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The effect of earnings management on bank efficiency: Evidence from ECB-supervised banks

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ABSTRACT

This study investigates the impact of earnings management on the efficiency of Eurozone banks, examining its chronological evolution until the implementation of International Financial Reporting Standard 9. Using data on 70 banks, we find that earnings management, defined as discretionary loan loss provisions, negatively affects efficiency. Meanwhile, when we also include non-discretionary provisions (those required by legal obligations), we estimate a positive impact of loan provisions on allocative efficiency—contrarily to a negative effect of discretionary provisions. This finding helps stress the importance of adequately defining earnings management, namely for the purpose of analyzing its effect on banking efficiency.

1. Introduction

The 2008 financial crisis showed that well-managed banks are crucial to the smooth functioning of the business fabric, as they promote the efficient allocation of resources in the economy (Pathan and Faff, 2013). However, efficiency is not achieved if institutions are involved in activities that compromise their integrity and that of the sector (Ujah et al., 2017). One example of these practices, identified in the literature as one of the motives behind the 2008 financial crisis, was the occurrence of less transparent earnings management (Alhadab and Al-Own, 2019) through, for instance, the creation of excessive loan loss provisions (LLP), by reserving financial resources beyond those deemed reasonable to deal with credit risk and the associated danger of default by borrowers.

The relationship between earnings management and bank efficiency has received little attention in the literature. To the best of our knowledge, the few studies on the subject are the papers by Ab-Hamid et al. (2018); Martens et al. (2021) and Wu et al. (2016). Using either Data Envelopment Analysis (DEA) (Wu et al., 2016) or Stochastic Frontier Analysis (SFA) (Ab-Hamid et al., 2018; Martens et al., 2021), these studies show that excessive LLP adversely impact the efficiency of banks. The justification for this negative effect stems from the fact that excessive LLP prevent banks from efficiently transforming their inputs (e.g., capital, labor, and deposits) into outputs (e.g., loans and investments). Furthermore, directors may not practice adequate controls and monitoring, thereby conditioning efficiency ("bad management hypothesis" proposed by Berger and DeYoung, 1997). However, other studies suggest that LLP could increase efficiency, as a high volume of provisions can be part of the bank's strategy because directors do not spend enough resources on credit risk ("skimping hypothesis" proposed by Berger and DeYoung (1997).

It is noteworthy that these studies do not take into consideration the important fact that LLP encompass two important components:

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discretionary and non-discretionary provisions; they only consider total LLP. In the present study, we examine the effect of earnings management practices on the efficiency of significant banks in the Eurozone, taking into account the distinction between discretionary LLP (due to directors' value judgments), which more appropriately represents earnings management (Arniati et al., 2019; Siddique et al., 2020), and non-discretionary LLP (due to legal obligations). Thus, to the best of our knowledge, the absence of studies that analyze the impact of discretionary provisions on banking efficiency, instead of the total LLP, justifies a new investigation and limits the generalization of the extant research.

The present paper may present relevant contributions, both for academics and practitioners, be they investors, managers or regulators. Firstly, the study focuses on the banking sector, which is extremely important for countries' economic development (Condosta, 2012) and macroeconomic stability (Bhatia et al., 2018). Secondly, the study is based on a sample of 70 banks supervised by the European Central Bank (ECB) (significant banks) during the period 2013–2017, corresponding to the preparatory period for the application of IFRS 9[1] which replaced the International Accounting Standard 39 (IAS 39). With regard to LLP, the application of IFRS 9 implied important changes: the replacement of the "incurred" loan loss model with the "expected" loan loss model (Novotny-farkas, 2016). The present study also covers the Basel III period adopted by European banking as of 2014 (Alhadab and Al-Own, 2019). Thus, we can produce an up-to-date account of current earnings management, as it relates to the efficiency of significant banks in the period after the implementation of the Basel III agreement and before the implementation of IFRS 9. Thirdly, in our view, our results may be used by ECB to assess the efficiency of banks and the possibility of abusive earnings management practices.

Bearing in mind the above considerations, the present study seeks to answer the following research questions: i. What was the evolution, from 2013 to 2017, of the economic, allocative and technical efficiency in banks directly supervised by the European Central Bank (ECB)? ii. What is the impact of earnings management on banking efficiency? iii. What is the differentiated impact of discretionary LLP, and of total LLP, on banks' economic, allocative and technical efficiency?

2. Methodological path

2.1. Sample

The sample used in the study comprises 70 banks supervised by ECB. Banks supervised directly by ECB represent 82% of the banking assets in the Eurozone (European Central Bank, 2018) and the banks included in the sample corresponded, in 2017, to 81% of the total assets of banks supervised by the ECB. Table 1 compares, across country, the population and our sample. We study the period 2013–2017.

2.2. Variables

In Table 2 we display the dependent and independent variables used in our study. Economic or cost efficiency (CE) is calculated, together with technical efficiency (TE) and allocative efficiency (AE). Regarding explanatory variables, three different measurements of earnings management are used. The first measure refers to the discretionary element of LLP and is obtained as the estimation residual of the panel data random effects model (in line with the related literature—e.g., Alhadab and Al-Own, 2019; Desta, 2017; Kolsi and Grassa, 2017):

$$LLP_{it}/TL_{i,t-1} = \alpha_0 + \alpha_1 NPL_{it}/TL_{i,t-1} + \alpha_2 \Delta NPL_{it}/TL_{i,t-1} + \alpha_3 \Delta TL_{it}/TL_{i,t-1} + \in_{it}, \quad (1)$$

where α_0,…, α_3 denote parameters, i and t are, respectively, unit- and time-indices, $\in$ represents the error, and the meaning of the remaining terms is as follows: *LLP*—Loan Loss Provisions; *TL*—Total Loans; *NPL*—Non-performing Loans. A proxy for the discretionary component of provisions is provided by the estimation residual from this model—denote this as *RD*.

The second measure, denoted as *RDS*, follows the proposal of Fan et al. (2019) and consists of *RD* scaled by the ratio of total loans to total assets: $RDS_{it} = RD_{it} \cdot Loans_{it}/Assets_{it}$; this measure will be used for robustness analysis. Finally, the third measure of earnings management, *LLPTL*, is defined as the ratio of total LLP to total loans. With regard to control variables, we included the most common variables in the literature; these are summarized in Table 2.

2.3. Method

In line with previous studies (e.g., Banna et al., 2019; Goswami et al., 2019), we adopt a two-stage approach. In the first stage, efficiency is measured using the traditional DEA method and in the second step the efficiency measures estimated in the first step are expressed as a function of earnings and control variables.

2.3.1. First stage

Following Banna et al. (2019) and Delis and Papanikolaou, (2009) the DEA-Variable returns to scale (VRS) procedure can be expressed as min*EFF*, subject to the constraints

[1] Its implementation is mandatory in banking as of January 1st, 2018 (European Central Bank, 2017b)

Table 1
Banks included in the sample by country.

Country	Country abbreviation	List of supervised entities by country	Banks in the sample by country
Austria	AT	6	2
Belgium	BE	7	4
Cyprus	CY	3	1
Germany	DE	21	13
Estonia	EE	3	3
Spain	ES	12	10
Finland	FI	3	1
France	FR	12	8
Greece	GR	4	2
Ireland	IE	6	1
Italy	IT	12	7
Lithuania	LT	2	2
Luxembourg	LU	6	2
Latvia	LV	2	2
Malta	MT	3	3
Netherlands	NL	6	3
Portugal	PT	3	2
Slovenia	SI	3	2
Slovakia	SK	3	2
Total		**117**	**70**

Table 2
Operationalization of variables.

Variable	Codename	Formula	Signal	Authors
1. Dependent variables				
Efficiency	*CE:* Cost efficiency *TE:* Technical efficiency *AE:* Allocative efficiency	Efficiency scores using DEA Intermediation approach Inputs: 1) interest expenses 2) personnel expenses 3) operational expenses Outputs: 4) total loans 5) liquid assets 6) other earning assets Inputs prices: 1) interest expenses/total deposits 2) personnel expenses/total assets 3) operationalexpenses/total assets	N.A.	Banna et al. (2019); Nair and Vinod (2019); Phan et al. (2018); Sulaeman et al. (2019)
2. Explanatory variables				
2.1. Explanatory variables of interest				
Earnings Management	*RD*	Discretionary component of LLP measured by the estimation residuals of Model(1).	+/-	Alhadab and Al-Own (2019); Desta (2017); Kolsi and Grassa (2017)
	RDS	RD standardized: $(RD_{it}{*}Loans_{it})/Assets_{it}$.	+/-	Fan et al. (2019)
	LLPTL	LLP_{it}/TL_{it}.	+/-	Ab-Hamid et al. (2018); Wu et al. (2016)
2.2. Control variables				
Size	*TA*	The natural logarithm of Total Assets	+/-	Ab-Hamid et al. (2018); Banna et al. (2019); Goswami et al. (2019); Phan et al. (2018)
Net interest margin	*NIM*	(Interest received - interest paid)/Total assets	+/-	Banna et al. (2019); Nair and Vinod (2019); Sulaeman et al. (2019)
Revenue diversification	*DIV*	Non-interest income/ Total income	+/-	Phan et al. (2018); Sufian (2009)
Economic growth	*lnGDPPC*	The natural logarithm of Gross Domestic Product *per capita*	–	Dell'Atti et al. (2015)
Unemployment rate	*UR (%)*	Unemployed/Civilian Labor Force	+/-	Nair and Vinod (2019)

$$\sum_{k=1}^{N} \varphi_k x_{ik} \leq x_{i0} EFF,\ i = 1, \ldots, r;\ \sum_{k=1}^{N} \varphi_k y_{jk} \leq y_{j0},\ j = 1, \ldots, s;$$

$$\sum_{k=1}^{N} \varphi_k = 1;\ \varphi_k \geq 0,\ k = 1, \ldots, N\ .$$

EFF denotes the efficiency score (if, for a given bank, $EFF = 1$, the bank is on the frontier, i.e., it is fully efficient; if $EFF < 1$, the bank is inefficient), *N* is the number of banks in the sample, x_{ik} is the level of input *i* that bank *k* utilizes to produce the level of output *j* (y_{jk}), and φ is the activity vector denoting the intensity levels at which each of the *S* output observations are conducted. For each bank in the sample, the corresponding values of efficiency—*CE, TE* and *AE*—were obtained through DEA. The DEA approach presents some methodological advantages; namely, it is a non-parametric method (Anton, 2013), it considers variables with different units of measurement (Charnes et al., 1994), and there is a lack of a pre-conceived structure regarding inputs and outputs (Huang et al., 2015), allowing the variables to be adjusted from bank to bank, as they operate differently from country to country (Du and Sim, 2016).

2.3.2. Second stage

In the second stage, the determinants of the different efficiency measures are analyzed, with a particular focus on earnings management. We specify a dynamic panel data model as

$$EFF_{it} = \beta_1 EFF_{i,t-1} + \beta_2 EM_{it} + \beta_3 EM_{it}^2 + \sum_{j=1}^{J} \gamma_j X_{it}^j + \nu_i + \varepsilon_{it}, \tag{2}$$

where Greek letters denote parameters, *i* and *t* are, respectively, individual- (bank-) and time-indices, *EFF* denotes the efficiency score, *EM* represents earnings management and X^j, $j = 1, \ldots, J$, denote control variates.

The model allows for a nonlinear (quadratic) functional relationship between *EFF* and the earnings management measure, *EM*. In our view this is a sensible choice, given the disparity of results reported in the literature, with some studies suggesting a positive linear impact of *EM*, measured by LLP, on efficiency (e.g., Banya and Biekpe, 2018; Nair and Vinod, 2019), and others reporting a negative linear effect (e.g., Ab-Hamid et al., 2018; Martens et al., 2021; Wu et al., 2016). Moreover, Berger and DeYoung (1997) highlighted that directors could have different loan quality decisions, conditioning efficiency. On the one hand, supporting the "bad management" hypothesis mentioned by Berger and DeYoung (1997), directors could not practice adequate monitoring and controls, decreasing banking efficiency. On the other hand, directors could decide not to spend sufficient resources on credit risk, increasing efficiency, even with a high level of non-performing loans, thus giving support to the "skimping hypothesis" (Berger and DeYoung, 1997). Thus, more or less discretion in provisions can have different effects on efficiency, as directors can make different decisions. In addition, in our view, discretionary provisions reflect the subjectivity of directors, which does not act in a linear/straightforward way, so, in our analysis, we should allow for a nonlinear relationship between these provisions and banking efficiency. Following this conviction, we adopt a quadratic model in the earnings management covariate, a simplified working approach that is frequently used as an approximation to nonlinear functional relations and lends itself to easy interpretation of the estimation results.

Each model was estimated by two-step system GMM, an estimator developed by Blundell and Bond (1998). This methodology overcomes endogeneity problems and controls for individual unobserved heterogeneity. In order to validate the adopted specification, two statistical procedures were used, following Moon, (2018) and —Rumler and Waschiczek, (2016)a serial correlation test of order 1 and 2, and the Hansen test.

3. Empirical results

3.1. Efficiency analysis

A comparative analysis of the average levels of efficiency reveals that banks perform best in terms of technical efficiency, followed by allocative and, finally, cost efficiency (Table 3).

Our results indicate that the CE and TE increased from 2013 to 2017, contrarily to AE. Moreover, we can conclude that the greatest

Table 3
Mean and number of efficient banks for each efficiency measures.

Cost efficiency	2013	2014	2015	2016	2017	Mean
Mean	0.455	0.426	0.381	0.570	0.518	0.470
Number of more efficient banks	10	10	7	8	6	4
Technical efficiency						
Mean	0.668	0.665	0.661	0.866	0.855	0.743
Number of more efficient banks	20	18	19	30	31	16
Allocative efficiency						
Mean	0.694	0.648	0.584	0.663	0.617	0.641
Number of more efficient banks	10	10	7	8	6	4

source of cost inefficiency comes from allocative efficiency, in line with the conclusion by Batir et al. (2017). This finding suggests that, in the present banking context, inefficiency stems more from an incorrect choice of inputs than from underutilization/waste of resources. In addition, these results also suggest a varying banking behavior, depending on the country where each bank's headquarters is located (Table 4).

3.2. Estimations results

In this section, we comment on the estimation results for the different variants of the regression model (2), displayed in Table 5. As the adopted base model is quadratic in the covariate *EM*, marginal effects of the latter are not constant. Therefore, marginal effects were estimated by computing average partial effects (APE), given by the sample average of partial effects (with respect to *EM*) across all banks for all periods. In addition, as in Law and Singh, (2014), we also computed marginal effects at the maximum and minimum values of *EM*.

Regarding the results with *RD* as earnings management covariate (Model A), we find that the estimated coefficients of *RD* and RD^2 are both negative and statistically significant at the 5% level, under all three efficiency measures, which indicates an inverted *U*-shaped curve. The APE's are negative across the different efficiency measures, a result that supports the general conclusion that, as the level of earnings management increases, efficiency decreases. More in particular: i) earnings management negatively affects the bank's ability to make its operations profitable (economic/cost efficiency); ii) earnings management practices prevent banks from using fewer resources (for a given output) or, equivalently, to produce more with given resources (technical efficiency); and, iii) earnings management causes costs actually incurred by the bank to be above the minimum costs, given the level of output produced (allocative efficiency).

A negative relationship between efficiency and earnings management has already been suggested in the literature (e.g., Ab-Hamid et al., 2018; Li et al., 2016), although within a linear regression framework (assuming constant marginal effects). Our results are supported by the existence of low quality loan portfolios (high levels of non-performing loans), which can lead to additional loan monitoring and execution costs (Sufian and Abd. Majid, 2007; Sufian and Akbar Noor Mohamad Noor, 2009; Sufian and Habibullah, 2010; Sufian and Kamarudin, 2015). In fact, the 2013 average ratio of non-performing loans to total loans was 10.2% and in 2017 it was 8%, levels that can be considered rather high (European Central Bank, 2017a). One other factor that helps justify the negative relationship between earnings management and efficiency is the fact that excess provisions, above what is prudently necessary (discretion), do not favor confidence in lending to banks, in such a way that the benefits of this lending surpass the expenses with provisions (Sharma et al., 2015). In addition, bank directors do not appear to be practicing adequate monitoring and controls and exhibit excess operational expenses ("bad management"), which further exacerbates inefficiency. Indeed, in the period under review and for the inputs considered, operational expenses from 2013 to 2017 increased 1.36% and personnel expenses grew 3.06%.

As mentioned, marginal effects of *RD* were also computed at the minimum and maximum sample values. These effects are positive and negative, respectively, suggesting that for a low level of *RD*, a positive impact of *RD* on efficiency can be supported by the "skimping hypothesis" (Berger and DeYoung, 1997), under which bank administrations decide not to spend sufficient resources on credit risk analysis, nearing efficiency even with a high level of non-performing loans (Banya and Biekpe, 2018). Regarding the impact of all the control variates on the different efficiency measures, our results are in line with the received literature.

As a robustness analysis, we find similar results to those highlighted above when *RDS* is used (Model B). However, for LLPTL we found different conclusions for AE, as the marginal effect is positive (Model C). This positive effect can be explained by: i) AE is affected by regulatory issues, and in this way, banks combine their inputs by considering government and/or market regulations (e.g., interest rates); ii) LLP's have a greater component of non-discretionary provisions (the larger fraction of *LLPTL*, resulting from legal

Table 4
Economic, technical and allocative efficiencies by country (mean values of the period 2013–2017).

Country/Efficiency	*CE*	*TE*	*AE*
Austria	0.362	0.597	0.599
Belgium	0.314	0.812	0.472
Cyprus	0.351	0.488	0.731
Deutschland	0.388	0.745	0.538
Estonia	0.653	1.000	0.653
Finland	0.344	0.459	0.798
France	0.719	0.855	0.857
Greece	0.311	0.482	0.598
Ireland	0.257	0.812	0.333
Italy	0.488	0.713	0.661
Latvia	0.517	0.938	0.553
Lithuania	0.634	0.861	0.730
Luxembourg	0.385	0.480	0.811
Malta	0.453	0.655	0.739
Netherlands	0.683	1.000	0.683
Portugal	0.363	0.451	0.761
Slovakia	0.157	0.796	0.202
Slovenia	0.195	0.404	0.532
Spain	0.527	0.751	0.686

Table 5
Results for the different specifications of the model (2).

	Model A - RD			Model B - RDS			Model C - LLPTL		
Dependent variable	*CE*	*TE*	*AE*	*CE*	*TE*	*AE*	*CE*	*TE*	*AE*
CE/TE/AE lagged 1	0.196***	0.531***	0.287***	0.223***	0.525***	0.311***	0.195***	0.516***	0.238***
RD	−1.971**	−1.076***	−1.507***						
RD^2	−31.445***	−26.517***	−25.321***						
RDS				−4.188***	−3.036***	−2.645***			
RDS^2				−80.454***	−62.173***	−65.707***			
LLPTL							−0.242	−0.537***	0.676***
$LLPTL^2$							−24.147***	−13.353***	−30.429***
TA	0.064***	0.015***	0.043***	0.064***	0.015***	0.040***	0.067***	0.016***	0.047***
NIM	−0.0002	−0.006**	0.008	−0.004	−0.005	0.0003	0.006	0.0001	0.012
DIV	−0.0009***	−0.0002	−0.0008***	−0.0007***	−0.0001	−0.0006**	−0.0006***	−0.00003	−0.0004***
lnGDPPC	−0.070***	0.013***	−0.031**	−0.072***	0.014**	−0.025*	−0.076***	0.012*	−0.037***
UR	−0.002	−0.001	0.0006	−0.002	−0.001	0.0003	−0.001	−0.001**	0.001
Z	50,488.81	780,499.76	336,604.51	62,321.59	1.88e+06	273,792.50	51,301.19	150,565.19	115,778.69
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
m_1	−5.050	−4.920	−4.520	−5.080	−4.890	−4.630	−4.840	−4.910	−4.320
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
m_2	1.970	−0.220	2.280	2.390	0.070	2.350	2.360	−0.070	2.410
	(0.049)	(0.825)	(0.023)	(0.017)	(0.944)	(0.019)	(0.018)	(0.948)	(0.016)
Hansen	45.640	46.970	44.850	42.460	46.990	44.200	47.800	46.080	41.820
	(0.070)	(0.054)	(0.082)	(0.125)	(0.054)	(0.092)	(0.015)	(0.023)	(0.058)
Marginal effects									
APE	−1.910***	−1.024***	−1.457***	−4.104***	−2.972***	−2.577***	−0.584***	−0.727***	0.245***
At *EM* min	4.234***	4.157***	3.490***	7.972***	6.361***	7.287***	2.945***	1.225***	4.693***
At *EM* max	−8.447***	−6.537***	−6.721***	−17.199***	−13.091***	−13.272***	−10.530***	−6.226***	−12.287***

Notes *p*-values associated with tests statistics in parentheses; *: *p*-value 0.10; **: *p*-value 0.05; ***: *p*-value 0.1.
Z denotes a Wald test statistic for the joint significance of all coefficients
m_i, $i = 1, 2$, denotes a serial correlation test of order *i*, asymptotically distributed as a $\mathcal{N}(0, 1)$ random variate under the null hypothesis of no serial correlation; *Hansen* denotes the value of the test statistic for over-identifying restrictions, asymptotically distributed as a chi-squared random variate under the null hypothesis of no correlation between instruments and error term. Check Table 2 for description of variables.

obligations); iii) AE increases with LLP growth. From this, we conclude that regulatory factors, affecting non-discretionary provisions, positively affect *AE* (Isik and Hassan, 2002). This finding stresses the importance of discerning discretionary loan provisions within total LLP, when studying the effect of earnings management on banking efficiency. Indeed, earnings management should only include the part of provisions that is discretionarily handled, excluding those that are imposed by regulations.

Finally, our specifications are statistically supported by the following results: the estimated coefficient of the lagged dependent variable is positive and statistically significant; there is no evidence of second-order error autocorrelation ($m2$ statistic); and there is no strong evidence of correlation between instruments and error terms (Hansen statistic).

4. Conclusion

This study investigates the impact of earnings management on the efficiency of Eurozone banks, examining its chronological evolution until the implementation of International Financial Reporting Standard 9. Our results suggest that the greatest source of cost inefficiency comes from allocative reasons, or equivalently, that inefficiency owes more to incorrect choice of inputs than to under-utilization/waste of resources. Regarding the impact of earnings management on efficiency, results suggest that the relationship between earnings management, measured through discretionary provisions (*RD* and *RDS*), and all efficiency scores (*CE, TE*, and *AE*) follows an inverted *U*-shaped form. However, we find a positive estimate of the impact of *LLPTL* on AE.

In view of the above, it appears that the division between discretionary and non-discretionary provisions should be disclosed by banks in their reports. Our study contributes to the literature on this topic, since, to the best of our knowledge, the effect of earnings management, gauged through the discretionary component of LLP, on banking efficiency has not been studied. The present study can also prove relevant for the Regulator to analyze these two dimensions in the supervised entities. It enabled a brief characterization of earnings management and banking efficiency under the preparatory period for the implementation of IFRS 9. In the future, it may prove interesting to study the effect of the expected loss model, sanctioned by IFRS 9, on the degree of discretion of provisions' management and, consequently, on the management of results. It may also be of interest to use dynamic network DEA in order to evaluate the efficiency. In addition, and as a way of overcoming the limitation of studying cost efficiency, we can analyze income efficiency, as it enables the identification of inefficiencies in both outputs and inputs (Berger and DeYoung, 1997). Finally, our paper only studies eurozone banks and does not consider governance determinants, which is a limitation. Looking at European banks and board characteristics like gender, independence, and political connections would be interesting in future investigations.

CRediT authorship contribution statement

All authors contributed to the study conception,design, material preparation, data collection, analysis, and writing. All authors read and approved the final manuscript.

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Declaration of Competing Interest

The authors have no conflicts of interest to declare that are relevant to the content of this article.

Data Availability

Data will be made available on request.

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