On competition and banking

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Chapter 3

Competition in the Dutch consumer credit market

3.1 Introduction

In this chapter, we analyze the Dutch market for consumer credit and try to measure the degree of competition in this market. In chapter 2 we discussed empirical evidence on competition in banking sectors all over the world. We mentioned that there are several approaches to measuring the competitiveness of a market. Below, we discuss some of these approaches that are commonly applied in the banking literature in more detail, and apply the well-known Bresnahan-Lau approach to the Dutch consumer credit market.

Although the consumer credit market may not be the most interesting submarket of the banking industry in terms of volume, it is definitely very interesting to both consumers and monetary authorities. For example, in February 2000 Statistics Netherlands announced that one out of three Dutch households makes use of consumer credit. Macroeconomic concerns play a role as well. Because of income and wealth effects in consumption and the possible effect of consumer confidence, the situation in the consumer credit market likely affects the business cycle. For monetary authorities the retail banking sector is a focal point of interest. Like the deposit market, the consumer credit market is characterized by a close bank-customer relationship. In this chapter we examine empirically whether banks and finance companies are able to exert market

[0]This chapter is a revised version of Toolsema (2002b).

power on the market for revolving consumer credit, concentrating on the case of The Netherlands for the period January 1993 - August 1999.

In the academic literature on banking, several authors have tried to assess the level of competition in banking markets, at different levels of aggregation. Some consider the whole of submarkets on which banks operate, sometimes modelling the deposit side explicitly (Suominen, 1994) but generally considering deposits as inputs (e.g. Shaffer, 1993; Molyneux et al., 1994; Shaffer and DiSalvo, 1994), while others concentrate on one (or more) specific submarket(s). The latter generally consider one or more of the following three markets: the market for business loans (e.g. Hannan, 1991a; Neven and Röller, 1999), the mortgage market (e.g. Swank, 1995; Neven and Röller, 1999), or the market for deposits (e.g. Hannan and Liang, 1993; Swank, 1995). To our knowledge, there is no such study that considers the market for consumer credit.

For European countries, studies of market power in banking sectors have generally found evidence of oligopolistic behavior or collusive conduct (see Molyneux et al., 1994; Neven and Röller, 1999; De Bandt and Davis, 2000; and Bikker and Groeneveld, 2000). However, the increasing number of providers of consumer credit in recent years in The Netherlands suggests that competition in this particular market may now be relatively strong. Our empirical results do indeed suggest that the Dutch consumer credit market is characterized by perfect competition.

The chapter is structured as follows. Section 3.2 discusses the econometric model we use in order to assess the level of competition. Section 3.3 describes the data on which the analysis is based. Section 3.4 presents the empirical analysis and its results. Section 3.5 concludes.

3.2 Assessing the degree of competition among banks

Various econometric models exist to test whether or not firms exert market power and to estimate the degree of competition in a market (for examples, see Martin, 1993, chapter 18). Two methods dominate, especially for more recent studies with respect to banking: first, the method of Panzar and Rosse (1987), and second, the conjectural-variation method or its alternative specification generally referred to as the method of Bresnahan (1982) and Lau (1982). We will discuss these approaches below, concentrating on the banking sector.

The method of Panzar and Rosse (1987) estimates reduced-form revenue equations from bank-specific data. A revenue equation relates total revenue of a bank (the dependent variable) to bank output or assets, input prices, interest expenses, and other costs. The more recent literature generally adds a market demand equation in which total bank output or assets are explained by market price (interest rate), aggregate income, price of a substitute, and other exogenous variables. The system of the revenue equations and the demand equation is estimated using a system estimator. The sum of the coefficients of the input prices from the revenue equation has become known as the Panzar-Rosse statistic (H). It can be interpreted as the sum of elasticities of gross revenue with respect to input prices. The Panzar-Rosse statistic provides a one-tailed test of competition: if $H > 0$, any form of imperfect competition is rejected. This shows the weak spot of the approach. If H turns out to be negative, the hypothesis of perfect competition cannot be rejected. In that case, the test is inconclusive. Furthermore, the interpretation of H as a sum of elasticities is unclear from a theoretical point of view. (See e.g. Shaffer and DiSalvo, 1994).

The conjectural-variation method provides an alternative tool. It is based on Iwata (1974), who introduced a method to econometrically estimate conjectural variations. This approach also involves the estimation of a system of equations. The first equation describes inverse market demand; the second equation is a (bank-specific) supply function, derived from the first-order condition for profit maximization. One of the parameters of the supply function equals the conjectural variation (the bank's anticipated response of its rivals to an output change). From this, the level of competition in the market can be inferred.[1] The econometric estimation of the system involves an identification problem, which was solved by Bresnahan (1982) and Lau (1982). Both Bresnahan and Lau use an alternative parameterization given by the conjectural variation elasticity (see Dickson, 1981). Also, they concentrate on aggregate data in their articles. In the literature, the 'method of Bresnahan and

[1]Corts (1999) criticizes this approach, arguing that in certain situations it does not accurately measure market power. In particular, the Bresnahan-Lau method may lack power in the sense that it may fail to reject Cournot competition when behavior is actually collusive. However, we do not face this problem in our empirical analysis, but find evidence of perfect competition. We assume here that the actors in the market play a conjectural variations game. In that case, market power is measured accurately.

Lau' thus refers to the conjectural-variation(-elasticity) method applied to aggregate data. This is the approach we use in our analysis.

The conjectural variation elasticity of bank i is defined by

$$\lambda_i \equiv \frac{\mathrm{d}Q/Q}{\mathrm{d}q_i/q_i},$$

where Q denotes aggregate output of the bank asset under consideration and q_i is the output of bank i. It describes the response of aggregate output relative to a change in the individual bank's output, as conjectured by bank i.

Assuming that each bank's goal is to maximize its profits, the market equilibrium will be characterized by equality of marginal cost and marginal revenue as perceived by the bank (this is the first-order condition for profit-maximization). With perfect competition, the perceived marginal revenue of the bank equals the price (interest rate). At the other extreme, for collusion, it corresponds to the marginal revenue of the whole banking industry. Total revenue of the industry is given by $PQ(P)$, so marginal revenue is described by

$$P + Q\frac{\mathrm{d}P}{\mathrm{d}Q}.$$

Thus, the banking industry's marginal revenue can be described as industry price P plus a function $h(\cdot)$ of aggregate output and other exogenous variables, where the function $h(\cdot)$ is defined as

$$h(\cdot) \equiv \frac{Q}{\mathrm{d}Q/\mathrm{d}P}.$$

This function describes the semi-elasticity of market demand. Note that $h(\cdot)$ may depend on other variables than Q only, since the demand function $Q(P)$ may depend on variables like income. The bank's perceived marginal revenue does not need to be equal to the industry's marginal revenue. In fact, for bank i the perceived marginal revenue is given by

$$P + q_i\frac{\mathrm{d}P}{\mathrm{d}q_i},$$

which equals $P + \lambda_i h(\cdot)$.

Let λ denote the industry average value of the conjectural variation elasticity. The range of possible values of the conjectural variation elasticity λ is given by $[0, 1]$. The two polar cases are perfect competition,

$\lambda = 0$, and perfect collusion (or monopoly), $\lambda = 1$. For any type of oligopoly, $\lambda \in (0, 1)$; the specific case of symmetric Cournot oligopoly results in a value of λ equal to the inverse of the number of banks (i.e. the market share). This shows that λ can be used as a measure for the level of competition. (See Shaffer, 1993.)

3.2.1 The Bresnahan-Lau approach

The method of Bresnahan (1982) and Lau (1982) estimates an aggregate conjectural variation elasticity λ which can be interpreted as the industry average conjectural variation elasticity. The parameter λ is estimated from a simultaneous system of two equations. The first equation describes aggregate asset quantity demanded Q as a function of price (interest rate) P, income Y, and (at least) one other exogenous variable Z. The additional exogenous variable Z is introduced in order to solve the identification problem in estimating λ, for which it is crucial that P enters interactively with an exogenous variable. In this way, it becomes possible for the slope of the asset demand function to change as a reaction to changes in exogenous variables, which results in identification of λ. For completeness, one might also allow for other interactions between the variables or include other exogenous variables. The demand relation can be interpreted as a first-order local approximation of the true aggregate demand function. The second equation of the system is a supply relation based on the assumption of profit maximization discussed above. The first-order condition for profit maximization requires that marginal revenue $P + \lambda h(\cdot)$ equals marginal cost. Using a linear[2] marginal cost (MC) function, the supply relation can be written in reduced form as $P = -\lambda h(\cdot) + MC + u$, where u is an error term. Omitting the time subscript, the Bresnahan-Lau method thus consists of the simultaneous estimation of the (non-linear) system

$$Q = a_0 + a_1 P + a_2 Y + a_3 Z + a_4 PZ + e \qquad (3.1)$$

$$P = -\lambda \frac{Q}{a_1 + a_4 Z} + b_0 + b_1 Q + b_2 W_1 + b_3 W_2 + u, \qquad (3.2)$$

[2]Shaffer (1993, p.52) uses a translog cost function. He argues that this type of cost specification may be more realistic for the case of depository institutions. However, the econometric estimation of the model with this specification requires a variable that describes total cost of a firm, or a bank in our case. Since this information is not available for our case, we do not use this specification.

where the a's, b's, and λ are the parameters to be estimated, W_1 and W_2 are input prices (e.g. wages and, for banks, deposit or money market rates), and e and u are error terms. Note that the parameter a_4 of the interaction term in the demand equation is crucial for the identification of λ; if we were to omit the interaction term, we could only estimate $-(\lambda/a_1) + b_1$ and we would have one estimate for the two structural parameters λ and b_1.

Several previous studies have applied the Bresnahan-Lau approach to banking sectors. For example, for US banking, Shaffer (1989) uses the method to show that banks are more competitive than Cournot competition (that is, his results indicate that $\lambda < \frac{1}{n}$). For the Canadian banking industry he obtains a similar result (Shaffer, 1993). Suominen (1994) estimates the model for the case of Finland distinguishing between two periods, before and after deregulation, with the surprising result that some market power was present in the banking sector during the second period whereas in the first period competition was strong. A dynamic version of the approach[3] was applied to banking by Swank (1995). He concludes that the Dutch markets for mortgages and savings were less competitive than Cournot competition, with the level of competition increasing over time for mortgages and decreasing over time for savings deposits. Zardkoohi and Fraser (1998) use the Bresnahan-Lau method in order to assess the effect of geographical deregulation in US banking, using annual observations on the individual states, finding only a small effect since the level of competition was already high before deregulation. (See also the discussion of the empirical evidence in chapter 2, section 2.5.)

The Bresnahan-Lau approach relies on some important assumptions. First, as was mentioned above, the banks are assumed to maximize profits. Second, banks are assumed to be price takers with respect to inputs. This may be a realistic assumption for labor (especially if one uses wages as determined in collective agreements, as we do below) as well as for funds obtained from the money market. However, if one would consider money borrowed from consumers, i.e. deposits, the corresponding input price (the deposit rate) may not be taken as given by the banks and the assumption of price-taking behavior may be violated. If banks have market power in the deposit market (i.e. monopsony power) in the estimation of the above system this will be attributed to the credit side

[3]For a discussion of a dynamic approach, see section 3.2.2.

and result in overestimation of the level of market power in the credit market (as explained in Shaffer, 1999, p. 191). As Shaffer (1993, p. 54) remarks, this assumption implies that the Bresnahan-Lau test of competition is *robust* in the sense that a finding of $\lambda = 0$ indicates that there is no market power at all (neither on the credit side, nor on the deposit side). Third, banks are assumed to be risk-neutral. However, since λ picks up any deviation of price from marginal cost, if banks are risk averse and there is a positive risk premium, this may result in $\lambda > 0$ even in the competitive equilibrium (Shaffer, 1999, p. 185) and the results of the empirical analysis must be interpreted carefully. Finally, the Bresnahan-Lau method is a static model that describes market equilibrium without allowing for changes over time. Therefore, we now turn to the discussion of a dynamic extension of their model.

3.2.2 A dynamic extension

Recently, Steen and Salvanes (1999) developed a dynamic version of the Bresnahan-Lau model, based on an error-correction framework. They apply it to the French market for fresh salmon. Their model describes long-run relationships for both demand and supply, and short-run deviations from these relationships. For simplicity, we consider here the model with lag length equal to one.

Before estimating the dynamic system, one has to test for the order of integration of all variables. If the variables are found to be non-stationary, but stationary in first differences, one can test for cointegration. If there are two or more cointegrating relationships, one should try to identify these relationships, finding one that represents the long-run demand equation and one that represents the long-run supply equation. Then, the dynamic system can be estimated.

The long-run relationships are similar in shape to the equations of the static model, (3.1) and (3.2). Let us denote the semi-elasticity of demand $\frac{Q}{\mathrm{d}Q/\mathrm{d}P}$ by Q^* here. Assuming that there exists a stable long-run equilibrium among the set of demand variables as well as among the set of supply variables, the long-run relationships are given by

$$\begin{aligned} Q &= \theta_0 + \theta_1 P + \theta_2 Y + \theta_3 Z + \theta_4 PZ & (3.3) \\ P &= -\Lambda Q^* + \xi_0 + \xi_1 Q + \xi_2 W_1 + \xi_3 W_2, & (3.4) \end{aligned}$$

omitting the error terms for simplicity, where Q^* is a function of the parameters from the long-run demand equation (3.3).

If there is cointegration, as we assumed above, an error-correction mechanism can be used to represent the adjustment towards the equilibrium paths (3.3) and (3.4). Steen and Salvanes (1999) write the dynamic system as

$$\begin{aligned}
\Delta Q_t &= \gamma \left[Q_{t-1} - \theta_1 P_{t-1} - \theta_2 Y_{t-1} - \theta_3 Z_{t-1} - \theta_4 P_{t-1} Z_{t-1}\right] \\
&\quad + \alpha_0 + \alpha_1 \Delta P_t + \alpha_2 \Delta Y_t + \alpha_3 \Delta Z_t + \alpha_4 \Delta P_t Z_t + \varepsilon_t \qquad (3.5) \\
\Delta P_t &= \psi \left[P_{t-1} + \Lambda Q^*_{t-1} - \xi_1 Q_{t-1} - \xi_2 W_{1,t-1} - \xi_3 W_{2,t-1}\right] \\
&\quad + \lambda_0 \Delta Q^*_t + \beta_0 + \beta_1 \Delta Q_t + \beta_2 \Delta W_{1,t} + \beta_3 \Delta W_{2,t} + \upsilon_t. \qquad (3.6)
\end{aligned}$$

Here, the subscript t refers to observation (or month) t, Δ denotes the difference operator, ε and υ are disturbances, and γ and ψ are parameters that measure the speed of adjustment towards the equilibrium paths. Note that the parameters θ_0 and ξ_0 are omitted here because the constant terms will be picked up by α_0 and β_0, respectively. In this dynamic version of the Bresnahan-Lau model there are two measures for the market power parameter λ: Λ measures long-run market power and λ_0 measures short-run market power.

There are two simplifications in the approach of Steen and Salvanes (1999). In general, their assumptions with respect to exogeneity are too strong. First, they test for cointegration among the sets of demand and supply variables separately. Because the system is simultaneous, one should test for cointegration among all variables in the system and identify two cointegrating relationships as demand and supply as mentioned above. Second, the fact that Steen and Salvanes do not treat the Bresnahan-Lau model as a simultaneous system implies that there is a simplification in their system $\{(3.5),(3.6)\}$. For example, in the demand equation (3.5) there is only an error-correction term for the deviation from the long-run demand equilibrium; there is no term that represents the effects of a deviation from the long-run supply equilibrium. A similar observation can be made for the supply equation (3.6). Since the Bresnahan-Lau model consists of a simultaneous system, one should include in each equation the deviations of both long-run relationships. Steen and Salvanes (1999) thus implicitly assume some adjustment parameters to equal zero. More precisely, they assume weak exogeneity of the long-run demand (supply) relationship in the short-run supply (demand) equation. We consider the application of this dynamic approach to the Dutch consumer credit market in section 3.4.

To conclude our discussion of the dynamic extension of the Bresnahan-

Lau approach, we mention that Swank (1995) has applied a similar extension based on an error-correction mechanism to banks. However, his approach is based on two markets, one for (mortgage) loans and one for deposits. It is based on a demand equation that describes demand for loans, a supply equation that describes the supply of deposits, and a cost function for banks that relates the two markets. Assuming that the bank maximizes the expected sum of its present and discounted future profits by setting loan and deposit rates, Swank derives two first-order conditions that describe the behavior of the bank. These equations can be compared to the supply equation of the Bresnahan-Lau method, which should also be interpreted as a first-order condition for profit maximization. The two equilibrium conditions describe how the bank determines the loan rate and the deposit rate, respectively. Each equation involves a parameter that corresponds to λ, the conjectural variation elasticity. In this way, Swank is able to measure market power in both markets. Since our analysis is more partial in the sense that we concentrate on one particular market, we do not use his approach here.

3.3 Data description

The sample period of our study is January 1993 - August 1999. Because of the availability of data on a monthly basis, we are able to confine ourselves to a relatively short and recent period. This is important for two reasons. First, the approach assumes the demand function to be constant (apart from a possible linear trend). Second, the number of actors in the market has changed dramatically in the last decades due to mergers and take-overs. The most recent merger between large actors took place in 1990 (ABN and AMRO), so well before the period under consideration here. The precise start of the period was partly dictated by the fact that the definitions of the raw data on which we based our data set are different before and after this month. On the other hand, it is an interesting starting point since in January 1993 the Second European Banking Directive, which provides the legal framework for cross-border banking in the European Union, came into force.

Since bank-specific data are not available for all variables required for the Dutch consumer credit market, we use aggregate data. With respect to consumer credit, we can distinguish among revolving and fixed credit. Revolving credit refers to a credit limit, up to which the consumer can borrow any amount, and the amount of credit actually used can be adjusted (upward or downward) at any time. Fixed credit refers to a fixed amount borrowed. That is, a consumer gets a loan of fixed size that he cannot adjust, and has to repay this amount plus interest according to some given repayment scheme. We concentrate on revolving credit.[4] We measure the amount of credit outstanding, not the credit limits, i.e. we do not measure unused commitments. The data allow us to distinguish between commercial banks and finance companies, which generally are subsidiaries of banks or insurance companies (Van Ewijk and Scholtens, 1999, p. 308). However, estimating the model for these two groups separately may not give correct results, since the loans of the groups are close substitutes to consumers. Therefore, we will not present those results in great detail. We will concentrate on the total revolving consumer credit issued by these two groups of actors in the market, and we will generally refer to them as banks. Further, credit card credit as well as consumer credit provided by municipal money-lending institutions and mail-order firms (which together have a market share of less than 10%) are not included in the analysis. The data we use in order to estimate the Bresnahan-Lau model will be discussed below. For a detailed overview of the data and its sources, see the appendix to this chapter.

In general, a system of demand and supply equations should be estimated using stocks, not flows. From the standard portfolio model, stocks are correlated with yields. So, for the aggregate output of revolving consumer credit Q we use the nominal quantity of revolving credit outstanding. Since the raw data concern the quantity outstanding *per ultimo* of that month, we compute an average in order to increase precision (in particular with respect to P; see below) and lose one observation, i.e. January 1993. Note that this quantity is net of interest and cost payments, where cost payments refer to costs other than interest and repayment of the principal, for example to administrative costs.

For the price variable P we use interest and cost payments divided by quantity. To be more precise, P is defined as total interest and cost

[4] The main reason why we do not present results for fixed credit is that the data available on fixed credit force us to use flows (i.e. newly issued loans) instead of stocks (the amount of loans outstanding) - see below. Also, the data include the *total* amount of cost and interest to be paid during the *complete term* of the loan whereas the terms of the loans are unknown, implying that the computed price variable is merely a proxy for the actual interest rate. For these reasons, and because the estimation results are very disappointing in the sense that hardly any variable is significant and the R^2's are very low, we do not present the results.

payments in the month under consideration, divided by the quantity of credit outstanding Q, times 100. We interpret P as the interest rate on revolving consumer credit (on a monthly basis).

The variable Y in the theoretical model represents income, and in empirical studies it usually refers to GDP. Data on GDP however do not exist on a monthly basis for The Netherlands. The commonly used alternative is industrial production (an index number with base 1995=100). The sign of the income elasticity is ambiguous. Income can be interpreted as the ability to pay. On the one hand, this may refer to ability to pay for consumer credit, implying a positive coefficient. On the other hand, it may refer to ability to pay for the goods bought with consumer credit, in the sense that a high income may imply less need for consumer credit. This explanation implies a negative sign. An alternative interpretation of Y is that of a measure of general economic activity or conditions. In that case, an alternative variable that could be used is consumer confidence. Since consumer confidence provides information on confidence and expectations of consumers with respect to economic activity, in this interpretation it can basically perform the same role as GDP in the model.

In general, in applications of the Bresnahan-Lau method to banking markets a money market interest rate is chosen for the other exogenous variable in the demand equation, Z. This rate can be interpreted as the price of a substitute, an exogenous variable that is used often in applications of the Bresnahan-Lau approach. In our case, we need the short-run (money-market) rate in the supply equation, as will be discussed below. For Z we therefore choose to use the long-run rate (10-year government bond yield). Alternatively, we could use the mortgage rate. The mortgage rate can be interpreted as the price of a substitute, and the corresponding parameter is expected to be positive. However, the mortgage rate closely follows the long-run rate, and the results do not depend much on the rate we use.

As input prices we use hourly wage rates (denoted by W_1) and the money market rate (W_2). W_1 is an index with base 1990=100, and is based on collective agreements on wages in the banking sector. W_2 is the interest rate on 3-month loans to local authorities, the usual empirical choice for the money-market rate in The Netherlands. An alternative rate that could be used for W_2 is the deposit rate. For finance companies, however, the deposit rate would not be a good choice since they generally do not obtain funds from deposits. Furthermore, in the literature the money market rate is usually interpreted as the appropriate marginal cost for banks. We converted the interest rates (i.e. Z and W_2) to a monthly basis and computed them as a percentage. In this way, their definitions correspond to that of the price variable. For an overview of the data, see figure 3.1.

Finally, we do not deflate nominal variables. There are several reasons to act as such. First, money illusion may play a role in the case of consumer credit. We do not expect the average Dutch consumer to investigate his real interest payments on consumer credit. Probably, (s)he will concentrate on nominal values. Second, inflation in The Netherlands has been relatively constant over the period under consideration (around 2% per year). This implies that the main effect of inflation, if any, will be that of a trend. Therefore, we use nominal variables in our analysis and include a deterministic trend as a regressor. Third, Shaffer (1993, p. 55) also suggests that qualitative differences between real and nominal specifications of the Bresnahan-Lau model are not to be expected.

3.4 Empirical analysis

For the empirical analysis of the Dutch consumer credit market, we start by comparing the price P to the maximum authorized rate of interest on consumer credit, which is determined by the Dutch government[5]. Banks are not allowed to set their consumer credit rate above this maximum rate. The maximum rate is adjusted whenever indicators of the capital and money markets show that there has been a 'considerable' change on these markets since the previous adjustment. In the period under consideration, there have been 11 adjustments (where the first was on January 1st, 1993). Although this implies that there is not much variation in the maximum rate, we do expect P and the maximum rate to change in the same general direction.

The price variable P is converted into an annual interest rate[6] in order to compare it to the maximum annual rate. Figure 3.2 shows the interest rate for revolving consumer credit on annual basis as well as the maximum rates for various credit limits. The higher the credit limit, the

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[5]Data on the maximum rate have been obtained from the Netherlands Ministry of Economic Affairs.

[6]For converting the price variable to an annual basis we use the formula $100[(1 + P/100)^{12} - 1]$.

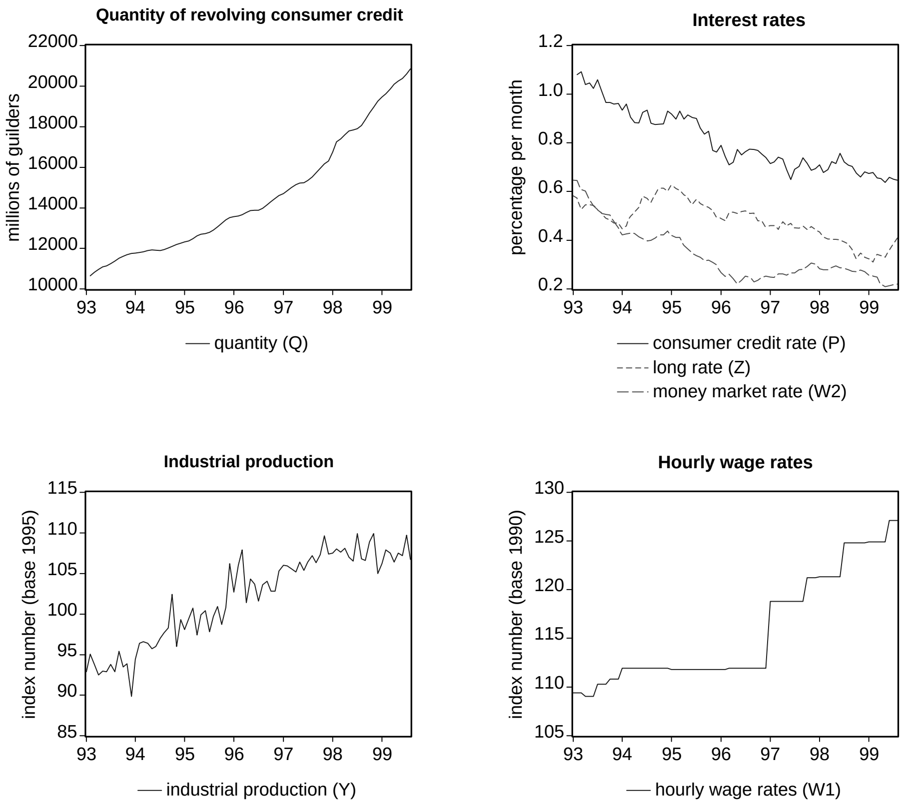

Figure 3.1: Dutch consumer credit market data (January 1993 - August 1999). For data sources, see the appendix to this chapter.

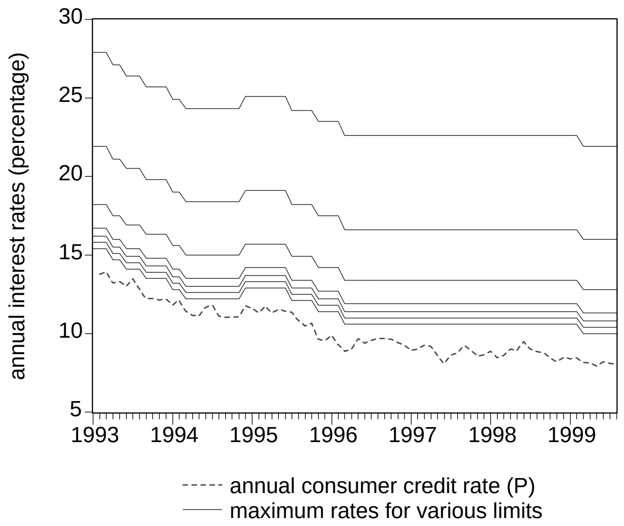

Figure 3.2: Annualized interest rate on consumer credit (P), and maximum annual interest rates for various categories of credit limits (where the highest and lowest maximum refer to credit limits of 0-2,500 and 30,000-50,000 Dutch guilders, respectively).

lower the maximum rate is[7]. For example, the upper curve represents the maximum rate for a credit limit in between 0 and 2500 guilders. From the figure, we conclude that the average actual consumer credit interest rate set by the banks is strictly below even the lowest maximum rate (i.e. the rate that corresponds to the category of highest credit limits).

The maximum rates for various credit limits for revolving credit are perfectly correlated with each other (as well as with those for fixed credit), and therefore with respect to the correlation coefficients it does not matter which limit we choose. The correlation coefficient of the maximum rate with the consumer credit rate P (on annual basis) is 0.97. This high value does not come as a complete surprise because it is an empirical fact that (changes in the levels of) interest rates are highly

[7]The categories of credit limits are 0-2500, 2500-5000, 5000-10000, 10000-15000, 15000-20000, 20000-30000, and 30000-50000 guilders.

correlated. Furthermore, the maximum rate is based on an indicator of the money market by construction and it seems reasonable to assume (which is confirmed by our estimation results) that the actual rate of interest on revolving consumer credit in a particular month depends strongly on the money market rate in that month. This implies that we should in fact expect to observe very high correlation coefficients.

If the equilibrium of demand and supply observed in the market would be in the region were regulation actually limits the rate that banks set, we would observe a rate equal to the maximum authorized rate. However, from figure 3.2, we conclude that the regulatory rates are well above the actual market rates, and regulation does not seem to constrain the banks in setting interest rates. Of course, in individual cases the regulation may be binding, but the figure suggests that this situation is limited to only a small part of the market. Thus, in general the actors in the market are able to set their interest rates in a profit-maximizing way and the Bresnahan-Lau model can be applied in order to assess the level of market power.

Static model

Now we turn to the estimation of the static Bresnahan-Lau model. Since the two equations (3.1) and (3.2) are interrelated because of the underlying economic model (through the semi-elasticity of market demand which appears in the supply relation), one should employ a system estimator such as three-stage least squares (3SLS) or full information maximum likelihood (FIML) rather than a single equation (limited information) method such as two-stage least squares. We use FIML in order to estimate the non-linear system.[8,9]

Table 3.1 presents the estimation results for revolving consumer credit. We present three specifications. In the first, we estimated the

[8] For the econometric analysis we use EViews, which makes use of the Marquardt algorithm for nonlinear estimation.

[9] Next to being a complete system approach, this estimation method has some other advantages. First, FIML does not require the use of instruments, as does 3SLS. Previous studies have used many instruments (see for example Suominen, 1994). As we have observed using our data, by varying the instruments included one can manipulate the results of the estimation quite a lot. Second, the results of nonlinear 3SLS depend on the starting values for the parameters. With our data we also find this effect and we doubt whether the best local solution found is actually the global solution.

basic model (adjusted from the system {(3.1),(3.2)})

$$Q = a_0 + a_1 P + a_2 Y + a_3 Z + a_4 PZ + a_5 TREND + e \quad (3.7)$$
$$P = -\lambda Q^* + b_0 + b_1 Q + b_2 W_1 + b_3 W_2 + u, \quad (3.8)$$

where $Q^* = \frac{Q}{a_1 + a_4 Z}$. We include a deterministic trend (that equals t for the tth observation) in the demand equation. The sign of the coefficient of the trend is expected to be positive, since there seems to have been a considerable change of attitude of consumers in favor of consumer credit, even in this recent period under consideration. From figure 3.1, the amount of revolving consumer credit Q is clearly increasing over time. Because Y and $TREND$ are strongly correlated with each other as well as with Q, which may imply multicollinearity, we also estimated the above system without Y as well as without $TREND$ in two additional model specifications. In each case, we eliminated non-significant parameters (except for the crucial parameter λ) one by one, and present the resulting final model.

Since 1997, there exists a maximum to the amount of interest payments on consumer credit that a consumer can deduct from income before taxes every year. Therefore, we included a dummy (which equals zero before January 1997 and one from that month on) in the demand equation in order to allow for a demand decrease due to this tax measure. Intuitively, we did not expect this dummy to be very important, since the maximum annual amount of interest payments that were tax deductible has been around 5,000 guilders (10,000 guilders for a married couple). Indeed, in all specifications, the coefficient of the dummy was not significantly different from zero (as expected) and therefore we omit this variable in the discussion of the results.

The adjusted R^2 is high for (almost) all estimated equations. The same holds for the F-statistic, which tests the hypothesis that all coefficients (except for the intercept) are zero. Unfortunately, the Durbin-Watson statistics are low. This is a common problem in the empirical literature using the static Bresnahan-Lau approach. Here, it may be caused in particular by the use of monthly stocks for revolving credit. The estimated signs of Z and the input price W_1 contrast our expectations. The long-run rate of interest Z may not simply perform the role of a substitute price here. There may be other effects as well. For example, the long-run interest rate may affect consumers' impressions or expectations of general (future) interest rate developments. Such effects may explain why its coefficient is negative. The estimate of the market

	Basic model		Without Y		Without $TREND$	
Demand (3.7)[a]						
constant	37000	(13.68)	30314	(12.02)	63135	(8.32)
P	-20455	(-6.78)	-20511	(-6.55)	-62093	(-9.00)
Y	-71.97	(-3.57)			71.36	(2.03)
Z	-44663	(-8.66)	-47152	(-9.07)	-99866	(-11.52)
PZ	45731	(6.85)	48337	(7.36)	106911	(9.01)
$TREND$	121.04	(18.69)	109.14	(20.16)		
Adj. R^2	0.99		0.98		0.95	
F^b	1112.63		1224.74		356.13	
DW[c]	0.51		0.41		0.64	
Supply (3.8)[d]						
Q^*	0.00014	(0.60)	-0.00112	(-0.89)	0.00122	(0.57)
constant	2.76	(7.62)	2.97	(6.57)	4.94	(2.92)
Q	4.33E-05	(3.89)	5.38E-05	(3.52)	0.00011	(2.09)
W_1	-0.03	(-5.58)	-0.03	(-4.87)	-0.05	(-2.43)
W_2	1.10	(12.92)	1.18	(10.37)	1.52	(4.19)
Adj. R^2	0.89		0.87		0.59	
F^b	110.60		89.39		19.39	
DW[c]	0.95		0.83		0.62	

[a] The demand equation reads $Q = a_0 + a_1 P + a_2 Y + a_3 Z + a_4 PZ + a_5 TREND + e$.

[b] F refers to the F-statistic. The relevant 99% critical values are given by $F(5, 73) = 3.28$ for the demand equation of the basic model; $F(4, 74) = 3.58$ for the demand equations of the other two specifications; and $F(6, 72) = 3.06$ for the supply equations.

[c] DW refers to the Durbin-Watson statistic.

[d] The supply equation is given by $P = -\lambda Q^* + b_0 + b_1 Q + b_2 W_1 + b_3 W_2 + u$, where $Q^* = \frac{Q}{a_1 + a_4 Z}$.

Table 3.1: Estimation results for the system {(3.7),(3.8)}: coefficient estimates, with corresponding t-statistics in parenthesis.

power parameter λ, the coefficient of Q^*, is not significantly different from zero in all cases. Using alternative variables, i.e. the mortgage rate for Z and consumer confidence for Y, does not alter the results in an important way. Also, estimating the model {(3.7),(3.8)} for banks and finance companies separately, we find that for both groups, λ is not significantly different from zero. Concluding, table 3.1 shows that our data do not support the hypothesis of market power for revolving consumer credit.

Dynamic model

The low Durbin-Watson statistics indicate positive serial correlation. This could imply very significant t-statistics (since standard errors are underestimated; see Gujarati, 1999, p. 382; Kennedy, 1998, pp. 122-123). Indeed, we find that most variables are highly significant. However, λ, the parameter of interest is *not* significant in any specification we estimated. Still, this suggests that it may be interesting to use a dynamic model such as the one discussed in section 3.2.2. We have tried to estimate the (simplified) system {(3.5),(3.6)} with the data as described above and some alternatives for Y and Z as well. For identification, in the demand equation we need a variable Z such that Z, P, and PZ (and their lagged values) are not too strongly correlated, but such that at least PZ does correlate with the dependent variable Q. It turns out that this is hard to find, and we cannot obtain results for the dynamic specification.

The main reason why even the simplified specification of Steen and Salvanes (1999) cannot be estimated seems to be multicollinearity (in particular in the demand equation). Several remarks can be made here. First, the problem is related to the fact that our sample period is relatively short and happens to be a period of cyclical upswing. Since it is not possible to obtain data over a longer period, this implies a lack of variation in the data, even if we choose alternative variables. A similar problem is encountered by Stock and Watson (1993). They consider the identification of a money (M1) demand equation. The lack of a cointegrating relationship between the variables M1, income, and an interest rate in their analysis of the post-war period can be explained by excessive multicollinearity. Both interest rates and income have risen steadily whereas there was effectively no growth in real balances, preventing unique identification of the cointegrating relationship. Second, the multicollinearity may be present in the static version of the model as well. However, in estimating the error-correction version we have to use additional right-hand-side variables in the sense that all right-hand-side variables are included with one lag as well as in first differences, which reinforces the problem. The multicollinearity problem is related to the dimension of the estimated equation (see Hendry, 1995, p. 274); in the dynamic model, it simply becomes too severe. Third, the major undesirable consequence of multicollinearity is that it implies low t-values for the coefficients of the correlated variables (Kennedy, 1998, pp. 184-185). In the estimation of the static model, the coefficients of those variables do, however, turn out to be significantly different from zero. This indicates that the multicollinearity problem is not very severe in the static model. Furthermore, the market power variable Q^* does not belong to the set of collinear variables, suggesting that the multicollinearity problem does not affect the significance of the parameter of interest in this study, λ.

A final issue in the estimation of the dynamic model is that of stationarity of the market power variable Q^*. We computed this variable using the static parameter estimates from table 3.1 (as in Steen and Salvanes, 1999) in order to determine its order of integration. It turned out that we cannot reject the hypothesis that Q^* is stationary (i.e. of integration order 0) for any reasonable significance level. This implies that it may only have short-term effects in the model. That is, it indicates that in the long run, there is no market power, confirming our static estimation results.

3.5 Conclusion

We investigated empirically the level of competition in the Dutch market for revolving consumer credit using the Bresnahan-Lau approach. Our analysis indicates that this market is characterized by perfect competition. This conclusion is different from the results of studies of market power in banking sectors of several European countries (including The Netherlands) which generally find evidence of oligopolistic behavior or collusive conduct, i.e. $0 < \lambda \leq 1$ (Molyneux et al., 1994; Neven and Röller, 1999; De Bandt and Davis, 2000; and Bikker and Groeneveld, 2000). One explanation could be that consumer credit serves as a 'loss leader' to banks, attracting new clients that they can sell other (profitable) services as well, but not earning the bank any profits itself. In that case, banks might choose to price consumer credit at marginal cost, implying $\lambda = 0$. Also, switching costs incurred by clients when switching to a different bank may be relatively low for consumer credit (in particular when compared to business loans). Furthermore, entry in the consumer credit market is relatively easy as compared to entry other banking markets. Other things equal, this would imply that banks have less market power in this particular market than they have in others.

Two caveats should be mentioned here. First, related to the interpretation of consumer credit as a loss leader, it is important to realize that banks may well have market power in general, the level of which may vary among different submarkets. Because the consumer credit market is small compared to the total banking industry, it may well be the case that there is perfect competition in this submarket whereas banks have market power in other, larger submarkets. This is confirmed by the findings of other authors (see the references mentioned above). Second, it seems reasonable to assume that there is asymmetric information in this market, in the sense that the consumers themselves are better informed with respect to their prospects than the banks. The result that banks do not abuse market power in the consumer credit market does not imply that the market is frictionless.

Appendix: Data and sources

The sample period is January 1993 - August 1999. Some of the data have been obtained from Statistics Netherlands StatLine. This can be found at http://argon2.cbs.nl/.

Q Nominal quantity of revolving consumer credit outstanding at banks and finance companies net of corresponding interest and cost payments, computed as the average of the quantity at the end of the month under consideration and the quantity at the end of the previous month (millions of guilders). Source: Statistics Netherlands StatLine.

P Price of revolving consumer credit outstanding at banks and finance companies, obtained by dividing cost and interest payments in the month under consideration by net quantity outstanding Q and multiplying by 100 (percentage). P thus corresponds directly to the monthly interest rate. Source: Statistics Netherlands StatLine (for 1993-1997 we compute cost and interest payments as the difference between gross and net quantity of consumer credit issued; for 1998-1999 cost and interest payments are available directly).

Y Industrial production (index with 1995=100). Source: IMF International Financial Statistics (IFS). (We have used consumer confidence as an alternative. This variable provides information on confidence and expectations of consumers with respect to developments of Dutch economic activity; it is measured as the balance between positive and negative answers to a questionnaire as a percentage of the total. Source: Statistics Netherlands StatLine.)

Z 10-year government bond yield (originally on annual basis); adjusted so as to correspond to a monthly basis using $Z = (1 + \text{gby})^{1/12} - 1$, where gby refers to the original series, and multiplied by 100 (percentage). Source: Thomson Financial Datastream, NLBRYLD: NL benchmark bond 10 yr (DS). (We have used the mortgage rate as an alternative. We used the average rate of interest of all newly registered mortgages for dwelling houses and combinations of dwelling houses and business premises, adjusted so as to correspond to a monthly basis and multiplied by 100 (percentage). Source: Statistics Netherlands StatLine.)

W_1 Hourly wage rates (from collective agreements) including holiday allowance and other benefits for banks (index with 1990=100). Source: Statistics Netherlands Sociaal-Economische Maandstatistiek (various issues).

W_2 Money market interest rate: interest rate on 3-month loans to local authorities; adjusted so as to correspond to a monthly basis (see the discussion of Z) and multiplied by 100 (percentage). Source: Statistics Netherlands StatLine.