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DOES MARKET POWER AFFECT PERFORMANCE IN THE DUTCH BANKING MARKET? A COMPARISON OF REDUCED FORM MARKET STRUCTURE MODELS**

BY

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Summary

This paper investigates whether reduced form market structure models can be used to test whether there is market power in the Dutch banking market. First, a traditional Structure-Conduct-Performance (SCP) model is introduced. Next, a simple Cournot-model is introduced, which results in a more flexible measure of market power for different market structures. Finally, the inclusion of a modified Efficiency hypothesis reduces identification problems. Theoretically speaking, the Cournot model provides a better foundation for testing the existence of market power than the SCP model. Likewise, explicitly correcting for and including efficiency results in a more correct test of the Efficiency hypothesis. Empirical results for Dutch data confirm that the introduced improvements based on the Cournot models are the only ones resulting in tests that are consistent with the underlying models. Evidence from the Cournot model suggests that we cannot reject the existence of market power, although its impact on performance may be small. It also formalizes the need for additional research into the importance of strategic interaction among banks.

Key words: Cournot, efficiency hypothesis, SCP hypothesis, x-efficiency

JEL classification: G21, L11, L22.

1 INTRODUCTION

The concentration in Europe's banking markets has been a popular subject of academic and mainstream analysis. This popularity has been fueled both by the high levels of concentration in many of these markets and by the fact that banks play a crucial intermediary role. The general tendency has been to raise concern over the possible existence of market power and the resulting potential damage to consumers.[1] Empirical evidence however has been widely

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1 See Economic Research Ltd. (1997) and Cecchini (1988).

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divergent. The use of different hypotheses, proxies and datasets has made it nearly impossible to compare empirical results.

This paper investigates to what extent past methodological developments have enabled us to arrive at better measures of market power. It emphasizes reliability and consistency over measurement accuracy and focuses on empirical applications, starting with a basic model and introducing a number of advances. In doing so, the aim is to develop a test for the null hypothesis that market power exists.

The resulting set of models is tested empirically using data on the Dutch banking market over the period 1992–1998. The sample period starts with the creation of the Single Market for Financial Services and ends before the introduction of the euro. In the beginning of the 1990s, the Dutch banking market experienced a rapid consolidation phase as a result of a series of mega-mergers that created ABN AMRO and ING.[2] In 1990, the Fortis conglomerate was set up in the Netherlands and Belgium as a much looser form of the same principle. As a consequence, The Netherlands currently has the highest market concentration of all EU countries, and the Dutch banking market is dominated by three large banks (ABN AMRO, ING, Rabobank), who together share roughly 80% of the Dutch banking market.

The remainder of this paper continues as follows. Section 2 starts with a short overview of the literature on reduced form market structure models. Purpose of this overview is not to be exhaustive, but rather to put the methodological and empirical exercises that follow into perspective. It focuses on the SCP model and present a series of improvements to this model. Section 3 discusses the Structure-Conduct-Performance (SCP) model. In Section 4, a simple Cournot model is introduced. Section 5 presents an alternative test aimed at resolving identification problems when testing the SCP hypothesis. Next, in Section 6 we describe our data and some of the key features of the Dutch banking market. Section 7 describes our results and Section 8 concludes.

2 LITERATURE

Market power models can be conveniently grouped in two distinct sets. The first set consists of structural models, the second set consists of reduced form models.[3] Important examples of structural models include the Monti-Klein model (Klein (1971)) of monopolistic competition and the Salop model (Salop (1979)) of spatial competition.

These models and the new industrial organization (NEIO) models that have been developed since have the advantage of providing accurate and

2 The ABN AMRO merger took place in 1990. ING Group was formed in 1989 through a merger of NMB and Postbank with Dutch insurance company Internationale Nederlanden. In 1991, Bank Mees en Hope and Pierson merged to form MeesPierson (effective in 1992). Summing up, 1993 is the first full year after the three mega-mergers took place.

3 For an overview, see Freixas and Rochet (1998).

direct measures of market power. Their major drawback is the fact that they empirical applications of these models are still relatively rare. Data and estimation problems prevent clean tests of these models, as is best witnessed by the fact that the empirical literature in this field cannot possibly keep up with theoretical advances.

Reduced form models at best provide close proxies for market power, albeit at the cost of reduced theoretical underpinning and empirical finesse. They enjoy a continuing popularity, spearheaded by the SCP model and (recently) the Panzar–Rosse model.[4] Within the group of reduced form models, a distinction can be made between models that rely on prices and models that rely on other proxies for market power.

Prices feature most prominently in the Panzar–Rosse model, where a competition measure (H) is defined as the sum of the elasticities of the reduced-form revenues with respect to the factor prices w. An estimated value of H equals perfect competition. Likewise, a value between zero and 1 indicates monopolistic competition, and a value smaller than zero indicates that behavior on the market is characterized by a monopoly.[5] The fact that this model is broadly embedded in Bertrand oligopoly models, is clear from its features. Its dependence on prices means it is not biased by any nonlinearities between market structure and market power. However, the fact that price information is notoriously scarce and unreliable for banking markets is the most important drawback to applying the Panzar–Rosse framework. In addition, it neglects product differentiation, and it assumes a long-run equilibrium, zero profits at the market level and a flat marginal cost curve. Finally, with quantity precommitments it reduces to a basic Cournot model.[6] Summing up, the Panzar–Rosse model has its advantages, but it is far from ideal for testing market power on banking markets, particularly given its dependence on price information.

The most popular reduced-form model that does not require price information is the SCP model. Although without a strong explicit micro foundation, SCP models have the potential to capture any type and size of market power as long as it affects performance through market structure. In addition, SCP models can incorporate nonlinear average cost curves (which have been proven to exist in banking, cf. Molyneux et al. (1997)).[7] On the downside, they provide relatively rough measures of market power and traditionally have trouble handling the fact that market power can be nonlinear in market structure.

4 See Bikker (2004) and Molyneux et al. (1997) for an overview and an empirical application to European banking markets.

5 A related, popular model was developed by Breshanan (1982). For an empirical application to European banking markets, see Bikker (2004) and Bikker and Groeneveld (2000).

6 On a more theoretical level, in its most basic form it can lead to the same 2-player competitiveness that burdens many (simple) Bertrand models.

7 See Berger and Humphrey (1991) for evidence on average costs in banking and Heggestad and Mingo (1976) on SCP models and nonlinear average cost curves.

In proxying for collusive behavior by using market structure, this type of reduced-form model hinges crucially on the extent to which a specific banking market is contestable. For the European Union as a whole, Molyneux (2000) finds that '[T]he only systems where foreign banks are strongly involved in domestic banking activities are Belgium, The Netherlands and Portugal' (p. 4). However, in the remainder of his analysis, Molyneux focuses on the increasing number of branches. In The Netherlands, the number of branches is very stable in the period under review, after an initial decline following the creation of ABN AMRO and ING Group respectively: 7518 in 1992 compared to 7219 in 1996. In short, whereas there has been an increase in the involvement of foreign banks in the Netherlands, this has not led to an increase in the total number of branches.[8]

The concern over market power and the impact its abuse has on consumers is traditionally the highest for consumer loans, deposits, mortgages and other, similar products for which switching costs and search costs are (relatively) high. This is confirmed by Hassan et al. (2000), who examine bank cross-border performance in Europe. Their findings show that bank performance is still predominantly 'national', with only modest revenue and profits from cross-border activities. Molyneux (2000), in an overview of financial restructuring in the European Union, cites deregulation and technological change as 'lowering entry barriers and making markets more contestable' (p. 1). This supports his claim that 'there is little evidence to suggest that market structure and bank size strongly influence performance' (p. 2). In general, however, the observation in the literature that deregulation and technological change have led to more contestable banking markets lacks convincing empirical support. Huizinga (1998) describes the entry of foreign banks in the Dutch banking market. At the end of the 1980s and the beginning of the 1990s, a number of foreign banks entered the market or significantly expanded their presence on the Dutch banking market. For some (mostly German) banks, their presence on the Dutch banking market was clearly an attempt to get a foothold in the market. Other banks (mostly Asian and American) merely started branches that have a banking license but are aimed at servicing existing clients abroad. The presence of both groups of foreign banks on the Dutch banking market has increased during the 1990s, but in total is still marginal.[9] In addition, for the Netherlands, Fase (1997) finds that cross-border substitutability between

8 Branching networks are excluded from my empirical analysis. Accurate data on branching networks are not available in IBCA/BankScope. However, in The Netherlands the three large banks are the only banks that have established truly national branching networks. The small(er) general banks have at most regional networks that are occasionally quite extensive (e.g. SNS bank). The specialized banks have very small networks.

9 Included in the analysis in this paper are only those banks that we can reasonably assume try to compete with all other banks in a broad range of services. This group consists of commercial banks with a banking license that offer loans and deposits to both commercial and private clients. This was checked through a telephone survey.

domestic and foreign deposits is almost non-existent. He estimates cross-border substitutability for the period 1984–1994 and, using M_2 as a denominator for the share of cross-border deposits finds a substitution elasticity of 0.22 (with a standard error of 0.07). Summing up, the Dutch (retail) banking market, in particular the market for deposits, is still confined to a large extent by its national borders.

So far, there is not much evidence in the literature that there is indeed market power in this Dutch banking market. However, studies that focus specifically on The Netherlands are scarce. Canals (1994) and Molyneux et al. (1997) include a descriptive analysis of European banking markets. Interestingly, although he does not include the Netherlands, Canals (1994) hints at possible signs of market power in banking markets (Germany, Italy) less concentrated than the Netherlands. Molyneux et al. (1997) also cite a range of European SCP studies, but find that the results are far from conclusive. Importantly though, in many cases evidence of market power disappears when the SCP hypothesis is tested against the Efficiency hypothesis. Molyneux and Forbes (1995) and Altunbas and Molyneux (1994) confirm this in an empirical analysis of European banking markets. However, Molyneux and Thornton (1992) already suggested that the link between market share and profitability is a lot stronger than the link between market structure and profitability. This idea is especially interesting given the observation in Molyneux et al. (1997) that scale economies are very small in European banking. Goldberg and Rai (1996) and Economic Research Ltd. (1997) also use the SCP model and find similar results. Using a different setup however, Vennet (1994, 1996) analyzes the impact of concentration, mergers, efficiency and entry barriers on European bank profitability. In line with the above, evidence of a significant impact from a decrease in entry barriers is absent. Mergers however, do seem to have some influence on bank profitability.

Concluding, evidence of market power is mixed, but it does appear to depend on the method in which market power is tested. In addition, inclusion of the Efficiency hypothesis alters results rather drastically. In what follows, the SCP model and related reduced-form market structure models will be explored in more depth for a number of reasons. First, as has been mentioned, the absence of reliable price information burdens other types of models. Second, we can show that some of the drawbacks of traditional SCP models can be corrected for. Third, in opting for the SCP model we can introduce a series of different but related models, which allow us to analyze whether any advances have been made. Fourth, there exists a long and broad literature related to SCP models, and we aim to provide a framework for interpreting this body of work. In doing so, we do not follow chronology, but rather try to describe developments in a logical order that facilitates comparison.

3 SCP MODEL

SCP models are loosely based on Chamberlin's monopolistic competition theory (Chamberlin (1933)) and seek to explain firm performance through market structure conditions, such as number and size distribution of firms and entry condition in the market. The SCP hypothesis explains the performance of firms by the structure of the market and is based on the premise that a more concentrated market indicates higher market power and consequently higher profits for all banks in the market.[10]

The basic SCP model can be formulated as follows (where t is time):[11]

$$P_t = f(M_t, D_t, C_t) \tag{1}$$

where P is a performance measure, M a (set of) market structure variable(s), D a (set of) demand variable(s) and C a set of firm/product-specific control variables.

A number of traditional concentration ratios have been used as market structure indices. Many of these however suffer from the fact that they suppose that the relationship between market power and market structure is linear.

An example is the C_3 ratio that is used in the first specification in Table 3. The most common way to overcome this problem is by using the Hirschman-Herfindahl index, where for market share $a_i : HH = \sum(a_i^2)$. This measure is less arbitrary, but gives extra weight to those banks that dominate the market.[12] The second specification in Table 3 therefore uses this concentration measure.

Regardless of the choice of a specific market structure indices, all tests of the SCP hypothesis may suffer from identification problems. Three broad classes of identification problems can be found in the literature. First, the minimum number of competitors (and the maximum level of concentration) necessary for having perfect competition is highly debatable. As an example, we already mentioned the contestability of banking markets. Another example may be the behavior of fringe competitors in reaction to a high concentration. If fringe competitors merge in order to more effectively complete with large players, then competition may actually increase with increasing concentration.[13] As a result, the coefficient for M_t could be negative, even though this is inconsistent with the SCP model. Second, banks in a highly concentrated market may behave according to the Quiet Life hypoth-

10 For an introduction see chapter 4 of Molyneux et al. (1997).

11 See Molyneux et al. (1997, p. 97).

12 Important to keep in mind here is the claim by Bikker and Haaf (2002) that 'it is [still] possible to find corresponding measures of concentration for every summary measure of concentration' (p. 57).

13 Cf. the creation of Fortis, as a possible reaction to earlier mergers in the Dutch banking market.

esis, which postulates that banks may use market power to lower the variance of returns (see Berger and Hannan (1993)). In this case, an increase in Mt is most likely to have no effect on performance (although the effect could again be negative as well). Finally, performance may be explained with the Efficiency hypothesis, and differences in performance may be caused by differences in effciency. In that case, market structure may have little or no effect on performance, but market share will. Importantly, both of these competing hypotheses are not mutually exclusive from each other and from the SCP hypothesis.

The next section is an attempt at making tests of market power less dependent on market structure and the choice of a market structure variable. In section 5, we return to the Efficiency hypothesis and show how it can be tested with the SCP hypothesis without identification problems.

4 COURNOT MODEL

The SCP model became subject to criticism. For example, the market structure measures used seem to assume that all banks benefit equally from a high market concentration. This idea runs counter to much of the theoretical literature that identifies strategic group behavior and more elegantly translates asymmetric market structures into performance differences. Therefore, we develop a market power model that is based on a dynamic Cournot model by Cowling (1976), Cowling and Waterson (1976) and based on Stigler (1964). The model by Cowling describes a relationship between *industry* performance and market concentration, both over time (intra-industry) and between industries (inter-industry). We modify his model slightly to get a relationship between *firm* performance and market share. This modification will make it easier to accommodate asymmetric market structures, differences in cost structures and collusive behavior.

The model derived here is based on a straightforward extension of a Cournot oligopoly model with profit maximization by collusive Cournot oligopolists. However, equilibrium conditions from this model can also be used to test more extreme models, namely perfect competition and myopic oligopoly behavior (the classic Cournot model).

Defining profit Π_i, output X_i, price p, firm-specific variable cost c_i and firm specific fixed cost F_i, firm i maximizes:

$$\begin{aligned} \Pi_i = \quad & pX_i - c_i(X_i) - F_i \\ s.t.\ p = & f\left(\sum_{i=1}^{N} X_i\right) = f(X) \end{aligned} \tag{2}$$

where $f()$ is the inverse market demand and N the number of firms. Profit is maximized if:

$$\frac{d\Pi_i}{dX_i} = p + X_i f'(X)\frac{dX}{dX_i} - c_i'(X_i) = 0 \tag{3}$$

where

$$\frac{dX}{dX_i} = 1 + \frac{d\sum_{j\neq i} X_j}{dX_i} = 1 + \lambda_i$$

and λ_i is know as the conjectural variation of firm i's output.[14] Multiplying by X_i gives:

$$pX_i - c_i'(X_i)X_i = -(X_i)^2 f'(X)(1+\lambda_i) \tag{4}$$

Dividing both sides by pX_i and rearranging gives:

$$\frac{pX_i - c_i'(X_i)X_i}{pX_i} = -\frac{X_i}{X}\frac{f'(X)X}{p}(1+\lambda_i) \tag{5}$$

Marginal costs, $c_i'(X_i)$, are constant but can differ from bank to bank. Revenue is denoted by pX_i. The left-hand side of the above equation therefore contains the ratio of profit $[\Pi_i]$ plus firm-specific fixed costs $[F_i]$ to revenue $[R_i]$. The right-hand side of the above formula can be broken down in three parts. First, (X_i/X) is firm i's market share, with $0 < MS \leq 1$. Second, $f'(X)X/p$ is the inverse of the market price elasticity of demand, $1/\eta_D$. Since the main prices for banks in the context of this analysis are interest rates, η_D is referred to as the interest elasticity of demand. Finally, $1+\lambda_i$ measures firm i's expectations about the reactions of its rivals dX/dX_i, with $-1 \leq \lambda \leq 1$. A Cournot oligopoly implies a value of 1 for $1+\lambda_i$, i.e. $\lambda_i = 0$. On the other hand a value of $\lambda_i = -1$ implies perfect competition. For the collusive oligopolist. $\lambda_i > 0$. Simplifying equation (5) further gives:[15]

$$\frac{\Pi_i + F_i}{R_i} = \left(-\frac{1}{\eta_D}\right) * (MS_i) * (1+\lambda_i) \tag{6}$$

There are two problems associated with using this equilibrium condition as a basis for estimating an SCP model. First, there is no precise measurement of η_D, the interest elasticity of demand. Secondly, there is no measure for the conjectural variation λ_i.

14 A high λ_i means a firm has a high awareness of its interdependence with other firms.
15 Cowling and Waterson (1976) sum over N firms to find: $(\Pi + F)/R = -(H/\eta_D)(1+\mu)$, where $H = \sum(X_i/X)^2$, i.e., the Hirschman-Herfindahl index, and $0 < H = 1$. Profits, fixed costs and returns are now summed for the whole industry, and $\mu = (\Sigma\lambda_i X_i)/(\Sigma X_i^2)$.

To solve these two problems, we have to make two additional assumptions. The first is that η_D, the price elasticity of demand is constant. If not, then the interpretation of a coefficient for MS_i – in the absence of a proxy for η_D – could be biased downward (upward) by increases (decreases) in the interest elasticity of demand over time. In the context of this paper, the above assumption requires a relatively constant interest elasticity of M_2.[16] A clear advantage here is the relatively short sample period of 7 years, during which no major crisis has occurred that would have changed the interest elasticity of demand. In addition, the assumption of a constant interest elasticity of demand is supported by empirical research for the Netherlands.[17]

The second assumption concerns the individual firm's conjectural variation λ_i, the extent to which it expects other firms to react to a change in output. Here, there are two options. The first is to assume that λ_i is constant and equal across firms, in which case it drops out of the above equation and we are left with a relationship between performance and market share. The time period considered here is again an argument in favor of this assumption; as reported before, in the period 1992–1998 the number of competitors in the Dutch banking market is relatively stable and relative sizes vary very little over time. Not surprisingly, this is also a necessary condition for the myopic Cournot oligopolist, who is ignorant of the impact of his actions on his competitors and therefore not prone to collusive behavior.

The second option is to formalize the relationship between λ_i and MS_i, under the presumption of collusive behavior. Following Stigler (1964), we can show that an increase in market share MS_i is expected to increase awareness (λ_i) and thereby lead to more collusive behavior [for proof, see the appendix]. Although this still leaves us without a direct measure of λ_i, it does allow us to capture its impact through MS_i. After all, the collusive oligopolist realizes a more than proportionate increase in performance as a result of an increase in market share. Alternatively, the penalty for not behaving collusively increases with market size.

All in all, when we take η_D to be constant and λ_i to increase and decrease with MS_i, we have now developed a basic relationship between performance and structure that is consistent with a dynamic Cournot equilibrium.[18] The

16 This is considered the most appropriate monetary aggregate in the light of this paper since it includes deposits.

17 See, for instance, Fase and Winder (1993), who analyze the demand for money for The Netherlands in 1970–1988 and consider 'the residual variation, which reflects the noise rather than the degree of misspecification, as a measure of stability' (p. 486). For M_2 money demand equations they find The Netherlands has the smallest standard error residual (0.12) of all EC countries.

18 As explained, for the collusive oligopoly we assume a λ_i that is not constant but unmeasurable – except through MS_i. In the collusive Cournot oligopoly an increase in output X_i by a bank i has the consequence that all banks in the market increase their output proportionally.

basic equation (without control variables) is then:

$$\ln\left((\Pi_i + F_i)/R_i\right) = \beta_0 + \beta_1 \ln((1+\lambda_i) * MS_i) + \varepsilon \quad (7)$$

The model now amounts to interpreting the combined impact of $\lambda_{i,t}$ and $MS_{i,t}$ on performance. In two extreme cases, interpretation of the coefficient $\hat{\beta}_1$ is straightforward. The Cournot oligopoly prediction is $\hat{\beta}_1 = 1$, since $\lambda_{i,t} = 0$ and impact of $MS_{i,t}$ is exactly proportional. If collusive behavior exists, $\lambda_{i,t} > 0$ and the impact of market share is more than proportional, the prediction for $\hat{\beta}_1 > 1$. Finally, in case of perfect competition an increase in market share has no impact on performance and since $\lambda_{i,t} = -1$, this means $\hat{\beta}_1 = 0$. The model therefore becomes:

$$\ln\left((\Pi_{i,t} + F_{i,t})/R_{i,t}\right) = \beta_0 + \beta_1 \ln(MS_{i,t}) + \varepsilon \quad (8)$$

Therefore, in interpreting the coefficient $\hat{\beta}_1$, we will focus on its sign and significance rather than its magnitude.

Finally, as argued by Cowling (1976), firms could need time to adjust to the new competitive situation and the impact of an increase in market share on performance may therefore involve a lag. We therefore again include a specification with an additional one-year lag:

$$\ln\left((\Pi_{i,t} + F_{i,t})/R_{i,t}\right) = \beta_0 + \beta_1 \ln(MS_{i,t-1}) + \varepsilon \quad (9)$$

Of course, this Cournot model does not measure exactly the same relationship as the SCP model. Whereas the latter concentrates on the impact of market structure, the former focuses on individual banks' market share. However, in doing so it more accurately captures asymmetric market structures, differences in cost structures and collusive behavior.

5 EFFICIENCY HYPOTHESIS

An important critique of both models discussed above is the fact that they consider market power to be the only explanation for differences in market share. The Efficiency hypothesis has been developed as an important alternative explanation. In this section, we critically review the way the Efficiency hypothesis can be tested against the market power hypothesis and provide an alternative test of the Efficiency hypothesis that resolves the identification problem we mentioned before.

The Efficiency hypothesis attributes differences in performance to differences in efficiency (Goldberg and Rai (1996), Smirlock (1985)). According to the Efficiency hypothesis, both high market share and good performance result from high efficiency. Thus, whereas according to the traditional SCP hypothesis and the above Cournot model a high market concentration is an explanatory variable for above average performance, within the Efficiency hypothesis it is seen as, at most, the result of a higher efficiency. Testing the Efficiency hypothesis against the SCP hypothesis therefore generally involves including both market shares and a market structure variable in the estimated equations. The premise is that if the Efficiency hypothesis holds, once individual banks' market share is controlled for, overall market concentration does not explain profits (cf. Demsetz (1973)).

Tests aimed at setting off both hypotheses against each other tend to suffer from identification problems, since the same market structure variable behaves similarly for both cases. In these tests, market share at once proxies for market power – as does the market structure variable – and for efficiency. The market structure variable is an aggregate measure that only changes over time. The market share variable, however, differs from firm to firm and over time. This identification problem resulting from testing both hypotheses is demonstrated in columns 4 and 5 of Table 3, where neither market concentration (C_3 and HH respectively) nor market share (MS) are significant. In addition, both carry a negative sign.[19]

In an attempt to overcome this problem, Berger and Hannan (1993) and Molyneux (2000) use both market share and efficiency as explanatory variables for bank profit. In these studies, however, a multicollinearity problem exists *if* the Efficiency hypothesis holds. As a solution, we propose to include the market share that is *not* explained by efficiency, using firm-specific efficiency measures.[20] First, we regress $MS_{i,t}$ on an efficiency measure. As evidenced by the discussion in Berger and Humprey (1991), X-efficiency is generally found to dominate scale efficiency in banking. Cost X-efficiency [CE] measures how close a bank's costs, conditional upon its output, input prices and equity level, are to the costs a fully efficient bank incurs under the same conditions. As such, it is considered here to be the best efficiency measure to use in this two step approach:[21]

$$\ln MS_{i,t} = \gamma_{0,t} + \gamma_1 \ln CE_{i,t} + \omega \tag{10}$$

We then estimate equation (8), but replace $MS_{i,t}$ with $MS(CE)_{i,t}$ – the residuals of the above equation. This efficiency measure $MS(CE)$ is by definition orthogonal on CE. The Cournot equation then reads:

$$\ln((\Pi_{i,t} + F_{i,t})/R_{i,t}) = \beta_0 + \beta_1 \ln(MS(CE)_{i,t}) + \beta_2 \ln CE_{i,t} + \nu \tag{11}$$

19 In the next sections, 201 observations on bank efficiency are taken from chapter 4 of Bos (2002). In order to get comparable results, the same observations are used here.

20 The modification we suggest is explained for the Cournot model and therefore in loglinear form. We have also applied it (without taking logarithms) to the traditional SCP model.

21 We also considered using profit X-efficiency, but this does not really solve the problem, since – to the extent that a bank with market power can maximize profits without minimizing costs – it basically captures the same effect as MS.

Now, we can test both the SCP hypothesis and the Efficiency hypothesis without any identification problems.[22] We can compare both hypotheses by comparing the results from estimating equation (8) with those of estimating equation (11). If the market power hypothesis holds, $\hat{\beta}_1$ is significant and positive in both specifications. On the other hand, if $\hat{\beta}_1$ is positive and significant when estimating equation (8), but zero or positive and significant when estimating equation (11), this is evidence in favor of the Efficiency hypothesis.

6 DATA

We use the IBCA data provided through BankScope. Taking care of overlap due to holding companies and eliminating non-bank financial intermediaries (e.g. ABN AMRO Lease Holding), a sample of approximately 60 banks results. For every year, only those firms for which all variables are available are included. This results in an unbalanced panel of 7 years. As can be seen from Table 1, the number of banks included increases slightly before decreasing again, which is the combined effect of several things. First, for later years data availability increases and thereby it becomes possible to include more banks for which reliable data are available. Second, as observed by Leeuw (1996), next to an influx of foreign banks there was also an increase in the demand for banking licenses as more financial institutions started roaming in the field of commercial banks. To the extent that these institutions effectively started supplying loans and demanding deposits, this is reflected in the data. Finally, there is the net effect of entry and exit. However, the main reason for the structure of the panel is the increased coverage of the database over time. As the coverage of the market is never below 95%, we do not think our results are significantly affected by sample selection problems.[23]

For the SCP model, we use the C_3 and HH. Both are based on deposits. For the Cournot model, we use a market share variable *MS*, also based on total deposits. The C_3 ratio remains relatively stable over the entire period, but expands slightly in 1997/1998, amongst other through growth of ABN AMRO and ING Group. The Hirschman–Herfindahl index mostly follows this trend, but – as can be seen in Table 1 more prominently captures the entry of small foreign players through a marked decrease in 1993. Finally, market share *MS* follows the same trends. As becomes clear from Table 1,

22 Note that $\nu = \varepsilon + (\beta_1 * \omega)$. Since we use a proxy instead of $MS_{i,t}$ in this two-step estimation, our standard errors may suffer from the generated regressor problem, and the accuracy of our estimates as well as the significance of our parameters may be over-estimated.

23 This was checked by comparing total assets in the dataset to total banking assets in the annual reports of De Nederlandsche Bank.

TABLE 1 – STRUCTURE DUTCH BANKING MARKET

Year	N	C_3	*HH*	*MS* Mean	SD	Minimum	Maximum
1992	42	0.7777	0.3098	0.0244	0.0845	0.00012	0.4955
1993	49	0.785	0.2401	0.0212	0.069	0.00009	0.4066
1994	56	0.7674	0.2265	0.0187	0.0632	0.00003	0.3892
1995	63	0.7639	0.2199	0.0169	0.0597	0.00007	0.3767
1996	62	0.752	0.2097	0.0176	0.0591	0.00008	0.3558
1997	54	0.8244	0.2600	0.0194	0.0694	0.00006	0.4174
1998	47	0.8625	0.2675	0.0220	0.0747	0.00006	0.3901

small players are very small indeed on the Dutch banking market, with market shares of 0.006% in 1998.[24]

For performance measurement there is a wide range of indices used in the literature. No agreement exists as to which measures are superior.[25] Performance measures range from purely financial measures such as profits, return on equity [*R.O.E.*], and return on assets [*R.O.A.*] to more eclectic measures such as market share stability, expenses and the number of bank employees. Most SCP studies use either *R.O.E.* or *R.O.A.* We will do the same, and opt for *R.O.A.* since it is invariant to (changes in) a bank's risk appetite.[26]

As a performance measure in the Cournot model we use a markup derived from the model. It consists of total revenue minus variable costs as a ratio over total revenue, which is in turn equal to profits (P) plus fixed costs (F) over revenue (R). It is included in Table 2 as *PFR*. In order to assess the robustness of the analyses, we also estimated nested versions of both the SCP and the Cournot model. The estimations reported in Table 3 include both market share and market structure variables. Other combinations, however, did not qualitatively change the conclusions in this chapter and are therefore not reported here.[27]

24 Note that both C_3, *HH* and *MS* do not change much when based on a different variable such as total assets or loans. Bikker and Haaf (2002) use a Lorenz curve to describe the 'size inequality of the banks in the Dutch banking sector' (p. 32). Their analysis is based on total assets, but the main conclusions stay the same. Interesting in this respect is the big difference between the largest small banks and the top three banks in The Netherlands. This highly skewed size distribution is hard to capture by many market structure variables used in traditional SCP models.

25 See Molyneux et al. (1997, chapter 4 and appendix I), Gilbert (1984), Heggestad (1979) and Berger (1995) for overviews of SCP studies of banking markets.

26 Note that ceteris paribus, if market power is present, *R.O.E.* (which is more closely watched by the market) and *R.O.A.* should yield the same results. In fact, using *R.O.E.* instead of *R.O.A.* does not significantly alter the results.

27 We also estimated the Cournot model with *R.O.A.* as a dependent variable, and the SCP model with *PFR* as a dependent variable. The results are robust in both cases.

TABLE 2 – DESCRIPTIVES

Variable	Mean	SD	Skew	Kurtosis	Min.	Max.	N
PFR	0.9305	0.1427	−1.44	8.05	0.2	1.37	351
$R.O.A.$	0.0062	0.0079	4.54	33.36	−0.009	0.081	351
MS	0.0198	0.0675	4.62	24.99	0	0.496	351
C_3	0.7884	0.0359	1.03	2.71	0.752	0.863	351
HH	0.2444	0.0308	0.85	2.77	0.21	0.31	351
Risk	0.5025	0.2488	0.05	2.33	0.001	0.984	351
Liquidity	0.3264	0.2201	0.46	2.43	0.001	0.88	351
Cost	0.685	0.2188	−0.41	3.3	0.067	1.4	351
Market	0.5709	0.1204	0.16	2.64	0.359	0.79	351
CE	1.3496	0.591	3.99	22.68	1.003	5.66	201

For all models, the same mix of the most popular control variables is included (see Molyneux et al. (1997), ch. 4 and appendix I). The number of control variables included is purposely restricted to avoid high correlation between different control variables which would render the interpretation of the model overly complicated. For each of the specification we checked whether including respectively excluding them altered sign or significance of the other variables. The set of variables as described below is highly robust and the explanatory variables as such are not highly correlated. For comparison purposes, we report the same set of control variables for all estimations, even if for some specifications control variables are highly insignificant.

Differences in risk attitude are usually controlled for using either loans over assets or equity over assets.[28] The former is expected to have a positive sign, the latter a negative sign. The variable *RISK* is defined as total net loans as a percentage of total assets. We expect it to carry a positive sign, reflecting a higher return to a more risky position.[29] We also include *LIQUIDITY*, liquid assets as a percentage of total assets. It is expected to have a negative coefficient, as banks trade o. liquidity for profitability. Finally, we include *COST*, the ratio of total operating expenses over total operating income. Of course, it is expected to have a negative coefficient.

We use the sum of demand deposits as a proxy for total demand.[30] Market size is therefore measured by *MARKET*, total deposits in billions of

28 The discussion whether or not this is the best risk measure is beyond the scope of this paper. It captures the exposure of banks to some extent. More refined measures using e.g. risk-weighted assets should be considered superior. They have however been largely absent from the literature discussed here (also for reasons of data availability).

29 The opposite is the case in the so-called ‘quiet life hypothesis’, that assumes banks trade o. (some of) their monopoly rents against a lower risk (Molyneux et al. (1997), pp. 117–118).

30 We have also estimated the SCP-models with GNP, but this variable was never significant and those results are not reported here.

guilders, measured in constant prices. It is expected to carry a negative sign if there is potential competition from both existing competitors and possible entrants. On the other hand, if the market is less contestable, an increase in its size leads to a positive expected effect on performance.

Estimated cost X-efficiency was taken from Bos (2002). In the first step, we regress the logarithm of a bank's market share on its cost X-efficiency estimate: $\ln MS_{i,t} = 0.038 - 0.007 \ln CE_{i,t} + \nu$, where ν is included in Table 3 as $MS(CE)$. Matching these efficiency results with the sample data used so far results in a further decrease of the number of observations to 201 (market coverage is still very high and the decrease is proportional per year).

7 RESULTS

Table 3, from left to right, displays estimation results from the different models in the same order as they were discussed in section 3. All models were estimated both with and without a one-year lag. Since they do not differ significantly from the non-lagged specifications, estimations with a lag are not reported in this and the following sections.[31] Since the fixed effects results do not differ, they are not reported here.[32] The sample period 1992–1998 is relatively stable, and relatively short. It is therefore not surprising that none of the fixed effects differed significantly from the intercept in the OLS model. In addition, coefficients for all variables were highly similar. We focus therefore on the OLS specifications. In discussing the estimation results, we focus on the market structure variables. Subsequently, we briefly elaborate on the control variables.

In the first column, we start by estimating the traditional SCP model. Contrary to expectation, the concentration ratio C_3 carries a negative sign. The specification with HH as a market structure variable tells the same story. For both specifications, overall fit of the model is good considering the small number of control variables and what is practice in the literature. As is also common in market power studies of the Dutch banking market, no evidence of market power is found.[33]

31 To minimize possible problems with heteroskedasticity, all models in this paper are estimated using weighted least squares with total assets as weights. We note that accounting practices themselves already lead to a lag; bank profit is a flow variable, whereas the independent variables, including market structure (and market share) are stock variables that change little from year to year. Both specifications are estimated both with simple OLS and as fixed effects models.

32 These results are available upon request from the author.

33 Given the way the market concentration measures are constructed, the variance in e.g. C_3 may of course simply be white noise. This constitutes an additional, empirical drawback of traditional SCP models.

TABLE 3 – RESULTS

	SCP		Cournot	Market power and efficiency				
	C3	HH	MS	SCP-traditional		SCP-modified		Cournot
H_0	C3 > 0	HH > 0	MS > 0	C3 > 0 & MS = 0	HH > 0 & MS = 0	C3 > 0 & MS(CE) = 0	HH > 0 & MS(CE) = 0	MS(CE) > 0 & CE = 0
H_1	C3 = 0	HH = 0	MS = 0	C3 = 0 & & MS > 0	HH = 0 & MS > 0	C3 = 0 & MS(CE) > 0	HH = 0 & MS(CE) > 0	MS(CE) = 0 & CE > 0
Model	1	2	3	4	5	6	7	8
	b(se)	b(se)	b(se)	b(se)	b(se)	b(se)	b(se)	b(se)
Constant	0.016 (0.003)	0.013 (0.002)	−0.068 (0.016)	0.017 (0.003)	0.013 (0.002)	0.017 (0.004)	0.013 (0.002)	−0.094 (0.028)
HH		−0.007 (0.003)			−0.006 (0.004)		−0.006 (0.004)	
C3	−0.008 (0.004)			−0.008 (0.005)		−0.008 (0.005)		
MS			0.006 (0.002)	−0.001 (0.001)	−0.001 (0.001)			
MS(CE)						−0.001 (0.001)	−0.001 (0.001)	0.007 (0.003)
CE	0.000 (0.000)	0.000 (0.000)	0.020 (0.015)					
Risk	−0.007 (0.001)	−0.007 (0.001)	−0.013 (0.013)	−0.007 (0.002)	−0.007 (0.002)	−0.007 (0.002)	−0.007 (0.002)	0.021 (0.021)
Liquidity	−0.009 (0.001)	−0.009 (0.001)	−0.039 (0.005)	−0.010 (0.001)	−0.010 (0.001)	−0.010 (0.001)	−0.009 (0.001)	−0.041 (0.006)
Cost	0.000 (0.001)	0.000 (0.001)	−0.016 (0.010)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	−0.004 (0.013)
Market	0.002 (0.001)	0.000 (0.001)	0.083 (0.014)	0.001 (0.002)	0.000 (0.001)	0.002 (0.002)	0.000 (0.001)	0.078 (0.017)
R^2adj.	0.287	0.288	0.284	0.319	0.317	0.316	0.314	0.348
Sample size	351	351	351	201	201	201	201	201

In the third column, the Cournot model has a fit similar to that of the SCP model. Again, estimating a fixed effects model does not change results. The coefficient β_1 for market share variable *MS*, although not very large, is highly significant. Since we find that $0 < \beta_1 < 1$, we cannot reject the hypothesis that there is market power.[34] Concluding, the Cournot model appears to be provide rather different evidence than the traditional SCP model. From this model we cannot reject the hypothesis that there is (some) market power in the Dutch banking market.

Columns 4 and 5 contain the estimation results for the SCP model with the traditional test for the Efficiency hypothesis. Columns 6 and 7 show the modified test results. Signs for both specifications and tests are similar. Results of the specification with C_3 as a market structure variable and *HH* as a market structure variable differ very little. This once again confirms the observation that empirically there does not appear to be a dominant market structure variable. Contradictory to expectation, the market share variable *MS* is positive but insignificant as are the market structure variables.

In the final column of Table 3, testing the Efficiency hypothesis with the Cournot model shows somewhat different results. The coefficient for *MS*(*CE*), which is orthogonal to efficiency, is positive and significant. Although somewhat larger in magnitude the coefficient for cost efficiency is marginally insignificant. This would seem to be evidence in favor of the existence of market power. Taken as such, these results confirm the results from the Cournot model estimated before and suggest that there is evidence of some market power on the Dutch banking market.

The control variables appear to be rather robust to different specifications. *RISK* carries an unexpected, negative and significant coefficient. The only exception is the Cournot model with a modified Efficiency hypothesis, where increasing *RISK* has positive but insignificant effect. As explained above it is composed of the ratio of net loans over total assets.[35] Although quite common in the literature as a risk measure, it apparently fails to capture the effects of increases in risk-taking on profits. *LIQUIDITY* is always negative and significant, indicating that banks pay for higher liquidity by lower profits. The effect is less for the Cournot model, possibly due to the fact that the dependent variable here only consists of the markup and not total profits. The coefficient for the *COST* variable is close to zero and never significant. This is in line with much of the empirical literature that tends to find weak links between bank performance and cost ratios.[36] Finally, the variable *MARKET* is only significant in the Cournot specifications, where it is positive. This results confirms earlier remarks that the Dutch (deposit) market is

34 Of course, we also estimated the Cournot model with ROA as a dependent variable. These results did not qualitatively differ from those reported here.

35 Correlation with *LIQUIDITY*, which is also a ratio over total assets is very low.

36 Note that this is different from the link between efficiency and performance.

not very contestable. Admittedly, though the results for *MARKET* are perhaps handicapped by the fact that in a static setting it is expected to capture a dynamic effect. However, additional estimations (results not included here) for this model specified in growth terms did not change its sign or significance however.[37]

Overall, the control variables carry the expected sign in most cases. Importantly, the Cournot model with the modified Efficiency hypothesis is the only specification where all the variables carry the expected sign. In addition, it has the highest fit and results in significant coefficients (except for the *COST* variable).

8 CONCLUSION

This paper investigated whether improving the traditional SCP model provides us with additional insights in the existence of market power in the Dutch banking market. We first improved the measurement of market structure. Then, we introduced a simple Cournot-model, which better enabled us to measure market power for different market structures. Finally, we included the Efficiency hypothesis and modified it to avoid identification problems when testing it jointly with the market power tests. Theoretically speaking, the Cournot model provides a better foundation for testing the existence of market power than the SCP model. Likewise, explicitly correcting for and including efficiency allows for a more appropriate test of the Efficiency hypothesis. Empirical results confirm this observation, at least for Dutch data. The introduced improvements based on the Cournot models are the only ones resulting in tests that are consistent with the underlying models. In addition, the Cournot model with the modified Efficiency hypothesis has the highest fit and is the only specification where all the control variables also carry the expected sign.

Concluding, the analysis presented here formalizes the doubt that is often expressed with respect to market power tests. Evidence from the Cournot model suggests that we cannot reject the existence of market power, although its impact on performance may be small. It also underlines the need for additional research into measuring strategic interaction and revives the need for additional explanations of differences in bank performance.

APPENDIX

THE STIGLER APPROACH

In this appendix we show that, under the presumption that collusive behavior de facto exists, the extent to which banks will engage in collusive behav-

37 It also did not change the rest of the conclusions.

ior is directly and positively related to their market share. An increase in market share (MS_i) leads to an increase in awareness (l_i), and thereby to collusive behavior.[38]

To prove this, we start with Stigler's rule that the (pricing) behavior of firms must be inferred from the way their customers react. The assumption then is that '[T]here is no competitive price-cutting if there are no shifts of buyers among sellers' (Stigler (1964), p. 48). Thus, the higher the loyalty of customers, the less likely a bank is to behave collusively. Intuitively, the higher customer loyalty is, the less a bank has to gain by cutting prices: it does not have to do it to keep its old customers and it does not expect to gain a lot of new customers. In terms of the dynamic Cournot model, the lower the conjectural variation λ_i, the more likely the bank is to engage in collusive behavior.

In line with Stigler (1964), a bank targets three groups of customers. First, it wants its share of the growth of new customers [C_n]. Second, it wants to retain as many of its old customers as possible [C_r]. Third, it wants growth through the other banks' old customers [C_o]. Let $N_n =$ number of new customers, and $N_o =$ the total number of old buyers in the market.[39] Also, let $n_o^i =$ the number of old customers for bank i. The probability of repeat purchases is denoted p, and MS_i is bank i's market share.[40] The expected number of customers for each group is given by:

$$E\left(C_n^i\right) = MS_i * N_n \tag{12a}$$

$$E\left(C_r^i\right) = p * MS_i * N_o \tag{12b}$$

$$E\left(C_o^i\right) = (1-p) * MS_i * (N_o - n_o^i) \tag{12c}$$

For each group the cost of cheating (i.e. not behaving collusively) is given by the variance of the expected number of customers. The higher this variance, the more likely a bank is to show collusive behavior. For each set of customers, variances are given by:[41]

$$var\left(C_n^i\right) = [N_n * MS_i * (1 - MS_i)] \tag{13a}$$

$$var\left(C_r^i\right) = [No * p * MS_i * ((1-p)MS_i)] \tag{13b}$$

$$var\left(C_n^i\right) = [(N_o - n_0^i) * ((1-p)MS_i) * (1 - (1-p)MS_i))] \tag{13c}$$

38 On a market level, the notion that concentration 'facilitates collusion between firms and increases industry-wide profits' (Tirole (1993), p. 222) is widely accepted.

39 Where $\sum_{i=1}^{N} X_i = X = f(N_0)$.

40 Where $MS_i = X_i / \sum_{i=1}^{N} X$.

41 A bank expects a consumer to become either customer (with expectations dependent on its current market share) or not. Thus, for the binomial mean $\mu = n * p$, variance is $n * \pi(1-\pi)$.

As explained, an increase in market share (MS_i) leads to more collusive behavior if $dvar(\cdot)/dMS_i > 0$. This requires:

$$\frac{dvar\left(C_n^i\right)}{dMS_i} = N_n - (2 * N_n * MS_i) > 0 \tag{14a}$$

$$\frac{dvar\left(C_r^i\right)}{dMS_i} = pN_o - (2 * N_o * p2 * MS_i) > 0 \tag{14b}$$

$$\frac{dvar\left(C_o^i\right)}{dMS_i} = \left((1-p)\left(N_o - n_0^i\right)\right) - \left(2(1-p) * \left(N_o - n_0^i\right) * MS_i\right) > 0 \tag{14c}$$

Equations (14a) and (14c) hold iff $MS_i < 0.5$. As can be seen in Table 2, the maximum market share held by a bank in the Dutch banking market over the period 1991–1998 is 0.45, so this is the case. Equation (14) holds *iff* $p > 2p^2 * MS_i$. Since $MS_i < 0.5$, this condition is also satisfied.

Since C_n^i, C_r^i and C_o^i are disjoint subsets of the whole customer population (i.e. there is no overlap), we can simply add up their variances, which under the above mentioned conditions are larger than zero. Summing up therefore, an increase in market share MS_i leads to an increase in awareness λ_i and thereby to more collusive behavior.

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