## INTRODUCTION

The famous Lerner index, as formulated in A.P. Lerner's paper 'The Concept of Monopoly and the Measurement of Monopoly Power' (1934), has been used extensively in the literature on monopolistic behavior and competition measures. Elzinga and Mills (2011) carefully summarize the major critics of the Lerner index such as the assumption of constant returns to scale and homogeneous-product markets. However, the existing literature has not investigated the crucial assumption of profit maximization which implicitly defines the Lerner index. The way a 'monopolist' and 'the social optimum' are defined by A.P. Lerner and the assumption of profit maximizing behavior of firms are crucial axioms determining the Lerner index.

The Lerner index has been a popular measure in the field of finance and banking in order to measure banking competition. However, this is done primarily in the context of commercial banks. In the context of credit unions concentration measures such as the Herfindahl index are used by Emmons and Schmid (2000) or new theoretical frameworks are developed in order to capture the different behavioral characteristics such as in

Smith, Cargill, and Meyer (1981).

Credit unions have a 'not-for-profit' nature and pursue quite different objectives compared to the commercial banks' aim of profit maximization. Specifically, the main aims of credit unions as described by Froman (1935) are encouraging thrift and providing credit for productive purposes at a reasonable cost for their members. In economic terms, the main objective of credit unions could be defined as maximizing revenues under a minimum profit constraint as some profit should be made to maintain solvency.

The focus of this paper will be measuring the degree of market power for credit unions by means of the Lerner index. However, using the Lerner index in the context of credit unions must be considered as a special case due to the fact that credit unions do not pursue profit maximization. Therefore, this paper will explore the theoretical implications of this change in the behavioral assumptions in order to find an answer to the question whether the Lerner index as a measure of competition between credit unions in the U.S. is still suitable, when the assumption of profit maximization is changed. Additionally, it will be tested empirically whether the value of the Lerner index for credit unions differs significantly from the value for commercial banks.

## CREDIT UNIONS

A credit union is a bank that typically can be described as a not-for-profit, co-operative and member-owned association, which provides small, short-term loans and savings. Originally its members are closely related in the sense that they usually have some common associated interest, e.g. the same employer, the same labor union, church, county or state (Froman (1935)). What do credit unions pursue? Clearly, not profit maximization. Credit unions rather aim to serve people in a community-oriented way in order to create an environment in which one can safely invest and obtain credit for productive purposes. It is unlikely that there exists considerable competition between credit unions. However, they do operate in a competitive environment as Emmons

and Schmid (2000) found evidence that commercial banks and credit unions directly affect each other's positions in local deposit markets. In this paper it is assumed that the credit union operates by means of revenue maximizing behavior under a minimum profit constraint. Using this as the behavioral assumption of credit unions will enable us to evaluate the Lerner index. Hereby, this paper complements the existing literature on the specification of the credit unions' objective function, such as Murray and White (1980) who use cost minimization subject to an output constraint or Taylor (1971) who uses minimization of the difference between loan and deposit interest rate.

### THE LERNER INDEX

Lerner (1934) argues that the degree of monopoly can be found in the economic and social implications of control over price and the degree of the accompanying social loss. It is the level of monopoly presence and the concomitant profit-maximizing behavior that causes a deviation from the social optimum and thereby causes social welfare loss. Therefore, a suitable measure of monopoly power should capture the degree of divergence from the social optimum, which is reached in the competitive equilibrium (p. 168). The social optimum is reached if price is equal to marginal cost (p. 165). From this the Lerner index follows:

$$LI(q) = \frac{P(q) - C'(q)}{P(q)} \quad (1)$$

where  $P(q)$  is the profit-maximizing price and  $C'(q)$  represents the level of marginal costs (MC). From the assumption that, generally, no negative profits are made (or only incidentally), the Lerner index is greater or equal to zero. A value of zero corresponds to the equality of price and marginal cost. This case represents 'perfect competition', a situation in which every firm has indefinite market power and no influence on price. Since profit maximization is assumed, the Lerner index is smaller or equal to one. A value of one corresponds to a perfectly monopolistic situation with complete market power and full influence over price. In the definition of the monopolistic behavior it is assumed that profit maximization is always pursued. Furthermore, the core variable  $P$  in (1) is the profit maximizing price, determined by the intersection of  $MR = MC$ . From this, the omnipresence of the profit-maximizing assumption is clear. In equilibrium situations where the MC-curve and the MR-curve intersect, the Lerner

index is equal to the absolute value of the inverse of the price elasticity of demand.

### THEORETICAL ANALYSIS

In this section, we begin to speculate what the Lerner index will be in context of U.S. credit unions and how its value might deviate from the case of commercial banks where the standard behavioral assumption of profit - maximizing holds. It is not expected that there is a change in the boundaries of the Lerner index. Therefore, the benchmark cases of the Lerner index are maintained and its the value for credit unions can be compared directly to its value for commercial banks. From this we might assume that the Lerner index maintains its ability to measure the degree of market power.

#### Presumptions

Presumably, the value of the Lerner index in the context of credit unions is either higher or lower than its value in the context of commercial banks. This is because two lines of reasoning can be followed. One which will lead to a relatively low value of the Lerner index, i.e. considerably close to zero, indicating a higher level of competition between credit unions. The other line of reasoning will lead to a relatively high value of the Lerner index, i.e. a value close to one, indicating a higher level of monopoly power of credit unions. The value of the Lerner index is considered low (high) when it is significantly lower (higher) than 0.2-0.3 as determined by Koetter, Kolari, and Spierdijk (2012) which holds on average for U.S. commercial banks. Using this value gives us some basis for comparing the resulting value of the Lerner index when the behavioral assumption is changed.

#### Formal theoretical analysis

In order to consider the Lerner index for credit unions we have to explore to what extent there is a deviation from the standard situation in which the Lerner's formula crucially depends on the assumption of profit maximization. A deviation from this situation is characterized by a new definition of the social optimum which is determined by the new behavioral assumptions. Credit unions are assumed to behave under revenue maximization subject to a minimum profit constraint. From Baumol and Bradford (1970), we see that the social optimum in this case is no longer determined by marginal-cost pricing. Consider a firm (credit union) that maximizes its revenues under a min-

imum profit constraint. Let  $P(q)$  be the inverse demand function and  $C(q)$  the cost function. Let the minimum profit be given by  $\pi_o > 0$ . The following optimization problem is faced:

$$\begin{aligned} \max_{q \geq 0} P(q)q \\ \text{s.t. } P(q)q - C(q) \geq \pi_o. \end{aligned} \quad (2)$$

A unique optimal solution to this problem can be found by using Kuhn-Tucker optimization. Spierdijk and Zaouras (2014) found that, under certain conditions, the optimal solution  $\tilde{q}$  to this optimization problem must satisfy  $\tilde{q} > 0$  and:

$$P'(\tilde{q})\tilde{q} + P(\tilde{q}) = \frac{\mu}{1 + \mu} C'(\tilde{q}) < C'(\tilde{q}) \quad (3)$$

where the Kuhn-Tucker multiplier  $\mu > 0$ . It is very hard or even impossible in this case to quantify the value of the Kuhn-Tucker multipliers  $\mu$ . From this we observe that revenue maximization under a minimum profit constraint yields a optimal output level  $\tilde{q} > q^*$  (the optimal profit-maximizing output). Also, the corresponding output price is lower than the profit-maximizing price:  $P(\tilde{q}) < P(q^*)$ . The new social optimum under the different behavioral assumption is given by the point where price is equal to  $[\mu/(1 + \mu)]$  times marginal cost opposed to the point where price is equal to marginal cost in the profit-maximizing case.

Spierdijk and Zaouras (2014) conclude that the original price-cost margin, the Lerner index under profit-maximizing behavior, underestimates the degree of market power when the firm under study is characterized by revenue maximizing behavior under a minimum profit constraint. Hence, measuring the degree of market power of credit unions by means of the original Lerner index will result in a lower degree of market power than actually is the case. In conclusion, the accuracy of the Lerner index as a measure of market power is diminished in the absence of profit maximizing.

## EMPIRICAL ANALYSIS

On the website of the National Credit Union Administration (NCUA) the quarterly Call Report data for over 7000 individual credit unions is available for 1994 - 2014. Because of inconsistencies in the dataset only the quarterly data of 2001-2013 is used for this analysis, which accounts for 359,048 useful bank-quarter observations.

The determination of the Lerner index yields

two intermediate steps by means of which the marginal cost element is estimated. Following Koetter et al. (2012) and Shaffer and Spierdijk (2013), we start by specifying a translog cost function. Herewith, a three-input one-output production technology is assumed following the intermediation model for banks (Klein (1971), Monti (1972), Sealey and Lindley (1977)). For credit union  $i$  and time period  $t$ , the translog cost function is given by<sup>1</sup>:

$$\begin{aligned} \log \widetilde{TOC}_{it} = & \alpha_i + \beta_1 \log \widetilde{F}_{it} + \beta_2 \log \widetilde{W}_{it} \\ & + \beta_3 \log Q_{it} + \frac{\beta_4}{2} (\log \widetilde{F}_{it})^2 + \frac{\beta_5}{2} (\log \widetilde{W}_{it})^2 \\ & + \frac{\beta_6}{2} (\log Q_{it})^2 + \gamma_1 \log \widetilde{F}_{it} \cdot \log \widetilde{W}_{it} \\ & + \gamma_2 \log \widetilde{F}_{it} \cdot \log Q_{it} + \gamma_3 \log \widetilde{W}_{it} \cdot \log Q_{it} \\ & + \xi_1 t + \xi_2 t^2 + \xi_3 t \log Q_{it} \end{aligned}$$

Differentiating this with respect to  $Q$  and using the estimated coefficients from the OLS regression give the marginal costs of credit union  $i$  and time period  $t$ ,  $MC_{it}$ . The output price  $P_{it}$  is given by the fraction of Total Income over Total Assets.

## Results

From this the estimates for the Lerner indices for each credit union  $i$  and time period  $t$  are deduced:

$$LI_{it} = \frac{P_{it} - MC_{it}}{P_{it}}$$

After excluding extreme outliers of the estimated values by using the winsorizing technique, the resulting values of the Lerner indices for the U.S. credit unions are obtained.

St. Dev.	0.11
Mean	0.37600
Min	0.08245
25% Quantile	0.30350
Median	0.37500
75% Quantile	0.44810
Max	0.65130

On average the degree of (monopoly) market power of a U.S. credit union is given by 0.376 with a standard deviation of 0.11. This result corresponds to a relatively high degree of market power and a relatively monopolistic behavior of credit unions. Moreover, the theoretical analysis has shown that the Lerner index in the context of credit unions is underestimating the actual degree of market power. Therefore, the actual degree of

<sup>1</sup>All variables with a tilde are variables which normalized with the price of fixed assets R in order to make sure that linear homogeneity in the input prices still holds as in Shaffer and Spierdijk (2013)

market power is expected to be even higher than 0.376. We can conclude that the average degree of market power is considerably higher for U.S. credit unions than for U.S. commercial banks.

## CONCLUSION

This paper investigates the theoretical implications of a change in the behavioral assumptions of the Lerner index. Credit unions are assumed to operate under revenue-maximizing behavior under a minimum profit constraint contrary to the paradigm of profit-maximizing behavior which applies to commercial banks. Despite this change of axioms and the ambiguity of the expected resulting values, the Lerner index still provides a suitable measure of the degree of market power for credit unions. It is found that for U.S. credit unions the Lerner index is, on average, 0.376 with a standard deviation of 0.11. This result corresponds to a relatively high degree of market power, evidencing that credit unions are relatively monopolistic. However, from the theoretical analysis it followed that the original Lerner index under the new behavioral assumptions underestimates the true degree of market power. This shows that, on average, the actual market power of U.S. credit unions is even higher than 0.376. However, because of computational complexity we cannot quantify the size of this underestimation effect. Thus, the original Lerner index is less accurate under the new behavioral assumption.

It can be argued that the assumption of revenue maximization in the context of a financial institution such as the credit union might be unrealistic. This is because a credit union which is issuing as much loans as possible under a minimum profit constraint in order to secure solvency does not seem to provide credit in a trustworthy way. Conceivably, a different objective function of credit unions might be formulated in such a way that it is not constrained. This would result in a more precise estimation of the actual degree of market power. Future research could be done on modelling a suitable and more precise objective function of credit unions which incorporates, presumably, optimizing the members' return on capital and minimizing the members' cost of loans.

## ROLE OF THE STUDENT

This paper is a shorter version of the bachelor thesis performed by Tobias Vervliet. The topic was proposed by his supervisor prof. dr. L. Spierdijk. After some fruitful meetings, he came to an original view on the subject, which led to a theoretical analysis which is inspired by the contributions of

L. Spierdijk. Furthermore, he conducted the empirical analysis and translated the large amount of data into an empirical model.

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