

# **Cross-Country Comparisons of Competition and Pricing Power in European Banking**

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## **Abstract**

Studies of banking competition and competitive behaviour both within and across countries typically utilise only one of the few measures that are available. In trying to assess the relative competitive position of banking markets in 14 European countries, we find that the existing indicators of competition often give conflicting predictions, both across countries and over time. Seeking greater consistency, we attempt to separate bank pricing power from other, non-core, influences embodied in competition measures. While there is some improvement in cross-country consistency, the main result is that our measure of bank pricing power suggests that banking market competition in Europe may well be stronger than implied by traditional measures and analysis.

Key words: competition, banking

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## 1. Introduction

Almost all studies of bank competition deduce competitive behaviour within or across countries from basically just one of a small number of measures. These include measures that are estimated statistically as well as other indicators (usually ratios) obtained from bank financial statements. While some researchers may prefer one measure over another, there is no consensus regarding the "best" measure by which to gauge competition (Northcott, 2004). Indeed, these measures are typically presumed to be equivalent and so are expected to yield essentially the same result. Our goal is to test this widely held view. We do this by determining how consistent the various measures are in predicting the level and change in competitive behaviour in Europe following the recent wave of banking consolidation. It turns out that the choice of which competition measure to use can make a difference. Attempting to achieve greater consistency, we utilise a procedure developed in the frontier efficiency literature to identify an indicator of bank pricing power separate from other influences contained in current measures of competition. Although the improvement in consistency is marginal, the result indicates that European banks' power over price appears to be weaker than implied using established approaches.

Over the past decade, European banking markets have become more concentrated. The number of banks in the European Union decreased from around 9,624 in 1997 to less than 7,500 in 2003, an 18% reduction (ECB, 2004). The asset market share of the five largest banks in 11 of the 14 European Union (EU) banking markets rose over 1997-2003. Overall, this five-firm concentration ratio (CR-5) expanded from 46% to 53% (ECB, 2004).<sup>1</sup>

If the different indicators of banking market competition move in the same direction and to a similar degree then a consensus on which measure may be the most informative and reliable is less important than if their movements are often quite different. As we show below, the latter has been the case for most countries in Europe. Consequently, the assessment of banking market competition within or across countries may differ depending on the measure chosen to assess it. This makes it more difficult to determine the overall state of banking market competition in Europe, to assess the effects of deregulation, and to judge the likely effects of prospective mergers.

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<sup>1</sup> Similar results for European banking sector concentration are reported in ECB (2003, 2004) and Jansen and DeHaan (2003) provide further information. The growth in asset concentration among the 10 largest banks in the U.S. was even more rapid, rising from 22% to 46% over 1980-2003 (Piloff, 2004).

In what follows we compare structural and non-structural indicators of competition across 14 European banking markets over 1995 to 2001. In particular, we measure competition using indicators from the so-called New Empirical Industrial Organization (NEIO) literature. This literature suggests that measures of the mark-up of price (average revenue) over marginal costs (giving a Lerner index) and the degree to which input price changes are reflected in output prices (the H-statistic) provide "realized" measures of the degree of banking market competition. These indicators are estimated using bank-level data for the European Union and compared with a standard market structure measure of concentration (a Hirschman-Herfindahl index) and other bank performance indicators (net interest margin and return on assets) that are often used to gauge the competitive features of the industry. The goal is to determine the consistency of these five different direct or indirect indicators of banking competition and, if inconsistent, try to determine what economic influences may be associated with these differences. Following an approach similar to that of Demirgüç-Kunt, Laeven, and Levine (2004) and Claessens and Laeven (2004), bank-specific and country-specific characteristics (such as cost efficiency and other influences) are examined to determine their influence on the various measures of competition in Europe.

This study is divided into six sections. Some background information on banking competition measures and results for Europe is provided in Section 2. This is followed in Section 3 with an analysis of the evolution of the different measures of banking competition over 1995-2001 for 14 European countries. In this cross-country comparison, we are looking for consistency among the various indicators of banking competition. An econometric analysis in Section 4 is used to try to identify the importance of cross country differences in cost efficiency, non-traditional services, impact of the business cycle and inflation influences contained in the various competition measures. This is applied to all 14 European countries and, later, to 4 of the largest countries. Using procedures developed in the frontier efficiency literature in Section 5, we attempt to isolate a perhaps more accurate indicator of bank pricing power from current measures of market competition. The cross-country variation of this indicator differs somewhat from that of standard competition measures. The study ends with a brief summary of our results in Section 6 along with a discussion of some implications of the analysis for competition policy in Europe.

## **2. Competition in Banking: A Brief Survey**

Two types of competition measures have generally been used in the established literature to analyse the competitive features of the banking industry – these are referred

to as structural and non-structural indicators. Traditional industrial organization theory focuses on the Structure-Conduct-Performance (SCP) paradigm where the competitive features of industry are inferred from structural characteristics that influence firm behaviour and performance. Market structure can be indicated by various measures including market shares, concentration ratios for the largest sets of firms, or a Hirschman-Herfindahl index. The SCP approach aims to see if there is a relationship between the structural features of an industry and firm performance (measured using either some profits or price indicator). Typically, this approach was based on empirical studies during the 1940s and 1950's that originally focused on manufacturing industries with high fixed costs, few competitors, and limited new firm entry. Under these conditions increased market concentration was associated statistically with higher prices and greater than normal profits. With smaller numbers of firms and limited contestability, it is easier to collude--explicitly or implicitly--to control various market outcomes, resulting in uncompetitive behaviour.

While the SCP approach argues that a concentrated market structure is associated with higher prices and profits, higher profits could alternatively be the result of greater efficiency in production and managerial organization (Smirlock, 1985; Evanoff and Fortier, 1988). Berger (1995) finds some evidence that the efficiency hypothesis holds in U.S. banking in that this hypothesis explains somewhat more of the variation in bank profitability than does the traditional SCP paradigm. However, the statistical relationships are weak and both hypotheses together explain less than 20% of the variation in profits across banks. While the earlier U.S. literature tends to find evidence that the traditional SCP paradigm holds, later studies that test both the SCP and efficiency hypotheses jointly tend to reject the SCP paradigm in favour of the efficiency hypothesis.<sup>2</sup> In contrast, European banking studies tend to find more evidence that the traditional SCP hypothesis holds (Goddard, Wilson, and Molyneux, 2001). For Europe, structural factors seem to be important in determining competitive behaviour.

An alternative view is embodied in the literature examining the strategic reactions of competing oligopolies (from the earliest work of Cournot and Bertrand to more recent work by Stigler, 1964). The extensive theoretical literature on oligopoly behaviour has long recognised that major firms in concentrated markets can compete aggressively with one another, and this usually involves firms having to guess the price and quantity reactions to strategic moves made by each other (so-called conjectural variations). In these relationships, the competitive environment is determined by the strategic reactions of firms and not necessarily by the structure of the market.

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<sup>2</sup> See Gilbert (1984) and Berger, Demsetz, and Strahan (1999) for reviews of the U.S literature.

In addition, the role of market contestability advanced initially by Baumol (1982) and Baumol, Panzar and Willig (1982) is an important qualification when assessing the likely predictive accuracy of the SCP paradigm. In contestable markets the competitive behaviour of firms is determined by (actual or potential) entry and exit conditions (sunk costs). With low entry restrictions on new firms and easy exit conditions for firms that fail to earn reasonable profits, incumbent firms in an industry are pressured to behave competitively to deter entry even if the existing market is concentrated. Here structural features of a market are irrelevant in determining market competition since entry and exit conditions determine competitive behaviour. As in the case of competing oligopolists, the competitive features of a contestable market cannot be inferred using structural indicators so separate indicators based on realized pricing behavior and/or market contestability need to be found.

Non-structural indicators of competition used to quantify realized firm pricing behaviour are (mainly) based on measures of monopoly power developed by Lerner (1934). In particular, these include measures of competition between oligopolists such as Iwata (1974)<sup>3</sup> and those that test for competitive behaviour in contestable markets by Bresnahan (1982), Lau (1982) and Panzar, and Rosse (1987). This empirical literature is referred to as the New Empirical Industrial Organization (NEIO) approach. These measures are developed from (static) theory of the firm models under equilibrium conditions and typically use some form of price mark-up over a competitive benchmark. In the Lerner index, it is the mark-up of price (average revenue) over marginal cost and the divergence of price from perceived marginal revenue for the Bresnahan measure. The higher the mark-up, the greater the realized market power. An alternative approach, developed by Panzar and Rosse (1987)--the H-statistic--focuses on the degree to which changes in the average cost of different inputs leads to subsequent changes in average revenues. The greater is the transmission of cost changes into price changes, in both directions, the more competitive the market is deemed to be since costs would then determine price--not market concentration.<sup>4</sup>

The Iwata (1974) model provides a framework for estimating conjectural variation values--firms' reactions to changing market shares and pricing by rivals--for banks that supply homogenous products. As far as we are aware, the Iwata measure has only been applied once to banking by Shaffer and Di Salvo (1994). While they find

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<sup>3</sup> Also see Berg and Kim (1998).

<sup>4</sup> Other approaches consist of those developed by Kessidis (1991) who develops a model of contestability focusing on sunk costs and Corvosier and Gropp (2002) who look at the role of information technology, its influence on sunk costs, and competition in European deposit and loan markets.

evidence of imperfectly competitive behaviour in a highly concentrated duopoly market, the market examined was very small and local in nature.<sup>5</sup>

Much wider use has been made of the measures suggested by Bresnahan (1982) and Lau (1982), following the empirical framework outlined in Bresnahan (1989). This approach requires a structural model of banking competition where a parameter representing the apparent market power of banks is included. This parameter simply measures the extent to which the average firm's marginal revenue varies from average revenue indicating the slope of the demand curve and hence the implied market power of firms over price. This approach was first applied to the banking industry by Shaffer (1989, 1993) for the U.S. loan market and the Canadian banking industry, respectively. Applications of this approach to European banking are numerous and include studies on Finnish banking by Suominen (1994), on various European countries by Neven and Röller (1999) and Bikker and Haaf (2002), on Italian banking by Coccorese (1998) and Angelini and Cetorelli (2003), on Dutch consumer credit markets by Toolsema (2002), and on Portuguese banking by Canhoto (2004)<sup>6</sup>. Most of this literature finds little evidence of market power in European banking, the exception being Neven and Röller (1999) who find significant monopoly collusive behaviour when they consider the corporate and household loan market across six countries between 1981 and 1989.

There is also an extensive literature that uses the Panzar and Rosse (1987) H-statistic, which relates cost changes to price changes, to investigate competitive conditions in European banking and elsewhere. Molyneux, Lloyd-Williams, and Thornton (1994), Bikker and Groenveld (2000), De Bandt and Davis (2000), Weill (2003), Boutillier, Gaudin, and Grandperrin (2004), and Koutsomanoli-Fillipaki and Staikouras (2004) all find that monopolistic competition is prevalent across various European countries. Claessens and Laeven (2004) examine the determinants of the H-statistic for a sample of over 50 banking markets including Europe. In virtually every country evidence of monopolistic competition is found. They also find no relationship between competitive conditions and market structure as measured by concentration ratios and the Herfindahl index. Individual country studies by Vesala (1995) for Finland, Coccorese (1998) and Hondryannis, Lolos, and Papapetrou (1999) for Greece, Hempell (2002) for Germany, Coccorese (2004) for Italy, and Maudos and Pérez (2003) and Carbó, Humphrey, and Rodríguez (2003) for Spain all come to similar conclusions – namely that monopolistic competition is prevalent in European banking systems.

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<sup>5</sup> The market investigated contained a sample of banks operating in south central Pennsylvania.

<sup>6</sup> See also Uchida and Tsutsui (2004) for a study of competition in Japanese banking using the Bresnahan approach.

Evidence as to whether competition in these countries is improving or not has been mixed.

Finally, a number of recent studies have used the Lerner index to try to determine the trend in competitive behaviour over time. Generally, these studies suggest a worsening of competitive conditions in European banking during the 1990's. (see Fernández de Guevara and Maudos, 2004; Fernández de Guevara, Maudos and Pérez, 2006). This is usually inferred from a rising margin or a higher Lerner index. However, Maudos and Fernández de Guevara (2004) show that while these margins fell in 10 out of the 14 EU banking sectors studied over 1993-2002, this reduction can be compatible with a weakening of competitive conditions (an increase in market power) as explained below. A similar result is found when the analysis is applied on a regional basis within a country (Carbó, Humphrey, and Rodríguez, 2003; Maudos and Pérez, 2003). These results are at odds with the general perception that competition has increased in Europe (c.f., Padoa-Schioppa, 2001; European Central Bank, 2003). A likely explanation for the difference in these views is that competition can increase in traditional markets for banking services--where the Lerner index is often seen to fall over time--while banking firms have found new sources of (fee) income which expands their overall return on assets. That is, the Lerner index may fall for deposits and/or loans (see Carbó, Fernández, Humphrey and Maudos, 2005) while at the same time a more aggregate indicator of overall competition--the return on assets--may rise as income from off-balance-sheet activities expands. Another explanation focuses on the increased efficiency experienced by European banks due to cost savings from the shift to electronic payments and the substitution of ATMs for expensive branch offices (Carbó, Humphrey, and Lopez del Paso, 2004; Humphrey, Willeson, Bergendahl, and Lindblom, 2006). Lower operating costs from these two sources of technological change can affect the Lerner index and return on assets but have no effect on net interest margins. For example, technological advances may lower marginal costs faster than prices suggesting a greater mark-up and hence greater market power. In such a case, simply studying reductions in traditional bank prices (such as a decline in net interest margins) may not be indicative of greater competition if costs have fallen faster -- yielding a higher Lerner index which suggests a decline in the competitive environment. Hence, different measures of competitive behaviour may imply varying results for competition, depending on which measure is being relied upon.

### 3. Measures of Banking Competition: How Consistent are They?

#### 3.1. Competition Measures and Sampled Banks

Measures of competitive behaviour of commercial banks in the European Union are first defined and then examined for consistency over 1995-2001. We include all types of depository institutions (commercial banks, savings banks, and co-operative banks) so as to provide a broad representation of banking sectors in each country. Our indicators of EU banking competition are based on a balanced panel of 1,912 banks over 7 years giving 13,384 observations. Data are from the BankScope database provided by Fitch-IBCA. The composition of the sampled banks is shown in Appendix Table A1.

The five indicators used to infer competitive behaviour in the EU banking industry are:

- NTMTA: Net interest margin/total assets. This reflects the loan-deposit interest spread or interest rate mark-up after controlling for different sized banks by deflating by total asset value.
- LERNER: Lerner index, defined as  $(P_{TA} - MC_{TA})/P_{TA}$ . Here  $P_{TA}$  is the price of total assets computed as the ratio of total (interest and non-interest) income to total assets.  $MC_{TA}$  is the marginal cost of total assets computed from a standard translog function with a single output (total assets) and three input prices (deposits, labour and physical capital) using panel data in a fixed effects model covering all 14 countries over 1995-2001. Our definition of price is broader than the usual net interest margin measure NTMTA since the numerator of the Lerner index includes both interest and non-interest income.<sup>7</sup>
- ROA: The ratio of bank net income to the value of total assets. This is a profitability measure that considers all sources of income, not just that from traditional loan and security asset holdings.

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<sup>7</sup>The model most often used to obtain the Lerner index of market power in banking is the Monti-Klein imperfect banking competition model. This model examines the behaviour of a monopolistic bank faced with a downward sloping loan demand curve and an upward sloping deposit supply curve. More details on the estimation of the Lerner index can be found in Fernández de Guevara, Maudos, and Pérez (2005).

- **H-STATISTIC:** Based on a reduced-form revenue equation, the so-called H-statistic (Panzar and Rosse, 1987) measures the sum of elasticities of revenues with respect to input prices. The estimated value of the H-statistic ranges between  $-\infty$  and 1. Under perfect competition, a decrease in input prices reduces marginal costs and revenues by the same amount as a cost reduction ( $H = 1$ ). A value of the H-statistic between 0 and 1 indicates monopolistic competition. Values equal or less than 0 are consistent with monopoly behaviour (as a decrease in input prices decreases marginal costs but would not also reduce revenues). We use panel data for each of the 14 countries over 1995-2001 to estimate a double log linear equation in order to derive the H-statistics. In general, the H-statistic is calculated as the ratio of the percentage change in total revenue (from all sources) to the percentage change in the sum of three input prices (funding, labour and capital costs), holding constant total banking output (total assets), leverage, and two balance sheet composition variables (loans to assets and deposits to total liabilities). Following an approach similar to other papers (Molyneux, Lloyd-Williams, and Thornton, 1994; De Bandt and Davis, 2000; Claessens and Laeven, 2004 and 2005; among others), the H-statistics are derived from a revenue function estimated separately for each country. However, we specify a more flexible (translog) revenue function which includes levels, interaction and squared terms for inputs prices, a trend dummy and the control variables<sup>8</sup>.
- **HHI:** A Hirschman-Herfindahl index of banking market concentration defined as the sum of the squares of the market shares of all banks (commercial banks, savings banks, co-operative banks, etc) existing in a country. More formally,
 
$$HHI = \sum_{i=1}^n (\Pi_i)^2$$
 with  $\Pi_i$  being the market share of every bank in the market, and  $n$  being the number of banks. The HHI measure is more informative than an n-firm concentration ratio since it will reflect the similarity or difference in market shares among firms in a market even when the n-firm concentration ratio between two countries (or time periods) are the same.

### 3.2. Similarities/Differences Among Non-Structural Competition Measures

The four non-structural measures of competitive behaviour are often used interchangeably since it is believed that they tend to effectively measure the same thing--control over price and profitability--but go about it differently. Before we relate these

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<sup>8</sup> This allows us to estimate H-statistics at the individual bank-level.

measures to one another and see how they vary over time in different countries, it is useful to first show more clearly how they are actually related. The base case to which each measure is compared is simply profits before losses or taxes per euro of asset value or  $(TR - TC)/TA$  where TR is total revenue, TC is total cost, and TA is total assets. The purpose is to illustrate what has to be done to  $(TR - TC)/TA$  in order to obtain the net interest margin (NTMTA), Lerner index, return on assets (ROA), and H-statistic measures that are commonly used to gauge market competition in banking. These manipulations are shown below:

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$$\begin{aligned} \text{NTMTA} &= (\text{interest income} - \text{interest expense})/TA \\ &= [(TR - \text{non-interest revenue}) - (TC - \text{operating cost})]/TA \\ &= (TR - TC)/TA - (\text{non-interest revenue} - \text{operating cost})/TA \end{aligned}$$

$$\begin{aligned} \text{Lerner index} &= (P - MC)/P \\ &= (TR/TA - \partial TC/\partial TA)/(TR/TA), \text{ holding input prices constant.} \\ &\text{Under constant returns to scale } \partial TC/\partial TA = TC/TA, \text{ we have} \\ &= (TR - TC)/TA \text{ divided by } TR/TA. \end{aligned}$$

$$\begin{aligned} \text{ROA} &= (\text{net income})/TA \\ &\text{Where net income} = TR - \text{losses} - \text{taxes} - TC, \text{ we have} \\ &= (TR - \text{losses} - \text{taxes} - TC)/TA \\ &= (TR - TC)/TA - (\text{losses} + \text{taxes})/TA. \end{aligned}$$

$$\text{H-statistic} = \sum \partial TR / \partial (\text{input prices}), \text{ holding output level and mix constant.}$$

As (average input prices) = (average cost), we have

$$\text{H-statistic} = \partial (TR/TA) / \partial (TC/TA) \text{ holding } TA \text{ constant.}$$

When the H-statistic is stable, the margin equals the average, so

$$(\text{stable H-statistic}) = (TR/TA)/(TC/TA) = TR/TC.$$

Subtracting 1 from both sides gives

$$(\text{stable H-statistic}) - 1 = TR/TC - 1 = (TR - TC)/TC.$$

Multiplying both sides by TC/TA, we get

$$[(\text{stable H-statistic}) - 1](TC/TA) = (TR - TC)/TA.$$


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This way of expressing our four non-structural competition measures suggests that the benchmark unadjusted return on assets  $(TR - TC)/TA$  can be defined as:

$$\begin{aligned}
&= \text{NTMTA} + (\text{non-interest revenue} - \text{operating cost})/\text{TA} \\
&= \text{Lerner index times } (\text{TR}/\text{TA}) \text{ assuming no scale economies} \\
&= \text{ROA} + (\text{losses} + \text{taxes})/\text{TA} \\
&= a \text{ (stable H-statistic - 1) times } (\text{TC}/\text{TA}).
\end{aligned}$$

Thus while the competition literature often uses these four measures interchangeably, they can differ in their cross-country competition predictions when:

- (a) there are important differences in the share of fee and off balance sheet revenues in TR across countries (reflecting expanded revenues from non-traditional banking deposit and loan services);
- (b) operating cost is falling at different rates across countries (due most likely to differences in the shift to lower cost electronic payments and ATMs);
- (c) scale economies differ due to markedly different average sizes of banks among smaller and larger European countries; and
- (d) there are marked differences in loan losses and taxes across countries.

In what follows we assess whether or not these differences may be important enough among banks within or across countries to affect the consistency of the predictions of the apparent level and change in competitive behaviour across countries in Europe.

### **3.3. Cross-Country Consistency of Market Competition Measures**

Table 1 shows the means of the five indicators of banking market competition across our 14 European countries over 1995-2001 as well as for the whole EU<sup>9</sup>. There are significant cross-country differences in these competition measures. For the net interest margin, Denmark and Italy have the highest margins (at 4.65% and 3.45%, respectively) while Luxemburg and Ireland have the lowest (at .79% and 1.15%). The EU average is toward the upper range of these two extremes (2.34%). As seen, the difference in average net interest margins is quite large.

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<sup>9</sup> We exclude Finland as only a limited number of observations per year are available.

The Lerner index (LERNER) is often used as an indicator of banking competition and also varies considerably across countries. Denmark and Spain have the highest values (at 21.6% and 20.1%, respectively) while Luxembourg (11.0%) and the UK (11.5) have the lowest. The overall mark-up of price over marginal cost for the EU is 15.6%. The Lerner index is not a mark-up over all costs, only over marginal costs. While these mark-ups may appear "high", they necessarily include the need to recover unit fixed expenses as well as a "normal" return on invested financial capital. The Lerner index is a "level" measure of the percent that price exceeds marginal cost while the H-statistic is a "change" measure indicating the extent to which percent changes in input costs are reflected in price changes. Thus one can think of them as basically reflecting the price-cost spread in average or marginal terms.

A broad measure of banking profitability is the return on assets (ROA) which for the EU averages 69 basis points. The ROA ranges from 27 basis points in Germany and 47 basis points in Luxembourg to 139 in Greece and 129 in Denmark.

**TABLE 1: MEAN VALUES OF COMPETITION MEASURES  
FOR EUROPE OVER (1995-2001)\***

	NTMTA	LERNER INDEX	ROA	H-STATISTIC	HHI
Austria	2.02%	16.85%	0.48%	0.75	677.33
Belgium	2.31	13.30	0.48	0.59	1201.08
Denmark	4.65	21.57	1.29	0.61	1027.72
France	2.49	14.08	0.61	0.63	426.42
Germany	2.64	14.23	0.27	0.62	188.21
Greece	2.55	16.93	1.39	0.57	1529.54
Ireland	1.15	15.42	0.56	0.79	805.05
Italy	3.45	15.80	0.74	0.69	327.64
Luxembourg	0.79	10.95	0.47	0.97	304.68
Netherlands	1.90	17.92	0.86	0.80	1285.03
Portugal	2.19	15.82	0.54	0.91	843.70
Spain	3.02	20.07	0.82	0.63	525.99
Sweden	1.65	13.92	0.64	0.50	968.72
U.K.	2.00	11.45	0.56	0.73	359.53
EU	2.34	15.59	0.69	0.70	747.90

\* Mean values of NTMTA, the Lerner index, and ROA are percentages. The H-statistic usually varies between zero and 1.0 while the HHI measure has no simple percent or basis point interpretation. The values of the H-statistic for each national banking system are derived from the estimated coefficients of a fixed effects model which is estimated separately for each country. To obtain yearly H-statistic values for each bank, we evaluated our estimated equations using each year's bank-specific input prices and other information, giving an H-statistic that varied by country, by year, and by bank. The NTMTA, Lerner index, and ROA measures also vary by country, by year, and by bank. For sample size see Appendix A1.

Turning to the H-statistic, a value close to 1.00 implies that changes in costs are basically fully reflected in changes in output prices, implying a competitive market, while a value close to 0.0 implies essentially no competitive pressure so banks adjust prices with very little regard to changes in costs. The intermediate values seen in Table 1 range from .50 to .97 and suggest that almost all countries are only partly sensitive to cost changes in setting prices. This indicates an intermediate degree of market power over price (monopolistic competition) which does not differ much among the countries. With somewhat higher H-statistics, Luxembourg (.97) and Portugal (.91) appear to have more competitive markets than do Sweden (.50) and Greece (.57)<sup>10</sup>.

The Hirschman-Herfindahl measure is an indicator of market structure (HHI) where higher values reflect more concentrated banking markets and (potentially) less competition. The highest level of banking market concentration within the EU is found in Greece (1,530) and the Netherlands (1,285) while the lowest is indicated for Germany (188) and Luxemburg (305). Market concentration in the EU averages 748, a value which would indicate a competitive market using the U.S. criteria for approving a banking merger.

Casual inspection of our five competition measures across European countries in Table 1 suggests that neither the net interest margin nor the Lerner index is well correlated with the HHI structural measure. This was also pointed out in Bikker and Haaf (2002), Fernández de Guevera, et al. (2004), and Claessens and Laeven (2004) who observe little relationship between structural and non-structural measures of bank competition. This can be seen more directly in Table 2 where the similarity or consistency of the five competition measures from Table 1 is shown. The correlation coefficients (r values) in Table 2 show the direction of the relationship between any two competition measures while the R<sup>2</sup>s in parenthesis show the extent to which the paired measures contain the same information. All correlation coefficients are positive so that when one measure is relatively high (low) the others are also relatively high (low). Since a higher H-statistic implies greater competition while for the other four measures higher values imply less competition, the H-statistic results have been multiplied by -1.0 in Table 2 (and in all subsequent analysis). Now in all cases a higher value of all competition measures implies less competition. Thus the positive relationship between the H-statistic and the other measures indicates that when the other four competition measures suggest greater competition, the H-statistic also suggests more competition.

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<sup>10</sup> The usual long-run equilibrium tests have been performed confirming that the H-values can be interpreted as equilibrium competitive measures.

The  $R^2$  values in parenthesis in Table 2 directly indicate the degree of consistency among our five banking competition measures. If any of these pair-wise values were equal to 1.0, then either of the paired indicators would be a perfect substitute for the other--each would contain the same information and be perfectly consistent with each another. If this pair-wise value were equal to .50, however, then variation in one competition indicator can only be explained by 50% variation in the other suggesting substantial measurement error and a lack of consistency between the two indicators. While there would be a degree of consistency between the paired competition measures if  $R^2 = .50$ , it would not be strong since some of the time one indicator could yield opposite results regarding the extent of banking competition. Finally, if the pair-wise value is at or close to 0.0, then the paired competition measures contain no similar information, are basically uncorrelated, and would only randomly yield similar information regarding competition.

**TABLE 2: CROSS-COUNTRY CORRELATIONS AMONG MEAN VALUES OF COMPETITION MEASURES FOR EUROPE\***

(Data are from Table 1, 1995-2001; n = 14)

	NTMTA	LERNER INDEX	ROA	H-STATISTIC	HHI
NTMTA	1.00				
LERNER INDEX	.68 (.46)	1.00			
ROA	.55 (.30)	.66 (.44)	1.00		
H-STATISTIC	.48(.24)	.24 (.06)	.33 (.11)	1.00	
HHI	.07 (.00)	.39 (.15)	.62 (.39)	.26 (.07)	1.00

\* Values not in parenthesis are correlation coefficients ( $r$ ) while next to them are their squared values ( $R^2$ ). The H-statistic was multiplied by -1.0 so now a higher value of all competition measures implies less competition.

The relationships between the five competition measures in Table 2 are not very strong since at most only 46% of the information in one competition measure--the net interest margin (NTMTA)--is also contained in another--the mark-up of price over marginal cost (the Lerner index). And at most 44% of the information in the Lerner index is contained in the ROA. All the other  $R^2$ s are usually considerably less than these values. In sum, the net interest margin, the Lerner index, and the return on assets all seem to be only weakly consistent with each other. The market structure measure HHI is mostly unrelated to these four non-structural indicators (apart perhaps from ROA with an  $R^2$  of 39%) while the H-statistic and the other measures are also weakly positively related.

Table 2 illustrated the relationship among country mean values of the five competition measures averaged over the 7 time periods (so  $n = 14$ , one value per country). Table 3 uses the time-series data underlying these country mean values so mean values for each of 14 countries are observed for each of 7 years (so  $n = 98$ ). The result, although weaker since variation over time is added to the analysis, is essentially the same as before. Namely, the net interest margin, the Lerner index, and the return on asset measures are only weakly positively related to one another, showing a low degree of consistency. The market structure measure HHI is only weakly correlated with the return on assets while variation in the H-statistic explains no more than 19% variation in the other measures. Could the consistency between the structural indicator HHI and the non-structural measures be improved by considering differences among countries? This is something we investigate below in Section 4.

**TABLE 3: CROSS-COUNTRY CORRELATIONS AMONG TIME-SERIES VALUES OF COMPETITION MEASURES FOR EUROPE**

(From annual data, 1995-2001;  $n = 7 \times 14 = 98$ )

	NTMTA	LERNER INDEX	ROA	H-STATISTIC	HHI
NTMTA	1.00				
LERNER INDEX	.47 (.22)	1.00			
ROA	.46 (.21)	.61 (.37)	1.00		
H-STATISTIC	.44 (.19)	.25 (.06)	.30 (.09)	1.00	
HHI	.06 (.00)	.29 (.09)	.49 (.24)	.23 (.05)	1.00

Values not in parenthesis are correlation coefficients ( $r$ ) while next to them are their squared values ( $R^2$ ). The H-statistic was multiplied by -1.0 so now a higher value of all competition measures implies less competition.

### 3.4. Within-Country Consistency of Market Competition Measures

Repeating the time-series correlation analysis seen in Table 3 for banks within each of the 14 European countries separately, we obtain Tables 4A and 4B. The weak conclusions regarding consistency among competition measures derived above are seen to be even weaker when individual countries are being compared since the strength of the relationships differ both in size and sign across countries (see last row in table). For example, when the net interest margin is paired with either the Lerner index or the return on assets (the first two columns in Table 4A), the relationship between these two pairs is negative for under half of the countries and positive for the remainder. Indeed, out of the 84 correlations shown in Table 4A, 63% (53) are positive while 37% are negative. Only Germany, Ireland and Sweden have positive correlations across all competition measures and half of the 14 countries (Belgium, Denmark, Germany,

Ireland, Netherlands, Sweden, and the UK) have all positive correlations among the NTMTA, Lerner, and ROA measures while the other seven countries do not.

**TABLE 4A: PAIR-WISE CORRELATIONS: NON-STRUCTURAL COMPETITION MEASURES\***

(Annual Data 1995-2001; n = 7)

Non-Structural vs. Non-Structural Measures						
	NTMTA LERNER	NTMTA ROA	NTMTA H-STATISTIC	LERNER ROA	LERNER H-STATISTIC	ROA H-STATISTIC
Austria	-0.55	0.32	-0.83	0.31	0.77	-0.30
Belgium	0.30	0.34	0.69	0.52	-0.44	-0.16
Denmark	0.60	0.96	-0.86	0.63	-0.25	-0.84
France	-0.82	-0.97	0.85	0.82	-0.83	-0.81
Germany	0.85	0.97	0.86	0.90	0.48	0.79
Greece	-0.85	-0.47	-0.94	0.59	0.90	0.32
Ireland	0.57	0.68	0.72	0.90	0.56	0.41
Italy	-0.67	0.70	0.41	-0.15	-0.39	0.20
Luxemburg	-0.67	-0.57	0.50	0.84	-0.47	0.03
Netherlands	0.50	0.28	-0.76	0.72	-0.44	-0.24
Portugal	-0.65	-0.43	-0.78	0.62	0.94	0.66
Spain	-0.88	-0.51	-0.88	0.71	0.98	0.68
Sweden	0.71	0.54	0.61	0.76	0.59	0.90
U.K.	0.83	0.50	-0.33	0.86	0.22	0.52
(+ r value)/14	7/14	9/14	7/14	13/14	8/14	9/14

\* Only correlation coefficients (r's) are shown here. The H-statistic was multiplied by -1.0 so now a higher value of all competition measures implies less competition.

Across countries, only one of the ten pair-wise comparisons in Tables 4A and 4B show a strong degree of consistency. This is shown in Table 4A, where there is a consistently positive relationship between the Lerner index and the return on assets (13 positive r's out of 14, Column 4). Viewing both tables, in the other pair-wise comparisons there is at least some positive relationship between ROA and three other measures - H-statistic, HHI and ROA (9 positive r's out of 14) and a negative relationship between net interest margins and the H-statistic and HHI ( 9 negative r's out of 14). Even so, this is a long way from using these different measures more or less interchangeably as is the maintained hypothesis in the literature when only one competition measure is used to draw conclusions from.

The conclusion so far has to be that it is apparently not possible to select one or two measures of banking competition that seem to be informative in one country and

necessarily expect the same two measures to be equally informative when applied to another country. The cross-country results are just too inconsistent. What about over time? Did the competition measures generally fall--indicating an improvement in competition--over time? Or are the measures also inconsistent over time as well?

**TABLE 4B: PAIR-WISE CORRELATIONS: NON-STRUCTURAL V STRUCTURAL COMPETITION MEASURES\***  
(Annual Data 1995-2001; n = 7)

Non-Structural vs. Structural Measure:				
	NTMTA HHI	LERNER HHI	ROA HHI	H-STATISTIC HHI
Austria	-0.18	0.13	-0.53	0.50
Belgium	-0.91	-0.07	-0.34	-0.77
Denmark	0.17	0.14	0.09	-0.22
France	-0.77	0.84	0.81	-0.51
Germany	-0.73	-0.39	-0.58	-0.80
Greece	0.91	-0.77	-0.48	-0.79
Ireland	0.94	0.73	0.84	0.69
Italy	0.55	-0.22	0.56	-0.18
Luxemburg	-0.41	0.66	0.58	-0.15
Netherlands	-0.33	0.43	0.63	-0.02
Portugal	-0.61	-0.02	0.08	0.05
Spain	-0.88	0.61	0.15	0.67
Sweden	-0.28	-0.55	-0.10	0.17
U.K.	0.39	0.39	0.45	-0.05
(+ r value)/14	5/14	8/14	9/14	5/14

\* Only correlation coefficients (r's) are shown here. The H-statistic was multiplied by -1.0 so now a higher value of all competition measures implies less competition.

The correlation of competition measures with time over our seven annual periods is shown in Table 5. A negative (positive) value indicates that the competition improved (worsened) over time. The net interest margin with only one positive correlation (Netherlands) with time out of 14 countries indicates an improvement in competition while for the majority of countries the other four measures rose, suggesting reduced competition. Thirteen of the 14 countries experienced a reduction in net interest margins while 6 to 8 countries experienced a rise in their Lerner index, their ROA, their H-statistic, and their HHI market concentration measure. This shows yet again that all five indicators may not say the same thing.<sup>11</sup>

<sup>11</sup> With only seven annual observations per country, the results in Table 5 should be treated with caution and the focus should be more on the sign of the correlation than on the size.

While the general rise in market concentration (HHI) across countries in Europe suggests that markets are possibly becoming somewhat less competitive, this is not confirmed unless we also see a rise in realized returns, such as a corresponding rise in the various mark-up and profitability measures in Table 5. In fact, the Lerner index did generally rise while the ROA was split between rising and falling over the period. However, the inference that competition may have lessened in Europe is inconsistent with the behaviour of net interest margins (NTMTA) which fell in all but one country. Since the net interest margin looks only at the net interest return while the Lerner index and ROA are more comprehensive and include non-interest (off-balance-sheet and fee) returns and non-interest (operating) cost, it may well be that competition in the traditional deposit and loan markets rose (reducing the net interest margin) while bank expansion into newer areas of business and the effect of technical change in reducing operating cost would be consistent with the rise in the Lerner index and the return on assets.

**TABLE 5: CORRELATIONS OF COMPETITION MEASURES WITH TIME\***

(Annual Data 1995-2001; n = 7)

	Four Non-Structural Measures:				One Structural Measure:
	NTMTA	LERNER	ROA	H-STATISTIC	HHI
Austria	-0.91	0.64	0.01	0.70	-0.16
Belgium	-0.95	-0.05	-0.36	-0.80	0.94
Denmark	-0.86	-0.51	-0.77	0.72	-0.05
France	-0.95	0.88	0.94	-0.74	0.91
Germany	-0.97	-0.89	-0.99	-0.80	0.60
Greece	-0.86	0.84	0.18	0.98	-0.68
Ireland	-0.92	-0.36	-0.45	-0.83	-0.83
Italy	-0.93	0.75	-0.52	-0.64	-0.24
Luxemburg	-0.76	0.87	0.80	-0.32	0.88
Netherlands	0.19	0.78	0.58	-0.56	0.61
Portugal	-0.93	0.63	0.44	0.68	0.75
Spain	-0.97	0.81	0.38	0.79	0.87
Sweden	-0.98	-0.68	-0.42	-0.49	0.38
U.K.	-0.98	-0.88	-0.58	0.18	-0.36
(+ r value)/14	1/14	8/14	7/14	6/14	8/14

\* Only correlation coefficients (r's) are shown here. The H-statistic was multiplied by -1.0 so now a higher value of all competition measures implies less competition.

If this explanation is accepted, then only the net interest margin would correctly indicate the change in competition for traditional banking loan and deposit services in Europe while the Lerner index and ROA may reflect less competition in non-traditional banking services and more pricing power in this area. After all, non-traditional sources

of revenue from off-balance-sheet activities will raise revenues much faster than costs and leave traditional banking output (total assets) almost unchanged. This would be consistent with an apparent rise in pricing power derived from the H-statistic. The concurrent rise in the concentration measure HHI is then likely to be reflective of the wave of banking mergers associated with these new activities rather than indicating a reduction in competition in traditional banking services. The following section goes further in trying to untangle the relationships among the various competition measures.

#### **4. Determinants of Differences in Cross-Country Competition in Banking**

##### **4.1. Is One Competition Measure Strongly Explained by the Other Four?**

It has been shown earlier that the four non-structural measures of competition can be re-expressed as functions of the ratio of gross banking profits (before losses and taxes) to assets. If the different manipulations needed to transform each of these measures into a common measure of profitability are not very important to predicting competition, then in principle some sort of weighted average or factor analysis composite of these separate measures may be a way to reflect better market competition than relying on only one indicator for this assessment. Such an arrangement would likely be more successful if the  $R^2$  from regressing any one of our competition measures ( $CM_i$ ) on the four remaining measures ( $CM_j, i \neq j, j = 1, \dots, 4$ ) was reasonably large.

As shown in Table 6, this does not seem to be the case. This holds whether the specified relationship is performed using all 14 EU countries, only just four of the largest countries (Germany, France, Italy, and Spain), or just one country (Spain). The greatest similarity among the five competition measures across the 14 countries seems to be the net interest margin (NTMTA) and the ROA with the other four indicators where 34% of their variation is "explained" by the other measures. The same is true when the analysis focuses on only four large countries (Germany, France, Italy, and Spain). When only one country is examined (for example, Spain), however, the similarity among competition measures is higher although less than 50% in three out of the 5 competition measures. These results confirm, from a different perspective, the lack of consistency among competition measures--both within and across countries in Europe.

**TABLE 6: EXPLAINED VARIATION (R<sup>2</sup>) AMONG COMPETITION MEASURES\***

$$(CM_i = f(CM_j) \quad i \neq j, \quad j = 1, \dots, 4)$$

	Across 14 Countries	Germany, France, Italy, Spain	Within 1 Country, Spain
NTMTA	.34	.35	.41
LERNER INDEX	.23	.19	.64
ROA	.34	.37	.61
H-STATISTIC	.10	.05	.22
HHI	.06	.07	.32
Sample Size	13,384	11,375	616

\* All values are coefficients of determination (R<sup>2</sup>). The H-statistic was multiplied by -1.0 so now a higher value of all competition measures implies less competition.

#### 4.2. Determinants of Differences in EU Bank Competitive Behaviour, 1995-2001

Competition measures can be affected by country-specific influences and thereby distort cross-country comparisons. An influence related to profitability and rates of return concerns differences in cost efficiency among countries. Countries with greater cost efficiency have a lower ratio of operating cost to asset value (OCTA) which, if not controlled for, may otherwise suggest less competition in a market for banking services. Importantly, bank unit operating costs have been falling over time due to the shift to electronic payments and expanded use of ATMs as opposed to more expensive branch offices. As well, banking profits tend to rise when a country is in the upswing of a business cycle (measured by the annual rate of growth of the real GDP--GDPGR) due to expanding loan demand and/or when inflation is high (measured by a cost of living index--COL<sup>12</sup>). However, these two effects are usually temporary and reversed when GDP growth is slow and inflation is low.<sup>13</sup>

Banks provide both traditional loan and deposit services as well as newer non-traditional services such as off-balance sheet activities including derivatives trading, fund management, underwriting, insurance and a host of other fee or commission based services. From a public cost and benefit standpoint, traditional loan and deposit services are more important than the newer specialized services since traditional activities affect more people and the users are less sophisticated and less likely to have the opportunity to shop around for a better price. This influence is partially controlled for by the ratio of

<sup>12</sup> GDPGR and COL variables come from the World Development Indicators of the World Bank. The cost of living is measured by the rate of change of the consumer price index.

<sup>13</sup> For example, Huybens and Smith (1999) show that inflation artificially increases banking margins. Demirgüç-Kunt et al. (2004) also note that both inflation and economic growth can influence interest margins. They find that inflation has a positive influence on margins, whereas economic growth has a small negative impact.

fee income to asset value (FEEINC) since fee revenue is mostly associated with supplying non-traditional services. Lastly, a dummy variable for the type of bank (commercial, savings, or cooperative) was also specified (TYPEBANK).

The full linear specification for explaining non-core differences in competition measures  $CM_i$  ( $i = NTMTA$ , Lerner index, ROA, H-statistic) across 14 countries is:

$$(1) CM_i = a_{0i} + a_{1i} OCTA + a_{2i} GDPGR + a_{3i} COL + a_{4i} FEEINC + a_{5i} TYPEBANK + e_i + u_i$$

where all the variables have just been defined. The OCTA and FEEINC variables differ by bank, by year, and by country while the COL and GDPGR variables differ by year and by country. The last term in (1),  $e_i + u_i$ , is a composite error term and is discussed further below. The results of the four OLSQ regressions are shown in Table 7 pooled over 14 countries ( $n = 13,384$ ).<sup>14</sup>

**TABLE 7: EXPLAINING COMPETITION MEASURES  
ACROSS 14 COUNTRIES IN EUROPE\***

Independent Variables:	Four Dependent Variables:			
	NTMTA	LERNER INDEX	ROA	H-STATISTIC
Intercept	.005***	.141***	.004	-.657***
Cost Efficiency (OCTA)	.463***	-.655***	-.024***	1.486*
Growth in Real GDP (GDPGR)	-.028***	-.320***	.025***	-2.066***
Inflation Index (COL)	.092***	.379***	.105***	-1.582***
Share of Fee Income (FEEINC)	-.465***	4.870***	.404***	-1.621***
Dummy for Type of Bank (TYPEBANK)	.002***	.009	-.001	.008***
R <sup>2</sup>	.57	.11	.16	.15

\* The H-statistic was multiplied by -1.0 so a higher value of all measures implies less competition. The asterisks, \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% level, respectively.

Consistent with the so-called "efficient structure" hypothesis that higher bank profits may (at least in part) be the result of efforts to reduce costs as well as the exercise of market power, the change in unit operating cost over 1995-2001 was negatively associated with the Lerner index and the return on assets. As this cost

<sup>14</sup> A fixed or random effects model is not appropriate here as we wish to determine the influence of the specified variables alone without also incorporating dummy variables to reflect unknown country or bank-specific influences.

efficiency measure fell by almost 6% between 1995-2001, the implication is that this cost reduction is associated with higher measured levels of these two market competition indicators and, if not adjusted for, these indicators would suggest that banking markets are less competitive than they actually may be. Improved cost efficiency, however, is positively associated with the net interest margin and the H-statistic so these competition indicators have fallen with the reduction in operating expenses. With respect to the other influences in Table 7, both the growth in real GDP and the cost of living index fell over 1995-2001 (by 31% and 29%, respectively) and both are associated with a reduction in the return on assets, a rise in the H-statistic, but have opposite and potentially offsetting effects on the interest margin and the Lerner index. Lastly, the 10% rise in fee income over 1995-2001 appears to have contributed to higher measured levels for the Lerner index and the return on assets since these two measures are broad-based profitability indicators that reflect both traditional and non-traditional sources of profits. The effect of higher fee income on the net interest margin and the H-statistic, which are more narrow indicators of profitability, is negative. Overall, for the 14 countries 11% to 57% of the variation in the four competition measures was "explained" by equation (1).

Results from re-estimating equation (1) using only bank observations for Germany, Italy, France, and Spain are shown in Table 8 (n = 11,375). Excluding the dummy variable for the type of bank, there was only one sign change among the four explanatory variables in Tables 7 (14 countries) and 8 (4 large countries). Thus little is changed by focusing only on the largest countries.

**TABLE 8: EXPLAINING COMPETITION MEASURES  
ACROSS GERMANY, ITALY, FRANCE and SPAIN\***

Independent Variables:	Four Dependent Variables:			
	NTMTA	LERNER INDEX	ROA	H-STATISTIC
Intercept	.006***	.156***	-.009***	-.635***
Cost Efficiency (OCTA)	.412***	-1.340***	-.045***	1.046***
Growth in Real GDP (GDPGR)	-.010	.085	.061***	-0.782***
Inflation Index (COL)	.111***	.760***	.110***	-1.267***
Share of Fee Income (FEEINC)	-.318***	6.204***	.502***	-.352**
Dummy for Type of Bank (TYPEBANK)	.004***	-.012	.000**	-.046*
R <sup>2</sup>	.49	.16	.20	.04

\* The H-statistic variable was multiplied by -1.0 so a higher value of all measures implies less competition. The asterisks, \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% level, respectively.

We can conclude the following from this explanatory analysis. Differences in real output growth and inflation have a significant influence on the non-structural measures of competition as do differences in cost efficiency and fee income from non-traditional services. As these influences have little to do with longer-term bank pricing power, they need to be considered when assessing the level of banking market competition across countries.

## 5. Deriving a Separate Indicator of Bank Pricing Power

It is one thing to point out that banking market-specific differences in cost efficiency, non-traditional activities, real output growth and inflation should be considered when assessing the predictions of bank pricing power and quite another to actually adjust competition measures for these influences. Not having detailed cost accounting data, our approach to making such an adjustment relies on developments in the frontier efficiency literature. In this regard, the expression  $e_i + u_i$  in (1) is a composite error term with  $e_i$  representing random error while  $u_i$  reflects the unexplained portion of each competition measure ( $CM_i$ ) which we suggest reflects a measure of bank pricing power after it has been adjusted for the statistically associated effects of (1) cost efficiency, (2) non-traditional banking activities, and (3) temporary changes in bank pricing power due to the business cycle and inflation. In effect, we "subtract" the influences associated with the independent variables in equation (1), and shown in Table 7, from each of the competition measure dependent variables.

Averaging  $e_i + u_i$  over time for all sampled banks in each of 14 countries separately is expected to generate an average  $e_i$  that approaches zero while the average  $u_i$  is expected to yield a truer indicator of the level of average bank cross-country control over market price.<sup>15</sup> As our goal is to adjust the measured level of our four competition measures, rather than only make relative comparisons as is done in the efficiency literature, the intercept of each estimated equation is added to the averaged residual for each equation so that only the effect of the independent variables is "subtracted". Denoting the estimated intercept plus the averaged composite error term  $e_i + u_i$  as  $PPM_i$  (a pricing power measure), the correlations among these adjusted competition measures

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<sup>15</sup> This approach is taken from the so-called 'distribution-free' application that is used in the efficiency frontier literature, where the  $u_i$  term is presumed to reflect the average unspecified cost or profit inefficiency "left over" and unexplained in a cost or profit function estimation. This is sometimes referred to as 'core inefficiency'. Berger (1993) provides a good discussion of this procedure, as do many other researchers in this area. Borrowing from this approach we assume a composite error term composed of random error  $e_i$  and another term  $u_i$  that reflects the unexplained portion of each competition measure not explained by the independent variables in the regression. To decompose the composite residual into its

are shown in Table 9 (the second part of each column). The correlations among these competition measures before they are adjusted (the first part of each column) were presented earlier in Table 2 and are repeated here to see if our adjusted measures (PPM) may be more consistent than before. Greater consistency occurs when the correlation coefficient (r value) in the second part of column is a higher positive value than the value shown in the first part of the column. Out of 10 possibilities, 4 show an improvement in consistency, 3 of which are restricted to the relationship among the net interest margin, the Lerner index, and the ROA. The relationship between these 3 measures and the H-statistic or the HHI is uniformly worse. Thus our adjustment moves the competition indicators that focus on profitability--NTMTA, Lerner index, and ROA--closer together but at the cost of making them less consistent with the H-statistic and HHI.

**TABLE 9: CORRELATIONS BETWEEN AVERAGE UNADJUSTED ( $CM_i$ ) AND ADJUSTED (PPM<sub>i</sub>) COMPETITION MEASURES FOR EUROPE\***  
(First column unadjusted values; Second column adjusted values; n = 14)

	NTMTA	LERNER INDEX	ROA	H-STATISTIC	HHI
NTMTA	1.00				
LERNER INDEX	.68 .83	1.00			
ROA	.55 .88	.66 .69	1.00		
H-STATISTIC	.48 .16	.24 .05	.33 .22	1.00	
HHI	.07 -.22	.39 .13	.62 .33	.26 .42	1.00

\* All values are correlation coefficients (r). The H-statistic was multiplied by -1.0 so now a higher value of all competition measures implies less competition.

The reason why there is now greater consistency among the net interest margin, the Lerner index, and the return on assets is that these three measures are all affected by changes in the value of operating cost and fee income, whether transmitted through the weighted average price or the quantity component of the change in value. In contrast, the H-statistic effectively holds operating input quantities constant (by holding banking output level and composition constant) and relies only on the association of changes in input prices with changes in average unit revenues. If only the prices of inputs, average unit total revenues, and average unit fee revenues were changing over 1995-2001, then all four of the non-structural market competition measures should become more consistent. Apparently, the quantity component of the value of operating inputs and the value of fee income have changed more than the average price or average revenue component. Hence the divergence seen in Table 9 between the H-statistic is likely due to the fact that the H-statistic is affected only by changes in prices while the NTMTA,

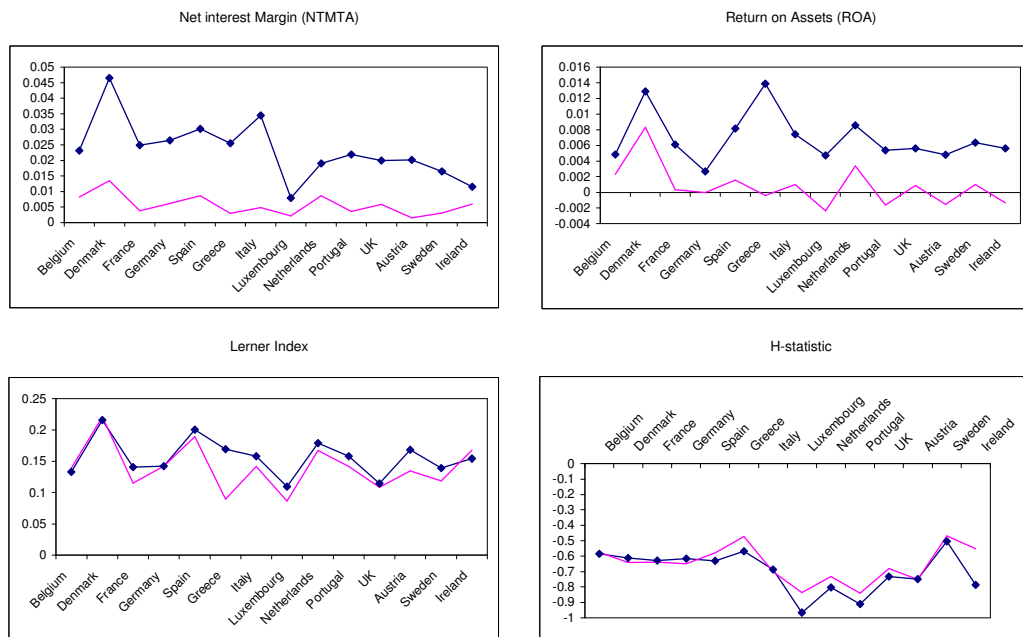
two components we assume that random errors average out to zero. Simply put, the average random error

Lerner index, and ROA are affected by changes in value derived from changes in price or quantity or both.<sup>16</sup>

The effect of the adjustment made to the market competition measures is seen better when the unadjusted values of each  $CM_i$  are plotted across 14 countries in Figure 1 (the lines with boxes) and compared to the adjusted  $PPM_i$  values (the solid lines). The pricing power portions of the net interest margin (NTMTA), the Lerner index, the return on assets (ROA) are all either somewhat or markedly lower and, seen in Table 9 for these three measures only, more similar in their cross-country variation than are the standard unadjusted measures. The pricing power results for the H-statistic, however, are higher (smaller negative value).<sup>17</sup>

**FIGURE 1: AVERAGE UNADJUSTED ( $CM_i$ ) AND ADJUSTED ( $PPM_i$ ) COMPETITION MEASURES FOR EUROPE**

( $i = NTMTA, LERNER, ROA, H\text{-Statistic}; n = 14$  countries  
Unadjusted = lines with boxes; Adjusted = solid lines)



"disappears" leaving an average  $u_i$ , which may reflect better underlying market competition.

<sup>16</sup> It is clear that the value of operating cost or the value of fee income can directly affect the net interest margin and ROA. Since the Lerner index is determined from the average "price" (unit revenue) of banking assets while changes in marginal cost can arise from changes in input prices or quantities, changes in the value of operating cost or fee income will also directly affect this measure as well.

<sup>17</sup> Recall that we multiply our unadjusted H-statistic by -1.0 so that higher values of all competition measures indicate less competition. This means that perfect competition for us is -1.00 while monopoly is 0.0 or a positive value.

Since in all cases a higher value of any of the four competition measures would indicate less competition, the pricing power values for the net interest margin, the mark-up of price over marginal cost, and the return on assets all suggest that actual price competition in our 14 country banking markets may be stronger than what would be otherwise inferred with the unadjusted--and typically applied--competition measures. The divergent results for the H-statistic is, as noted above, apparently due to the fact that input or output quantities are effectively held constant in this measure so only price changes--not changes in values--will be reflected here. Consequently, our tentative conclusion is that the H-statistic is not a good candidate for the adjustment procedure we propose. We conclude that the net interest margin, the Lerner index, and the return on asset measures will likely reflect more accurately changes in competition over time

Using the unadjusted competition measures to approximately rank the 14 countries in terms of their apparent degree of competition across all four of the non-structural measures shown in Figure 1, the banking markets of Luxemburg, Ireland, the U.K., and Germany (with the lowest unadjusted values) seemingly represent the most competitive while Denmark, Italy, Spain, and Greece (with the highest values) seem to be the least competitive. Using the adjusted competition or pricing power measures (PPM), Luxembourg (again) and Greece would be the most competitive while Denmark and Spain (both again) would be the least competitive. At the extreme ends, the country competition rankings are not changed much by our adjustment. The main effect of the adjustment we make is to suggest that banking markets in Europe are seemingly more competitive than the standard measures would indicate. This is understandable since our purpose was to try to "subtract" the apparent effects of cost efficiency, business cycle, inflation and non-traditional banking services from the non-structural measures of competition. Also, as can be seen in Figure 1, the measured differences in the competition indicators across countries is markedly reduced after our adjustment, suggesting that these banking markets are not as different as previously thought.

## **6. Conclusions and Policy Implications**

Many studies have attempted to determine the degree of competition in banking markets. The vast majority have made this assessment relying upon only one of the various measures developed for this purpose. As we demonstrate here for a cross-section of 14 European countries over 1995-2001, our comparison of five well-known indicators of banking market competition often give conflicting predictions of competitive behaviour across countries, within countries, and over time. These five measures--net interest margin, Lerner index, return on assets, H-statistic, and HHI

market concentration--are only weakly positively related to one another. The measures were computed for 14 countries using a balanced panel of 1,912 banks over seven years (giving 13,384 observations).

The essence of our results can be simply illustrated. Using average values across countries, the coefficient of determination ( $R^2$ ) between net interest margins and the Lerner index, between the Lerner index and the return on assets (ROA), and between ROA and HHI are only .46, .44, and .39, respectively.<sup>18</sup> Other relationships are weaker still. If these pair-wise relationships were .50, then effectively only 50% of the time would these measures contain the same information for assessing market competition. These and other results detailed in the text suggest that cross-country comparisons of banking competition in Europe lack consistency and may be unreliable as presently constructed. Our set of competition measures are treated in the literature as being more or less substitutable but we find that the determination of competition may differ depending on the measure chosen to assess it. Thus conclusions regarding competition should be shown to be robust by utilizing more than one measure. Our finding of only a weak positive association among the various competition measures makes it more difficult to determine with confidence the overall state of banking market competition in Europe, to assess the effects of deregulation on competition as some studies have attempted, or for policy makers to judge the likely effects of prospective mergers.

In attempting to identify some of the reasons why competition measures differ in their predictions, we found that cost efficiency and fee income from non-traditional banking services were important influences that are currently bundled into and reflected in standard measures of market competition. Business cycle effects and inflation also appear important. These results were obtained by applying a composed error regression model to our four non-structural competition measures (net interest margin, Lerner index, ROA, and the H-statistic). The composed error approach enabled us to try to identify and "subtract" the effects of cost efficiency, etc., from our set of standard competition measures and obtain an estimate of underlying bank pricing power in European markets.

Using either the standard measures of market competition or our implied measures of bank pricing power, the most competitive banking market in Europe appears to be in Luxembourg while the least competitive appears to be in Denmark. While the most and least competitive banking markets appear to be the same after our adjustment, the measured differences in competition indicators across countries is

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<sup>18</sup> From Table 2 in the text.

markedly reduced with our adjustment, suggesting that banking markets in Europe may not be as different as previously thought. Overall, the pricing power indicator we derive suggests that competition among European banking systems may well be more substantial than implied by traditional measures and analysis. At a minimum, it seems prudent to adjust competition measures for contemporaneous cost efficiency and the effects associated with non-traditional banking services. This presumes that competition policy should be focused on assessing competition in traditional deposit and loan services as this is where a lack of competition affects the most people as well as economic growth.

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## APPENDIX

**TABLE A1: NUMBER OF BANKS BY COUNTRY AND YEAR  
(1995-2001)**

<b>Country</b>	<b>Each Year</b>	<b>Total</b>
Austria	41	287
Belgium	28	196
Denmark	62	434
France	184	1,288
Germany	1,155	8,085
Greece	8	56
Ireland	6	42
Italy	198	1,386
Luxembourg	61	427
Netherlands	10	70
Portugal	6	42
Spain	88	616
Sweden	7	49
United Kingdom	58	406
EU	1,912	13,384

Note: Given that only one Finnish bank observation was available across all the years we excluded Finland from our analysis.