Bank-specific, industry-specific and macroeconomic determinants of bank profitability: evidence from the UK

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Abstract

Purpose – The purpose of this study is to examine the effect of bank-specific, industry-specific and macroeconomic determinants of bank profitability amongst domestic UK commercial banks.

Design/methodology/approach – This study used an empirically driven single equation framework that incorporates the traditional structure–conduct–performance (SCP) hypothesis. A generalised method of moments technique was applied to a panel of UK banks covering the period 1998–2018 to account for profit persistence.

Findings – The estimation results show that all bank-specific determinants, with the exception of credit risk, significantly affect bank profitability in the anticipated way. However, no evidence was found in support of the SCP hypothesis. Interest rates, especially longer-term interest rates, and the rate of inflation has a significant effect on bank profitability, with the business cycle having a symmetric insignificant effect once other variables have been accounted for. Profitability persists to a moderate extent within the UK banking market, indicating that there exists a departure from a perfectly competitive market structure.

Originality/value – The literature that examines the actual underlying determinants of UK domestic bank profitability is limited.

Keywords Profitability, Determinants, UK, Banking, Finance, Accounting

Paper type Research paper

1. Introduction

At the time of writing, the UK exit from the European Union poses the largest threat to the stability and profitability of the UK banking system since the financial crisis. Over 400 financial firms in Britain have shifted activities, staff and a combined £1tn in assets to hubs in the European Union owing to this exit from the single market. There is an overwhelming consensus amongst academic that in the long term, this departure from the EU will reduce the UK's real per-capita income level, with economic growth forecasts stunted to below-trend growth for the next decade. We know from the existing literature that in this scenario the resilience of the banking sector is key to the avoidance of large-scale dislocations in credit markets (Huang and Ratnovski, 2009). The Treasury's ringfencing regime introduced in 2019 aims to protect the core retail banking services on which customers rely; however,

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banking lobby groups oppose this measure citing the risk of harming post-Brexit competitiveness. As such, it is pivotal for policymakers to have a clear and up-to-date understanding of the impact of key structural balance sheet fundamentals on bank profit-generating activities. This can allow for the identification of systemic risk build-up and potential for errors in forthcoming policy and regulatory oversight methodology.

Despite the financial deregulation policy introduced by successive UK Governments since the 1980s aimed at internationalizing domestic financial markets, academic research on the UK banking sector has been rather limited (Drake, 2001; Kosmidou *et al.*, 2012; Kanella *et al.*, 2021). In the literature reviewed below, we outline a number of studies investigating the determinants of bank profitability for other countries, while studies on UK banks have focused mainly on other aspects of bank performance. For example, Holden and El-Bannany (2004) investigate the effects of information technology investment on the profits of major UK banks. Drake (2001) and Webb (2003) study the efficiency of the UK banking sector, a concept that differs from underlying determinants of bank profitability. Kosmidou *et al.*(2006a) analyse a variety of performance measures to identify the distinguishing characteristics of UK foreign and domestic banks' profits, while Kosmidou *et al.* (2005) examine the determinants of profitability of domestic UK commercial banks from 1995 to 2002. Other studies on bank profitability have included UK banks as part of a larger sample pooled across a number of countries (Molyneux and Thornton, 1992; Staikouras and Wood, 2004; Pasiouras and Kosmidou, 2006).

Kanella *et al.* (2021) provide the most up-to-date study on the UK banking market. The authors examine a set of internal (bank-specific) and external macroeconomic factors in a sample of UK commercial banks during the period 2007–2018. We believe that an examination of the determinants in the UK banking period over an extended period of time with respect to industry-specific measures, such as concentration, and bank-specific and macroeconomic factors is needed in this literature.

In this paper, we investigate the determinants of profitability of domestic commercial banks in the UK over the period 1998–2018. White (1998) finds that the UK experienced more merger and acquisition activity in its banking sector (in value terms) between 1991 and 1996 relative to European counterparts, providing us with a fitting starting point. We explore, in a single equation framework, the effect of bank-specific, industry-specific and macroeconomic determinants on bank profitability. This equation structure was first put forward by Athanasogloua *et al.* (2008). The group of the bank-specific determinants of profitability involves operating expenses, financial risk, capital holdings and size. The second group of determinants describes industry–structure factors that affect bank profits but are not the direct result of managerial decisions, such as industry concentration. The third group of determinants relates to the macroeconomic environment within which the banking system operates.

Our study differs from those outlined above for three main reasons. First, much of the existing literature focused on the examination of the determinants of bank profitability use panels of short duration which can result in quite a wide variation in findings across studies (De Haan and Poghosyan, 2012; Kanella *et al.*, 2021). Our study examines an extended period of analysis to ensure robustness in results as a result of volatility in our variables across time. Second, the selection of variables used to date can sometimes lack internal consistency, insofar as they measure similar identities, with some multi-country studies applying a set of identical variables to each country in that study regardless of relevance to each particular country (Ben Khediri and Ben Khedhiri, 2009; Dq and Ngo, 2020). Lastly, much of the focus is on internal or industry-specific factors, with the effects of the macroeconomic environment on bank profitability undergoing less investigation. Also, as introduced by

Athanasogloua *et al.* (2008), the econometric methodology in many studies of bank profitability does not adequately account for some features of bank profits (e.g. persistence), which may lead to the estimates obtained containing some bias and inconsistency.

2. Literature review

Early studies of Short (1979) and Bourke (1989) outline how financial market structure and the barriers to entry into the market were the main driver of bank profitability, with little consideration given to other bank-specific factors and omitting macroeconomic influences entirely.

Empirical studies on the determinants of bank profitability can also be split into two categories: country-specific (Athanasogloua *et al.*, 2008; Kosmidou *et al.*, 2012) and cross-country (Pasiourasa and Kosmidou, 2006b). The first multi-country study was undertaken by Molyneux and Thornton (1992), which was then followed on by Abreu and Mendes (2001) and Staikouras and Wood (2003). While each study is different in terms of the composition of the panel, the number of countries in the panel and time dimension to be examined, the shared focus for these studies is profitability–business cycle relationship. Studies examining an individual country are generally focused on the USA (Berger *et al.*, 1987; McMillan and McMillan, 2016) or other advanced economies (English, 2002; Bolt *et al.*, 2012), with fewer studies focusing on emerging market economies (Barajas *et al.*, 1999; Guru *et al.*, 1999).

Studies that include internal determinants, often coined bank-specific determinants, use variables such as capital, operating expenses, size and risks associated with business activities. Much of the early literature focuses on the idea that expense control is the primary, and in some cases sole, determinant of profitability. Molyneux and Thornton (1992) and have found a positive relationship between profitability and management decisions of higher quality across 18 European countries between 1986 and 1989, while Bourke (1989) has found the opposite across 12 countries in Europe, North America and Australia. Zimmerman (1996) found that management decisions, especially regarding loan portfolio concentration, were an important contributing factor in bank performance. The idea that a capital ratio should be included as one of the main drivers of overall profitability is a prominent theory in the literature. Bourke (1989) reports that capital ratios are positively related to profitability, assuming that a well-capitalized bank may have access to cheaper sources of funding that contain less risk. Furthermore, Berger (1995) outlines the expected bankruptcy cost hypothesis which states that the larger the exogenous influences increases in expected bankruptcy costs, the higher is the optimal capital ratio for a bank. Interestingly, some authors (Hoffman, 2011) find a negative link between the capital ratio and the profitability, thus supporting the theory that banks are operating over-cautiously and ignoring potentially profitable trading opportunities.

Size is widely introduced across individual and cross-country studies to account for existing economies or diseconomies of scale in the banking market. Generally, a larger size may result in economies of scale that will reduce the cost of gathering and processing information (Boyd and Runkle, 1993) and also lower volatility in profit levels (McMillan and McMillan, 2016). Short (1979) puts forward the argument that size is closely related to the capital adequacy of a bank, and since larger banks have the ability to raise capital at a lower cost, they appear to be more profitable. Smirlock (1985) also finds a significantly positive relationship between size and bank profitability across a sample of multinational banks and their subsidiaries in a large number of countries; however, Berger *et al.* (1987) finds that increasing the size of a banking firm provides little cost saving for a sample of US banks. Some studies find evidence to support economies of scale (Berger and Humphrey, 1997;

Altunbas *et al.*, 2001), while others find evidence to suggest diseconomies of scale (Pallage, 1991; Vander Vennet, 1998).

More recent studies focus on the supervisory and regulatory environment in which the bank operates (Barth *et al.*, 2003, 2004); however, no significant findings suggest that there exists a definitive relationship. Demirguc-Kunt and Huizinga (2000) outline how the legal and regulatory environment that affects bank profitability is closely linked to firm size. Bikker and Hu (2002) and Goddard *et al.* (2004) also link bank size to capital, and in turn to overall bank profitability. Focusing on the external determinants of bank profitability, we must first differentiate between systematic or "core" variables such as gross domestic product (GDP) and inflation, and market-specific variables of the characteristics of the banking sector such as concentration or ownership. The structure–conduct–performance (SCP) hypothesis is prevalent in almost all papers investigating profitability within any given sector, as it asserts that increased market power yields monopoly profits. Several papers that have directly tested competing hypothesis with regard to the effect of market structure on overall profitability (Demsetz, 1973; Pelzman, 1977; Carter, 1978 and Marshall, 1984) have provided evidence in favour of the efficient structure hypothesis. Using both ordinary least squares and generalised method of moments estimation, McMillan and McMillan (2016) show that market concentration, as measured by Herfindahl-Hirschman index (HHI), has a relatively benign effect on profits, profit persistence and risk. However, increased market power, examined via Lerner Index, leads to high profits and higher persistence (indicating lower competitive pressure), while increased market share is associated with increased levels of risk as well as higher persistence.

In terms of the influence of the macro environment, the findings of Demirguc-Kunt and Huizinga (2000) and Bikker and Hu (2002) outline the extent to which bank profits are correlated with the business cycle. Chronopoulosa *et al.* (2013) find evidence that US banking profits are pro-cyclical. That said, the variables used were not direct measures of the business cycle, with Demirguc-Kunt employing gross national product per capita and Bikker opting for real GDP growth. Kosmidou (2006) and Hassan and Bashir (2003) find evidence to support that positive relationship between GDP growth and the performance of the financial sector, although, again, we must question the use of the variable. Revell (1979) introduces the effects of inflation on bank profitability, linking inflation to wage increases within the bank and the subsequent impact on profitability. Perry (1992) states that the extent to which inflation affects bank profitability depends on whether forecasts are accurate and inflation expectations are anticipated, which implies that bank's management can appropriately adjust their interest rate strategy to increase their revenues faster than their costs and reap higher profits. Similarly, Kohlscheen *et al.* (2018) find that higher long-term interest rates tend to boost profitability, while higher short-term rates reduce profits by raising funding costs.

In recent times, we have seen various determinants of bank profitability extensively studied, particularly in the USA (Chaudhry *et al.*, 1995; Chronopoulos *et al.*, 2015; McMillan and McMillan, 2016; Feng and Wang, 2020). The UK banking market has not received the same level of analysis. It is necessary to make the distinction between studies that focus on the determinants of profitability and those that focus on bank performance. There are various studies on UK bank performance which focus on the profit performance and efficiency of UK banks. Ashton (1998) examines the efficiency of the UK retail banking sector over the period 1985–1996. Berger *et al.* (2000) compares the efficiency of banks in the UK and US using profit and cost frontiers. Drake (2001) examines panel data for the main UK banks over the period 1984–1995 to investigate changes in productivity and relative efficiency, using frontier methodology. The most recent study by Kanella *et al.* (2021)

examines the internal (bank-specific) and external macroeconomic factors on UK bank profitability from 2007 to 2018. The findings of this study indicate that the size of the banks has a negative relationship with profitability, with no relationship found between either GDP or liquidity on overall profitability.

Therefore, the literature that examines the actual underlying determinants of UK domestic bank profitability is limited. The econometric analysis in most empirical literature does not take into consideration classical problems such as endogeneity or simultaneity when modelling certain variables, such as the capital variable, and unobservable heterogeneity of the data, which are common in studies examining managerial decisions (Arellano and Bover, 1990).

3. Model specification and data

3.1 Background

To perform a systematic evaluation of the determinants of bank profitability in the UK, we use annual data for the major British banks groups. We obtain micro-level bank balance sheet data from Thomson Reuters Eikon database, supplemented by macroeconomic and industry information from the Bank of England database. This source provides data for the period 1998–2018, with figures consolidated on the 31 December each year. Banks had to meet the following criteria to be included in the sample. First, they had to be classified as commercial banks in the Eikon database, with total assets exceeding €1bn. Second, they had to be UK-owned banks operating within the UK banking sector, as determined by the Bank of England's nationality analysis (as of 31 December 2018). Third, they had available data (Thomson Reuters Eikon database) for at least one year between 1998 and 2018. This yielded an unbalanced panel data for 16 commercial banks, consisting of 241 observations. The time period of 1998–2018 was partly chosen due to the availability of data, but it also encompassed a time of structural change and digitisation of the UK banking sector, along with a large financial crisis. The literature generally comes to the consensus that the appropriate functional form for testing is a linear function. Given that we are dealing with pooled data which contains a large number of cross-sectional observations and fewer time series observations, it would be prudent to test the robustness of our findings with respect to the sample composition, the period of estimation and our pooling approach.

3.2 The model

The general model to be estimated is of the following linear form:

$$\Pi_{\mathrm{it}} = \alpha + \sum_{c=1}^{c} \beta_c \mathrm{X}_{it}^{c} + \sum_{p=1}^{p} \beta_p \mathrm{X}_{it}^{p} + \sum_{m=1}^{m} \beta_m \mathrm{X}_{it}^{m} + \varepsilon_{\mathrm{it}}, \varepsilon_{\mathrm{it}} = \nu_{\mathrm{i}} + \mu_{\mathrm{it}}{}^{1}$$

where Π it is the profitability of bank i at time *t*, with i = 1., N, t = 1., T, a is a constant term, $\mathrm{X_{it}}$'s are the set of explanatory variables, ε is the disturbance, ν_{i} is the unobserved bank-specific effects and μ is the idiosyncratic error. This regression model is a one-way error component model, where $\nu_{\mathrm{i}} \sim$ independent and identically distributed (IID)(0, $\sigma 2\ \nu$) and is independent of $u_{it} \sim$ IID(0, $\sigma 2$ u). The $\mathrm{X_{it}}$'s are organised into bank-specific $\mathrm{X^{c}_{it}}$, industry-specific $\mathrm{X^{p}_{it}}$ and macroeconomic variables $\mathrm{X^{m}_{it}}$. As previously outlined, bank profits have been shown to persist over time, resulting in barriers to market competition and sensitivity to macroeconomic shocks to the extent that these are serially correlated (Berger *et al.*, 2000). Chronopoulosa *et al.* (2013) find evidence of short-run profit persistence in US banking, particularly post financial crisis when policy interventions prioritised stability over

competition. As a result, we adopt a dynamic specification of the model as introduced by Athanasogloua *et al.* (2008), through the inclusion of a lagged dependent variable among the regressors. Equation (1), augmented with lagged profitability, is:

$$\Pi_{\mathrm{it}} = \alpha + \theta\,\Pi_{\mathrm{i,t-1}} + \sum_{c=1}^{c} \beta_c \mathrm{X}_{it}^{c} + \sum_{p=1}^{p} \beta_p \mathrm{X}_{it}^{p} + \sum_{m=1}^{m} \beta_m \mathrm{X}_{it}^{m} + \varepsilon_{\mathrm{it}}, \varepsilon_{\mathrm{it}} = \nu_{\mathrm{i}} + \mu_{\mathrm{it}}$$

where $\Pi_{\mathrm{i,t-1}}$ is the one-period lagged profitability and θ is the speed of adjustment to equilibrium (average). A value of θ between 0 and 1 implies that profits persist, but they will eventually return to their normal level. A value close to 0 means that the industry is fairly competitive, as there exists a high speed of adjustment to the normal value, while a value of θ close to 1 implies there exists a less competitive structure.

3.3 Determinants of bank profitability

There exists some debate in the literature as to the most accurate measure of performance of a commercial bank. This study uses return on average assets (ROAA) to evaluate a bank's performance, as calculated by net profits for a given year expressed as a percentage of average total assets [1]. We use the average value of total assets to control for differences that occur in assets during the fiscal year. For the UK banking sector, it can be said that the ROAA is increasing over time. We prefer this measure over the profits-to-equity ratio, i.e. the return on equity (ROE), as it incorporates the risks associated with higher leverage and less equity, which itself emerges from banking regulation. We also use the net interest margin (NIM) as a dependent variable to ensure robustness in our results. As potential determinants of UK banks' profits, we consider seven internal bank-specific characteristics and five measures representing the effect of market concentration and the macroeconomic environment.

3.3.1 Bank-specific profitability determinants

3.3.1.1 Capital. We use a the equity-to-assets ratio as a proxy variable for bank capital. This ratio is used heavily across the literature (Molyneux and Thornton, 1992; Athanasogloua *et al.*, 2008). Bank capital refers to the amount of own funds available to support a bank's business activities and, therefore, it should act as a safety net on which the bank can fall back on during adversity. As outlined above, we find contrasting findings on the relationship between capital ratios and bank profitability. Therefore, it would be expected to see a positive relationship between capital and bank profitability over an extended period of time. Berger (1995) has noted how bank capital ratios are positively related to returns on equity, insofar as higher bank capital can Granger-cause higher earnings. As a result of this, we need to consider that our capital variable may not be exogenous, as modelled by Staikouras and Wood (2003)..

If the perfect capital structure presented by Modigliani and Miller (1958) is relaxed, along with the one-period assumption, it allows for an increase/decrease in earnings to cause an increase/decrease in bank capital. Also if we relax the symmetric information assumption and say that better-quality information may transmit into higher bank capital, then we can say that the capital variable itself is better modelled as an endogenous variable. Much of the reform which took place post 2008 was to increase bank resilience through stronger capital and liquidity buffers, so as to minimise the impact of bank failure on the wider economy. Our interest is on the effects of these significantly higher minimum capital requirements and so-called "buffers" on bank profitability (Table 1).

Variable	Measure	Notation	Expected effect
Profitability	Net profit after tax divided by average total assets	ROAA	
Capital	Equity/Assets	EA	Positive
Credit risk	Loan loss provisions/Total loans	CR	Negative
Deposits	Deposits/Assets	DEP	Negative
Liquidity	Cash and other liquid assets/Total assets	LIQ	Negative
Productivity	Revenue per employee	PROD	Positive
Expense control	Operating expenses/Total Assets	EC	Negative
Size	Real Assets and log of real assets	SZ	?
Concentration	Five-bank asset-concentration	CON	Negative
Inflation	Current inflation rate, bank rate or 10-year government bond rate	INF	Positive
Cyclical output	Deviations of actual output from segmented trend	CO*	Positive
Loan growth	Annual growth of gross loans	LG	Positive

Table 1.
Measures, notation and expected effect of the explanatory variables of Model (2) on bank profitability

3.3.1.2 Credit risk. To proxy credit risk we use the loan-loss provisions to total gross loans ratio, a measure used across a variety of multi-country and country-specific studies (Kosmidou *et al.*, 2012) [2]. The variables represent the quality of the bank's earning assets which comprise each of their loan portfolio. Studies of banking crises all over the world have shown that poor asset quality (loans) are the key factor of bank failures (Stuart, 2005). Theory would suggest to us that greater credit risk would be associated with lower levels of bank profitability, as shown by Angbanzo (1997). This would allow for a negative relationship between ROAA and our credit risk measure. Improved screening and monitoring should lead to less provisions being held by the bank, and increased profitability through lower levels of loan defaults. Interestingly, Boahene (2012) finds that bank profitability does in fact benefit from high default risk due to prohibitively lending/interest rates, fees, and commission. That said, we expect to find a negative relationship.

3.3.1.3 Deposits/assets. We use a ratio of deposits to assets to as a proxy variable representing the stability of funding. Funding costs have a significantly negative impact on the return on assets, as found by Dietrich and Wanzenried (2011). Similar to our capital variable, the liability side of bank balance sheets was not considered to be a concern or driver of bank performance before 2008. The scale of short-term funds held by banks to fund their profit generating lending activities has since been uncovered. As a result, variables constructed to represent bank funding structure have been overlooked in many previous studies. We know that the cost of holding deposits instead of short-term bank funding weighs on overall bank profitability (Bordeleau and Graham, 2010), and so, we would expect a negative relationship been this funding ratio and overall profitability.

3.3.1.4 Liquidity. The ratio of cash and other liquid assets to total assets indicate the percentage of bank customer and short-term liabilities that could be met if funds were withdrawn immediately. Similar to capital, higher levels of short-term liquid assets are associated with a more liquid bank, which is less likely to fail due to this extra liquidity and short-term funding to meet obligations. Bordeleau and Graham (2010) show how profitability is improved for banks that hold some liquid assets; however, there is a point at which holding further liquid assets diminishes a bank's profitability as the cost of holding lower-yielding liquid assets may impact banks' ability to generate revenues through credit extension. Bordeleau and Graham (2010) have the same finding in a panel of large US and

Canadian banks. The authors outline how this result is consistent with the idea that funding markets reward a bank, to some extent, for holding liquid assets, thereby reducing its liquidity risk.

3.3.1.5 Productivity. Revenue per employee measures the amount of sales generated by one employee and so acts as a performance measure of human resources of the bank. More efficient utilization of the bank's human resources should lead to higher profitability and so we would expect there to exist a positive relationship. To examine this, we include the rate of change of revenue per employee over the sample period. Prasad and Harker (1997) make use of the Cobb–Douglas function along with a variety of other studies (Lichtenberg, 1995; Brynjolfsson and Hitt, 1996). Alexiou and Sofoklis (2009) utilize assets per employee. All studies outlined find a positive relationship between the measure used and bank profitability; therefore, we expect to find the same.

3.3.1.6 Expense control. Many studies make use of a cost-to-income ratio to proxy for expense control (e.g. Kosmidou *et al.*, 2012). The total costs of a bank can be split into operating expenses and operating costs. However, only operating expenses can be seen as an outcome of decisions made by bank management, which is the main focus for the study. Improved management and reduction of operating expenses should increase efficiency. Therefore the ratio of these expenses-to-total assets should be negatively related to bank profitability.

3.3.1.7 Size. Keeping in line with many other studies we use the total assets of the bank as a proxy measure for size. Generally, a larger size may result in economies of scale that will reduce the cost of gathering and processing information (Boyd and Runkle, 1993). However, a growing size may result in inefficiencies or management issues, which may have a negative impact on profitability. We will therefore use the logarithm of banks' real assets and their square root to try capture this potential non-linear relationship between size and profitability. It has been noted that smaller UK banks tend to be more profitable when higher capital ratios are imposed by regulators (Bank of England, 2003); however, there exist a variety of findings, and so we cannot form any expectations for our study.

3.3.1.8 Loan growth. Many studies have concluded that profitability responds positively to bank-specific credit growth. As found by Kohlscheen *et al.* (2018), banks with higher rates of loan growth are systematically more profitable, which suggests that the credit cycle may be a key driver of bank profitability. We use the growth rate in gross loans as a measure to capture this potentially strong significant driver profitability.

3.3.2 Industry-specific profitability determinants

3.3.2.1 Concentration. The structure–conduct–performance (SCP) hypothesis focuses on market structure and states that a higher degree of market concentration enhances the probability of effective collusive behaviour. Market concentration is usually measured by the proportion of the total market controlled by a small number of firms (e.g. Smirlock, 1985). To examine the SCP hypothesis, we use the five-bank asset-concentration of the UK banking sector. This measure looks at the assets of five largest banks as a share of total commercial banking assets as a proxy measure for market power in the banking market. We would expect to see a larger concentration of bank assets to coincide with higher levels of bank profitability owing to this increase in pricing power. A large proportion of studies proxy market concentration through a Herfindahl-Hirschman index. The view of this paper is that the metric used gives a more implicit measure of concentration, as opposed to an erroneous conflation of market power with consumer disutility (Roberts, 2014). However, to ensure robustness in our results, we have also included HHI as a second measure.

3.3.3 Macroeconomic profitability determinants

3.3.3.1 Inflation. The relationship between bank profitability and inflation expectations (as measured by longer-term bond yields) is unclear. In this study we use current inflation to proxy expected inflation, and we used the long-term government bond rate as a measure of the long-term interest rate, which also incorporates future inflation expectations. Current inflation is used in line with the findings of Revell (1979), where the effect of inflation on bank profitability depends on whether banks' wages and other operating expenses increase at a faster rate than inflation. The longer-term rate is utilized so as to capture the extent to which inflation expectations are fully anticipated by the bank so that management can appropriately adjust interest rates so that their revenues increase faster than costs (Perry, 1992).

3.3.3.2 Cyclical output. We use the deviations of real GDP from its segmented trend for estimating cyclical output. There are various reasons why we do this: first, bank lending will be procyclical. Second, provisions held by banks will be dependent on the quality of their loans, which will in itself also be procyclical. Last, the capital held by a bank will exhibit the same behaviour as equity throughout each phase of the business cycle. As mentioned in the literature review, many previous studies undertaken have focused on a relatively short time period, with real GDP used as crude measure of economic activity (Hoggarth *et al.*, 1998). Yüksel *et al.* (2018) makes use of GDP growth and finds a positive relationship with bank profitability. As a result, similar to the method undertaken by Athanasogloua *et al.* (2008), the present study will use the deviations of real GDP from its segmented trend to estimate cyclical output. The output gap is positive in periods where GDP is above its trend, and vice versa. When GDP is below the segmented trend, we would expect bank profits to fall and vice versa. We examine the possibility that the effects of positive and negative output gaps on bank profitability may be asymmetric by splitting the business cycle variable into two separate variables; the first includes the years that output gap is positive and the second the years that output gap is negative.

4. Empirical results

4.1 Econometric methodology

The present study uses an unbalanced panel of commercial banks in the UK spanning the period 1998–2018, which can be found in the Appendix. Table 2 presents summary statistics

Variable	Descriptive statistics Mean	SD	Minimum	Maximum
ROAA*	0.802	1.08636	−1.99197	4.50426
EA*	6.6843	4.32706	−22.33146	21.22816
CR*	0.8503	0.78847	−0.65781	3.9877
DEP*	63.3927	34.168	0	393.4198
LIQ	11.4552	7.742366	0	77.25821
PROD	186891.9	80582.36	40080.6	571734.4
EC	−0.0325985	0.0323723	−0.1581668	0.0800532
SZ	129.0942	57.53583	18.19443	219.2175
CON	68.3483	10.70911	42.4609	82.723
INF	1.985106	1.05659	0	4.5
INF*	3.38062	1.478459	1.231754	5.54648
CO	−0.169821	1.604667	−3.004	3.765
LG	0.196723	0.1967234	−0.083	6.78

Note: [a]Variables with an asterisk are percentage values

Table 2. Reflective measurement model analysis[a]

of the variables used in the study. The panel is unbalanced, as it contains banks entering or leaving the market during the sample period (e.g. due to mergers or failures). Most of the existing literature deals with balanced panels. Given the in-depth nature of this study, we use an unbalanced panel to avoid the survivor bias element of balanced panels. (For further discussions on unbalanced panels, see Baltagi, 2001).

The econometric analysis of Model (2) must take into consideration the following issues: first, we use a unit root test for unbalanced panels to test for stationarity of the panel. Second, we examine whether individual effects are fixed or random so as to determine the appropriate model for the panel. Third, we use techniques for dynamic panel estimation that deal with the biasedness and inconsistency of our estimates. Fourth we must also examine whether our capital variable would be best modelled as an endogenous variable. We must also test our error component to determine whether time effects are present (Athanasogloua *et al.*, 2008).

Until this point, we have discussed only the positive attributes in using a relatively large time period of analysis. However given the lengthy time period, we must carefully consider the stationarity of the panel. We test for non-stationarity using the Fisher-type unit root test due to the unbalanced nature of the panel we are using (Maddala and Wu, 1999). The null of non-stationarity is rejected at the 5% level for all variables using various trend and drift terms for each along with suitable lags. We therefore continue with the estimation of the model including all of the variables outlined.

The second issue is to determine whether a fixed effects (FE) or a random effects (RE) model is appropriate for our analysis. We run both potential models followed by a Hausman test. The test indicates that the difference in coefficients between FE and RE is systematic, which supplies evidence in favour of an FE model. Results also indicate that individual effects are present, as the relevant F-statistic is significant at the 1% level. However, as outlined by Arellano and Bond (1991), the least squares estimator of the FE model is both biased and inconsistent, as we have included a lagged dependent variable among the regressors.

The issues of biasedness and inconsistency of estimates are commonplace is studies that contain a methodology similar to that which we have put forward. We refer to Arellano and Bond (1991) who suggest that consistency and efficiency gains can be obtained by using all available lagged values of the dependent variable, plus lagged values of the exogenous regressors as instruments. However this approach to deriving estimators has faced some criticism, with some arguing that under such conditions, this estimator is inefficient if the instruments used are weak and the time period of the analysis is short (Arellano and Bover, 1995). However, in our study, with $T = 20$, we should be able to avoid such problems.

Having outlined how much of the literature struggles to confront issues such as endogeneity or simultaneity, we must also question the way in which our variables should be modelled, in particular our capital variable. Theory suggests that capital should be modelled as an endogenous variable, that being it has a value derived from other variables in the system (Milne and Whalley, 2001). To decide how to model our capital variable we run two separate models, similar to the method used by Athanasogloua *et al.* (2008). First we model capital as an exogenous variable. We repeat the method by modelling capital as an endogenous variable. We then use Sargan test to determine whether we have over-identifying restrictions (Athanasogloua *et al.*, 2008). The results find that the hypothesis which states that capital is better modelled as an exogenous variable as per the Sargan test is rejected, but the same is strongly accepted in the case of endogenous modelling of this variable.

Finally, given the length of our period of analysis, we must be aware that time effects may be present in our error component as shown below:

$$\Pi_{it} = \alpha + \theta\Pi_{i,t-t} + \sum_{c=1}^{c} \beta_c X_{it}^{c} + \sum_{p=1}^{p} \beta_p X_{it}^{p} + \sum_{m=1}^{m} \beta_m X_{it}^{m} + \varepsilon_{it}, \varepsilon_{it} = \nu_i + \lambda_i + \mu_{it}$$

We use a Lagrange multiplier (LM) statistic to test the joint significance of the unobservable time effects: *H0*: $\lambda 2 = \lambda 3 = \cdots = \lambda t = 0$. The LM test shows that *H0* is rejected at the 95% confidence level ($\chi^2(13) = 59.87$, p-value = 0.000). This result would indicate that we need to include year-specific dummy variables to account for these time effects. We experiment with dummy variables representing each year of our study. As determined by a t-test, the only statistically significant dummy variable is that of the year 2008, possibly due to developments in the in international banking system that year and the subsequent effect on bank profitability. We can therefore expand our model to include this relevant dummy variable:

$$\Pi_{it} = \alpha + \theta\Pi_{i,t-t} + \sum_{c=1}^{c} \beta_c X_{it}^{c} + \sum_{p=1}^{p} \beta_p X_{it}^{p} + \sum_{m=1}^{m} \beta_m X_{it}^{m} + \gamma D_{08} + \varepsilon_{it}, \varepsilon_{it}$$
$$= \nu_i + \lambda_i + \mu_{it}$$

Our LM test can now not reject *H0*: $\lambda 2 = \lambda 3 = \cdots = \lambda t = 0$, and we can therefore continue with the estimation of our model.

4.2 Results

The empirical results of the estimation of Model (3) are presented in Table 3. We also present the results when we use NIM as the dependent variable in Table A2. The size and significance of the relationships are very similar for both dependent variables. As previously outlined, we use two alternative measures of inflation expectations, concentration, and effects of the business cycle. The table also presents the relevant specification tests for each estimated equation. We can see from our Sargan test no evidence of over-identifying restrictions. Also, we can conclude from our Wald test that we have a very satisfactory goodness of fit.

The highly significant coefficient of the lagged profitability variable across all models confirms that our decision regarding the dynamic nature of the model specification was correct. The value attached to the coefficient is 0.53, which suggests that profits persist to a moderately strong extent amongst UK domestic banks. This result implies that we do not have a perfectly competitive market structure over the estimation period. In contrast to our finding, Goddard *et al.* (2011) note that in countries where institutional development is further advanced and external governance mechanisms are stronger, persistence tends to be weaker and competition more intense. We do not find this to be the case for the UK over the sample period.

The coefficient on the capital variable is positive and highly significant, indicating the strength of the financial condition of UK domestic banks in our period of analysis. This strong relationship shows how a bank with a sound capital position is able to seek business openings all the more viably and has additional time and flexibility to manage issues emerging from unforeseen misfortunes, hence accomplishing greater profitability

	(1) Coefficient	*t*-statistic	(2) Coefficient	*t*-statistic	(3) Coefficient	*t*-statistic
Intercept	−0.0108335	0.0057704	0.002216	0.05	−0.0104721	−1.81
Π_{t-1}	0.5338555	6.16	0.5468054	6.04	0.534654	6.21
EA	0.1847344	2.95	0.188153	2.64	0.184043	2.95
CR	0.0077199	0.12	0.0415005	0.67	0.005628	0.09
DEP	−0.0111043	−2.14	−0.014747	−2.26	−0.011	−2.13
LIQ	0.0005615	2.03	0.0007495	2.15	0.000554	2.00
PROD	2.51e −08	4.37	2.13e 0.08	4.11	2.50e −08	4.36
EC	0.0392584	0.106	0.004184	0.20	0.039353	1.61
SZ	−0.0000286	−2.68	−0.000017	−1.47	−0.0000286	−2.69
CON	−0.0000262	−0.85	−0.0001117	−2.16		
HHI*					−0.0701	0.11
INF			−0.001267	−3.02		
INF*[a]	0.001559	3.25			0.0015323	3.14
CO	−0.0003067	−1.06	−0.0000718	−0.31		
CO+[b]					−0.0002432	−0.50
CO−[c]					−0.003637	−0.82
LG	0.002341	3.31	0.0022952	3.10	0.0023301	3.25
D_{08}[d]	−0.0032543	−2.87	−0.0047707	−2.12	−0.006225	−2.84
Wald test	$\chi^2(13) = 474.68$	0.000	$\chi^2(13) = 419.08$	0.000	$\chi^2(14)$ 476.10	0.000
Sargan test	501.36	0.000	534.07	0.000	497.28	0.000
AR(1)[e]	$z = -7.23$	0.000	$z = -7.03$	0.000	$z = -6.96$	0.000
AR(2)	$z = -1.08$	0.3158	$z = -1.24$	0.215	−1.48	0.139

Notes: [a]10-year government bond rate; [b]Cyclical output when the actual value is above segmented trend; [c]Cyclical output when the actual value is below segmented trend [d]Dummy variable for 2008 [e]*H0*: no autocorrelation

Table 3. GMM estimation with equity/asset modelled as endogenous (dependent variable: ROAA)

(Athanasogloua *et al.*, 2008). This finding also reinforces our prior thought that the assumption of perfect information and one-period perfect capital markets for the UK is not accurate as implied by the endogeneity of the capital variable.

We find statistically significant coefficients on both our funding and liquidity measures across each model. The negative value coefficient on our funding variables reflects the funding strategy used by the banking sector in recent history, where customer deposits are replaced with short-term assets to fund bank assets, resulting in greater profitability. Over an extended period, banks holding less deposits relative to assets, compared to other banks in the market, can expect to see higher levels of overall profitability owing to the reduced cost of holding expensive customer deposits. Finance theory assumes an inverse relation between liquidity and profitability; however, research has established that the management of liquidity by banks has positive implications on the profitability of banks (Khan and Ali, 2016; Ibe, 2014). Our result shows that banks that increase their holdings of short-term liquid assets over the period of analysis have seen higher levels of overall profitability, which is in line with many previous findings. The accepted rationale for these relationships is that funding markets reward a bank for holding liquid assets, thereby reducing its liquidity risk. However, this benefit will eventually be outweighed by the opportunity cost of holding such comparatively low-yielding assets on the balance sheet (Bordeleau and Graham, 2010).

Our productivity measure of revenue per employee has returned a highly significant positive coefficient, indicating the importance of continued productivity growth, as found in the majority of studies (Kosmidou and Tanna, 2012).

Size appears to be an important determinant of profitability. The negative coefficient value would support economic and finance theory, as it suggests that over our period of analysis, the larger the size of the bank (measured in terms of total assets), the less profitable the bank will be. Smaller-sized, recently settled banks are not especially profitable (if at all profitable) in their first period of activity, so they would place more emphasis on expanding their overall market share which in turn will see improved profitability. Similarly, as a bank increases in size, it may be able to avail of economies of scale through more efficient information systems, while perhaps at the same time encounter inefficiencies or management issues. It appears that in the case of UK domestic banks the latter is more accurate, and as such, we find no evidence to support the findings of Boyd and Runkle (1993).

The empirical results indicate that concentration affected bank profitability negatively over the sample period, but this effect is insignificant for both our concentration variables. Therefore, this study finds no evidence to support the SCP hypothesis within the UK banking market. Staikouras and Wood (2003) examined the EU banking sector over the period 1994–1998 and also found no evidence to support the SCP hypothesis. This outcome is in accordance with Berger (1995) and other more recent studies.

Cyclical output as a standalone variable is not statistically significant. This may be due to the fact that we have controlled for the effects of other determinants which have a strong correlation with the business cycle, such as capital ratios and loan loss provisions. When we differentiate our variable into periods positive and negative output gaps, a method introduced by Athanasogloua *et al.* (2008), we still do not see a significant positive coefficient on our below cyclical trend variable.

We can see highly significant coefficient on our inflation variables across all models, that being actual and long-term inflation rates. The positive coefficient on our 10 years' bond yield as a proxy for inflation expectation supports the view of Kohlscheen *et al.* (2018), as higher long-term interest rates tend to boost profitability. This is potentially owing to more accurate inflation forecasts put in place by the bank with inflation expectations more anticipated than customers. We also find a positive relationship between profitability and short-term interest rates. We see a negative coefficient on our actual inflation variable, as measured through the consumer price index (CPI). This suggests that UK commercial banks tend to not profit in inflationary environments. This is surprising as the findings of both Revell (1979) and Perry (1992) outline how an inflationary environment can allow bank revenues to increase at a quicker pace than costs.

The highly significant coefficient presented on the loan growth variable indicates that banks with higher rates of loan growth are more profitable, suggesting to us that the credit cycle has been a key driver of bank profitability over the period of analysis. We can therefore say that UK domestic banks with higher rates of loan growth are in fact systematically more profitable, a finding supported by many studies (Kohlscheen, 2018).

5. Conclusions

In this paper, we specified an empirical framework to investigate the effect of bank-specific, industry-specific and macroeconomic determinants on the profitability of UK domestic banks. The novel features of our study include an extended period of analysis, more in-depth analysis of the effect of the business cycle on bank profitability and the use of an appropriate econometric methodology for the estimation of dynamic panel data models so as to account for some of the characteristics of bank profitability which had overlooked in previous studies.

We find that the financial strength of a bank as seen through robust capital ratios is important in explaining bank profitability and that increased holdings of short-term liquid assets boosts profitability. We also find that the funding strategy implemented by the bank affects overall profitability, with lower levels of deposit-funded assets increasing profitability. Additionally, labour productivity growth has a positive and significant impact on profitability, while operating expenses are negatively but not strongly linked to profitability, showing that cost decisions of bank management are not central in the determination of bank profitability. The estimated effect of size does not provide evidence of the presence of economies of scale in banking, as we find that smaller-size banks are systematically more profitable. The structure–conduct–performance (SCP) hypothesis is not verified in this study, so we can say that once the other effects are controlled for in the model, concentration is not related to profitability. Finally, macroeconomic control variables such as inflation, clearly affect the performance of the banking sector.

Overall, these empirical results provide evidence that the profitability of UK commercial domestic banks is shaped by bank-specific factors, which are affected by bank-level management, and the macroeconomic environment within which the bank is operating. Industry structure does not seem to significantly affect profitability. We can say that over our period of analysis, UK commercial banks tend to perform better in higher interest rate environments with higher levels of loan growth. At the time of writing, the UK economy is experiencing the lowest rate of loan growth in the past four years as a result of the uncertainty surrounding the UK exit from the European Union and the potential long-lasting effects of the COVID-19 pandemic. The UK economy has now returned to pre-pandemic levels during the month of November following a growth of 0.9%, according to the latest figures from the Office of National Statistics, with economists expecting the Bank of England to hike interest rates consecutively for the first time since 2004 as the central bank looks to steer the UK economy through persistent high inflation. This study has found that, in this environment, the risks to bank profitability would almost certainly be on the upside.

Notes

1. For the calculation of these ratios we use the average value of assets of two consecutive years. We do not use year-end values
2. Other notable ratios used to measure credit risk and liquidity risk were loans/assets, loans/deposits and provisions/assets. These ratios produced similar results in terms of relationship direction

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Appendix. Data appendix

Total assets, total shareholders' equity, net profit after taxes, loan loss provisions, value of total gross and net loans, gross total revenue, deposit and short-term asset levels and operating costs and expenses are all sourced from year-end bank balance sheets and consolidated income statements. The five-bank asset concentration for the UK was obtained from the Federal Reserve of St. Louis. Data on the CPI and 10-year government bond rate were obtained from the Bank of England website. Deviations of real GDP from its segmented trend were taken from the Office of National Statistics. Helgi Library provided the HHI index (Table A1).

Bank	Data Period	Observations
HSBC	1998–2018	21
Barclays	1998–2018	21
Co-operative	2004–2016	13
Standard Chartered	1998–2018	21
Royal Bank of Scotland	1998–2018	21
Bank of London and The Middle East	2010–2017	8
Alliance	1998–2007	10
Close Brothers	1998–2018	21
Santander Group	1998–2018	21
Arbuthnot Latham	1998–2018	21
CYBG plc	2012–2018	7
Metro	2013–2018	6
One Savings	2011–2018	8
Charter	2012–2018	7
TBC	2013–2018	6
Secure Trust	2010–2017	8
Lloyds	1998–2018	21

Table A1. The banks and data period

Table A2.
GMM estimation with EA modelled as endogenous (dependent variable: NIM)

	(1) Coefficient	*t*-statistic	(2) Coefficient	*t*-statistic	(3) Coefficient	*t*-statistic
Intercept	0.01662	2.06	0.01747	2.18	0.02681	3.09
Π_{t-1}	0.57895	5.89	0.58856	6.01	0.57591	6.13
EA	−0.2474	−8.43	−0.2472	−8.40	−0.2416	−8.35
CR	−0.2338	−2.24	−0.2310	−2.20	−0.3312	−3.06
DEP	−0.01320	−2.61	−0.01266	−2.54	−0.01661	−3.25
LIQ	0.00043	1.78	0.000673	1.90	0.000500	1.91
PROD	0.00030	2.66	0.00028	2.58	0.00034	2.77
EC	−0.92098	−0.23	−0.92881	−0.24		
SZ	−0.00010	−3.97	−0.00010	−3.90	0.00009	−3.62
CON	−0.00021	−0.02	−0.00001	−0.09		
HHI					0.0651	0.10
INF			−0.00099	−2.05		
INF*[a]	0.0010	2.85			0.001873	3.33
CO	−0.00046	−0.71	−0.00070	−1.20		
CO+[b]					0.00220	0.195
CO−[c]					−0.00387	−0.288
LG	0.00211	3.09	0.002109	3.07	0.00232	3.19
D_{08}[d]	−0.0032507	−2.91	−0.004801	−2.13	−0.006114	−2.78
Wald test	$\chi^2(13) = 459.65$	0.000	$\chi^2(13) = 421.03$	0.000	$\chi^2(14) = 467.18$	0.000
Sargan test	491.56	0.000	502.3	0.000	489.25	0.000
AR(1)[e]	$z = -7.11$	0.000	$z = -7.01$	0.000	$z = -6.89$	0.000
AR(2)	$z = -0.95$	0.353	$z = -1.06$	0.196	$z = -1.35$	0.151

Notes: [a]10-year government bond rate; [b]Cyclical output when the actual value is above segmented trend; [c]Cyclical output when the actual value is below segmented trend; [d]Dummy variable for 2008; [e]*H0*: no autocorrelation

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