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**HOW EFFICIENT IS THE POLISH BANKING
INDUSTRY?**

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How efficient is the Polish Banking Industry?

Abstract

In 2004 Poland entered the EU. This paper investigates whether the Polish banking industry is prepared for entry by looking specifically at its comparative efficiency in relation to one of the largest banking sectors in the EU, that of the UK. A range of efficiency measures is used. The empirical results reveal a surprising degree of relative efficiency in the Polish banking industry, no doubt reflecting the substantial economic changes introduced in Poland since 1989. The results suggest that the Polish banking sector should be able to survive the new competition that it will face following entry into the EU.

Keywords: Poland, UK, commercial banking, efficiency, performance.

JEL classification: C52, F36, G21

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1. Introduction

Poland entered the EU as one of a number of new Member States in 2004. Entry into the EU implies increased competitive pressures for Polish industry created by the single market and EU competition law. This is particularly true for Poland's financial services that until recently were state owned and protected from competition. The banking industry has been transformed in the EU during the last decade as a result of three major developments: (a) the establishment of a Single European Market in financial services, which has intensified competitive pressures and forced the pace of rationalisation across the industry; (b) the impact of developments concerning information technology and the consequences for the delivery of financial products and services, as well as new product development (involving, for example, internet banking and money transmission services); and (c) extensive merger activity, bringing about closer integration and, to a large degree, the globalisation of financial markets. This has created a business environment in which institutional investors are now challenging the dominant positions of commercial banks in both deposit-taking and loan-financing facilities. Also, Poland is by far the largest country amongst the new EU Member States and, therefore, can be expected to attract considerable attention from the European financial services industry, as its economy develops and gravitates towards the EU average.

The purpose of this paper is to consider the competitive performance of the Polish banking industry following EU entry. The contributions of the paper are in terms of identifying the relative competitiveness of Poland's commercial banking sector and in applying a number of measures including stochastic cost frontier analysis. To make the research manageable, the efficiency of Poland's commercial banking sector is compared with the efficiency of commercial banking in the UK. The UK's banking sector is one of the largest in the EU ¹ and generally recognised as internationally competitive. It therefore provides a useful benchmark for comparing the efficiency of Polish banks with those of the EU in general.

The alternative, of comparing Polish banking with the average performance of banking across the EU would arguably be less satisfactory because average EU performance masks differences within the EU. A number of performance measures are used, namely financial ratios, including profitability, and figures for operating and financing costs. Later in the paper performance differences are also investigated using a stochastic cost frontier analysis. The paper concludes that the Polish commercial banking sector already seems broadly comparable to the UK's commercial banking sector in many areas of performance. It is, however, still relatively small scale and competition is not as developed as it is in the UK when measured in terms of the number of competing banks. It also suffers from a relative weakness in terms of liquidity and poorly performing loans.

The structure of the remainder of the paper is as follows: in Section 2, we describe developments in the Polish banking system since 1989, to provide an appropriate context for the statistical analysis. Section 3 details the various performance measures used to assess efficiency differences between the Polish and UK commercial banking sectors, describes the data used and provides results using descriptive statistics and tests of significance between means. In Section 4 relative performance using a stochastic cost frontier analysis is reported. Finally, in Section 5, some implications for future research are considered.

2. The Polish Banking System since 1989

Prior to 1989 Poland's banks were state-owned and competition was limited. In 1989 the sector was primarily composed of co-operative banks. By 1993 there were still 1653 co-operative banks out of a total of 1740 banks in the country². With the collapse of communism and the introduction of Poland's economic reform programme to create a market economy, the Polish banks underwent privatisation, so that by 2000 most of the banks had been transferred to the private sector. By then the industry consisted of 754 banks, however around 680 were still small co-operative units.³ A total of 47 of the larger banks had come under foreign ownership with banking organisations in EU Member States being the largest single set of foreign owners (Baka, 2000).

Since 1989 the Polish banking sector has experienced three main stages of development. Firstly, from 1989 to 1992 there was a dramatic

increase in competitive pressures, but was still lacking the necessary institutional underpinning to develop a sound market-based banking system. In particular, a robust legal and regulatory framework was missing. Secondly, between 1992 and 1997 a restructuring of financial institutions occurred including recapitalisation of the banks, privatisation,⁴ and new legal reforms that led to a more orderly competitive environment⁵. Thirdly, from 1998 strategic investors became progressively more active, taking advantage of the benefits brought about by privatisation and market liberalisation. In other words, during the 1990s the banking sector became more commercially orientated, involving significant restructuring; restructuring that paralleled changes going on elsewhere in the Polish economy.

In recent years, the pace of competition within the banking sector in Poland has intensified in both the corporate finance and retail sectors. This has resulted largely from an influx of foreign-controlled banks. In fact, more than 75% of the capital in the Polish banking industry is now foreign-owned - German, Austrian and Dutch investors dominate (Balcerowicz and Bratkowski, 2001; Baka, 2000). The consequence has been the development of new competitive strategies, the promotion of new human resource skills⁶ and the expansion of systems to identify and capture new markets (Balcerowicz and Bratkowski, 2001)⁷. In the retail sector there has been extensive development of branch networks and the use of IT in money transmission services⁸.

There has also been an improvement in the public perception of the banking industry in general, as the less popular and less efficient banks have either been closed or been merged with more efficient banks. (Styczek, 2003⁹). However, it appears that there are still some areas of the financial market which remain under-developed, especially the housing market. Very few Polish banks seem to specialise in providing mortgages¹⁰ and, those which do, impose a number of conditions which restricts the number of people eligible to apply for a mortgage¹¹. This compares unfavourably with the position in the EU Member States and especially the UK with its well-developed mortgage market supplied by banks and building societies.

Chmielewski and Karbowska (1999) compared banks operating in Poland and Western Europe according to a range of efficiency ratios and concluded that, in 1997, Polish banks were less efficient. However, given the continuing changes in the Polish banking sector it seems timely to assess its performance again, and using a wider range of performance measures including econometric analysis.

3. Performance Measurement, Data and Initial Findings

In recent years, several studies have focused on performance in the banking sector, however many of them have concentrated on a particular country and the analysis of scale and scope economies. For example, Berger (1993) analysed US banks between 1980 and 1989 and concluded that management of resources is critical to achieving efficiency, while scale differences played a relatively minor role. Additional studies that have evaluated the performance of US Banks include those by Peristiani (1996), Berger and Mester (1997), Mukherjee *et al.* (2001), Barr *et al.* (2002) and Akhigbe (2002). Other performance studies of banking include those by Gough (1979), Hardwick (1989, 1990), Drake (1992), Dietsch (1993) and Lang and Welzel (1996).

Altunbas *et al.* (2001) extended the existing literature on modelling costs in banking systems by estimating scale economies, inefficiencies and technical change. In this study a sample of EU countries was used and efficiency was measured using stochastic cost frontier (SCF) techniques (for an explanation of SCF, see pages 20-22). Their results revealed that production inefficiencies were larger than scale inefficiencies, a finding consistent with the majority of US studies. The study also concluded that inefficiencies tend to vary across countries and over time. Since then, other studies have focused on cost and profit efficiency issues related to EU banking, such as Maudos *et al.* (2002) and Weill (2003).

However, despite the imminent entry of a number of Central and Eastern European countries into the EU, there appear to have been few studies of the performance of banks in these countries. The majority of studies tend to be descriptive and a number are restricted to a comparison of accounting ratios, such as return on assets or return on equity (Weller, 2000; Marek and Baun, 2002; Keren and Ofer, 2002). Although a few studies have applied econometric modelling including SCF analysis (Mertens and Urga, 2001; Hasan and Marton, 2003), the literature lacks a direct comparison between the banking systems in these countries and members of the EU pre-2004. As Berger and Humphrey (1997) conclude from a survey of studies of efficiency of financial institutions, international comparisons deserve additional attention.

In this paper, performance in Poland's commercial banking sector is compared with performance in UK commercial banking. Bank

performance can be measured along a number of dimensions, including charges, financial ratios and costs of operation. Economists usually differentiate between allocative efficiency and productive efficiency when assessing economic performance. Allocative efficiency is concerned with price-cost margins and productive efficiency with costs of production. A distinction is also made between static efficiency gains, which are gains at a point in time or the short-run, and dynamic efficiency gains, which are more concerned with longer-term economic performance improvements, usually associated with innovation in products and processes.

In this study, for reasons of data availability, the concern is with performance over a short period of time, 1999-2001, and with efficiency in the provision of outputs. Data do not exist to discuss price-cost margins and therefore allocative efficiency (although the existence of competition in UK banking and growing competition in Polish banking implies a high degree of allocative efficiency) or of longer-term dynamic gains. The focus is therefore on relative static efficiency using measures of productive efficiency.¹²

The main measures used are profitability, because in a competitive market place profits reflect cost control as well as revenue maximisation, other financial ratios and costs of production. The data are drawn from the Bankscope data base which contains balance sheet and income statement data published by the London-based International Bank Credit Analysis Ltd. The sample used comprises of 216 banks, 179 of which are UK banks and the remaining Polish. Prior to 1999 the data in Bankscope are incomplete, which prevented including a period of study before that year. An analysis was also carried out including a further year of data, for 2002. While the pattern of the results is consistent with the ones presented below, data for 2002 increased standard deviations within each category of the results. This may be due to the fact that 2002 has recently been added to the Bankscope database and adjustments to the data may still be needed. In addition, including the extra year meant reducing the number of banks in the study to 145, therefore impacting the total number of observations. Moreover, pooling data over a longer period increases the risk that the functional form does not remain the same. The same functional form is an assumption for the use of pooled data in a SCF analysis.

The banks in the Bankscope data base fall into the following categories: commercial, savings, co-operative, real estate and mortgage, medium and long-term credit and investment banks and securities houses,

with the majority being commercial banks. For the UK, around one third of the banks are real estate and mortgage banks and just over one fifth are classified as investment banks and securities houses. In contrast, the Bankscope data base has no Polish banks classified as investment banks and securities houses. This means that for Poland the classification ‘commercial banks’ includes banks that provide services which in the UK are mainly offered by specialist real estate and mortgage banks and investment banks. This introduces a potential lack of homogeneity in the classification of banks’ activities across the two countries. However, banks in the Bankscope data base are categorised according to their primary activity or, more precisely, the activity to which more than 50% of operations relate. This means that heterogeneity in activities is limited and should not constitute a significant problem when comparing commercial banks in Poland and the UK.

Table 1: Data Sample – UK and Polish Banks

	<i>Country</i>	
	<i>United Kingdom</i>	<i>Poland</i>
<i>Total Assets (US\$m.)</i>	7,365,779	145,162
<i>Sample Assets (US\$m.)</i>	3,823,901	104,730
<i>% Assets included</i>	52	72
<i>% of Commercial Bank assets included</i>	84	87
<i>Total number of banks</i>	179	37
<i>Commercial banks</i>	75	34
<i>Savings banks</i>	2	1
<i>Co-operative banks</i>	0	1
<i>Real Estate and Mortgage banks</i>	61	0
<i>Medium and Long Term Credit banks</i>	0	1
<i>Investment banks and Sec. houses</i>	41	0

The information in Table 1 highlights other important differences in the two countries' banking systems. In particular, there are many more banks in the UK than in Poland and each of the banks has much larger average assets – averaging \$3,834 billion in the UK as against \$104.7 billion in Poland. Performance results may therefore be affected by firm size or scale of operation, something we test for later in the paper. It is also clear from the table that the commercial banks dominate both banking systems. For this reason, in the discussion below we concentrate upon the relative performance results for the commercial banks. As can be seen from Table 1, more than 50% of the total assets of the banks in both countries are included in the study and over 80% of commercial banks' assets, which suggests that the sample used is sufficiently large to offer a fairly representative picture of performance in the UK and Polish banking sectors, especially commercial banking.

Table 2 presents the results for a range of performance indicators for the commercial banks in the two countries. The indicators are chosen to reflect key banking metrics, namely: asset quality ratios, capital ratios, operations ratios and liquidity ratios. Standard deviations are given in parentheses and indicate for some of the indicators, such as profitability, that no major differences exist in data dispersion between Polish and UK banks, permitting a focus on the mean figures. For other indicators, such as impaired loans (defined as loans with suspended interest), there is a noticeable difference in the data dispersion, which means that both the means and standard deviations should be considered together. Two-tailed t-tests were undertaken to determine whether the difference between means for each of the performance measures was statistically significant at the 10% level. The results are provided in the final column of the table.

**Table 2: Cost and profitability ratios of Commercial banks in the UK
and Poland, average 1999 – 2001.**

Commercial banks	United Kingdom^a	Poland^a	Difference statistically significant (2-tailed test; 10% level)
Asset quality ratios^b			
<i>Loan loss reserves/gross loans</i>	2.986 (11.896)	5.525 (3.541)	No
<i>Impaired loans/gross loans</i>	4.079 (5.519)	15.521 (7.072)	Yes
Capital ratios			
<i>Equity/total assets</i>	13.543 (12.723)	13.994 (12.937)	No
<i>Equity/liabilities</i>	20.006 (27.445)	23.134 (45.499)	No
Operations ratios			
<i>Net interest margin</i>	3.080 (2.866)	4.690 (1.852)	Yes
<i>Average profit (profit/assets)</i>	0.014 (0.013)	0.016 (0.012)	No
<i>Return on Assets employed</i>	1.007 (1.130)	1.185 (1.057)	No
<i>Return on Equity</i>	9.976 (11.557)	9.624 (8.463)	No
<i>Average costs (costs/assets)</i>	0.063 (0.019)	0.099 (0.027)	Yes
<i>Average operational costs</i>	0.022 (0.016)	0.023 (0.011)	No
<i>Average financial costs</i>	0.041 (0.014)	0.076 (0.022)	Yes
<i>Cost to income ratio</i>	65.546 (54.545)	64.100 (19.128)	No
Liquidity ratios			
<i>Net loans/total assets</i>	43.573 (29.455)	50.908 (13.850)	No
<i>Liquid assets/total deposits & borrowing^b</i>	48.780 (46.432)	15.509 (13.246)	Yes

^a Standard deviations in parentheses.

^b The ratios were constructed with data from 75 UK banks and 34 Polish banks, with the exception of the following ratios where fewer banks were considered, due to data limitations: loan loss reserves/gross loans (54 UK and 11 Polish banks), impaired loans/gross loans (23 UK and 10 Polish banks) and liquid assets/total deposits and borrowing (61 UK and 20 Polish banks).

Starting with the asset quality ratios, it is clear from the figures in Table 2 that in Poland impaired loans to total loans are significantly higher than in the UK, confirming that Poland has a more serious problem with underperforming loans in its banks' balance sheets (Polish commercial banks also record higher average loan loss reserves to gross loans, but the difference between means is not statistically significant at the 10% level). This result is almost certainly a legacy of the economic restructuring of the 1990s and the greater difficulty in assessing a borrower's credit worthiness in Poland than the UK, with its less-well developed system of credit referencing. In terms of capital ratios, however, there is no statistically significant difference at the 10% level between Poland's and the UK's commercial banks, suggesting that the banks in Poland are not obviously relatively under-capitalised. Looking at the standard deviations, it is clear that loan loss reserves in the UK vary more across UK commercial banks; although the reverse is true for impaired loans. On balance, the standard deviations do not detract from the general conclusion that Poland has a greater problem with underperforming loans. With regard to the capital ratios, both UK and Polish commercial banks have similar ratios of equity financing, albeit with a wider dispersion around the mean figure in Poland for the equity to liabilities indicator.

Turning to the operations ratios, profitability is conventionally measured as a return on assets employed and as a return on equity. The profitability figures in Table 2 suggest that for commercial banks in Poland and the UK, profits on assets employed vary little between the two. Also, while at first inspection the descriptive statistics may suggest that profitability is higher in Poland's commercial banks than in the UK equivalents, the mean differences proved statistically insignificant (again at the 10% level). The conclusion is that the Polish and UK commercial banking sectors have similar profitability.

By contrast, costs of production in relation to assets employed are lower in the UK and this result is statistically significant, while the cost to income ratio is similar to that in UK commercial banks.¹³ This leads to the conclusion that commercial banks in Poland have higher costs per assets than in the UK but not as a share of income. The higher costs per assets seem to be compensated for by higher revenues in relation to assets employed (note the higher net interest margin for Poland's commercial banks), probably reflecting the lower level of competition in Polish

banking. In turn this suggests that as competition puts downward pressure on bank charges, the Polish commercial banks will need to reduce their asset base, probably through further consolidation, if they are to remain competitive.

In banking, costs of production can be divided between the costs of operating the bank, including branch networks, and the cost of raising loanable funds. It is therefore useful to explore performance differences separately in terms of operational costs and financial costs. Table 2 provides figures on operational and financial costs in relation to assets employed in commercial banks in Poland and the UK. In relation to operational costs, there is no statistically significant difference in the mean figures across the two countries' commercial banks – a finding consistent with the similar cost to income ratio in the two countries. In contrast, financial costs in relation to assets employed are on average much higher in Poland – a mean figure of 0.076 compared with 0.041 – and there is more variability around the mean. This finding is consistent with the notion that Poland's financial market is less advanced and competitive than the UK's. This means that, in general, it costs Polish banks more to raise loanable funds than is the case for UK banks with an equivalent asset base. However, with the entry of Poland into the EU and the creation of single money and capital markets this differential is likely to be eroded. This may be expected to improve the competitiveness of Polish commercial banks in terms of raising finance.

Finally, the liquidity ratio figures in Table 2 suggest that Poland's commercial banks are more exposed in terms of liquid assets to total deposits and borrowing. The latter finding is of particular concern when set alongside the ratio for impaired loans. Together the results suggest that a number of Poland's commercial banks are likely to be less able to absorb the impact of a financial crisis than commercial banks in the UK.

4. A Cost Frontier Analysis

So far the relative performance of Polish and UK banks has been measured using descriptive statistics. Here we assess performance using econometrics and specifically a stochastic cost frontier. Cost functions provide a more comprehensive analysis of costs than the simpler ratio analysis reported earlier and, as we saw earlier, they have been used to measure the performance of banks. A cost function relates the costs of production observed in the data period, in this case 1999-2001, to input

and output variables and derives directly from the theory of the firm (Varian, 1992). We would have liked to have included an assessment of Polish and UK banks performance also based on a profit frontier analysis. However, like Bos (2002) and Bikker (2004), we found that while one single cost frontier exists when comparing across countries, this does not hold true for the profit frontier, probably due to different market conditions. Hence, the profit function approach does not allow for satisfactory comparisons across countries or regions.

Cost efficiency is the ratio between the minimum cost (C^{min}) necessary to achieve a desired level of output and the observed total cost (C). Total Costs are therefore a function of the output (y), the price of inputs (w) and a set of other factors, which we here decompose into two parts: the level of cost inefficiency in production (u) and a random part (v). The latter accounts for measurement error and other random factors, such as the effects of weather, strikes, etc, on the value of the output variables, together with the effects of unspecified input variables in the cost function (see Coelli *et al*, 1998). Assuming that u and v are multiplicatively separable from the other variables of the function and also that the variables are expressed in logarithms, then the cost function can be written as:

$$\ln C = f(y, w) + \ln u + \ln v . \tag{1}$$

Cost efficiency for an individual bank can then be described by the function:

$$\text{Cost efficiency} = \frac{C^{min}}{C} = \frac{\exp[f(y, w)] \exp(\ln v)}{\exp[f(y, w)] \exp(\ln v) \cdot \exp(\ln u)} = \exp(-\ln u) \tag{2}$$

The model employed in this paper is a standard translog functional form (Casu and Girardone, 2002). Hence the cost equation to be estimated is:

$$\begin{aligned}
\ln C = & \alpha + \sum_{i=1}^3 \beta_i \ln w_i + \frac{1}{2} \sum_{i=1}^3 \sum_{j=1}^3 \beta_{ij} \ln(w_i) \cdot \ln(w_j) + \sum_{n=1}^2 \gamma_n \ln(y_n) + \frac{1}{2} \sum_{n=1}^2 \sum_{m=1}^2 \gamma_{nm} \ln(y_n) \cdot \ln(y_m) \\
& + \sum_{i=1}^3 \sum_{n=1}^2 \rho_{in} \ln(w_i) \cdot \ln(y_n) + \delta_E \ln(E) + \frac{1}{2} \delta_{EE} \ln(E)^2 + \sum_{n=1}^2 \lambda_{En} \ln(E) \ln(y_n) \\
& + \sum_{i=1}^3 \tau_{Ei} \ln(E) \ln(w_i) + \ln v + \ln u
\end{aligned} \tag{3}$$

where restrictions of symmetry and linear homogeneity have been imposed on input prices. The variables included in the model are total costs (C), which include financial and operating costs, input prices described as price of loanable funds or the costs of raising funds to lend out (w_1), price of labour (w_2) and price of physical (fixed) capital e.g. buildings (w_3), and quantity of outputs, which are deposits, including loans (y_1) and other earning assets (y_2) and financial capital (E), which is a proxy for banks' insolvency risk.^{14 15} The price of loanable funds is obtained by dividing financial cost by the corresponding liabilities, which include deposits, money market funding and other funding. The price of labour would ideally be the marginal cost of employing labour, but in the absence of this data an approximation was used based on the ratio between personnel expenses and total assets. The rationale for this approximation is that it crudely represents the labour cost per worker adjusted for variations in labour productivity (Altunbas *et al.*, 2001).¹⁶ Finally, the price of physical capital is approximated by dividing expenditures on plant and equipment (non-labour costs) by fixed assets (Bikker and Haaf, 2002; Maudos *et al.*, 2002). One possible difficulty relating to the analysis is aggregation bias because of the mixing of different sizes of banks in the two countries. We tested for this by including the logarithm of total assets. However, this proved to be insignificant in the explanation of total costs. Therefore, the mixing of different sizes of banks in UK and Poland does not seem to affect the results.

In common with some of the earlier studies of bank performance reviewed above, we estimate an *efficient frontier* for the banking industry. A bank's performance is then assessed by measuring how efficient it is based on its distance from the efficient frontier, a concept that dates back to Farrell (1957). Such values are sometimes referred to as measures of X-inefficiency (Berger, 1993). Here the frontier is estimated by amalgamating data from the Polish and UK banking sectors and again drawing from the Bankscope data base. In this stage of the analysis all banks in Poland and the UK were included in the data set so as to maximise the degrees of freedom and provide a more robust

estimate of the cost frontier. To model the frontier we used stochastic cost frontier analysis (SCF), as proposed by Aigner, Lovell and Schmidt (1977), and equation 3 above.¹⁷ SCF breaks down the error term into the two distinct parts already referred to, namely v_i or the random error, which is assumed to be independently and identically distributed following a normal distribution, and u_i . This is a non-negative inefficiency term and assumed to be independently and identically distributed and to follow a truncated normal or exponential distribution. The estimated inefficiency for any firm is taken as the conditional mean of the distribution of the inefficiency term, given the observation of the composed error term.

The model proposed by Battese and Coelli (1995) is used in this paper and is close to that proposed by Aigner, Lovell and Schmidt (1977). It differs in imposing allocative efficiency and allows the use of panel data.¹⁸ The estimation of the model occurs in three main steps. The first involves the estimation of the function by Ordinary Least Squares (OLS). The parameters obtained are all unbiased with the exception of β_0 (intercept) and σ_s^2 (sum of the variance of u_i and v_i). The second step is carried out with the estimation of a likelihood function based on Battese and Corra (1977),¹⁹ which is evaluated for a series of values of γ between zero and one - where γ equal to zero means that the deviations from the frontier are due only to noise, while a value of one indicates that the deviations are due entirely to inefficiency. The estimates for σ_s^2 and β_0 are adjusted, with the remaining coefficients unchanged. The final step uses the best estimates from the second step as starting values in an iterative procedure to achieve the final Maximum Likelihood estimates.

An individual bank's cost efficiency is then predicted from the estimates of the stochastic cost frontier. Battese and Coelli (1988) point out that the best predictor of $\exp(-u_i)$ is given by:

$$E[\exp(-u_i) | e_i] = \frac{1 - \Phi(\sigma_A + \gamma e_i / \sigma_A)}{1 - \Phi(\gamma e_i / \sigma_A)} \exp(\gamma e_i + \sigma_A^2 / 2) \quad (4)$$

where $\sigma_A = \sqrt{\gamma(1-\gamma)\sigma_s^2}$ and $e_i = \ln(y_i) - x_i\beta$.

The resulting cost efficiency estimates are reported in Table 3. They were calculated based on data which were pooled for 3 years (1999 to 2001 inclusive) for 216 UK and Polish banks, giving a total number of

observations of 648. Details of the calculations at each stage of the SCF analysis are available from the authors.

The results confirm the earlier findings relating to relative costs in commercial banks in Poland and the UK based on descriptive statistics. Although commercial banks in Poland are marginally more cost efficient than equivalent UK banks using SCF analysis, the difference is statistically insignificant. The results also highlight the high relative efficiency of real estate and mortgage banks within the UK banking sector.

Table 3: Relative Cost Efficiency using SCF Analysis

Banks	United Kingdom ^c	Poland ^c
<i>By specialisation</i>		
<i>Commercial</i>	0.707 (0.140)	0.711 (0.0987)
<i>Savings</i>	0.595 (0.150)	0.674 (n.a.)
<i>Real estate and Mortgage</i>	0.805 (0.068)	-
<i>Investment</i>	0.548 (0.238)	-
<i>Co-operative</i>	-	0.667 (n.a.)
<i>Medium and long term credit</i>	-	0.750 (n.a.)
<i>By size</i>		
<i>Large</i>	0.700 (0.204)	0.702 (0.110)
<i>Small and medium</i>	0.727 (0.192)	0.717 (0.074)

^c Average cost efficient estimates. The corresponding standard deviation (s.d.) values are in parentheses. Where only one bank is included, s.d. is not applicable (n.a.).

Table 3 also presents cost efficiency results from the SCF analysis according to bank size. As we saw earlier, the average size of banks in the UK is appreciably larger than banks in Poland. This means that size or economies of scale may affect the relative costs of production. To test for this, efficiency in relation to bank size was assessed. In the analysis a large bank is one with total assets of over one billion US dollars, a definition consistent with that used by Bankscope. The estimates reveal

that differences in costs across small and large banks and between UK and Polish banks, as presented in Table 3, are not statistically significant. This suggests again that differences in the size of banks between the UK and Poland do not obviously bias our cost results.²⁰

5. Conclusions

The paper has considered the prospects for Polish banking following the country's accession to the EU by comparing financial ratios and other performance measures between commercial banks in Poland and the UK. The UK banking sector is used as an exemplar because it is generally recognised to be one of the most efficient and competitive in Europe.

The Polish banking sector has gone through considerable changes since 1989 and the results from this study suggest that, while Poland's commercial banks still seem to be weaker in terms of impaired loans and liquidity, in other respects they are now well placed to compete successfully in the EU, in particular they appear to be competitive in terms of profitability and operating costs. We did find evidence that Polish banks suffer higher costs of raising funds and this almost certainly reflects the less well developed money and capital markets in Poland than the UK. EU entry should lead to more competitive financial markets and this should assist Polish banks in reducing financing costs in the future.

Our results have focused mainly on the commercial banks because there were an insufficient number of banks in our data set operating in the more specialist areas of banking, such as savings, real estate financing and investment and securities, to permit meaningful comparisons between Poland and the UK. Future research could usefully focus on the specialist banking functions to see whether our comparative results for commercial banking also apply to specialist banking services. In addition, while the use of the UK as a 'best practice' benchmark for the rest of the EU seems sound, further research might focus on comparisons between Polish banking and banking elsewhere within the EU. Moreover, our approach could be usefully extended to analysing the performance of banks in other accession countries, such as Hungary and the Czech Republic, especially where the banking sector has less foreign ownership than is the case in Poland. Is the relative performance of Polish commercial banks a function of the high levels of foreign investment? In the SCF analysis we found no evidence that small and medium-sized banks suffered a cost disadvantage compared to larger

banks, implying a low minimum efficient scale in banking in both the UK and Poland. It would be interesting to test the robustness of this result further and to know whether it applies to banks in other European countries too. Finally, future research should consider other bank performance dimensions that we were unable to assess given the available data, in particular customer service levels.

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Appendix

The table presented below refers to the final Maximum Likelihood Estimates (MLE) from which the cost efficiency estimates in Table 3 are derived.

The equation estimated is based on equation (4) and takes into account the restrictions of symmetry and linear homogeneity, which have been imposed on input prices.

Table A1: Final Maximum Likelihood estimates, obtained by using the Stochastic Frontier Approach.

	<i>coefficient</i>	<i>t-ratio</i>
α	1.700	3.530
$\ln w_1 - \ln w_3$	0.667	6.324
$\ln w_2 - \ln w_3$	0.211	0.660
$\ln y_1$	-0.244	-0.754
$\ln y_2$	0.067	2.548
$\ln y_3$	-0.028	-0.962
$(\ln y_1)^2/2$	-0.043	-2.478
$(\ln y_2)^2/2$	-0.088	-1.957
$(\ln y_3)^2/2$	0.065	1.390
$\ln y_1 \cdot \ln y_2$	0.031	1.855
$\ln y_1 \cdot \ln y_3$	0.126	1.924
$\ln y_2 \cdot \ln y_3$	-0.054	-0.802
$(\ln w_1)^2/2 - (\ln w_3)^2/2$	0.598	4.783
$(\ln w_2)^2/2 - (\ln w_3)^2/2$	0.0356	9.223
$\ln w_1 \cdot \ln w_2 - (\ln w_3)^2/2$	0.0608	11.99
$\ln w_1 \cdot \ln w_3 - (\ln w_3)^2/2$	0.164	7.990
$\ln w_2 \cdot \ln w_3 - (\ln w_3)^2/2$	0.022	2.585
$\ln w_1 \cdot \ln y_1 - \ln w_3 \cdot \ln y_3$	-0.062	-5.609
$2 \cdot \ln w_1 \cdot \ln y_2 - \ln w_3 \cdot \ln y_3$	-0.081	-9.557
$2 \cdot \ln w_1 \cdot \ln y_3 - \ln w_3 \cdot \ln y_3$	-0.038	-4.111
$\ln w_2 \cdot \ln y_2 - \ln w_3 \cdot \ln y_3$	-0.078	-5.474
$2 \cdot \ln w_2 \cdot \ln y_3 - \ln w_3 \cdot \ln y_3$	0.125	5.801
$\ln E$	0.062	1.554
$(\ln E)^2/2$	0.141	3.701
$\ln E \cdot \ln y_1$	-0.225	-3.249
$\ln E \cdot \ln y_2$	-0.060	-1.530
$\ln E \cdot \ln y_3$	-0.091	-2.466
$\ln E \cdot \ln w_1$	0.174	2.523
$\ln E \cdot \ln w_2$	-0.004	-0.105
$\ln E \cdot \ln w_3$	0.010	2.383
σ^2	0.281	9.115
γ	0.972	246.47
Log likelihood f(.)	281.99	
LR test ($\chi^2_{(1)}$)	819.36	

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- ¹ The UK banks' total assets amounted to US\$7,450 bn. in 2001, only overtaken in the EU by German bank assets which amounted to US\$8,465 bn. in the same year.
- ² For an overall idea of the number and type of banks operating in Poland from 1993 to 2000, see Table 3 in Balcerowicz and Bratkowski (2001).
- ³ Banking is now dominated by 16 listed banks, 15 of which are privately-owned (USAID, 2000).
- ⁴ Privatisation was one of the main objectives of the reforms that were carried out from January 1990 and the programme for the privatisation of state-owned banks was approved in March 1991. However, the preparation of each privatisation proved time-consuming and the process did not actually start until 1993. The delay was mainly due to the enormous amount of bad debts held by state-owned banks.
- ⁵ The current supervision of banking and capital markets is based on guidance provided by the Basle Committee on Banking Supervision and the Joint Forum on Financial Stability. The Banking Act and the Act on the National Bank of Poland, which were introduced in 1997 reinforced the legal reforms. Finally, new amendments came into effect in 2000, which aimed at addressing needs related to the improvement of supervision and the application of sanctions.
- ⁶ Opiela (1999) claims that the strategies of what he considers the most efficient banks operating in Poland are supported by fewer, but more highly paid and effective human resources.
- ⁷ Examples are the fast growth of retail banking, together with the intensification of the development of new IT, the creation of new products, such as credit cards and home banking, and the linkage between traditional banking and insurance services. Moreover, banks started to look at small and medium-sized enterprises as a new target market.
- ⁸ By 1999, more than 52% of Polish households had at least one bank card, compared with none in the mid-1990s. Moreover, from 1995 to 1999, consumer loans increased by 4% to 6% of total GDP (USAID, 2000).
- ⁹ In his report, Styczek states that this is being achieved at the cost of changes in the way the financial environment is controlled and the elimination of inefficient entities through mergers and acquisitions.
- ¹⁰ According to the classification used by the Bank Guarantee Fund and to Gołajewska and Józefowska (2001), there are currently three banks specialised in providing mortgages.
- ¹¹ The Mortgage Bond and the Mortgage Banks Act restricted housing lending to individuals whose maximum loan-to-value (LTV) ratio per single loan was 80% (however, in 2002 this was increased to 100%), with an average LTV for the whole portfolio of 60% plus 10% of the total assets secured with mortgages (from 2002, increased to 60% plus 30%) (Kempny, 2002). As Chiquier (1999, p.15) also claims "lenders are given strong incentives to use alternative forms of collateral, such as a general pledge over the whole patrimony of the borrower, third-party guarantees and pledged leases".
- ¹² Due to a lack of comparable data, the study also does not consider quality of service as perceived by consumers.
- ¹³ However, the standard deviation for the cost to income ratio is substantially higher in the UK, reflecting a greater variability in this cost ratio in UK than Polish commercial banking.
- ¹⁴ A bank's objective is to lend and invest profitably but not to do so recklessly so that there is high risk of insolvency. Hence, it is legitimate to include insolvency risk as a bank output alongside loans and other earning assets.
- ¹⁵ We have also, in an initial stage, included a variable in the model to test for possible aggregation bias – the logarithm of total assets -, however this proved to be

insignificant in the explanation of total costs. Therefore, the mixing of different sizes of banks in UK and Poland do not seem to affect the results in this study.

¹⁶ This follows because $(PE/A) = (PE/L).(L/A)$, where PE is personnel expenses, A is total assets and L is labour employed.

¹⁷ An alternative approach to frontier analysis uses linear programming techniques, referred to as data envelopment analysis (DEA). DEA is a non-parametric method that has the advantage over SCF analysis in not requiring the prior specification of a functional form. It has, however, the major disadvantage of attributing all deviations from the frontier as inefficiency and is more easily biased by outliers in the data. As a cross-check on the SCF results, a DEA analysis was undertaken using the same data. The results suggested a larger gap in efficiency between Polish and UK banks, in favour of Polish banks. The DEA results can be obtained from the authors, but we consider them less robust than the SCF results because of the properties of DEA. Hence, our preference to report the SCF results.

¹⁸ See Coelli et al. (1998) for a more detailed explanation of the model used.

¹⁹ Battese and Corra (1977)'s log-likelihood function is equal

$$\text{to: } \ln(L) = -\frac{N}{2} \ln\left(\frac{\pi}{2}\right) - \frac{N}{2} \ln(\sigma_s^2) + \sum_{i=1}^N \ln[1 - \Phi(z_i)] - \frac{1}{2\sigma_s^2} \sum_{i=1}^N (\ln y_i - x_i \beta)^2$$

where $z_i = \frac{(\ln y_i - x_i \beta)}{\sigma_s} \sqrt{\frac{\gamma}{1 - \gamma}}$ and $\Phi(\cdot)$ is the distribution function of the standard normal random variable.

²⁰ When we added an extra year of data to the analysis (2002), we obtained similar patterns of results. Note that the efficiency of commercial banks in both countries diminished slightly, while standard deviation across banks increased considerable. UK commercial banks have, in this case, an efficiency of 0.67 (0.18) and their Polish counterparts have an efficiency of 0.63 (0.2). However, the difference between the efficiency estimates in the two countries is not statistically significant.