Laura Vajanne

Inferring market power from retail deposit interest rates in the euro area

EUROJÄRJESTELMÄ
EUROSYSTEMET

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Abstract

This paper tests for the existence of market power in banking, using data on demand deposit rates of households and corresponding market rates in five euro area countries. An implicit measure for market power is based on a partial adjustment model that also allows for an asymmetric response of deposit rates to changes in market rates. The period covers the ten years since introduction of the euro. The analysis indicates that banks are exercising major market power within the euro area. In addition to general sluggishness, bank deposit rates' reactions are clearly asymmetric: flexible when market rates are decreasing and rigid when rates are increasing. The degree of asymmetric behaviour can be interpreted as a further indication of the market power banks exercise. Despite country differences, a general pattern of interest rate adjustment in demand deposit pricing is observable.

Keywords: competition, banking industry, retail interest rates

JEL classification numbers: G21, L11, L13

Markkinavoiman mittaaminen pankkien talletuskoroista euroalueella

Suomen Pankin keskustelualoitteita 27/2009

Laura Vajanne
Rahapolitiikka- ja tutkimusosasto

Tiivistelmä

Tässä työssä testataan pankkien markkinavoimaa viidessä euromaassa markkinakorkojen ja kotitalouksien käyttelytilien talletuskorkojen välisten reaktioiden avulla. Markkinavoimaa mitataan implisiittisellä mittarilla, jossa talletuskorkojen oletetaan sopeutuvan markkinakorkojen muutoksiin osittaisen sopeutumisen mallin mukaisesti. Mallissa sallitaan myös talletuskorkojen epäsymmetrinen sopeutuminen markkinakorkojen muutokseen. Tutkimusperiodi alkaa tammikuusta 1999 ja ulottuu maaliskuuhun 2009. Tulosten mukaan euroalueen pankkien talletusten hinnoittelussa on löydettävissä yhtenäisiä piirteitä huolimatta pankkitoiminnan eroavaisuuksista maiden välillä. Pankeilla on ollut huomattavasti markkinavoimaa hinnoitellessaan talletuksia. Talletuskorot reagoivat niukasti markkinakorkojen muutoksiin, ja lisäksi talletuskorkojen reaktiot ovat selvästi asymmetrisiä. Talletuskorot joustavat enemmän markkinakorkojen laskiessa kuin niiden noustessa. Asymmetria voidaan tulkita lisäevidenssiksi pankkien markkinavoimasta.

Avainsanat: kilpailu, pankkitoimiala, vähittäispankkikorot

JEL-luokittelu: G21, L11, L13

Contents

1 Introduction

The aim of this paper is to propose a straightforward measure for assessing market power in banking by means of a model in which demand deposit rates are modelled as a function of corresponding market rates. Deposit pricing is one of the core businesses of banking having a direct effect on banks' profitability. Compared to pricing loans, the competition effect should be more pronounced for deposits as they are less affected by risk factors and other informational imperfections such as moral hazard and adverse selection problems. Concentrating only on the demand deposit pricing confines the bank's optimization problem which varies depending on the maturity of its liabilities.

The model is based on the paper by Hutchison and Pennachi (1996). The authors presented a deposit pricing model where retail deposit rates are modelled as a function of corresponding market rates and where the response of deposit rates to changes in market rates describes the market power of banks. If the markets were perfectly competitive banks' retail rate adjustment would be complete and retail rates would follow market rates without any delay. When the competition is imperfect, the response of retail rates describes the pricing power banks have when setting their interest rates. This basic model is enlarged allowing asymmetric responses of retail deposit rates which seem, by and large, to improve the results of the basic model.

The measurement of competition in banking is of considerable policy relevance. A competitive banking sector is a highly important element in the financial system in general and especially in the euro area where the financial structure is to a large extent bank centred. A more competitive banking market is expected to drive down bank loan rates and to give a fair compensation to depositors, thereby adding to the welfare of households and enterprises. The monetary policy transmission also depends crucially on the intensity of competition in banking markets. Less competition might indicate a sluggish and rigid pass through of the official rate changes to retail interest rates thus mitigating the expected effect of the change in the monetary policy. The recent financial crisis has also stressed the need for a proper competition measure in banking. Particularly the trade-off among competition and financial stability is a highly relevant issue currently under discussion.

The results of research assessing banking competition in the euro area have shown to be ambiguous when answering the question of competition intensity. Different measures tell us different stories about the trends and developments of competition. Competition measures are complex to estimate and difficult to interpret. Carbo et al (2009) demonstrate in their recent study for a cross-section of 14 European countries over the period 1995–2001, that the comparison of indicators often gives conflicting predictions of competitive behaviour across

countries, within countries, and over time. The usual measures are only weakly positively related to one another. Hence it is a challenge to search for an indicator to answer questions such as how intense competition in banking in monetary union member countries can be or whether the creation of the monetary union possibly changed the competitive position in banking among the countries.

A pass-through from market rates to retail banking rates has rarely been used to investigate the degree of competition or imperfection in the banking market. Traditionally the pass-through analysis concentrates to investigate the monetary policy transmission mechanism, where the transmission from monetary policy rate onto lending and deposit rates is considered.[1] Empirical results from previous studies show that retail interest rates tend to adjust slowly and less completely to changes in competitive market interest rates. In addition, responses seem to be asymmetric eg deposit rates are displaying rigidity when market rates increase but flexibility when market rates decrease. Available evidence for the euro area banking sector also suggests that there are significant differences across the countries in the way banks adjust their interest rates in reaction to changes in corresponding market rates; both as regards the long-term multipliers and the speed of adjustment to long-term equilibrium.

This paper presents a test for market power utilizing a partial adjustment model. The sensitivity of demand deposit rates to changes in market rates is used as an indicator for the level of competition. The hypothesis tested is the following: the less flexible deposit rates the more market power banks are exercising. To be able to construct this type of an indicator and perform comparisons across the countries there are necessary assumptions the underlying circumstances must fulfil. Firstly, market rates should represent the cost of banks' refinancing and in competitive markets changes in costs are reflected in banks' deposit pricing. Within the euro area, the common currency and single monetary policy guarantee that banks face a common wholesale interest rate, which can be assumed to represent the opportunity cost for refinancing. The interbank markets are also exogenous when seen from the banks' viewpoint.[2] Secondly, there must be a sufficiently similar regulatory and operational framework for banking to facilitate the comparisons. In Europe there have been noteworthy differences in the regulatory framework regarding banking deposits (eg taxation practices) but the significance of these regulatory measures has been declining over time. During the last ten years, banks have already been facing a widely harmonised supervisory and regulatory environment within the monetary union.

[1] Empirical literature of the pass-through is very rich, see eg van Leuvensteijn et al (2008) and the references therein. Closely related to this strand of literature is research where the link between bank interest rate margins and the market structure of the banking system is investigated eg Hannan and Berger (1991), Neumark and Sharpe (1992).

[2] The existence of the interbank markets allows us also to assume that lending rates and deposit rates are priced independently.

In addition, we have to assume that the demand deposit interest rates stand for sufficiently harmonised banking products in order to be comparable across the countries. Using data on overnight deposit accounts for households collected by European System of Central Banks (ESCB) should fulfil this condition. The content of these accounts can be assumed to include the same kind of services across the countries. Demand deposit accounts generally include the possibility to use a payment card, an electronic access to the account and an opportunity to pay bills from the account. Thus even if banks offer highly differentiated products to their customers and bundle their services, the content of demand deposit accounts seems to be a highly homogeneous product across the euro area. The most relevant feature – to withdraw deposits without any termination clause – is by definition a common feature for the demand deposits category.

The contributions of this paper are the following. First, a straightforward approach for assessing banking competition is proposed. Second, the above-mentioned highly homogeneous deposit interest rates of a well defined banking product over the whole period of the euro are used. The ESCB harmonised interest rate data collection from Monetary Financial Institutions did not start until 2003, but an historical data series going back to 1999 is available for some of the euro countries being tested here. Third, in this study changes in the European Central Bank's (ECB) refinancing interest rate defining the stance of the monetary policy are used to describe the movements of the short term market rates.

The paper is structured as follows. Section 2 proposes a test of competition making use of a partial adjustment model. A profit maximizing bank facing a less than perfectly elastic demand for its deposits is assumed. An optimal retail interest rate is derived as a function of the competitive market rate. The theoretical model is estimated in a discrete time form allowing the possibility of retail rates to an asymmetric adjustment of changes in market rates. Section 3 describes the data used in the study. It consists of monthly data for households' overnight deposit interest rates for the period 1999/01 to 2009/03, collected from monetary financial institutes of five euro area member countries (Austria, Finland, Germany, Italy and Spain) plus the euro area as a whole. In section 4 the model is estimated and the results are presented. Section 5 provides discussion of the results and conclusions.

2 Inferring market power from retail deposits interest rates

Traditional models in finance usually assume that prices of financial assets and liabilities are set in perfectly competitive markets. Perfect competition would indicate that banks were price takers and a profit-maximizing bank would adjust its volume of loans and deposits such a way that it would pay an interest rate on deposits equal to the marginal cost of capital, less any cost of doing business; and borrowers would pay for loans the same cost of capital plus a compensation for credit risk and marginal operating costs. Changes in marginal costs would be converted entirely to retail prices.

This competitive market paradigm is, however, less defensible for many financial instruments. Significant market power can exists particularly in retail financial markets. As empirical evidence indicates, retail deposit rates tend to be lower, and adjust more slowly and less completely to changes in competitive market interest rates. Consequently, theoretical models in banking usually assume an imperfect competition, often within an oligopolistic or monopolistic framework (Freixas and Rochet, 2008). In these models, competitors face linear downward sloping demand functions and retail rates are set as a mark-up over the original (opportunity) cost of funds. If banks exercise some market power the decision of a bank to adjust its deposit rate to a change in corresponding capital market rate depends positively on the interest rate elasticity of the deposit supply curve faced by an individual bank.[3] This elasticity is in turn a positive function of the degree of competition in the deposit market.

A wide range of factors maintain the market power in banking. Entry into the banking sector is restricted by regulatory agencies, creating one of the preconditions for a degree of monopoly power and administrated pricing. Market power and an inelastic demand for retail bank products may also result from the existence of switching costs and asymmetric information costs. Switching costs may arise when bank customers consider switching from one bank to another, for example when a household intend to transfer its savings deposits from bank A to bank B. Costs of acquiring information and search and administrative costs are potentially important in markets where significant information or transaction costs exist. The costs are also expected to be high in markets with long-term relationships and repeated transactions (Sharpe, 1997). Generally the existence of switching costs results in market segmentation and reduces the demand elasticity (Klemperer, 1987). Moreover, even in the presence of small switching costs, the theory predicts that the smaller the proportion of customers that are 'new' to the

[3] Also other factors than competition affect to the response of retail bank rates to changes in market rates like costs associated with adjusting retail rates.

market, the less competitive prices will be. Thus, even with non-co-operative behaviour, switching costs result in a retail bank interest rate adjustment of less than one to a change in the market interest rate (Lowe and Rohling, 1992).

A relevant question regarding the responses of deposit rates to changes in market rates is whether the responses are likely to be asymmetric with respect to increase and decreases in the market rates. The presence of the asymmetry is well documented in many empirical researches considering deposit rates responses to market interest rates.[4] The general finding is that deposit rates are slower to increase when market rates are mounting than they are to decrease when market rates fall ie there is positive asymmetry.

Asymmetric pricing has been documented in several other sectors, as well as in banking. Gasoline prices respond more quickly to crude oil price increases than decreases (Borenstein, Cameron, and Gilbert, 1997). Lach and Moraga-Gonzáles (2009) examine asymmetric price effects of competition using data on gasoline prices. They found that as competition increases, the distribution of prices spreads out: the low prices go down while the high prices go up. As a result, competition has an asymmetric effect on prices. These findings are consistent with a theoretical model where consumers differ in the information they have about prices. In producer and consumer goods Peltzman (2000) finds that the prices of more than two-thirds of these products rises more quickly in response to input cost increases than they decline in response to input decreases. This leads Peltzman to the strong conclusion that the standard economic theory of markets is wrong, because it does not predict or explain the prevalence of asymmetric price adjustment.[5]

The asymmetry in deposit pricing is commonly linked to the market power and lack of competition since profit maximizing behaviour forces firms in competitive markets to adjust their prices to new cost conditions immediately and presumably symmetrically. This hold when frictions and imperfections are absent. If the intensity of competition in the market for deposits is rather low and banks have market power in their pricing, they might be slower to adjust deposit rates upwards in order to increase average profits over the interest rate cycle. The fact that banks are delaying changes that would shrink their profits refers to oligopolistic structures of banking. Banks may expect their competitors to be more likely to follow rate reductions than increases, especially if mistaken for attempts at gaining market share. Moreover, in the presence of collusive

[4] In US banking Hannan and Berger (1991), Neumark and Sharpe (1992), Mester and Saunders (1995) and Kahn, Pennacchi and Sopranzetti (2000); Scholnick (1996, 1999) in Malaysian, Singaporean and Canadian banks; Hofmann and Mizen (2001), Heffernan (2007) for UK banks; Sander and Kleimeier(2002, 2004) and Gropp et al (2007) for euro area banks.

[5] See also a comprehensive survey of asymmetric price transmission by von Cramon-Taubadel and Meyer (2004).

arrangements, the risk of triggering a price war through rate increases may make upward revisions inherently costly.[6]

The possible existence of asymmetric price transmission is of considerable importance. It could have important welfare and, hence, policy implications. It implies that in the case of banking depositors do not benefit from a market interest rate rise that would, under conditions of symmetry, have taken place sooner and/or have been of a greater magnitude than observed. Thus it implies a different distribution of welfare than would be obtained under symmetry, because it alters the timing and/or the size of the welfare changes that are associated with price changes.

As a summary from the discussion above, we need to take into account at least following points when estimating the response of retail bank deposit rates to changes in corresponding market rates:

(i) Banks are price setters for deposits: imperfect competition in markets.
(ii) Banks are price takers in wholesale markets.
(iii) Deposit interest rates are adjusting only partially to changes in corresponding market rates.
(iv) Responses of the deposit rates might be asymmetric to increases and decreases in market rates.

2.1 Theoretical model

This section presents a simple model where the aforementioned features of setting deposit interest by a bank are taken into account. The model is based on a seminal paper by Hutchison and Pennacchi (1996), where they model retail interest rates in order to measure rents and interest rate risk of banks in imperfect financial markets. The model has been evolved later in eg O'Brien (2000) and Dewachter, Lyrio and Maes (2006).

The market for retail deposits is modelled by Hutchison and Pennacchi as having a downward sloping demand curve that is a function of deposit interest rate, the competitive market interest rate and other market variables. Individual banks are assumed to set their equilibrium prices and quantities so as to maximize

[6] The oligopolistic behaviour where rivals will quickly match price reductions but only hesitantly and incompletely (if at all) follow price increases is the basis for kinked demand curve. This pattern of expected behaviour produces a kink at the existing price in the demand curve for the product of an oligopolist, and the corresponding marginal revenue curve will possess a discontinuity the length of which is proportional to the difference between the slopes of the upper and lower segments of the demand curve at the kink. Thus, if the marginal cost curve passes between the two parts of the marginal revenue curve, the fluctuations in marginal cost are not likely to affect output and prices ie for small changes in marginal costs, prices do not move; for larger changes, adjustment is stickier in the upward direction. See Stigler (1947).

profit based on considerations and the degree of competition in the market. The degree of competition in the market on the other hand is determined by demand conditions and characteristics of interaction between firms.

Banks take savings in the form of deposits and subsequently lend them out for investments, and an efficient market would imply that the interest paid to deposit holders at time t $r_d(t)$ would equal the marginal cost of capital r(t), less the transaction costs c(t). If the bank's marginal revenue from investing its deposits equals the market interest rate we can solve the optimal interest rate $r_d^*(t)$ as a function the competitive rate and other exogenous variables.

The solution to the problem is the following

$$r_d^*(t) = r(t) - c(t) - D/(\partial D/\partial r_d) \tag{2.1}$$

If a bank's retail deposit market is perfectly competitive, $\partial D/\partial r_d = \infty$ and thus $r_d(t)$ would equal the competitive rate r(t)–c(t). A less than perfectly elastic demand for deposits implies a deposit interest rate that is below r(t)–c(t). The smaller the elasticity, the greater is the market power of the bank on deposit.

To generate an equilibrium process for the bank's optimal deposit interest rate the form of the bank's demand function and the processes for the competitive market rate must be specified. Consistent with the equilibrium results in Hutchison (1995), Hutchison and Pennacchi assume that the inverse demand elasticity $D/(\partial D/\partial r_d)$ is a linear function of the market rate. This results to the bank's optimal retail deposit interest rate having the simple linear form

$$r_d^* = d_0 + d_1 r(t) + e(t) \tag{2.2}$$

2.2 Empirical implementation

It is not at all clear in which form the theoretical model should be estimated. Perhaps the simplest way of estimating eq. (2.2) is to use a partial adjustment mechanism of the form

$$r_{dt} - r_{dt-1} = b[r_d^* - r_{dt-1}] \tag{2.3}$$

Substituting eq. (2.2) into (2.3) and rewriting it we get the standard partial adjustment model

$$r_{dt} = \alpha + \beta r_t + \gamma r_{dt-1} + \varepsilon_t \tag{2.4}$$

The coefficient α is a constant mark up – actually 'mark down' in the case of deposits – on marginal costs while the size of the parameter β depends on the demand elasticity for deposits, and ε is the error term.

This type of partial adjustment model is a practical way to represent deposit rate stickiness such that the model dynamics are estimable and tractable. The marginal cost facing banks is assumed to be the corresponding money market rate, as this could be a proxy for bank's cost of funding being directed to a segment concerned. If banks were operating effectively in a perfect competition, the response to a change in market rates would be direct and there would be a complete pass-through of adjustment in money market rates to subsequent changes in a bank's retail rates; β would get a value close to unity. Retail bank interest rates in less competitive or oligopolistic segments of the retail bank market adjust incompletely and only with a delay; β gets a value less than unity and the smaller is the response of a change of market rate to deposit rate, the greater is the market power of a bank. When the intensity of competition increases, bank interest rate becomes more sensitive to changes in market rates. An imperfect pass-through can be viewed as a result of imperfect competition.[7]

The equation will be estimated in differenced form

$$\Delta r_{dt} = \alpha' + \beta' \Delta r_t + \gamma' \Delta r_{dt-1} + \varepsilon_t' \qquad (2.5)$$

where $\varepsilon_t' = \varepsilon_t - \varepsilon_{t-1}$ and the constant α' is included to take the possible trend effect from eq. (2.4) into account.

As a diagnostic check on the model specification I have used a differencing test proposed by Davidson, Godfrey and Mackinnon (1985) which is a simplified version from the test proposed by Plosser, Schwert and White (1982). Testing results point to marginal problems in a couple of cases.[8] One way out of the problems is to add some additional variables or to use an alternative functional form in estimation. Thus, as implicit in the model above was the assumption that the response of deposit rates to market rates is symmetric; that is, the response does not depend upon whether market rates are moving upwards or downwards,

[7] A low estimate of β for the average bank should be interpreted, however, with care. A low estimate of β necessarily implies is that a bank's current period deposit rate has a relatively high correlation with its previous period deposit rate, compared with its correlation with the current month's market rate. This may reflect expectations of mean reverting market interest rates, costs of adjusting prices, or even the possibility that the market rate is a noisy measure of marginal opportunity cost. See Neumark and Sharpe (1992).

[8] The differencing test gives a warning of misspecification in the case of Finland and in the euro area as a whole. Values of the F-test were 4.41 with probability of 0.014 and 3.60 with probability 0.030 respectively. Other four cases passed the test. Typically specification errors include omitted variables, measurement errors or simultaneous equation problems.

we try next to capture explicitly asymmetry in rising versus declining market rates by modifying equation (2.5) to a non-linear adjustment model.[9]

Allowing the asymmetric reaction of deposit rates to changes in market rates, we get the following equation

$$\Delta r_{dt} = \alpha^* + \beta_1 D1\Delta r_t + \beta_2 D2\Delta r_t + \gamma^* \Delta r_{dt-1} + \varepsilon_t^* \qquad (2.6)$$

where
D1 = 1, D2 = 0 when ECB's refinancing rate is decreasing or stable
D1 = 0, D2 = 1 when ECB's refinancing rate is increasing.

This type of a model can be seen as a special case of the smooth transition regression models which are belonging to a larger group of regime-switching models (Granger and Teräsvirta, 1993). The regime in our case is defined by the monetary policy stance (easing or tightening) and thus any kind of smoothing or non-zero threshold does not seem necessary. The model reduces to a standard partial adjustment form under symmetric adjustment. As the emphasis of this study is in the price sensitiveness we pay less attention to the possible non-linearity of the adjustment speed towards the long run equilibrium which is the framework commonly used in non-linear error correction models.[10]

Equation (2.6) is compared to eq. (2.5). If the price responses are asymmetric $\beta_1 \neq \beta_2$, and if deposit interest rates respond stronger when market rates are decreasing compared to increasing market rates $\beta_1 > \beta_2$. Positive asymmetry means that banks are slower to adjust deposit rates upwards (β_2) in order to increase average profits over the interest rate cycle than vice verse. On the other hand, if the markets are very competitive, banks might be more reluctant to adjust deposit rates downwards in order to avoid loss of customers. The behaviour refers to oligopolistic structures of banking and to the market power banks exercise.

[9] There could be also possibilities to use functional forms not explicit on asymmetry but more flexible than the standard (symmetric) partial adjustment model or those recognize higher-order or more complex lag dependencies on market rates like in Jarrow and van Deventer (1998) or in Hawkins and Arnold (2000).

[10] Sanders and Kleimeier (2004) estimate five asymmetric specifications for the adjustment of interest rates in the error correction framework. They allow different smoothing processes and thresholds.

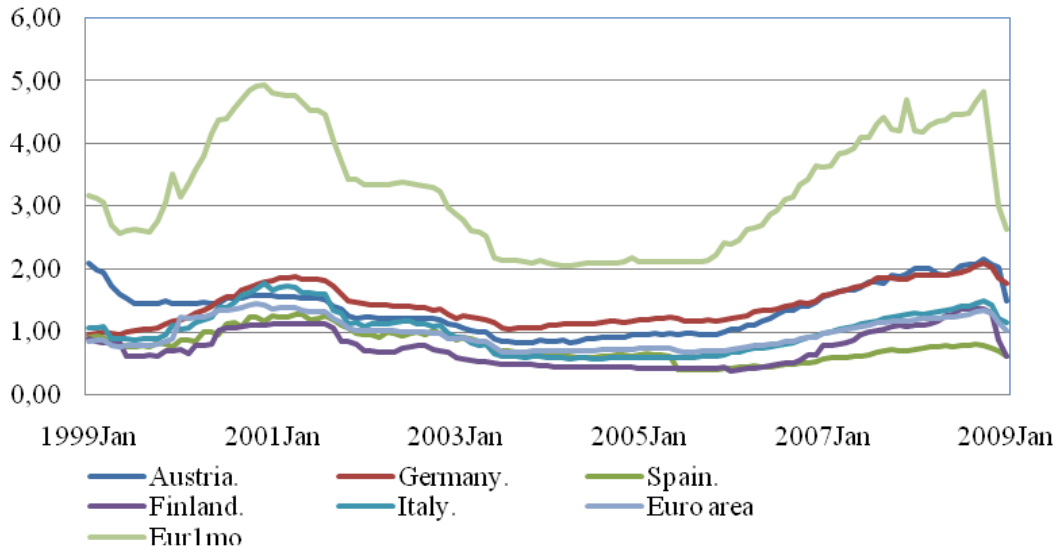
3 The data

The analysis is based on overnight deposit rates for households as defined by the ESCB in the interest rate data collection for Monetary and Financial Institutions. Overnight deposits include all transaction account deposits, overnight debt instruments and overnight money market deposits without any agreed fixed terms to maturity.

The overnight deposits cover around one third of households' deposits in the euro area. The other main categories are deposits redeemable at notice and deposits with agreed fixed term to maturity. The harmonised data collection started in Eurosystem in January 2003, but for some euro area countries central banks have compiled historical series backwards. We have had the possibility to use in estimations data from 1999 onwards for Austria, Finland, Germany, Italy and Spain plus the euro area as a whole.

One month Euribor is used as a competitive market rate. It has been chosen because it correlates closely with overnight deposit rates indicating the role of corresponding competitive market rate. The developments of the interest rates are shown in Figure 3.1. The overnight deposit rates are clearly below the market rates. The levels of the overnight interest rates vary across the countries, on the average the highest deposit rates have been paid in Germany and the lowest in Finland. The spread between Euribor and overnight deposit rate has been in the whole euro area slightly more than 220 bps. Also the sluggishness of deposit rates is clearly observable. The standard deviation of the overnight deposit rates is only around one third of Euribor's standard deviation.

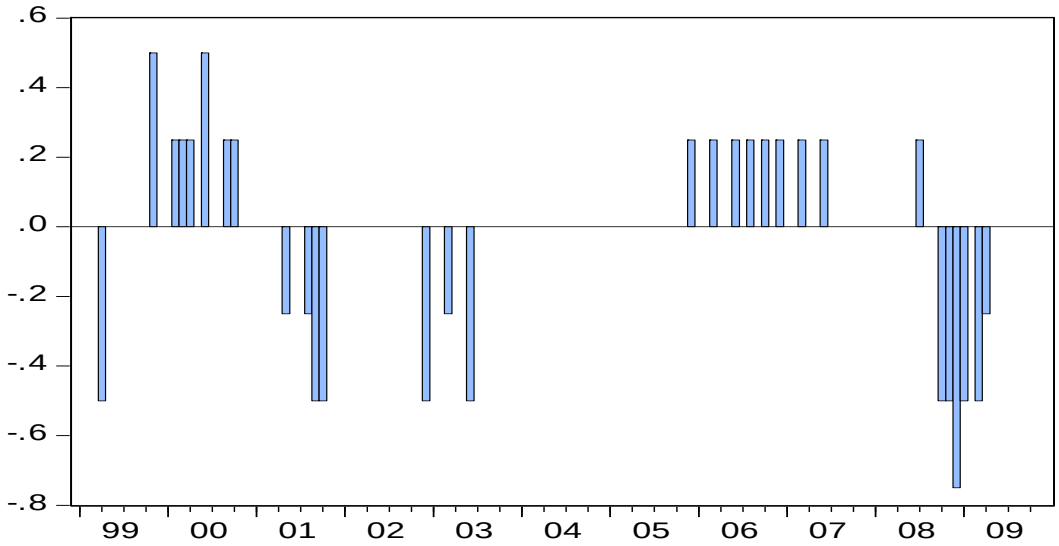
Figure 3.1 **Overnight deposit interest rates and one month euribor in 1999–2009, %**



Differences in interest rate levels across the euro countries are still likely to reflect the same product heterogeneity, differences in market practices and in fiscal framework. However, it seem to be a common practice all over the euro area that banks remunerate overnight deposits at low interest rates and in return charge low fees for transaction services (money transfer, credit card, internet banking). Nor might the relevance of differences in fiscal framework eg exemption from withholding tax, be very significant in overnight deposits compared to deposits with longer maturity.[11] The relative differences between interest rate levels seem in any case to have remained rather stable during the last ten years, which indicates that the differences in interest rate levels don't have an impact to the estimation results.

Changes in the ECB's refinancing interest rate are chosen to describe the changes in market rates regime. The changes in the ECB's refinancing rate are shown in Figure 3.2. The changes in the Eurosystem monetary policy have been outspoken and consistent signalling the stance of the monetary policy during the last ten years. Thus choosing to use the policy rate as an indicator for increasing or decreasing interest rate regime instead of changes in Euribor rates removes randomness and noise which are characteristic of changes in short term market rates.

Figure 3.2 **Changes in ECB's policy rate, percentage points**



[11] Sometimes these average spreads are used as a measure for competition but for the reasons mentioned they might misleading More detailed analysis of differences in MFI interest rates across the euro area countries can be found in the ECB (2006).

4 Estimation results

As a summary, the estimated models, used symbols and their operational counterparts are following

$$\Delta r_{d_{i(t)}} = \alpha' + \beta' \Delta r_t + \gamma' \Delta r_{d_{i(t-1)}} + \varepsilon_t' \quad (4.1)$$

$$\Delta r_{d_{i(t)}} = \alpha^* + \beta_1 D1 \Delta r_t + \beta_2 D2 \Delta r_t + \gamma^* \Delta r_{d_{i(t-1)}} + \varepsilon_t' \quad (4.2)$$

$r_{d_{i(t)}}$ is the overnight deposit rate in country i, Δ is the difference operator, r_t one-month Euribor, α takes the possible trend effect into account while the size of the parameter β depends on the demand elasticity for deposits. D1 = 1, D2 = 0 when ECB's refinancing rate is decreasing or stable D1 = 0, D2 = 1 when ECB's refinancing rate is increasing. γ is the adjustment coefficient. The estimation period is 1999/1–2009/03.

The elasticity of changes in market rates on deposit rates (β) is used as a test of imperfect competition: Retail bank interest rates in less competitive bank market adjust incompletely and only with a delay, while bank interest rates set in a fully competitive environment respond quickly and completely.

> *$\beta < 1$ is a measure of market power. The closer β is to unity, the more competitive banking markets are.*

If there is an asymmetric response $\beta_1 \neq \beta_2$, and if $\beta_1 > \beta_2$ retail interest rates are more sensitive to decreasing than increasing market rates. And,

> *The larger the relative difference $(\beta_1 - \beta_2)/\beta$, the less competitive the markets.*

4.1 Basic model

The summary of the regression results of equation (4.1) are presented in Table 4.1.[12] The model equations explain around 30 to 60 per cent of the variation in the bank rate on overnight deposits. For Spain, the correlation coefficient is small, only 0.06 indicating clearly different pricing rules in the overnight deposits compared to other countries included in the study. The response of overnight deposit rates to a 100 basis points change in Euribor varies from 7 to 23 basis points. The estimated β-coefficients are all at least within the 95% confidence

[12] Detailed regression results are available from the author.

level. The smallest response is in Spain, where banks take from a change of 100 basis points in market rates only 7 bps on board to deposit rates. Respectively, in Italy the pass-through is 23 bps to deposit rates. The average reaction in the euro area is 8.5 basis points given a 100 bps change in market rates. The lagged endogenous variable does not seem to be particularly important: in two cases out of six it is not significant and in three cases it is significant only at the 10 per cent level. In Germany it is highly significant. The constant α does not diverge statistically from zero in any of the cases indicating that there is not a trend factor.

Table 4.1 **Summary table of the regressions results from the basic model**

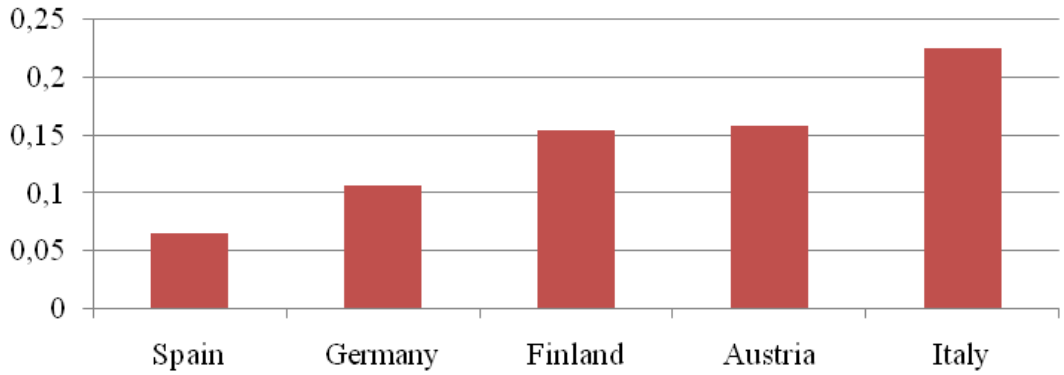
Region	**β**	**γ**	**R^2**	**DW**
Austria	0.159**	0.160*	0.31	2.42
Finland	0.155***	0.150*	0.32	2.52
Germany	0.107***	0.456***	0.57	2.60
Italy	0.226***	0.137*	0.62	2.74
Spain	0.066***	-0.103	0.06	2.16
Euro Area	0.085**	0.246	0.27	2.45

Note: OLS-estimation of equation $\Delta r_{d_{i(t)}} = \alpha' + \beta' \Delta r_t + \gamma' \Delta r_{d_{i(t-1)}} + \varepsilon_t'$ with White heteroskedasticity-consistent standard errors & covariance. One, two and three asterisks indicate a level of significance at the 10%, 5% and 1% respectively. N = 121.

In the light of the estimation results, it seems obvious that banks exercise market power in the markets of household overnight deposits in the countries included as well as in the euro area as a whole.[13] All estimated β-coefficients differ significantly from one tested with the Wald-test. Market power exercised by the banks seems to be most evident in Spain and Germany (Figure 4.1). On the other hand, deposit rates react more flexible in Italy, Austria and Finland indicating more competitive banking markets.

[13] The data quality might not be at the same level for the whole euro area as for individual countries included in the estimations.

Figure 4.1 **Estimated responses of deposit interest rates to market rates**



Hutchison and Pennacchi (1996) have estimated their model also in a discrete-time form for US individual bank data for money market deposit accounts (MMDA) and for Negotiable Orders of Withdrawal (NOW). The estimated immediate response is especially low and significant only in 16 per cent of the cases (244) for NOW accounts, while the beta for MMDA is larger and significant in 94 per cent of the cases (216). The time period covers the years from 1984 to 1991.

The results presented above are in line with Gropp et al (2007). They investigate the price setting behaviour of banks in euro area countries by estimating the dynamic adjustment of bank spreads for various bank loan and deposit categories to changes in market rates as a function of various exogenous factors in 1994–2004. Using a panel estimation technique, they find that the response of overnight deposit rates to changes in market rates after one quarter is less than 20%. In the longer term, after six months, the response is still around 25%. In a previous study at the euro area level, de Bondt (2002) found the response of overnight rates even less incomplete; in the short run about 4% and even in the longer run less than 20%.

4.2 Asymmetric response

The summary of results of estimation the equation (4.2) is collected to Table 4.2. The results indicate asymmetry in overnight deposit pricing. Depending on the stance of the monetary policy (ECB's policy rates decreasing, stable or increasing), banks price overnight deposits differently. When the monetary policy has been easing or stayed liberal, the response of deposit rates to changes in market rates is significantly larger than in the period of increasing policy rates. β_1

is significantly larger than β_2 in all cases except Italy.[14] In addition to Italian banks Finnish and Germany banks show some responses of overnight interest rates also to increasing market rates. The estimation results are also more solid measured with adjusted R^2. The lagged endogenous variable loses further its explanatory power compared to previous results.

Table 4.2 **Summary table of the asymmetric estimation results**

Region	β_1^-	β_2^+	γ^*	$(\beta_1-\beta_2)\beta$	R^2	DW
Austria	**0.249*** **	**-0.007**	0.126	1.61	0.42	2.30
Finland	**0.220*** **	**0.053**	0.100	1.08	0.37	2.48
Germany	**0.142*** **	**0.046**	0.428***	0.90	0.60	2.53
Italy	0.255***	0.179***	0.113	0.34	0.63	2.64
Spain	**0.101*** **	**-0.008**	-0.082	1.66	0.10	2.06
Euro area	**0.149*** **	**-0.035**	0.230	2.16	0.38	2.18

Note: OLS-estimation of equation $r_{d_{i(t)}} = \alpha^* + \beta_1 D1\Delta r_t + \beta_2 D2\Delta r_t + \gamma^* \Delta r_{d_{i(t-1)}} + \varepsilon_t^*$ with White heteroskedasticity-consistent standard errors & covariance. One, two and three asterisks indicate a level of significance at 10%, 5% and 1% level, respectively. H_0: $\beta_1 = \beta_2$ tested with Wald test. The cases where β_1^- is statistically significantly larger than β_2^+ are denoted with bold markings. N = 121.

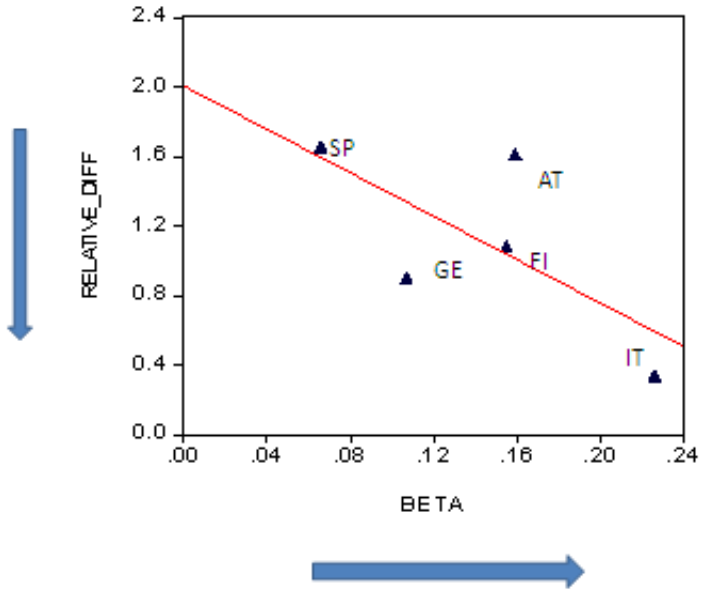
Having such an asymmetry in deposit pricing raises an interesting question about the long run behaviour of the mark up between market rates and overnight deposit interest rates. For example a series of decreasing market rates would produce cumulatively higher margins, which conflicts with the basic equilibrium concept. Thus there must be some long-term counter forces which will restore the equilibrium. Since the purpose of model used in this study is to reveal the short term responses of the deposit rates, the mechanism for restoring the balance is left out of this study.[15]

Figure 4.2 shows the combination of the estimation results of eqs (4.1) and (4.2) where the relative difference $(\beta_1 - \beta_2)/\beta$ is plotted against the original β.

The scatter diagram gives us a slightly different account of the relative situation of countries included. The deposit rates are most flexible in Italy and less flexible in Spain as in previous case, but market power measured as relative difference of asymmetric pricing Austrian banks seem to have used market power more than eg German or Finnish banks.

[14] The differences as indicated by the Wald test are statistically significant at 95% confidence level.
[15] Peltzman (2000) has a discussion about the issue.

Figure 4.2 **Deposit rate responses and relative differences of responses**



Comparing to some previous empirical country studies in the euro area these results are in line. Lago-Gonzáles and Salas-Fumás (2005) concluded that there is substantial and asymmetric rigidity in Spanish deposit rates in relation to market rates. Their analysis was based on bank level data over the years 1988–2003. Gambarcorta and Iannotti (2005) found for Italian part that the introduction of Consolidated Law on Banking in 1993, which fostered competition in banking, accelerated noteworthy the speed of adjustment and reduced the asymmetric behaviour of deposit rates. Their study covered the years 1985–2002.

Summarizing the results from the estimations give us the following conclusions:

(i) Households' overnight deposit responses to changes in competitive market rates vary from 7 to 23 basis points if market rate change100 basis points. Most flexible interest rates are in Italy and most rigid in Spain.

(ii) Deposit interest rates responses are significantly asymmetric in the countries investigated except Italy, where banks react both to increasing and decreasing market rates symmetrically.

(ii) Assuming only a symmetric reaction might be misleading, while the response can be only due to banks' reactions to decreasing market rates. A large coefficient (elasticity) for the market rate does not in that case indicate

a competitive banking market but instead less competition and more market power.[16]

(iii) Taking the asymmetry into account, in addition to Italy, most competitive banking in the households overnight deposit markets seems to be in Finland and Germany. In Italy, banks deposit rates elasticity to increasing market rates has been around 0.18 and in Finland and Germany around 0.05. In Spain and Austria deposit rates have not reacted to increasing market rates.

(iv) In the euro area as a whole, the retail overnight deposit rates for households seem to be very rigid and strongly asymmetric. Thus on the average banks seem to exercise significant market power measured with deposit pricing.

4.3 Robustness checks

A number of robustness checks were undertaking to ensure the consistency of the results. To check the effect of rather limited amount of observations per country, panel estimation was run over the whole sample. These results support quite well the country estimations.

Next the equation (4.1) was estimated for different monetary policy regimes to check the robustness of the non-linear estimates. The whole period was divided into four sub-periods with increasing, decreasing or stable interest rates. These regressions clearly confirmed the asymmetric pricing behaviour. Overnight interest rates followed the increasing market rates only slightly or not at all but decreasing market rates were followed undoubtedly. Banks behaviour seems to be surprisingly systematic in all countries included.

The estimations were run also for all euro area countries for 2003–2009, since the harmonised data for overnight deposits are available for the whole euro area since 2003. The results are shown in Appendix, Table A1.1. The results for countries not included in the basic estimations indicated also strong asymmetry. The highest response in overnight deposits to changes in market rate was found in Luxembourg following Ireland which is well in line with the common opinion of highly competitive banking markets in those countries. Overnight interest rates are especially rigid in France and Portugal in addition to Spain, indicating different pricing principles for overnight interest rates in those countries.

However, the estimation period is still short and there are only few observations to distinguish the asymmetric reactions so these results are only tentative and require more than usual reservations.

[16] The same reservation must be made when commenting the pass-through of policy rates to retail deposit rates. The asymmetry in banks' reactions has of course implications to the monetary policy transmission.

5 Conclusion

This paper has investigated the possibility to measure the market power of euro area banks using a partial adjustment model where households' overnight deposit interest rates are modelled as a function of corresponding market interest rate. The results showed that banks exercise market power when pricing these overnight deposits. The banks' behaviour was strengthened when asymmetric pricing was included into the model. Overnight deposit rates seem to be much more flexible when monetary policy was eased or stayed stable compared to increasing interest rates regime. Banks transform only a limed amount of increasing interest rates to overnight deposit rates. Even if the banks behaviour was observed to have systematically similar features in all countries included, differences are still, however, noteworthy across euro area member countries.

The results of this study suggest, in line with the theoretical literature, that banks use the pricing power in the markets for short term deposits. The results show also that it is possible to get a rough estimate of the market power using a simple partial adjustment model. There are, however, many possibilities to expand the model. The deposit pricing of the banks is depended in addition to competitive market rates on costs to switch banking account, on the bundling of banking services and on competitive nature of the banking markets. Controlling the impacts of these factors the results might be improved. To study the pricing of other deposit accounts in the standpoint from competition would, of course, be interesting.

In terms of policy implications, the relationship between banking competition and financial stability is of highly relevance. At the retail level, as studied in this paper, despite of modern banking practices, market power is still a concern. Price rigidities are clearly observable in deposit markets and competition policy has an active role to play. An interesting test of flexibility in deposit interest rates is coming when the recovery from the current crises starts and a regime shift in monetary policy is expected.

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Appendix

Table A1.1 **Regression results for 12 euro area member countries 2003/1–2009/3**

Region	β	β_1^-	β_2^+	γ	R^2	DW
Austria	0.181**			0.080	0.33	2.48
		0.258**	**-0.022**	0.035	0.43	2.31
Belgium	0.086***			0.152	0.30	2.08
		0.102***	0.047	0.131	0.31	2.03
Finland	0.157**			0.232*	0.46	2.56
		0.226**	**0.017**	0.142	0.55	2.57
France	0.009			-0.450***	0.19	2.21
		0.005	0.020	-0.452***	0.18	2.18
Germany	0.092***			0.504***	0.56	2.61
		0.125***	**0.011**	0.457***	0.59	2.56
Greece	0.079***			0.394*	0.34	2.22
		0.092**	0.041	0.383*	0.34	2.20
Ireland	0.193***			0.159	0.48	2.07
		0.249***	**0.067**	0.110	0.53	1.87
Italy	0.149***			0.442***	0.76	2.65
		0.182***	**0.072*****	0.392***	0.79	2.60
Luxembourg	0.264***			0.370***	0.60	2.46
		0.350***	**0.078**	0.309***	0.64	2.39
Netherlands	0.066			-0.048	0.35	2.19
		0.068***	0.060***	-0.057	0.35	2.16
Portugal	0.039			-0.251*	0.12	2.27
		0.058	**-0.015**	-0.253	0.16	2.33
Spain	0.046***			0.142	0.12	2.05
		0.059***	0.012	0.139*	0.16	1.99
Euro area	0.074***			0.552***	0.74	2.51
		0.100***	**0.010**	0.501***	0.78	2.43

Note: OLS-estimation of equations (4.1) and (4.2) with White heteroskedasticity-consistent standard errors & covariance. One, two and three asterisks indicate a level of significance at the 10%, 5% and 1% respectively. H_0: $\beta_1 = \beta_2$ tested with Wald test. The cases where β_1^- is statistically significantly larger than β_2^+ are denoted with bold markings. N = 73.

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