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COMPETITION IN THE HUNGARIAN BANKING MARKET[1]

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Abstract

This paper investigates the degree of bank competition in Hungary on various submarkets. An overview of stylised facts on the market structure, pricing behaviour and entry barriers suggests that the degree of competition may be rather different in the individual submarkets. Looking at the pricing practice of Hungarian banks, a possible use of market power may be conjectured in consumer lending. By contrast, it may be presumed that competitive pricing prevails in the corporate lending market. We prove our assumption by using the Bresnahan model, which belongs to the non-structural approaches of measuring competition. We conducted our empirical investigation using different measures of output, i.e. interest-bearing assets, loans, interest-bearing liabilities and deposits, for the period between December 1996 and September 2003. In respect of consumer loans, we analysed a panel sample for a shorter time horizon, i.e. the period between March 2001 and September 2003. Based on our results, it is safe to assume that the degree of competition in the loan and deposit markets falls between perfect competition and the Cournot equilibrium. In contrast, the consumer credit market is characterised by a much lower degree of competition, i.e. between Cournot equilibrium and perfect collusion. In addition to measuring competition, we attempted to determine losses in consumer surplus caused by banks, as well as the degree of the market power (measured by the Lerner index).

Key words: market structure, degree of competition and market power

JEL codes: D43, G21, L13

1 Introduction

The Hungarian banking system has undergone significant transformation during its relatively short history. Of the major structural changes, the dominance of foreign ownership and a substantial degree of deconcentration, concomitant with the natural evolution of the banking market, deserve mention. In addition to a large number of foreign entries, other trends have also pointed to increasing competition over the past decade and a half. Such trends include, for example, the growing importance of cross-border lending in corporate finance (due to the presence of multinational companies) and an increasing market share of non-bank financial intermediaries in household savings. A substantial shrinkage of the net interest margin in the second half of the 1990s also indicated increasingly fierce competition. It should be noted, however, that narrowing margins may also reflect other important impacts such as a considerable decrease in risk premia (due to macro-economic stabilisation), a fall in the reserve requirement ratio, disinflation and improved cost efficiency.[2]

Increasingly intense competition in the banking market is reflected not only in lower margins, but also in the non-price factors of competition. The latter include a dynamic expansion in the range of banking products and services (in the household segment in particular), the modernisation of branch networks, the spreading of alternative distribution channels and the emergence of more sophisticated risk management systems. These factors had a beneficial effect on welfare through improving the availability and quality of banking services to customers.

Nevertheless, there are also signs suggesting that the degree of competition is still not satisfactory. Compared to banking markets in developed economies, the net interest margin, although shrinking significantly, is still high in Hungary. This may be attributable not only to imperfect competition, but also to other factors including significant inflation differential, higher credit risks, differences in asset structure (a higher proportion of customer loans) and economies-of-scale problems arising from the small size of the market. A higher interest margin is also attributable to the fact that the operating costs of Hungarian banks, relative to their business activity (i.e. compared to total assets), are still relatively high by international standards. Well exceeding the average of advanced European economies, the profitability of the Hungarian banking sector raises the possibility that domestic banks use their market power to a larger extent, which allows them to improve profitability without reducing their average costs more drastically.

An important aspect of analysing competition in the Hungarian banking market is to find out whether or not banks' behaviour, and hence the degree of competition, is different in the major market segments. A comparison of the market structure and banks' pricing behaviour in the household and corporate segments indicates that concentration is higher and the interest margin is wider in the household market. This is, however, far from being a country-specific behaviour, since both a more concentrated structure and less competitive pricing have general underlying economic causes. One is that barriers to entry into the retail market are higher, i.e. this market segment is less contestable, due primarily to the need for and the high costs associated with the establishment of branch networks. Moreover, higher switching costs and spatial differentiation play a more dominant role, which, in turn, may serve as a source of pricing power for banks in the retail market. Although banks in Hungary earn a relatively high margin on household loans and deposits, compared to their counterparts in developed economies in Europe, the extent to

[2] Empirical studies also provide support for the importance of these factors in developments in the margin. For a large country sample, see Demirgüc-Kunt and Huizinga (1998) and for CEEC's Móré and Nagy (2003).

which this can be ascribed to higher risks, costs and inflation and even less fierce competition can only be identified empirically.

Based on the above overview, we may well arrive at the conclusion that, though the overall degree of competition has increased significantly over the past decade, the actual degree of competition in individual submarkets remains unidentified. In order to measure this we adopt the Bresnahan model, which belongs to the non-structural methods of measuring competition. Another major issue is the amount of oligopolistic rents that banks may have earned in the individual market segments, i.e. the extent to which they have exploited their market power.

This study is structured as follows. Section 2 provides stylised facts on the structure of the Hungarian banking market and banks' pricing behaviour, paying special attention to the differences between the corporate and the household market. Furthermore, we also discuss other major factors influencing competition, focussing on the role of entry barriers and non-price factors. In section 3, following a brief overview of empirical methods, we adopt the Bresnahan model to assess the degree of competition in the Hungarian banking market. Then we attempt to gauge the amount of welfare loss arising from imperfect competition, as well as the degree of market power (the Lerner index). Section 4 summarises the results and puts them in an international context. It also draws some major conclusions.

2 Main characteristics of the structure of the Hungarian banking market and pricing behaviour

2.1 Structural features of the Hungarian banking market

2.1.1 Major structural developments and differences between the individual market segments

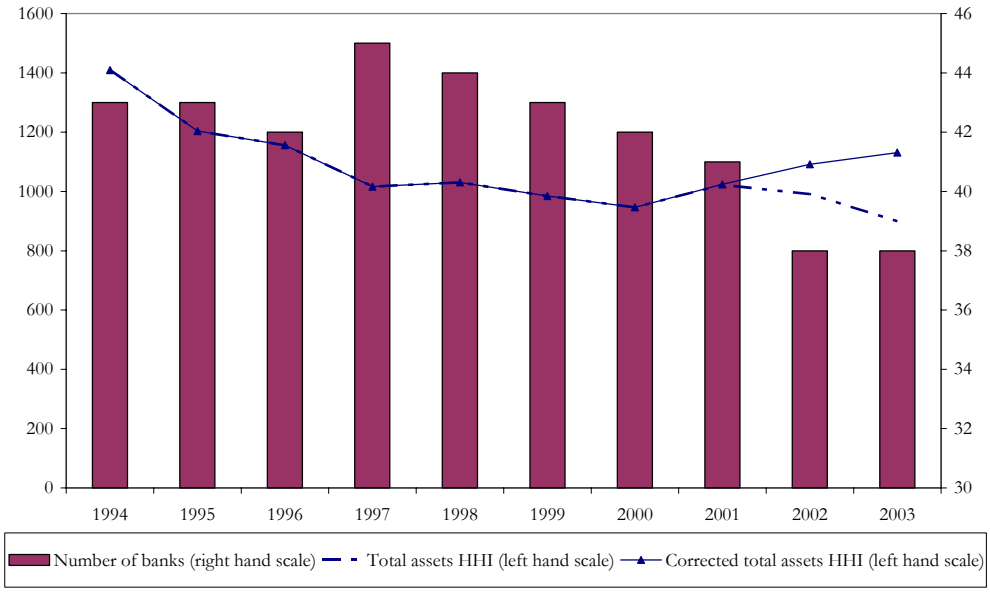
Virtually throughout the 1990s, the concentration of the Hungarian banking market was constantly decreasing as a natural consequence of market evolution, with the number of banks increasing dynamically. The number of market players grew by 40% between 1990 and 1997, with a simultaneous fall from over 1,800 to approximately 1,000 in the concentration index.[3] As to the number of banks, the final years of the 1990s witnessed the signs of a consolidation process similar to that in the EU: in spite of new market entries, the number of banks[4] fell by 16% between 1997 and 2003. The underlying reasons for this include primarily mergers, and a few instances of small foreign banks' withdrawing from the market or banks going bankrupt.[5]

Developments in market concentration during the same period are, however, less unambiguous in indicating the start of the consolidation process. Although the downward trend of market concentration halted temporarily in 2001, later it continued, albeit at a more moderate pace. As a result, the Herfindhal-Hirschman index (HHI), calculated on the basis of total assets, fell to approximately 900 by 2003. It should be noted, however, that the institutional structure of mortgage lending and the subsidised house purchase scheme also contributed to the decline in concentration in 2002 and 2003.[6] If mortgage banks and their parent banks are consolidated, the

[3] Calculated on the basis of total assets.
[4] MFB and Eximbank included. However, in calculating concentration indices, we disregarded them.
[5] Between 1997 and 2003 there were 10 mergers. In two cases the acquisition of assets and business lines influenced concentration to a certain degree, but left the number of market participants unaffected.
[6] The dynamic expansion in mortgage lending occurred in rather a concentrated manner in the Hungarian banking sector, where the mortgage bank of the market leader bank acquired a dominant market share. As the establishment

2001 increase in concentration can no longer be considered as temporary, since the rise in the adjusted HHI also continued in 2002 and 2003 (see Chart 1).

Chart 1 Number of banks and concentration in the Hungarian banking market



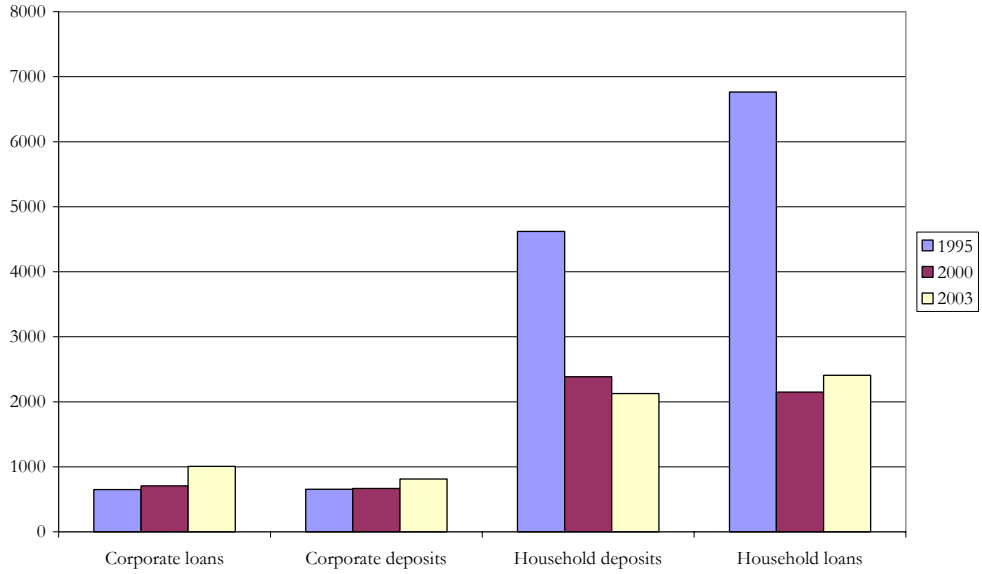
Sources: MNB, authors' calculations.

Similarly to trends in the EU, consolidation was unaccompanied by a decline in the number of branch offices. On the contrary, relative to 1997, when the number of banks began to diminish, the size of branch networks even increased somewhat. Nevertheless, branch density is still low by international standards: the number of bank branches per 1,000 inhabitants is 0.11, which is only half of what it is in the banking systems with the lowest branch density in the EU. In addition, along with a rapid spread of cash substitutes, the network of alternative (physical) distribution channels has been expanding vigorously since the mid-1990s. Compared to 1995, the number of ATMs increased by 4.5 times, totalling almost 3,000 at year-end 2003. The number of POS devices for cash withdrawal purposes and retail transactions also grew very robustly, by over 550% and nearly 650% respectively, relative to 1997.

Analysing the individual submarkets, the degree of concentration in corporate lending did not change materially in the second half of the 1990s, with the HHI remaining broadly flat at the low levels (approximately 700) that evolved after a rapid deconcentration in the first half of the 1990s. Recent years have seen a reversal in this trend, owing mainly to mergers in 2001, with the concentration index rising to 1,000 by 2003. Concentration in the household deposit market continued to decrease even in the period after 2000, albeit at a much slower pace than earlier. From 2000, judging by the adjusted HHI, the trend of deconcentration in household lending reversed, due predominantly to the explosive rise experienced in the concentration in housing loans (see Chart 2).

of mortgage banks was fuelled by interest rate subsidy maximisation, and given that mortgage bank subsidiaries and parent banks constitute, in essence, one business unit, it stands to reason that they should be treated as one when the concentration index is calculated.

Chart 2 Concentration in the individual submarkets (HHI)



Sources: MNB, authors' calculations.

Despite the convergence between market segments in recent years, concentration in the household market has remained much higher than in the corporate market. Whereas the HHI is still standing at around 1,000 in corporate lending in spite of the recent increase, it is 2,400 in household lending as a whole and over 3,400 in the market of housing loans accounting for the bulk of household loans.[7] Consumer credit and other loans, the concentration of which dropped close to 1,000 following a trend of decrease over the past years, seem to be an exception to the typically more uneven size structure of household markets.

It should be borne in mind, however, that consumer credit and other (non-housing) household loans constitute rather a heterogeneous (i.e. differentiated) group of banking products according to purpose or risk characteristics. Thus, concentration indicators calculated for the entire market segment may prove misleading. Currently there are only two or three major participants in the main product markets (e.g. hire purchase loans, personal loans, car loans and overdraft facilities), with dominant banks varying from one product to the next. As a consequence, concentration is much higher in the individual product markets. The concentration index[8] for hire purchase loans, personal loans and overdraft facilities was respectively around 3,400, 2,900 and 6,700 at end-2002. Given that substitutability between these products is incomplete, this concentrated structure may enable banks to use their market power in pricing.

The difference between concentration in the household and corporate markets is also extremely marked in respect of deposits. Of all the market segments under review, corporate deposit taking is the least concentrated, with the HHI amounting to slightly over 800. By contrast, the concentration index for household deposits exceeds 2,100. Within this, the concentration of household current account and sight deposits is even higher (over 3,100). In addition to housing loans and household deposits, concentration is also extremely high in the card business, where

[7] Also judging from the concentration index adjusted with mortgage bank subsidiaries.
[8] For 2003, no data available on consumer loans by product breakdown. Concentration in car purchase loans is also high, but car finance banks also compete with leasing firms. In fact, the latter account for the larger part of car financing. It follows then that concentration in car purchase loans originated by banks is less relevant for the competitiveness of this product market.

the HHI is over 5,000 (based on the volume of transactions concluded with domestically issued cards).

Some authors argue that differences between the market shares of major banks can describe market structure better than can concentration indices (Molyneux, 1993). In addition to measures of concentration, the difference between the market share of the market leading bank and that of the second largest bank clearly illustrates the strikingly different structures of the household and corporate markets. While this difference varies from 15% to 48% in the individual household market segments, it is a mere 1%–1.5% in the market of corporate loans and deposits.

2.1.2 Causes of higher concentration in the household market

Higher concentration in the household market is attributable predominantly to *differences in the initial market structures*. An important characteristic of the banking systems in transition economies is that the market has not evolved as the result of organic development. In these countries in the era of command economy, in addition to a monobank that functioned both as a central bank and a commercial bank, there was also a savings bank specialising in the collection of household deposits and a bank responsible for foreign trade finance. In the period preceding the establishment of the two-tier banking system, a few joint venture banks had also been founded in Hungary, in order to provide services for mainly foreign-owned companies.

Accordingly, there were even significant differences in the initial market structure between the corporate and household business. While, at the outset, the market of corporate loans and deposits was oligopolistic (with the dominance of three state-owned banks), that of retail banking services was monopolistic. In other words, 'first mover advantage' in the household market was greater, which had a profound impact on the later distribution of market positions. Analysing the period between 1972 and 2002, Berger and Dick (2004) find evidence for the first mover advantage, claiming that the later banks enter the market, the smaller their respective market shares are, compared to those of early movers.[9] In the case of Hungary, the impact of the inherited structure is primarily reflected in the household deposit and housing loan markets.

Obviously, differences in the structure of the household and the corporate markets cannot be attributed solely to those in the initial structure. This is, indeed, why it is important to study developments in the contestability of markets in the individual market segments, i.e. whether there were any such *barriers to entry* that are likely to have contributed to the preservation of existing differences in the structure of the individual submarkets. Retail banking markets are generally reckoned to be less contestable due to higher entry barriers than corporate markets. The most important barrier to entry in the household market is the necessity of and the large costs implied in establishing branch networks (see, for example, Dick, 2003).

In the first half of the 1990s, a number of foreign banks entered the Hungarian banking market. However, they mainly targeted the corporate business. They managed to reduce their average costs through gaining economies of scale, on account of large-volume corporate lending. Furthermore, as they had no 'inherited' bad portfolios and adopted more state-of-the-art risk management practices, they were able to offer more competitive prices and, hence, acquired larger market shares. In contrast, due to the costliness of setting up branch networks, the

[9] At first sight, this empirical result sounds as if it stated the obvious. However, theories on market entry do not confirm early mover advantage unequivocally. Early entry may affect later market positions neutrally or even negatively, owing to the following factors: late movers may be able to use more advanced technologies, and the cost of entry may also change with times.

establishment of the household business is a project that only breaks even over the long term. This meant an effective entry barrier for potential entrants, while offering a competitive edge to incumbents. Initially focussing their activities on the corporate sector, foreign banks did not provided en masse household services for a long time, and they only targeted upper income groups of households. Accordingly, their strategies only included organic growth and a few minor acquisitions for a prolonged period. However, declining profitability in the corporate business urged these banks to shift focus. Recently, several banks have decided to pursue a more aggressive strategy in the retail market, which foreshadows increasingly fierce competition in this market segment.

Developments in competitive conditions in the housing loan market in recent years clearly illustrate the role of branch networks as a barrier to entry in the retail market. As the massive dominance of subsidised housing loans left limited room for price competition, the pace of market acquisition mainly hinged on the extensiveness of branch networks.[10] Accordingly, the explosive growth in mortgage lending occurred in a rather concentrated manner in 2002 and 2003.

In addition to the costliness of establishing branch networks, the acute presence of *problems arising from asymmetric information* in household lending may also be a major barrier to entry. A group of creditworthy clients (e.g. multinational and resident large firms) emerged sooner in the corporate than in the household sector, where debtors have shorter credit histories. Furthermore, as regards lending to households, banks seem to share information to a much lesser extent. In particular, in contrast with the corporate sector, there is still no credit bureau with records of all the debtors. As a consequence, dominant market players in household lending have a competitive edge in terms of information, which further impedes their competitors' faster market acquisition.

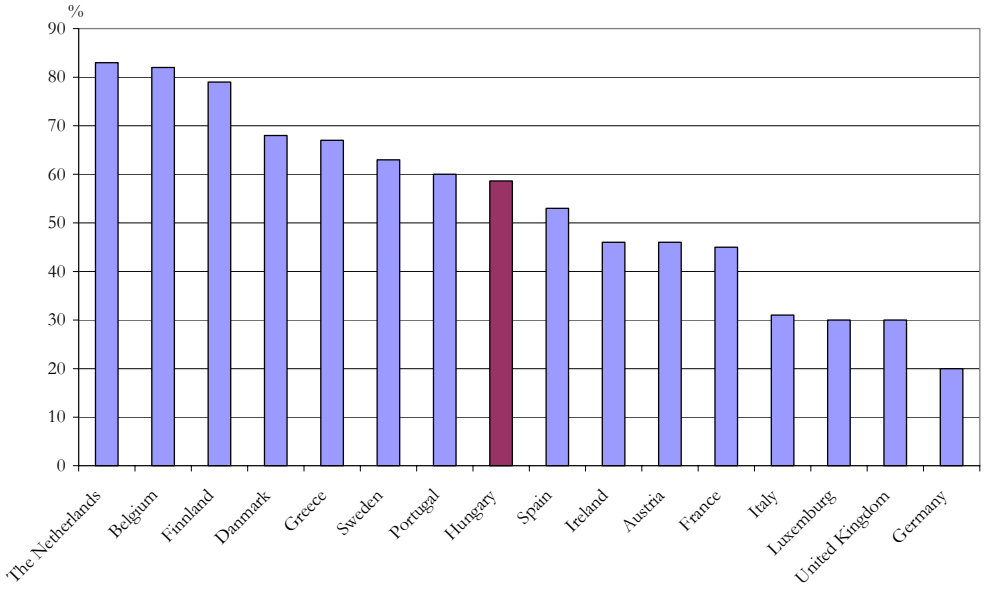
2.1.3 The structure of the banking market in an international comparison

Based on total assets, the concentration of the Hungarian banking market is at a medium level in comparison with EU-15 countries, with the combined market share of the five largest banks amounting to 59% (in 2002) (see Chart 3).[11] When making such comparisons, it is important to bear in mind that the size of a country (market) correlates with the degree of market concentration negatively. Accordingly, market concentration in Hungary is comparable to smaller EU-15 member states. Compared to CEECs, concentration in the Hungarian banking market only exceeds that in the Polish banking market.

[10] Furthermore, it is important to note that only one bank had had experience in housing finance before.

[11] Calculated on the basis of the banking sector's total assets, HHI reveals that the relative position of the Hungarian banking system is similar in comparison to the EU15 countries.

Chart 3 Combined market share of the five largest banks compared to EU-15 countries



Sources: ECB, MNB.

However, when comparing the difference between the market share of the two largest banks across the CEECs (for 2001), a slightly different picture emerges with respect to the relative position of the Hungarian banking sector within the region in terms of competitive conditions. While the difference between the market share of the first and the second largest bank was below 5% in three countries (the Czech Republic, Poland and Slovakia), it was 11% in Hungary and well over 20% in Slovenia.

In respect of the market structure of the individual submarkets, comparative data are only available for CEECs (see Table 1). A comparison of the 2002 H1 concentration indices in corporate and household lending reveals that concentration is higher in the latter in all CEECs, with the difference being larger than in Hungary only in Slovakia. A partial explanation for higher concentration in household lending in the entire region is that household lending took off much later in these countries. By contrast, corporate lending is already a relatively mature market.

Table 1 Concentration in corporate and household lending in CEE 5

	Corporate lending	Household lending
Czech Republic	1,127	1,469
Poland	744	1,140
Slovakia	949	3,098
Slovenia	1,668	1,779
Hungary	955	1,714

Source: National central banks.

2.2 Pricing behaviour of banks

The interest margin is one of the simplest indicators of the degree of competition. Its usability in analysing competition is, however, heavily restricted by the fact that it contains the impact of a number of other factors. As a starting point, however, we believe that it is important to provide

an overview of recent developments in interest margin and the factors (e.g. market structure, risks, inflation and the reserve ratio) affecting it. We then go on to summarise the theoretical factors that may provide an explanation for the relatively high interest margin in Hungary, paying special attention to the household segment. An important aspect of banks' pricing behaviour is to what extent and how quickly they adjust lending and deposit rates in response to changes in market rates. As the extent and speed of interest rate pass-through is a better indicator than simple interest margin indicators (Gual, 2004), we also assess the results of tests on interest rate pass-through in the Hungarian banking system.

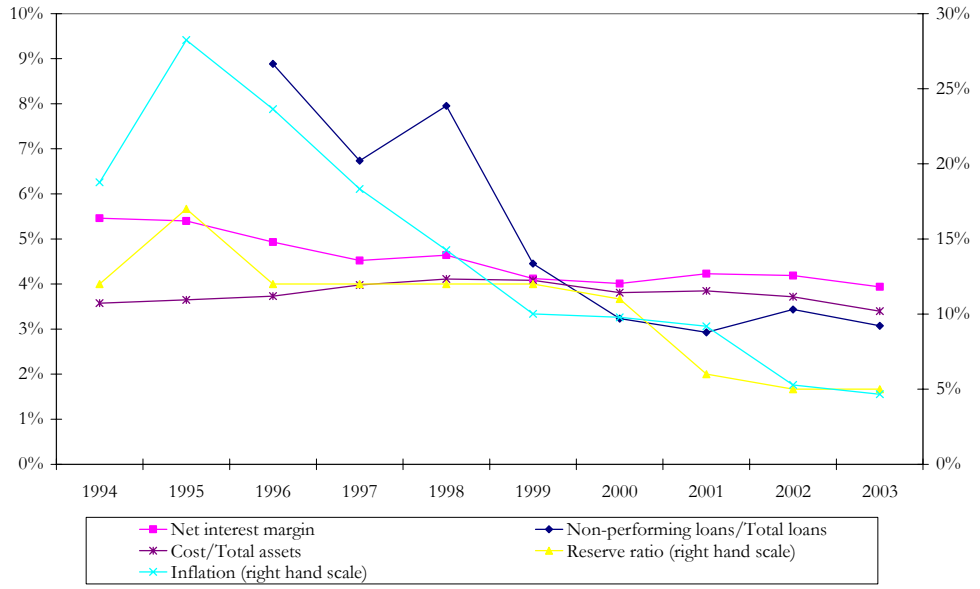
2.2.1 Developments in factors determining net interest margin

The net interest margin was declining constantly in Hungary during the second half of the 1990s. In 2000, however, the net interest margin stopped narrowing and stabilised around 4%, which is rather high in international comparison.[12] Developments in the degree of competition can only be inferred indirectly from changes over time in the interest margin. A decline in risk premium, disinflation and reserve ratio all contributed to shrinking margins (see Chart 4). This is suggested by the fact that the proportion of non-performing loans, inflation and the reserve ratio are all in a close positive correlation with the interest margin. Nevertheless, caution is warranted in assessing any causal link since each variable experienced a negative trend. The shift in the structure of bank assets has had a beneficial impact on the net interest margin, since the proportion of loans, in particular that of higher margin household loans recently, has increased significantly.

However, costs, another major component of pricing, moved in the opposite direction to margins in the middle of the period under review (1996–1999). This period saw the implementation of large-scale IT and network development projects, concomitant with the development of retail business, which raised the cost level in the banking system. Weak negative correlation (-0.18%) calculated for this period suggests that cost developments are unlikely to account for the narrowing of the interest margin.

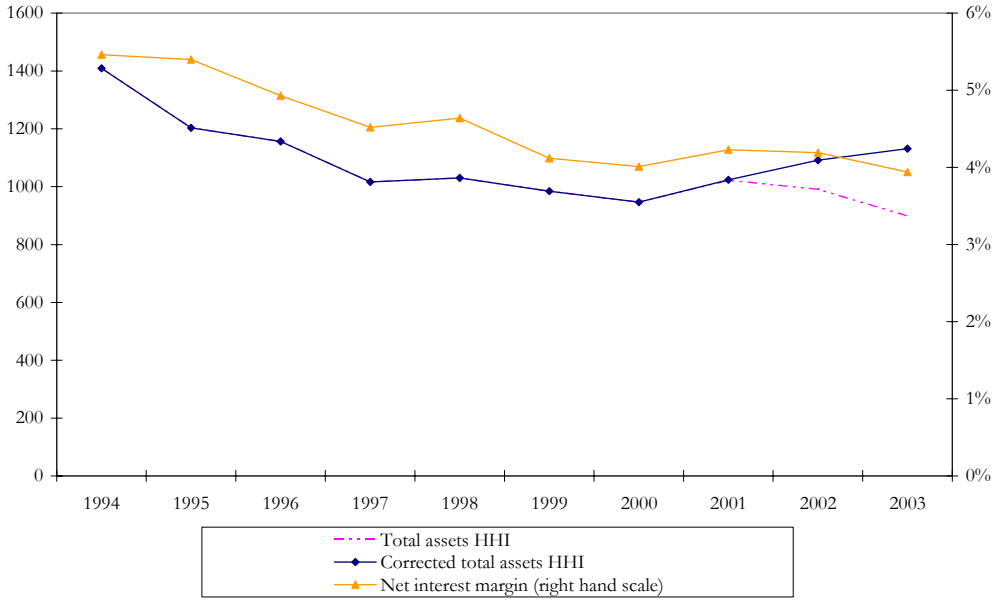
[12] Net interest margin is the ratio of net interest income to average total assets.

Chart 4 The net interest margin and its main determinants



Sources: MNB, authors' calculations.

Chart 5 Interest margin and market concentration in the Hungarian banking system



Sources: MNB, authors' calculations.

A closer look at the relationship between market structure and pricing reveals that the narrowing of margins was accompanied by decreasing concentration (see Chart 5).[13] This suggests that increasing competition may have also played a role in the narrowing of the interest margin, in addition to a decline in risks, inflation and the costs of complying with minimum reserve requirements. It should be noted, however, that the adjusted concentration index moved in the opposite direction to that of the interest margin in 2002 and 2003.

[13] If, allowing for mortgage bank subsidiaries, we examine the adjusted concentration index, the correlation is somewhat weaker due to different movements in 2002 and 2003.

2.2.2 Net interest margin in international comparison

In spite of the shrinkage over the past decade, the net interest margin is still high by international standards. Based on 2002 data, the average interest margin of Hungarian banks exceeded the average of EU15 and even CEEC-5 countries, by 2.6 percentage points and 1 percentage point respectively. For the purposes of our study it is important to identify the market segments where Hungarian banks can earn this relatively high margin. A comparison of margins in submarkets with those in the euro area reveals that the main reason for this is that margins are higher in the case of both household loans and deposits, and corporate deposits (see Table 2).[14] This difference is particularly striking in the case of consumer credit. In contrast, lending margins on corporate loans are lower than the euro area average, which points to competitive behaviour in this market segment.

Table 2 Lending and deposit margins in comparison with the euro area (percentage points, 2003)[15]

	Euro area	Hungary
Corporate loans (< EUR 1 M)	2.0	1.9
Corporate loans (> EUR 1 M)	1.0	0.4
Corporate deposits	0.1	1.4
Consumer credit	5.1	11.7
Household loans	0.2	1.9

Sources: ECB, MNB.

Looking at margins between lending and deposit rates, a striking difference emerges between the corporate and household segments. While the margin between corporate lending and deposit rates, depending on loan size is only 0.7 to 1.2 percentage points higher in Hungary than the euro area average, the differential between consumer credit and household deposit rates exceeds it by 8.3 percentage points.

2.2.3 Possible causes of high household margins

A comparison of margins by submarkets indicates that, relative to developed banking systems in Europe, Hungarian banks may have larger market power in the household segment. It should be borne in mind, however, that in addition to imperfect competition, a number of other factors may also explain the high margins between household lending and deposit rates. What follows is a list of possible causes:[16]

[14] The very small margin on corporate and household deposits in the EU may be somewhat surprising. Most recent studies prove that deposit markets are highly competitive in the EU. Studying nine EU countries, Bikker (2003) found that, except for two countries, the hypothesis of perfect competition cannot be ruled out. (This applies to an earlier period, though.)

[15] Lending margins are calculated on loans with an initial rate fixation of less than 1 year, deposit margins are calculated on deposits with a maturity of less than 1 year. Lending margin: lending rate–money market rate. Deposit margin: money market rate–deposit rate. Interest margin was calculated on the basis of 3-month EURIBOR and BUBOR. Data denote annual averages.

[16] This overview does not cover such general factors (e.g. inflation, cost efficiency and reserve ratio) that provide similar explanations for higher-than-euro-area average margins in both segments.

- *Higher risk premia.* Household lending is a relatively new market in Hungary.[17] Hence, the fact that banks do not have sufficient information on their debtors' creditworthiness, i.e. that their retail clients only have a short credit history, adds to the risks facing banks in this segment. This information asymmetry is further exacerbated by the fact that, contrary to the practice adopted in the case of non-financial corporations, only borrowers in default are registered in the debtor information system on individuals ('negative list').
- *A smaller size of the household segment.* Empirical studies show that the relative size of the banking market (i.e. financial depth) correlates negatively with interest margins. When corporate and household lending are compared, in terms of depth, the household market still lags far behind the corporate market, despite households' recent rapidly growing indebtedness. The corporate loans-to-GDP ratio is approximately half the euro-area average, whereas the household loans-to-GDP ratio is only one-third of that.
- *Clients' low interest rate sensitivity.* Consumer loans may provide a good example of retail customers' low interest rate sensitivity. Demand for consumer credit remained strong despite extremely high nominal interest rates (and APRC). Paradoxical as it may seem, newly granted consumer loans and APRC correlate positively between 1998 and 2003 (MNB, 2004). Possible underlying motives for rising demand included the establishment of and improvement in the supply-side conditions of consumer lending, hence the easing of liquidity constraints. This suggests that, given the relatively low amount of instalments, for the time being, most clients seem to pay little attention to high interest and additional costs.
- *Lack of market pricing in mortgage lending.* Recent years have seen an unequivocal dominance of subsidised housing loans in mortgage lending. Accordingly, it is changes in the subsidy scheme rather than market mechanisms that have determined the pricing of housing loans recently. As mortgage lending has a short history, no satisfactory amount of information is available on the loss ratio typical of the Hungarian market. In the absence of relevant information, it is difficult to judge the extent to which high lending margins (first 7%–8%, then 4%–5%) prior to end-2003 can be attributed to higher risks, or whether they can be considered to be extra profit generated by a generous subsidy scheme.[18]
- *Lower degree of disintermediation.* A relatively high interest margin on household deposits may also be attributable to the fact that, in spite of a marked pick-up, non-bank savings, which compete with bank deposits, are still less popular in Hungary than in advanced European economies.
- *Higher level of cross-subsidisation.* The fact that the pricing of certain retail banking services is reflected in lower deposit rates rather than in commissions or fees may also have contributed to relatively high household deposit margins (cross-subsidisation). It should be noted, however, that a gradual increase in the weight of commission and fee income and a substantial (higher-than-inflation) rise in the costs of providing certain financial transaction services for households point to a recent weakening of cross-subsidisation. At the same time, however, non-interest type charges (e.g. bank account maintenance fees) in Hungary are still lower than in the EU; expected convergence may lead to an increase in such charges (in contrast with an anticipated shrinkage in the interest margin).

2.2.4 Interest rate pass-through and market power

The extent and speed of interest rate pass-through may indirectly indicate the degree of competition. For the purposes of this study, it is highly important to ascertain whether or not there are significant differences in the transmission between money market rates and bank rates

[17] A take-off in consumer lending and housing finance began in the late 1990s and 2001 respectively.
[18] Modifications in the decree on subsidies in December 2003 signalled a shift towards the increased importance of market mechanisms in pricing housing loans.

in the individual submarkets. The degree of competition in the banking sector may affect the extent and speed of interest rate pass-through, i.e. intense competition among banks will result in a more flexible adjustment of borrowing and deposit rates.

The empirical results on Hungary (Horváth-Krekó-Naszódi, 2004) show that corporate loan rates adjust to changes in market rates fully and the most quickly. The adjustment is only partial in the remaining market segments, with consumer credit rates and short-term household deposit rates appearing to be particularly sticky. Thus, the results of the pass-through test suggest that competition in the household segments, as regards consumer credit in particular, is much weaker. The short-term adjustment of short-term corporate loan rates is rapid even by international standards; that of consumer rates is, however, strikingly inflexible.

Nevertheless, when adopting the pass-through test as an indirect indicator of competition, it is important to allow for the fact that there may be a number of such causes of interest rate rigidity that do not necessarily reflect the lack of competition (Gual, 2004).

- Lending rates may also be inflexible due to information asymmetry and adverse selection problems. Therefore, banks can only raise lending rates to a lesser extent relative to money market rates for fear of deterioration in their loan portfolio quality.
- Risk premia may be a relatively more important determinant of prices in the case of high-risk lending products (e.g. credit cards and consumer credit); consequently, prices may respond less sensitively to changes in market rates.
- High switching costs may contribute to the stickiness of interest rates significantly.
- Finally, menu costs may be an additional cause of interest rate rigidity.

2.3 Summary assessment of market structure, pricing and other factors of competition

Analysing the structural characteristics of the Hungarian banking sector, we can assert that the medium level concentration, on the basis of total assets, reflects rather different size structures across individual market segments. Despite recent convergence in the individual submarkets, concentration in the household segments, housing finance and household deposits in particular, is still much higher than in the corporate segments.

Assessing the pricing behaviour of Hungarian banks from the perspective of developments in the interest margin, it seems that, compared to the European average, spreads are relatively much wider in the household business, especially in the case of household deposits and consumer lending.[19] Furthermore, lending and deposit rates adjust to changes in market rates more quickly and more fully in the corporate segments. Consumer lending rates adjust rather rigidly even by international standards.

In addition to market structure, there are other factors which may significantly influence banks' behaviour, the most important being barriers to entry. According to the theory of contestable markets, even with a low number of market participants (or high concentration), competitive behaviour may prevail if market entry is easy and the expenses of market entry can be recovered upon exit (i.e. there are no sunk costs). However, in the household segment certain entry barriers are still of great importance in the Hungarian banking market. Of these, the most important are as follows:

[19] Owing to the distortion caused by widespread subsidies, the pricing of housing loans cannot be compared to that in advanced economies.

- *The extent of the branch network* is one of the major aspects of differentiation among banks. The proximity of branch offices as an indicator of service quality is traditionally one of the most significant non-price factors of banking competition. As the use of the various forms of remote banking (e.g. Internet-based banking services) is much less widespread in Hungary than in advanced economies, the use of the physical distribution channels (i.e. branch and ATM networks) remains dominant. Large-scale fixed investments, needed for a major shift in market positions and for challenging the dominance of the market leading bank, would incur high costs and take long to break even owing to *the small size of the market.*
- *Problems arising from information asymmetry* are much more serious in household than corporate lending, as clients' credit histories are much shorter in the former, the reason for this being that household lending only took off in the late 1990s. Moreover, information sharing among individual banks is much less comprehensive. Both factors make borrowers' creditworthiness harder to assess, which increases switching costs, thereby raising higher entry barriers and providing market power to incumbents.

Based on the above overview of banking market structure, pricing behaviour and barriers to entry, we can assume that the degree of competition may differ markedly in the corporate and household segments. Given Hungarian banks' pricing practice, there may be a strong reason to believe that they exploit market power, especially in consumer lending.

With the issue of the structure-pricing relationship addressed, the following section seeks to define the degree of competition by quantifying banks' behaviour. We examine aggregate output (i.e. interest-bearing assets/loans, interest-bearing liabilities/deposits), while paying special attention to the consumer credit submarket.

3 Measuring the degree of competition in the Hungarian banking market

3.1 A brief overview of the methods of measuring competition

Based on the methods adopted in measuring competition, empirical studies on banking competition belong to two major schools of thought: the structural and non-structural approaches. The structural approach is based on the structural characteristics of the market with linking the degree of competition to market concentration (and the distribution of market shares). The non-structural method, e.g. the Panzar-Rosse method and the Bresnahan model, directly quantifies market participants' behaviour, thereby determining the degree of competition.

The use of *the structural approach*, i.e. the testing of market power hypotheses[20] has yielded mixed results.[21] The use of structural measures has also been severely criticised on the grounds of theoretical and methodological considerations. Criticism focused on, for example, the efficiency hypothesis, the theory of contestable markets, the lack of a solid theoretical foundation underlying SCP models, the difficulties of measurement and ignoring non-price factors, etc. (For an overview, see Móré and Nagy, 2003.) Based on an overview of studies testing market power hypotheses, it is safe to say that the structural characteristics (e.g. concentration) of the market alone are not satisfactory indicators of the extent to which banks' behaviour is competitive.

Criticism levelled against the structural method urged researchers to work out new empirical methods for measuring competition. The literature uses the umbrella term 'new empirical industrial organisation' to refer to the non-structural methods thus developed. Non-structural

[20] Structure-conduct-performance (SCP) and relative market power (RMP) hypotheses.
[21] For a detailed overview of empirical literature, see, for example, Molyneux et al. (1996).

methods seek to capture banks' behaviour directly in order to determine the degree of competition.

Of the non-structural approaches, two methods, the Bresnahan model and the Panzar-Rosse test, have gained in popularity recently. The *Panzar-Rosse test* relies on the H statistics in assessing the degree of banking market competition and banks' market power. The H value quantifies the extent to which changes in input prices are reflected in banks' equilibrium revenues.[22] The estimated H value should fall into the (-∞,1] range. In the case of monopoly or perfect collusion, revenues do not respond to changes in costs, or if they do, it is in the opposite direction ($H \leq 0$). In case of monopolistic competition, revenues do not increase in proportion to costs ($0< H <1$), while in the case of perfect competition $H=1$. The adaptability of the Panzar-Rosse method presupposes that banks operate in a long-term equilibrium and banks' performance depends on competitors' moves. It further assumes that demand elasticity is larger than 1, and that cost structure is homogeneous.

The advantage of the method, compared to the SCP model, is that there is no need for identifying markets in advance. Thus, possible distortions arising from any inaccurate definition of the relevant markets can be avoided. However, a drawback to its application is that, under certain circumstances, it may yield misleading results. If, for instance, the number of the banks included in a given sample is not fully adjusted to market conditions, results may be biased towards monopoly.

The *Bresnahan model* is based on the simultaneous estimation of a market demand function and a price-setting equation, and is used to determine, mostly on the basis of aggregate data, the market power of an 'average' bank empirically. One of the parameters of the supply function is conjectural variation, λ, denoting competitor banks' responses as expected by a given bank to an initial change of its own output. The degree of competition can be inferred from the estimated value of λ:

- the possible values of the parameter can fall into the [0,1] range; in the case of perfect competition and monopoly, it is $\lambda=0$ and $\lambda=1$ respectively;
- in any oligopoly, it is $\lambda \in (0,1)$; in the symmetric Cournot oligopoly, it is $\lambda=1/n$, where n denotes the number of banks.

The advantage of the Bresnahan method over the Panzar-Rosse test is that it is a more accurate measure of the degree of competition, i.e. it can even be compared to the Cournot oligopoly within the range of the two extreme values. For the purposes of this study, another major consideration is that only the Bresnahan model is suitable for assessing the competitive conditions of the various submarkets (Bikker, 2003).

The application to the banking market of Bresnahan or similar types of model, which estimate the degree of competition using banks' behavioural equations, started to gain ground in the 1990s. Table 3 provides an overview of the major results of the empirical studies that use banks' behavioural equations for estimating the degree of competition (see Table 3).

[22] The H value is calculated on the basis of reduced revenue equations as the sum of input price elasticities of total bank revenue (or net interest income).

Table 3 An overview of the empirical studies that estimate the degree of competition using banks' behavioural equations

Authors	Country	Period	Market	Degree of competition
Shaffer (1989)	USA	1941-1975, 1941-1983	output: total assets	perfect competition
Shaffer (1993)	Canada	1965-1989	output: total assets	perfect competition
Suominen (1994)	Finland	September 1986-December 1989	loan and deposit markets	utilisation of market power to some extent in both markets; less competitive behaviour in the deposit market
Swank (1995)	Netherlands	1957-1990	mortgage lending and savings deposits	more oligopolistic than Cournot equilibrium in both markets
Berg-Kim (1998)	Norway	1990-92	retail and corporate lending	retail lending: more oligopolistic behaviour than Cournot equilibrium (collusion); corporate lending: behaviour in between perfect competition and Cournot equilibrium
Neven-Röller (1999)	EU as a whole (an aggregate of 7 EU countries)	1981-1989	mortgage and corporate lending	more oligopolistic (cartel like) than Cournot equilibrium
Gruben-McComb (1999)	Mexico	April 1987-December 1993	output: total assets	prior to privatisation: competitive; post-privatisation: 'super competitive' behaviour
Barajas et al. (1999)	Colombia	May 1992-August 1996	lending	competitive
Nakane (2001)	Brazil	August 1994-August 2000	lending	perfect competition and perfect collusion ruled out
Toolsema (2002)	The Netherlands	January 1993-August 1999	consumer lending	perfect competition
Coccorese (2002)	Italy	1988-2000	lending	between perfect competition and Cournot equilibrium
Bikker (2003)	EU as a whole and 9 EU countries[23]	1976-1998 (varies from one country to the next)	loan and deposit markets	EU as a whole: competitive behaviour in both markets EU countries: the hypothesis of perfect competition cannot be ruled out in the loan market of 4 countries and the deposit market of 6 countries[24]
Várhegyi (2003)	Hungary	1995-2002	lending	between perfect competition and Cournot equilibrium

Of the general conclusions of those empirical studies that identify the degree of competition by quantifying banks' behaviour, the following should be highlighted:

[23] Belgium, the UK, France, The Netherlands, Germany, Italy, Portugal, Spain and Sweden.

[24] *Loan market*: perfect or high degree of competition in Belgium, France, The Netherlands and Italy. The degree of competition is between perfect competition and Cournot equilibrium in Germany, Portugal, Spain and Sweden. The Cournot equilibrium cannot be rejected in the case of the UK loan market.
Deposit market: perfect or high degree of competition in the UK, France, The Netherlands, Italy, Portugal and Sweden. The degree of competition is between perfect competition and Cournot equilibrium in Spain. The Cournot equilibrium cannot be rejected in the case of the German deposit market.

- Measuring competition with the Bresnahan method in the various market segments clearly shows that the degree of competition may vary across submarkets even within one country. In Norway, Berg and Kim (1998) identified oligopolistic behaviour in retail lending and competitive behaviour in corporate lending. As regards the banking sector in The Netherlands, a number of studies have been carried out on different market segments. While Swank (1995) found considerable market power in mortgage lending and the savings deposit market, Toolsema (2002) identified perfect competition in consumer lending.
- Another major consideration in interpreting results is to what extent estimates of the degree of competition are in line with the size of market power expected on the basis of concentration indexes. A number of studies (e.g. Shaffer, 1993 and Berg-Kim, 1998) adopting the Bresnahan method reached the conclusion that high market concentration did not necessarily go hand in hand with non-competitive behaviour, and that an increase of concentration in time was not inevitably accompanied by weakening competition (e.g. Angelini-Cetorelli, 1999).
- Another major aspect of measuring competition involves the development over time in the degree of competition, particularly in the light of whether or not competition increased in the wake of deregulation that began in the 1980s or, more specifically, following the establishment of the European single market. The majority of the results support the view that the dismantling of regulatory (or other entry) barriers has resulted in increased competition. For Canada, see Shaffer (1993), for Mexico, Gruben and McComb (1999), for EU mortgage lending, Neven and Röller (1999) and for the banking sector in Italy, Angelini and Cetorelli (1999). The only exception is Suominen's study (1994). Examining the Finnish banking sector, he arrived at the surprising conclusion that, while intense competition had been common in the pre-deregulation era, a certain degree of market power could be identified in the post-deregulation era.

Várhegyi (2003) applied a method similar to the Bresnahan model to the Hungarian banking sector (Coccorese, 2002). Investigating the lending market between 1995 and 2002, she arrived at the conclusion that there was no collusion. The banking sector was characterized by a state between perfect competition and Cournot equilibrium. Furthermore, she found that there had been strong price competition in lending during the period under review, and that credit demand responded sensitively to changes in the interest rate differences among banks.

In our empirical analysis we apply the Bresnahan model to cover a wider segment of the Hungarian banking sector, including the loan and deposit markets, as well as consumer lending. Investigating the consumer credit market separately, we seek to find an answer as to whether comparatively very high lending margins, along with banks' setting higher risk premia, also reflect banks' non-competitive behaviour.

3.2 Applying the Bresnahan model to measure the degree of comparison

In the following we present the algebraic demonstration of the Bresnahan model. Then we go on to offer some major critical ideas about its applicability. Finally, we provide estimates of the degree of competition in various market segments and present our empirical results.

3.2.1 Theoretical demonstration of the Bresnahan model

Assuming that there are N number of banks of identical size in the market, offering homogenous products, profit of bank *i* can be written in the following way:

$$(1)\ \Pi_i = PQ_i - C_i(Q_i, Z_i) - F_i,$$

where π denotes profit, P denotes price, Q denotes output, C denotes variable costs, Z is input prices and F denotes fixed costs. Furthermore, banks face the following inverse market demand curve:

$$(2)\ P = f(Q, V_i) = f(\sum_{i=1}^{N} Q_i, V_i),$$

where V is exogenous variables affecting demand.

The first order condition for profit maximising of bank *i* gives:

$$(3)\ \frac{\partial \Pi_i}{\partial Q_i} = P + \frac{\partial f(Q, V_i)}{\partial Q}\frac{\partial Q}{\partial Q_i}Q_i - \frac{\partial C_i(Q_i, Z_i)}{\partial Q_i}$$

Provided that each bank produces identical quantities, i.e. $Q_1=Q_2=...=Q_N$, then:

$$(4)\ P + \frac{\partial f(Q, V_i)}{\partial Q}\frac{\partial Q}{\partial Q_i}\frac{Q}{N} - MC_i = 0,$$

and

$$(5)\ P = -\lambda \frac{\partial f(Q, V_i)}{\partial Q}Q + MC_i,$$

where:

$$(6)\ \lambda = \frac{\partial Q}{\partial Q_i}\frac{1}{N}.$$

If, for instance, the average bank is perfectly competitive, then conjectural variation (λ) is zero. The reason for this is that if a bank increases its output, the other banks respond to this by jointly reducing theirs in an identical quantity. In this case, price and marginal cost are equal in a perfectly competitive market. In contrast, if there is perfect collusion, an increase in the output of one of the colluding market participants will generate an identical amount in the increase of output by the rest of the colluding banks. In this case the conjectural variation is 1, which means that colluding banks optimise output prices as if they were monopolists. Eventually, between the

two extremes, the conjectural variation in Cournot equilibrium will be 1/N for the average bank, as each bank expects that its competitors will not respond to any change in its own output.[25]

The above method provides an unbiased estimate of the value of λ only if the product market is homogenous, and banks' behaviour is identical. Owing to limited data availability, a number of empirical analyses, e.g. Shaffer (1993) and Shaffer and DiSalvo (1993) used total assets, as output, to measure the degree of bank competition. If, however, banks compete with each other in a number of product markets, the conjectural variation shows the average extent of market power in the various markets. The value of λ and any conclusion drawn from it may be misleading, as banks' behaviour may be significantly different with respect to interest-bearing assets versus total loans or household lending versus corporate lending. Thus, our primary objective in determining the degree of competition is to provide estimates for the most homogenous markets, depending on data availability.

It is equally important to note that banks may respond to competitors' moves differently in a given market. It may be the case that some banks behave as if they were perfectly competitive, while others may behave as if they were oligopolists. In such a case, representing the average behaviour of market participants in a given market, the value λ may mask marked differences among individual banks. If individual bank data are available, this problem can be solved by allowing for the variation of λ across banks.

Finally, the Bresnahan model discussed above presupposes that banks optimise profits[26] separately in the individual submarkets, i.e. banks are price setters in output markets, whereas they are price takers in input markets.[27] According to Shaffer (1993), this hypothesis may hold for the labour and the capital market, since banks may well compete with a large number of other companies for input, both inside and outside the banking industry. In the case of the lending market, perfect competition is a less realistic hypothesis for inputs such as interest-bearing liabilities (deposits, securities etc.). If banks have market power with respect to interest-bearing liabilities, the value of λ will overestimate the actual degree of competition because market power in the two segments adds up. Such distortion can be eliminated only if interest-bearing liabilities are also examined in terms of competitive conditions.

3.2.2 Lending and deposit market models

In the section above, we pointed out that in order for the value of λ to be estimated, there should be an inverse demand curve and supply relationship derived from a profit maximisation function. In what follows we apply the Bresnahan model to the lending market. In defining the demand curve, we adopted the models of Shaffer (1993), Shaffer and DiSalvo (1993) and Bikker (2003). Bank *i* faces the credit demand function below:

$$(7)\quad Q_i^L = a_0 + a_1 P_i^L + a_2 Z_i^L + a_3 Y + a_4 P_i^L Z_i^L + a_5 P_i^L Y + a_6 Z_i^L Y + u_i^L .$$

[25] In this case, banks consider market share to be their target variable, which corresponds to quantity-based competition.

[26] Empirical literature seems to be divided over whether banks optimise profits jointly or separately in the individual submarkets.

[27] The sections below reveal that in our model input prices include liabilities and wages in the case of the loan market, whereas they only include wages in the case of the deposit market.

In the equation Q^L denotes the size of the loan portfolio, P^L is the lending rate, Z^L denotes competitors' lending rate, Y is GDP and u denotes an error term. The demand curve is made up of a linear and an interaction term; as a result, the sensitivity and elasticity of quantity vary from one explanatory variable to the next. This hypothesis is more realistic than models stipulating constant sensitivity and elasticity.[28] It is important to note, however, that according to Lau (1982) and Bresnahan (1982), when a demand curve of this shape is used, λ^L can be identified only if the equation contains the endogenous price variable (P^L) and the interaction terms with the rest of the variables (Z^L, Y). Thus, estimates can only be provided if in equation (7) a_1, a_4 and a_5 are significantly different from zero.

In order to set the conditions for profit maximisation, based on the demand curve, we calculated the marginal revenue (MR) function.

$$(7') \quad P_i^L = \frac{1}{(a_1 + a_4 Z_i^L + a_5 Y)}(Q_i^L - a_0 - a_2 Z_i^L - a_3 Y - a_6 Z_i^L Y - u_i^L) \text{ and}$$

$$(8) \quad R_i^L = P_i^L Q_i^L = \frac{Q_i^L}{(a_1 + a_4 Z_i^L + a_5 Y)}(Q_i^L - a_0 - a_2 Z_i^L - a_3 Y - a_6 Z_i^L Y - u_i^L),$$

then taking the first order condition with respect to quantity, and defining S_I as bank *i*'s market share in a given market yields:

$$(9) \quad \begin{aligned} MR_i^L &= \frac{\partial TR_i^L}{\partial Q_i^L} = \frac{1}{(a_1 + a_4 Z_i^L + a_5 Y)}(Q_i^L - a_0 - a_2 Z_i^L - a_3 Y - a_6 Z_i^L Y - u_i^L) \\ &+ \frac{1}{(a_1 + a_4 Z_i^L + a_5 Y)} \frac{\partial Q^L}{\partial Q_i^L} S_i Q_i^L = P_i^L + \frac{\lambda^L}{(a_1 + a_4 Z_i^L + a_5 Y)} Q_i^L \end{aligned}.$$

With MR defined, we selected the shape of the cost function. Our primary objective was to take the aspects of elasticity and the provision of a U-shape, appropriate for average and marginal costs, into account. Accordingly, like Shaffer (1993) and Coccorese (2002), we used a translog cost function.

$$(10) \quad \begin{aligned} \ln C_i &= \beta_0 + \beta_1 \ln Q_i^L + \beta_2 (\ln Q_i^L)^2 + \beta_3 \ln I_i + \beta_4 \ln W_i + \beta_5 (\ln I_i)^2 / 2 \\ &+ \beta_6 (\ln W_i)^2 / 2 + \beta_7 \ln I_i \ln W_i + \beta_8 \ln Q_i^L \ln I_i + \beta_9 \ln Q_i^L \ln W_i + u_i \end{aligned}$$

This function uses two factor inputs, where C denotes total costs, I and W denote the two input prices, unit interest expense and unit wage cost respectively.

Empirical studies often use capital as a third input factor in banks' production and cost functions. A number of researchers, including Gilligan and Smirlock (1984), accept the hypothesis which supposes that the price of capital is fixed, thus marginal costs do not depend on unit capital cost. In contrast, Shaffer (1989) provided empirical evidence showing that considering the cost of capital as fixed is reasonable only in the case of cross-section samples and short time series. If the time series is longer, variable costs account for an increasingly large share of the cost of capital.

[28] Coccorese's log-linear form (2002), which presupposes constant elasticity, can also be employed as an alternative demand curve.

As the time series of the panel sample that we adopted can be regarded as short, we accept the hypothesis of the capital costs being fixed.

Accordingly, as a next step, the MC function can be calculated with taking the first order condition of the translog cost function with respect to quantity in the following manner:

$$(11)\ \frac{\partial \ln C_i}{\partial C_i}\frac{\partial C_i}{\partial Q_i^L} = \frac{1}{Q_i^L}(\beta_1 + 2\beta_2 \ln Q_i^L + \beta_8 \ln I_i + \beta_9 \ln W_i),$$

$$(12)\ MC_i = \frac{C_i}{Q_i^L}(\beta_1 + 2\beta_2 \ln Q_i^L + \beta_8 \ln I_i + \beta_9 \ln W_i) = AC_i(b_1 + b_2 \ln Q_i^L + b_3 \ln I_i + b_4 \ln W_i),$$

if $\beta_1 = b_1, 2\beta_2 = b_2, \beta_8 = b_3, \beta_9 = b_4$.

Based on equation (12), marginal cost (MC)[29] can easily be expressed as the product of average cost (AC) and the quantity elasticity of costs. The latter is also referred to as scale efficiency factor.[30]

Provided that bank *i* is a price taker in the market of input prices (in this case, in that of wages and financial liabilities), the lending rate can be determined on the basis of the following condition for profit maximisation (MR=MC):[31]

$$(13)\ P_i^L = -\frac{\lambda^L}{(a_1 + a_4 Z_i^L + a_5 Y)}Q_i^L + AC_i(b_1 + b_2 \ln Q_i^L + b_3 \ln I_i + b_4 \ln W_i).$$

It follows that bank *i*'s lending rate is the sum of the product of λ^L and 'mark-up'[32] plus marginal cost.[33] The higher the degree of competition, the lower is the lending rate, and vice versa. The λ for the loan market can be determined by estimating equations (7) and (13) simultaneously.

The deposit market model can be worked out very similarly to the lending market model. Adopting Bikker's method (2003), we defined the deposit supply function as follows:

$$(14)\ Q_i^D = c_0 + c_1 P_i^D + c_2 Z_i^D + c_3 B_i + c_4 P_i^D Z_i^D + c_5 P_i^D B_i + c_6 Z_i^D B_i + u_i^D.$$

Deposit supply (Q^D) is subject to deposit rates (P^D), deposit rates set by competitors (Z^D) and branch networks[34] (B). Similarly to what was discussed above, λ^L can be identified only if the respective values of c_1, c_4 and c_5 are other than zero. The marginal revenue function can be easily obtained from the supply curve:

[29] The marginal cost function is linearly homogenous if $b_3 + b_4 = 0$.
[30] The quantity elasticity of costs is identical to scale efficiency. If the value of elasticity is 1, it follows from AC=MC that the firm's output is at the minimum point of the average cost curve.
[31] The model presupposes that banks' risk perceptions of the individual instruments either do not change over time, or if they do, the directions of the changes are identical.
[32] The product of the derivative by quantity of the lending rate and quantity.
[33] λ is the coefficient of mark-up (mark-down).
[34] In the deposit supply function we used the number of branch offices rather than GDP, since the former leads to significant improvement in explanatory power.

$$(15)\ MR_i^D = P_i^D + \frac{\lambda^D}{(c_1 + c_4 Z_i^D + c_5 B_i)} Q_i^D .$$

Obviously, in the case of the deposit market, the marginal cost function contains only one input price:

$$(16)\ MC_i = AC_i(d_1 + d_2 \ln Q_i^D + d_3 \ln W_i)$$

It follows then that the condition for profit maximisation in the deposit market is:[35]

$$(17)\ P_i^D = -\frac{\lambda^D}{(c_1 + c_4 Z_i^L + c_5 B_i)} Q_i^D + AC_i(d_1 + d_2 \ln Q_i^D + d_3 \ln W_i)$$

Bank *i*'s deposit rate is the sum of the product of λ^L and 'mark-up'[36] plus marginal cost. The higher the degree of competition, the higher the deposit rate, and vice versa. The λ for the deposit market can be determined by simultaneously estimating equations (14) and (17).

The most important criterion is that the slope of the loan demand curve must be negative, whereas that of the deposit curve must be positive.[37] Essentially, this means that the price sensitivity of quantity in the case of loans is below zero, whereas it is above zero[38] in the case of deposits. Due to substitution, interest rates set by competitors correlate positively with loans and negatively with deposits. This follows from the assumption that, among the competing banks, the output of those which set the lowest market rate will rise, while that of those which set the lowest deposit rate will fall. Furthermore, an increase in GDP used as the proxy of income is likely to expand the loan portfolio of the banking sector through companies' increased propensity to invest. By contrast, a higher number of branch offices may, due to spatial differentiation, lead to improved ability to collect deposits.[39]

If there exists a supply relationship that sets the criteria for banks' profit maximisation, the marginal cost will always be positive, which means that the elasticity of costs according to quantity is above zero. In the credit market, higher input prices, higher interest expenses and costlier labour justify higher lending rates. By contrast, a higher unit wage cost may account for lower deposit rates. Finally, as was pointed out earlier, λ should take a value within the [0,1] range.

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[35] This can be viewed as a profit maximisation condition, as banks may take the same investment decisions, and all of them have the opportunity to place funds in the interbank market. Accordingly, this is in fact both a cost minimisation condition and a profit maximisation condition in the deposit market. Under perfect competition, output at a maximum deposit rate ensures the MC=AC(=P) equality, i.e. the minimum value for AC. Consequently, the question is how much lower interest rate may evolve relative to this ideal state as a result of market power used by banks and how much cost saving can be achieved relative to perfect competition.

[36] The product of the derivative by quantity of the deposit rate and quantity.

[37] It is important to bear it in mind that we applied a model identical to the loan market one to all asset-side products, while one identical to the deposit market model to liability-side products. Thus, our expectations for the signs of the parameters of identical variables are, of course, identical.

[38] A loan demand curve with a negative slope: $a_1+a_4Z^L+a_5Y<0$. A deposit supply curve with a positive slope: $c_1+c_4Z^D+c_5B>0$.

[39] For details, see the description of Salop's model of bank networks (1979).

3.3 Main features of the models for submarkets

In defining the focus of our investigation, we had to choose, as a first step, the price variable that best suited our purposes. Fundamentally, there were two price variables to select from: interest rates for new business or on outstanding amounts. For theoretical and practical reasons, we decided on the average quarterly interest rates on outstanding amounts as derived from the balance sheet total and the income statement. The reason why we used this kind of inferred price variable rather than the interest rate for new business is that while the latter represents ex ante behaviour, the former represents average ex post decision, which is more consistent with the rest of the ex post variables pertaining to the same period. Furthermore, in an economic environment where there is relatively rapid interest rate convergence towards the euro-area level, interest rates for new business fail to satisfactorily reflect banks' interest revenue targets. In fact, they undershoot them. Finally, loss of interest revenues attributable to default on payment is taken into account in the average quarterly interest rate on the outstanding amount. Accordingly, available individual bank data allowed us to estimate λ for interest-bearing assets, loans[40] and consumer credit, as well as interest-bearing liabilities and deposits. Due to a lack of data, we were unable to investigate the corporate and household markets separately, and therefore we can only offer intuitive suggestions for these individual market segments.[41] Table 4 gives an overview of the model variables with definitions.

Table 4 Definitions of model variables

	Assets (interest-bearing assets, total loans and consumer credit).	*Liabilities (interest-bearing liabilities and deposits)*
Q	Average quarterly stock	
P	Ratio of quarterly interest revenues to average stock (quarterly interest rate earned on average stock)	
Z	Competitors' rates	
B	-	Number of branch offices
Y	Nominal GDP	-
AC	Ratio of the sum of quarterly operating and interest expenses to total assets	Ratio of quarterly operating expenses to total assets
I	Ratio of quarterly interest expenses to interest-bearing liabilities	-
W	Ratio of quarterly wage expenses to staff	

We analysed the Hungarian banking sector by deriving the necessary data from the balance sheets and income statements of commercial banks. In order to obtain a long enough time series and a

[40] Most of the housing loans are not represented among loans, as mortgage banks have not been included in the sample due to the shortness of the time series.

[41] Unfortunately, a breakdown of interest revenues by sectors is not available in the case of either loans or deposits. Loans mean non-bank loans, while deposits mean non-bank deposits.

cross-section of satisfactory size, we investigated 20 banks between December 1996 and September 2003. The only exception to this was consumer credit, in connection with which we used time series of 14 banks between March 2001 and September 2003. For the purposes of our analysis, we used seasonally adjusted quarterly data.

The reason why we used separate models for increasingly shrinking market segments was to identify a λ that is homogenous, relative to models examining aggregate output. We were only able to do so partially, since we could not break down the cost function by market segments. Such shortcomings are attributable not only to data unavailability, but also to the fact that such separation is close to being impossible to achieve technically. Expenses in the individual market segments cannot, as a rule, be added as universal banks can operate 'scope' efficiently. Due to the complexity of other alternative methods, in estimating λ we employed the additional assumption that the level of average costs and unit input costs is identical in each market segment.[42] We defined average costs as the ratio of total costs to total assets.

As regards the models for submarkets and the variables used, two important remarks must be made. First, the rate of inflation in Hungary is rather high; thus inflation may have an explanatory power in the loan and deposit equations. Accordingly, we transformed all current price stock data into constant price figures[43] using the GDP deflator. However, we did not deflate interest rates. In our judgement, there is economically sound reason to assume that, due to liquidity constraints, opportunity cost and the money illusion hypothesis, it is mainly nominal interest rates that affect loan demand and deposit supply.[44]

Finally, it is important to note that we used identical models and identical numbers of variables and types of variable within both the assets and liabilities. There are, however, significant differences between assets and liabilities in terms of model specification. Therefore, the results are comparable only to a limited degree.

3.4 Estimating the degree of competition

As a first step, we determined the value of λ by measuring the degree of competition in three increasingly narrower submarkets. In order to estimate equations (7) and (13) simultaneously, we adopted the two-stage weighted least squares (2SWLS) method, which – according to Greene (1997) – is a simultaneous estimation of two equations, and which, if variables are endogenous, provides unbiased estimates for the values of the coefficients of variables.[45] We used the one period lagged value of each variable as our list of instrumental variables. The value of each parameter was fixed in time and by cross-sections. Potential heteroscedasticity was mitigated by weighting with variances. Residuals obtained as final results revealed that autocorrelation was medium in the case of interest-bearing assets/liabilities and consumer credits, and low in the case of loans and deposits.[46]

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[42] Taking the role of 'scope' efficiency into account, Berg and Kim (1998) provided a joint rather than separate estimate for market segments.

[43] The model was also applied to nominal time series; however, the results for the value of λ were not qualitatively different. We obtained better results in respect of the fit and the significance of parameters.

[44] Liquidity constraints: the borrower takes the nominal interest rate into account in calculating the interest and instalment burden during a given period. Opportunity cost: alternative investments can be compared and assessed at a nominal level. Money illusion: erroneously, borrowers consider rising interest as loss, while depositors as increasing return, independently of the prevailing rate of inflation.

[45] In order to run the model, we used Eviews 4.1.

[46] We used correlograms (AC, PAC and Ljung-Box's Q statistics) to test autocorrelation.

First, we examined whether the demand curve met the criteria and supported the assumptions outlined in the previous section. Table 5 reveals that, consistent with out expectations, the own-price elasticity of demand is negative in all three markets.[47] By contrast, in the market of consumer credit, the sign of the price elasticity of competitors was invariably positive. In keeping with our forecast, income elasticity also had a positive value. Overall, the value of λ can be identified, since the demand curve has the appropriate shape.

Table 5 Major characteristics of the demand curve for assets[48]

	Interest-bearing assets	Loans	Consumer credit
Own-price elasticity	-	-	-
Competitors' price elasticity	+	+	0
Income elasticity	+	+	+

' +/- denotes positive/negative elasticity; 0 means that the relevant variable is unable to explain the quantity of output significantly.

The estimated λ values reveal that, in the case of interest-bearing assets, competition in the 'aggregate' market is high. At the same time, however, the hypothesis that there is perfect competition in the market can be ruled out, as the value of λ is significantly different from zero. In addition, the Cournot state does not hold true of interest-bearing assets either. If the Cournot state holds, the value of λ can be approximated by average market shares.[49] With respect to interest-bearing assets, this Cournot point develops when λ is 0.05, which is much higher than our estimated value of 0.008. A further analysis of our empirical results unambiguously reveals that the value of λ in the increasingly narrower market segments of loans and consumer credit is significantly different from that in the case of interest-bearing assets. This means that no conclusive inference about market segments can be drawn based on aggregate measures of output (like interest-bearing assets).

Both perfect competition (λ=0) and perfect collusion (λ=1), the two extreme states of competition, can be ruled out in the lending market. The estimated value of λ in the loan market is higher than that in the case of interest-bearing assets. Nevertheless, the degree of competition is higher than in Cournot equilibrium. In the credit market, too, this Cournot point develops when λ is 0.05, which is higher than our estimated value of 0.04. Thus, though the degree of competition is lower in the credit market than in that of interest-bearing instruments, banking behaviour is still more competitive than the Cournot level.

Of the three levels of aggregation, the market of consumer credit turned out to be the least competitive. Both perfect competition and perfect collusion can be ruled out in consumer lending. However, we cannot rule out weaker competition than the Cournot state. In this market a Cournot state develops if λ reaches 0.071, i.e. the average market share. In this case, however,

[47] The signs of elasticity were invariably calculated from the derivation of demand function according to the adequate variables.

[48] It is very important to bear it in mind that we assessed only one section of both the demand and supply curves for available output quantities (i.e. those during the period referred to); thus, there may be modifications in the shape of the curves if such output is included in the sample that does not feature in it. It should be emphasised that, based on these factors, results cannot be used to provide the entire length of either the demand or supply curve.

[49] Obviously, in this case the value of λ is 1/N, as our assumption is that our pattern covers the entire banking sector.

the value (0.20) of λ that we calculated well exceeds this reference value. Based on this, it is safe to say that the degree of competition in the consumer credit market is lower than in Cournot equilibrium. Finally, it may be worth noting that, based on the results, competitors' rates of interest have no significant explanatory power for developments in output. This alone may imply the lower degree of competition. According to Cournot's competitive behaviour, each bank assumes that competitors do not respond to, for instance, the changes in its interest rates. This explains why competitors' rates of interest fail to offer an explanation for changes in the output in the market of consumer lending. Another likely explanation is that, if competition is weaker than that in a state of Cournot equilibrium, banks can be characterised with a certain level (tacit or deliberate) of collusion.

Table 6 Estimation results for the asset-side

	Interest-bearing assets	Loans	Consumer credit
a1	-254,100***	-277,169***	-55,824**
	(-3.19)	(-8.48)	(-2.19)
a2	-173,812***	753,881***	71,253
	(-4.74)	(9.05)	(0.00)
a3	-0.312***	0.180***	0.048**
	(-3.57)	(6.92)	(2.11)
a4	20,080***	23,296***	1,163*
	(3.16)	(9.30)	(1.75)
a5	0.059***	0.041***	0.025*
	(3.20)	(5.70)	(1.91)
a6	0.096***	-0.496***	-0.035*
	(3.58)	(-13.30)	(-1.69)
b1	1.106***	1.590***	2.437***
	(4.87)	(6.25)	(5.66)
b2	-0.003***	-0.046***	-0.014***
	(-4.99)	(-3.04)	(-11.10)
b3	-0.006**	-0.072***	-0.141***
	(-2.29)	(-10.25)	(-14.20)
b4	0.032***	0.210***	0.053**
	(9.53)	(12.26)	(2.37)
λ	**0.008****	**0.042*****	**0.203****
	(2.31)	(3.86)	(2.28)
N	560	560	154
$R^2(1)$	0.71	0.76	0.39
$R^2(2)$	0.74	0.84	0.44

'*,**,*** at 10%, 5% and 1% significance levels.
" With t statistics in parenthesis.
"' $R^2(1)$ is demand equation (7), while $R^2(2)$ is the multiple-determinant coefficient of supply equation (13).

Despite the lack of required data for investigating the market of corporate lending, an intuitive suggestion can be offered for the competition in this market segment. Between December 1996 and September 2003 corporate loans accounted for the overwhelming majority (82%) of the loans granted by the Hungarian banking sector; a smaller portion (13%) involved lending to households, and a mere 5% was lending to the government and other sectors. Fundamentally, an aggregate λ is the weighted average of the degree of competition in the individual market

segments. Based on the above breakdown, corporate lending was predominant in the period under review. Thus, the degree of competition should be similar to that in total lending.

As our next step, we estimated equations (14) and (17) simultaneously. In the case of liabilities, we first examined the shape of the deposit supply curve. As shown in table 7, the slope of the deposit supply function is positive, as the own-price elasticity is above zero. In this case, the price elasticity of competitors is negative, since higher deposit rates offered by competitors reduce the stock of deposits of a given bank. Finally, consistent with our expectations, the number of branch offices is positively correlated with output. Thus, given the necessary characteristics of the supply curve, the liabilities side value of λ can be identified.

Table 7 Main characteristics of the liabilities-side supply curve

	Interest-bearing liabilities	Deposits
Own-price elasticity	+	+
Competitors' price elasticity	-	-
Branch office elasticity	+	+

' +/- denotes positive/negative elasticity; 0 means that the relevant variable is unable to explain the quantity of output significantly.

In the case of interest-bearing liabilities, the value of λ does not depart from zero significantly, which suggests that, overall, there may be perfect competition in the market of liabilities, with interest as a given for banks. This is hardly surprising, seeing that the majority of the banks in Hungary dispose over a considerable amount of foreign and domestic interbank liabilities. In view of this, it should also be added that the asset-side estimate of λ is unbiased, since our assumption that banks are price-takers in the case of interest-bearing liabilities has been justified.

However, the hypothesis of perfect competition is rejected for the deposit market. The value of λ is 0.03, which means that the degree of competition in the deposit market lies between perfect competition (λ=0) and monopoly (λ=1). Furthermore, it is equally safe to say that the degree of competition is higher in the deposit market than in a Cournot state (λ=0,05). As the largest share (70%) of total deposits comprises household deposits and as concentration is very low in the more modest corporate segment, it is equally safe to assume that the degree of competition in the market of household deposits is lower than that in the market of aggregate deposits.

Finally, in the case of loans and deposits, we added a dummy variable to equations (13) and (17) in order to measure changes in the degree of competition over time.[50] The time effect proved to be significant in both markets. Based on the results, we propose that in the period under review the degree of competition decreased in lending and grew in deposit-taking. In the case of the loan market this can be explained by the growing proportion of household lending, which is more concentrated than corporate lending. In the case of deposits, a decline in the concentration of the household market segment and a deterioration in households' propensity to save over the past two years are likely to have contributed to more intense competition.

[50] Fundamentally, we added a term to equations (13) and (17) in which the dummy variable was multiplied by the mark-up, mark-down and the coefficients of the temporal impact. The coefficients of the temporal impact denotes changes in the degree of competition. Relying on the results of break tests, the dummy takes the value of 1 from December 1996 to December 2000 and takes 0 between March 2000 and September 2003. In the case of deposits, the dummy takes the value of 1 from December 1996 to December 2001 and takes 0 between March 2002 and September 2003.

Table 8 Estimation results for the liabilities-side

	Interest-bearing liabilities	Deposits
c1	3,431***	18,366***
	(2.62)	(5.48)
c2	-5,022***	5,660***
	(-8.78)	(3.08)
c3	512.45***	694.52***
	(4.91)	(7.98)
c4	-504.67**	-5,459***
	(-2.30)	(-5.32)
c5	70.24***	280.48***
	(2.90)	(5.48)
c6	-76.50***	-189.30***
	(-3.22)	(-7.68)
d1	2.219***	1.272***
	(7.56)	(7.32)
d2	-0.107***	-0.054***
	(-2.96)	(-3.35)
d3	-0.651***	-0.792***
	(-17.42)	(-10.81)
λ	-0.001	**0.031****
	(-1.02)	(2.29)
N	560	560
$R^2(1)$	0.48	0.51
$R^2(2)$	0.50	0.54

' *,**,*** At 10%, 5% and 1% significance levels.
" With *t* statistics in parenthesis.
"' $R^2(1)$ is a multiple-determinant coefficient of demand equation (14), while $R^2(2)$ is that of supply equation (17).

3.5 Striving to define the extent of welfare loss and market power

In the following section, we seek to calculate the amount of welfare losses incurred to customers by the Hungarian banking sector through less competitive pricing than in the case of perfect competition. Such losses arise from dead weight losses, lower output than in the case of perfect competition and banks' extra profits earned through higher prices. Our study endeavours to calculate the latter, which bears relevance to consumer welfare and financial stability. Assuming non-competitive pricing, we seek to provide an estimate for that portion of additional losses incurred to consumers that are converted into producer (or, in our case, bank) surplus.[51]

(18) $WL = |P - P^*|Q$

In equation (18) WL denotes additional losses incurred to consumers, P denotes actual interest rate, P* denotes the interest rate in perfect competition and Q denotes output.

We tested consumer surplus losses for loans and deposits as they best represent welfare losses

[51] Obviously, on the level of society (banks and other sectors), these two impacts neutralise each other; thus, in effect, only dead-weight losses mean welfare losses.

caused to the resident non-bank sector. The share of the non-resident sector is rather small (6%–7%) in these markets, and, compared to interest-bearing assets and liabilities, these aggregates do not include interbank loans and deposits or other instruments which bear market or fixed rates (e.g. securities or central bank deposits).

In providing an estimate for consumer surplus losses, as a first step, we calculated the product of λ and mark-up (mark-down) for each bank. Then, we provided the weighted averages of profit margins in both loan and deposit markets. The annual weighted average interest premium attributable to imperfect competition has been 80 and 140 basis points for the loan and deposit markets respectively over the past seven years. This may appear surprising, as the value of λ is lower in the case of the deposit market. Thus, the only plausible explanation for a higher interest premium is that the average weighted mark-down for deposits is higher than the mark-up for loans, i.e. either concentration is higher or the price elasticity of demand is lower in the deposit market than in the loan market.

As a second step, using average interest rate premia between December 1996 and September 2003, we calculated the forint value of the annual average consumer surplus losses as a proportion of average loans and deposits. Our estimates, expressed as a percentage of GDP, for losses in consumer surplus arising from non-competitive pricing of banks are 0.24% for loans and 0.51% for deposits. Based on our calculations, overall, the Hungarian banking sector incurred an annual average welfare loss of approximately 0.7%–0.8% as a proportion of GDP vis-à-vis its customers over the past seven years.

Finally, we believe that it is important to compare loan, consumer credit and deposit markets in terms of the extent of market power. It follows from banks' profitability and related strategic considerations that it is the extent of market power rather than the degree of competition alone that matters. Banks' non-competitive behaviour is only one source of market power, the other being price elasticity characterising a given market.

Interest rate premia indicating market power can be defined as the product of the degree of competition and mark-up or mark-down (or somewhat more simply, 'interest premia' = $|P - MC|$). Relative market power can be measured with the Lerner index, which is the ratio of interest premia and nominal interest rates. The Lerner index can easily be derived from equations (13) and (17):

$$Lerner - index = \frac{|P - MC|}{P} = \frac{\lambda}{|\varepsilon|} \quad \text{, where} \quad \varepsilon = \frac{\partial Q}{\partial P}\frac{P}{Q} \quad (19)$$

In equation (19) ε denotes the price elasticity of loan demand and deposit supply. $1/|\varepsilon|$ denotes the largest extent of market power that banks can exploit in a given market. λ denotes the actual proportion of market power that, subject to the degree of competition, banks are able to use. For instance, in case of a monopoly or perfect collusion, banks can exploit the full extent of their market power. By contrast, under perfect competition, market participants can earn no oligopolistic rents. Thus, the Lerner index measures the extent to which market power is utilised.

Table 9 Market power by submarkets

	λ	Interest premia	Lerner index
Loans	4.2	0.7	3.8
Consumer credit	20.3	4.4	20.5
Deposits	3.1	1	8.4

' λ, interest rate premia and the Lerner index denote unweighted banking system average.
" Values to be interpreted as percentages.

Table 9 reveals that the degree of competition is the lowest in the consumer credit market, which, coupled with price elasticity lower than that in the loan market, results in very high interest premia. According to the Lerner index, monopoly power is the strongest in the market of consumer credit. Although, based on the value of λ, competition appears to be strongest in the deposit market, it is the second most profitable market in terms of the nominal (Interest premia) and relative (Lerner-index) extent of market power. Allowing for the volume impact as well, it is easy to see that, in terms of income, the most attractive market is deposit-taking.[52] Interest rate premia and the Lerner index, and hence market power, are the lowest in lending.[53] Given the sectoral breakdown of the three market segments, the results underpin our earlier hypothesis that banks' market power is higher in the household market than in the corporate market.[54]

3.6 Sensitivity of results to banks' costs and risks

However, the results of measuring the degree of competition and market power must be treated with caution, especially in such markets where costs and credit risks exceed banks' average costs and credit risks. With respect to costs, we assumed that a given bank's unit interest expenses and unit wage costs were the same in all market segments. This assumption can be regarded as realistic. By contrast, the homogeneity of average costs, particularly in the market of consumer credit, is not a realistic assumption. In the Hungarian banking sector, at 14%–18%, average costs as a proportion of their total assets of small banks specialising mainly in consumer lending are approximately twice as high as the banking sector average of 9%. Based on this, we tested the sensitivity of consumer credit-related results to the level of average costs. Our sensitivity analysis revealed that neither the degree of competition, nor the level of market power had changed significantly when average costs doubled. Marginal costs even remained unchanged. An increase in average costs resulted in a significant reduction in the scale efficiency term.[55] Based on this, we assert that results are not sensitive to our assumptions for the cost curve.

When risks are examined, a similar issue may arise, particularly when results related to market power are evaluated. In fact, it may well be the case that, in addition to the degree of competition and price elasticity, the default risk can also provide an explanation for estimated interest premia on loans, chiefly on consumer credit. Our model allowed for credit risks only partially.[56,57] We

[52] This, however, only holds true for those banks that are already in the market. Developing branches reduced the profit margin of new entrants significantly.
[53] According to the calculations of Angelini and Cetorelli (1999), the Lerner index for bank assets was around 20% in Italy between 1984 and 1992; by 1997 it had fallen below 7%. Based on this, market power in the Hungarian loan market cannot be considered as very low.
[54] The household sector accounts for 100% of consumer credit and 70% of deposits. The corporate sector accounts for over 80% of total loans.
[55] The value of the size efficiency term fell below 1, which is a more realistic result in the case of a new market segment.
[56] We did not allow for loan write-offs, owing to their low level.
[57] The reason for this is there were no available data on the rate of losses of the individual banks either in the market as a whole or in the individual market segments.

incorporated losses in interest revenues from default on payment, but excluded expected losses in capital from it. The latter factor is difficult to quantify. In our opinion, the best possible proxy is the ratio of loan loss provisioning to the gross amount of loans over a given period of time.[58] With respect to the banks under review, this was negligible in the case of loans (0.1% to 0.2%). Thus we have every reason to exclude the risk of default on payment. As regards consumer credit, however, it is important to take into account the risks arising from losses in capital. Over the past three years, loan loss provisioning as a percentage of the loan portfolio has been 1% to 1.5%.[59] This suggests that close to one-third or one-quarter of the 4.4% risk premium on consumer credit should have arisen from higher risk-taking. Obviously, it cannot be ruled out that domestic banks have, owing to the 'young age' of the portfolio, charged higher risk premia, chiefly in consumer lending, over the past few years. Due, however, to the low level of actual loan losses in the period under review, this has been transformed into oligopolistic profits.

4 Conclusions

Adopting the Bresnahan model, this study aimed to determine the degree of competition in the Hungarian banking sector. We set up equilibrium models, which we applied to markets with various degrees of aggregation. To measure the degree of competition, we estimated conjectural variation (λ) for each of these markets.. Our empirical study of the banking sector in Hungary included interest-bearing assets, loans, interest-bearing liabilities and deposits, covering the period between December 1996 and September 2003. In respect of consumer credit, we analysed a panel sample for a shorter time horizon, i.e. the period between March 2001 and September 2003. In addition to measuring the degree of competition for the main submarkets of the Hungarian banking system, we also provided evidence that, if using total assets as an output measure, a distorted conclusion might be drawn concerning the degree of competition in the individual submarkets.

We further proved that, although the degree of competition can be considered to be very high in the case of interest-bearing assets in Hungary, banks' behaviour is not perfectly competitive. As regards loans, however, it is safe to say that the degree of competition is lower in lending than in the case of interest-bearing assets, with banks being more competitive than in the Cournot state. It is important to point out that our results are in line with that of Várhegyi (2003), i.e. in Hungary the degree of competition in lending is between the Cournot state and perfect competition. The degree of competition in the loan markets does not differ markedly from that in the banking sectors of other countries. Bikker (2003), for instance, arrived at the conclusion that the degree of competition had approximated the Cournot equilibrium only in the UK. In other countries, the estimated λ values suggested either perfect competition (Italy, The Netherlands, Belgium and France), or, similarly to what is experienced in Hungary, competition was in between perfect competition and the Cournot equilibrium (Germany, Portugal, Spain and Sweden). Our calculations reveal that in Hungary intense competition in lending has led to relatively small market power, as measured by the Lerner index. Compared to Angelini and Cetorelli's study on Italy (1999), the market power that Hungarian banks exploit in the loan market cannot be considered very low.

Contrary to the lending market as a whole, the degree of competition is rather low in the

[58] This value somewhat overshoots the amount of losses arising from default on payment of the principal, since it jointly represents default on payment of interest and that on loans, already taken into account.
[59] As data on provisioning are only available for total loans, with no sectoral breakdown, this value was calculated from the respective income statements of such banks that are specialized in consumer lending.

consumer credit market. In fact, banks' pricing behaviour proved to be more oligopolistic than in the Cournot equilibrium. Furthermore, we provided evidence showing that a low level of competition, coupled with a relatively low price elasticity of demand, had allowed banks to earn high oligopolistic rents over the past three years. This, in turn, means that, mainly due to high profit margins and low entry costs, consumer lending is one of the most profitable market segments for banks in Hungary. It follows that competition in this segment is likely to become increasingly intense in the future.

Based on our results, the perfect competition hypothesis cannot be rejected for interest-bearing liabilities. This is likely to be attributable to the fact that Hungarian banks have significant foreign and interbank liabilities. By contrast, we ruled out perfectly competitive pricing in the deposit market. We further realised that the degree of competition was higher than in a Cournot state. However, competition is weaker in the deposit market in Hungary than in the EU. Bikker (2003) arrived at the conclusion that banks were near-perfect competitors in the deposit markets of the EU. Competition in between perfect competition and the Cournot state, as in Hungary, has only been found for Germany and Spain. It is also important to add that, despite a relatively high degree of competition, banks have had substantial market power in the domestic deposit market over the past seven years, owing possibly to the low elasticity of supply. Based on international comparisons and due to high profit margins, we expect competition to increase in the deposit market, and in the household deposit market in particular. Nevertheless, we think that, because of high entry costs (e.g. those associated with establishing branches), the dynamics of increase in competition will only be moderate.

We also sought to define the welfare losses incurred by banks vis-à-vis customers. In our estimation, for the loan and deposit markets combined, losses in consumer surplus arising from the fact that the pricing of banks was not perfectly competitive amounted to an annual average of 0.7%–0.8% of GDP between December 1996 and September 2003. Banks caused 0.24% and 0.51% welfare losses in the loan and deposit market respectively during the period under review. Judging from similar empirical studies, it is safe to say that the Hungarian banking sector does not seem to have caused high welfare losses to customers. Oxenstierna (1999) found that the Swedish banking system had caused a 1.1% loss as a proportion of GDP in consumer surplus between 1989 and 1997. Non-competitive pricing led to 0.2% and 0.9% loss in welfare for the loan market and deposit market respectively. This comparison is, however, rather distorted by the fact that financial intermediation in Sweden is much deeper than in Hungary. Taking this into account, the loss in consumer surplus caused by the Hungarian banking sector no longer seems low.

Nevertheless, owing to the trade-off between financial stability and welfare losses incurred to customers, banks' non-competitive pricing cannot always be considered unfavourable. If higher interest income is not used to finance operational inefficiency, then banks' improving profitability may contribute to stronger financial stability. According to the quiet life hypothesis presented by Berger and Hannan (1998), the management of banks with stronger market power pays less attention to efficiency as the use of pricing power 'automatically' increases revenues. Thus, larger market power results in lower efficiency. In this case, the utilisation of market power causes welfare losses through financing inefficient operations, with no improvement in financial stability at all. It is easy to see that in Hungary high oligopolistic profits arising from pricing are in fact associated with high profitability, i.e. the utilisation of market power does not finance inefficient operation as a whole. However, it cannot be ruled out that banks' non-competitive pricing behaviour and resultant management behaviour generate some degree of inefficiency. Therefore, future research should focus on the role of efficiency factors in banks' performance. A detailed investigation of the impact of X-, scope and scale efficiency on banks' pricing and profitability

may represent a major step towards a better understanding of the operation of the banking system.

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