

# Uncertainty in the banking sector and its impact on bank profitability

Dissertação de Mestrado

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## RESUMO

O nosso estudo investiga o impacto da incerteza na rentabilidade dos bancos, um tema de enorme relevância para a literatura do sistema financeiro. Em particular, centramo-nos na incerteza bancária e quantificamo-la utilizando a dispersão transversal de choques na evolução do balanço de cada banco. Utilizando dados de painel de 597 bancos comerciais de 28 países, para o período compreendido entre 2004 e 2020, e o estimador do método dos momentos generalizado do sistema de dois passos em modelos de painel dinâmico, encontramos provas consistentes de que a incerteza bancária reduz a rentabilidade dos bancos. Mais especificamente, os nossos dados revelam que a incerteza bancária tem um efeito negativo na rentabilidade. Adicionalmente, constatamos que as provisões para perdas com empréstimos afetam negativamente a rentabilidade, ao passo que a dimensão, o capital, a liquidez e o crescimento do crédito concedido afetam positivamente. Estes dados reforçam a ideia de que a incerteza bancária faz com que os bancos atuem de forma cautelosa como medida de precaução, sendo este estudo um contributo para a literatura existente, para o meio académico, para o sistema financeiro e para as entidades reguladoras que têm como objetivo minimizar os riscos incorridos pelo setor bancário e financeiro.

Palavras-chave: Bancos; Rentabilidade; Risco; Incerteza

## ABSTRACT

Our study investigates the impact of uncertainty on bank profitability, a topic of enormous relevance to the financial system literature. In particular, we focus on bank uncertainty and quantify it using the cross-sectional dispersion of shocks in the evolution of each bank's balance sheet. Using panel data from 597 commercial banks in 28 countries, for the period 2004-2020, and the generalized method of moments estimator of the two-step system in dynamic panel models, we find consistent evidence that bank uncertainty reduces bank profitability. More specifically, our data show that banking uncertainty has a negative effect on profitability. In addition, we find that loan loss provisions negatively affect profitability, while size, capital, liquidity and loan growth positively affect it. These data reinforce the idea that banking uncertainty causes banks to act cautiously as a precautionary measure, and this study is a contribution to the existing literature, to academia, to the financial system and to regulators whose aim is to minimize the risks incurred by the banking and financial sector.

Keywords: Banks; Profitability; Risk; Uncertainty

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## Index

RESUMO .....	I
ABSTRACT .....	II
AGRADECIMENTOS .....	III
ACKNOWLEDGMENTS .....	III
CHAPTER I - INTRODUCTION.....	1
CHAPTER II - RELATED LITERATURE AND HYPOTHESES DEVELOPMENT .....	3
2.1 Lending.....	3
2.2 Loan Growth .....	5
2.3 Loan Loss Provisions .....	6
2.4 Bank liquidity hoarding.....	6
2.5 Bank risk .....	7
2.6 Uncertainty in banking .....	7
2.7 Profitability.....	8
CHAPTER III - DATA AND METHODOLOGY .....	11
3.1 Model specification and variables .....	11
3.2 Data .....	12
CHAPTER IV - RESULTS .....	15
CHAPTER V - CONCLUSION.....	19
CHAPTER VI - REFERENCES .....	21

## CHAPTER I - INTRODUCTION

Uncertainty and its impact on the economy became the subject of greater attention and study after the 2008 global financial crisis (Ahir *et al.*, 2018). The market tends to invest and finance itself less when uncertainty is high to avoid the irreversibility of choices (Alessandri & Bottero, 2020).

Though there is a large amount of empirical research on the overall effect of uncertainty, there is little information on the relationship between uncertainty and bank profitability. Considering the importance of financial institutions in the economy, this work aims to analyze the impact of uncertainty in the banking sector, more precisely on the profitability of several banks.

Banks can be affected by uncertainty in various ways. Net interest income, non-interest income, and loan loss provisions are the main indicators (profitability and risk) used to ascertain the impact of uncertainty on a bank. Regarding net interest income, banks can adopt a wait-and-see strategy to control the expansion of the asset portfolio (Wu *et al.*, 2020a), thus improving income through their assets.

In periods of heightened uncertainty, banks are advised to diversify their sources of income. That is, replacing lending activities (which generate interest) with business aspects based on fees and commissions associated with the provision of services (Dell'Araccia *et al.*, 2014). In this way, it is possible to generate non-interest income.

Regarding provisions created for loan losses, banks also adopt a wait-and-see posture, suspending these provisions until uncertainty decreases (Pindyck, R. S., 1988; McDonald & Siegel, 1986).

For the methodology, annual panel data from OECD countries in different banks is used for the period between 2004 and 2020. Using the two-step system GMM method, this work proposes to analyze how the uncertainty of the banking sector influences the profitability of banks, with uncertainty being measured through the dispersion of shocks between risk variables of the various banks under analysis. Profitability will be measured through specific ratios, such as profit margin or gross margin. In this sense, the dependent variable will be directly related to profitability, and the main explanatory variable under study will be directly related to uncertainty and risk in the banking sector.

We make two major contributions to literature. First, no research has been conducted to analyze bank profitability in the setting of OCDE bank uncertainty. Aside from precisely gauging uncertainty in the banking sector, this uncertainty measure has the

advantage of not requiring a high frequency of market data as market-based uncertainty proxies (Buch *et al.*, 2015), and it addresses the issue of the accuracy and reliability of information in newspapers as text-based uncertainty indices (S. R. Baker *et al.*, 2016; Bilgin *et al.*, 2021). Second, we investigate the impact of bank risk profiles on the relationship between uncertainty and bank profitability. Our methodology is similar to previous efforts that use a cautious motivation to analyze bank activities in the face of uncertainty (Ashraf, n.d.; Berger *et al.*, 2022).

In this context, we provide fresh empirical evidence that there is a negative effect of uncertainty on the bank's total return. Also, loan loss provisions have a negative impact on bank profitability, but size, capital, liquidity, and loan growth have a favorable impact.

To satisfy the defined objectives, the dissertation will be structured into five chapters. The first corresponds to the introduction, the following will present the literature review, where the hypotheses to be studied are substantiated, followed by the chapters on methodology and estimations, which consist of the evaluation and application of the most appropriate method for the study. Finally, the empirical results and conclusion are presented.

## CHAPTER II - RELATED LITERATURE AND HYPOTHESES DEVELOPMENT

This section goes through the numerous ways that uncertainty may affect bank profitability. Our hypotheses are then developed.

Although there is a large amount of empirical research on the general effect of uncertainty, there is little data on the relationship between uncertainty and bank profitability.

While uncertainty has long been a source of concern for economists and policymakers, its economic implications have gained prominence in the aftermath of the global financial crisis (S. Baker & Bloom, 2013; Nicholas Bloom, 2009; Stock & Watson, 2012).

"Economic Policy Uncertainty" (EPU) refers to the degree of uncertainty in an economy regarding government policies, notably fiscal and monetary policies. EPU in the banking sector refers to the specific impact and uncertainty faced by banks and financial institutions due to changes or uncertainties in government policies, regulations, and economic conditions. According to previous research, the EPU can be used as an early warning indication of a recession (La-Bhus Fah Jirasavetakul & Mr. Antonio Spilimbergo, 2018).

Since its introduction by Baker *et al.*, (2016), EPU has been used as a major proxy for uncertainty measurement.

It is also important to understand the impact of uncertainty on bank income components and bank-level control variables.

### 2.1 Lending

The link between bank profitability and lending is complex. Banks make money largely through interest revenue generated by lending activities. However, a bank's profitability and capacity to lend are influenced by a variety of circumstances.

A growing amount of literature investigates the relationship between economic uncertainty and bank lending behaviour. According to Gissler *et al.* (2016), banks are sensitive to and adverse to uncertainty. In response to EPU, banks may decrease lending growth to reduce risk exposure (Bordo *et al.*, 2016).

A pioneering work by Bordo *et al.* (2016) discovers in one of the first studies that EPU harms credit development, particularly the growth of commercial and industrial

loans in the United States. Alessandri and Bottero (2017) use loan application data in Italy to investigate how uncertainty impacts credit supply, and they find that growing EPU decreases the acceptance rate of credit applications and slows the flow of cash to the economy. According to Chi and Li (2017), EPU increases non-performing loan ratios, loan concentrations, and the normal loan migration rate, meaning that credit risks rise as loan quantities fall. Berger *et al.* (2022) contend that banks hoard liquidity to protect themselves, store more cash and other liquid assets, and provide less credits to enterprises and consumers during difficult times. Hu and Gong (2019) evaluate the impact of EPU on bank loan growth for 19 major economies and find that EPU reduces bank credit growth, although the impact varies between banks. The negative impact is greater for larger and riskier banks, whereas more liquid and diverse institutions are less affected.

According to Barraza *et al.* (2019), an exogenous increase in EPU induces a fall in the supply of business loans owing to a decline in demand for funds, implying that EPU shocks are communicated to the economy via a decline in the availability of funds to the business sector. Using panel-corrected standard errors and feasible generalized least squares, Nguyen *et al.* (2020) demonstrate that a greater level of domestic EPU reduces bank loan growth; nevertheless, changes in EPU volatility have a positive influence on bank credit growth.

Caglayan and Xu (2019) find a negative association between uncertainty and credit levels, and that uncertainty raises the ratio of non-performing loans and loan-loss provisions to gross loans. Gozgor *et al.* (2019) extend the analysis of Caglayan and Xu (2019) to 139 countries using a different measure of uncertainty, and they indicate that growing uncertainty leads to a decline in the amount of domestic loans. While this impact is evident in low- and middle-income economies, it has no influence on high-income ones.

Buch *et al.* (2015) discover considerable evidence that higher uncertainty leads to a smaller share of loans in a bank's portfolio, but subject to the bank's balance-of-sheet soundness. Valencia (2017) arrives to a similar result, namely that banks restrict loan supply when faced with increased uncertainty, particularly for those engaged in high-leverage activities. Raunig *et al.* (2017) similarly find an uneven credit decrease in the aftermath of uncertainty shocks among banks of varying size and liquidity.

Other studies, in addition to those on the impact of general uncertainty, look at how banks respond to specific categories of uncertainty, such as political uncertainty (Francis *et al.*, 2014) regulatory uncertainty (Gissler *et al.*, 2016), and economic policy uncertainty (Bordo *et al.*, 2016). According to Valencia (2017), when uncertainty increases, banks

with lower capital ratios reduce lending more than banks with higher capital ratios, because it is unlikely that borrowers with lower net worth - who would also reduce credit demand when uncertainty is high-borrow precisely from banks with lower capital ratios.

According to Alessandri and Bottero (2020), the credit market plays a passive role in the transmission of uncertainty shocks. In particular, heightened overall uncertainty has several effects. Firstly, it diminishes the likelihood of companies having their loan applications approved, leading to reduced availability of fresh credit (Alessandri & Bottero, 2020). Secondly, uncertainty hampers the flow of funds into the real economy, resulting in longer wait times for successful loan applicants, particularly when uncertainty is high (Alessandri & Bottero, 2020). Lastly, the extent of this financial amplification process varies significantly among different banks and businesses (Alessandri & Bottero, 2020). As per the theory's predictions, uncertainty is primarily transmitted through the decisions of thinly capitalized banks, and its consequences are more pronounced for enterprises located far away from the bank they apply to.

Gong *et al.* (2018) created a theoretical model to investigate the drivers of bank lending in the face of uncertainty. The authors discover a positive association between loan spreads and the amount of uncertainty using data from 19 major economies. This study suggests that banks charge an uncertainty premium, which raises the cost of borrowing for businesses.

## 2.2 Loan Growth

Several studies show a negative relation between loan growth and profitability (Miller & Noulas, 1997; Molyneux & Thornton, 1992) or no relationship at all (Al-Khouri & Arouri, 2016). This shows that excessive loan growth may increase risks, resulting in a decrease in bank profitability. Profitable banks, on the other hand, are more likely to increase lending because they can recruit more cash. Several research have found the reverse (Al-Khouri & Arouri, 2016).

EPU can have an impact on loan growth in both direct and indirect ways. It can have an impact on borrower behaviour, bank lending policies, economic conditions, and government initiatives, all of which can affect loan demand and supply.

He and Niu (2018) show that the EPU has a negative association with bank values. Because of the increase in the EPU, this has a negative influence on bank loan growth. As a result, the EPU reduces bank loan growth, which in turn reduces bank value.

### 2.3 Loan Loss Provisions

Loan loss provisions are costs incurred by banks to offset expected or probable loan losses. When a bank increases its provisions, its reported profits for the period are reduced since the provisions are subtracted from the bank's earnings. Loan loss provisions and profitability have an inverse connection. When provisions rise due to a larger anticipation of loan losses (e.g., economic downturn, poor credit quality), net income falls, thereby affecting profitability. Overall, loan loss provisions are the most important accruals in banks (Beatty & Liao, 2011), owing to expected loan losses and the significant discretion that bank managers have in determining the size of loan loss provisions estimates (Bushman & Williams, 2015; Curcio & Hasan, 2015). Understanding how banks' loan loss provisions respond to economic policy uncertainty is critical because banks play a critical role in providing credit to the domestic economy, and any excess provisions can harm bank lending, profitability, and economic growth (Ng *et al.*, 2020).

Caglayan and Xu (2019) also investigate the impact of EPU on credit levels, nonperforming loans, and loan-loss provisions in an 18-country panel dataset. According to the authors, increased uncertainty reduces credit availability and raises banks' non-performing loans and loan-loss reserves.

### 2.4 Bank liquidity hoarding

Excess liquidity (cash and easily marketable assets) held by banks in excess of what is necessary for day-to-day operations and regulatory requirements is referred to as liquidity hoarding. During times of uncertainty or when there is a heightened danger of liquidity shortages, banks may hoard money as a precautionary measure.

Liquidity hoarding and profitability often have an adverse connection. When banks hoard excess liquidity, the funds are not used for more profitable lending or investing. As a result, because the bank is not earning as much interest revenue as it might, its total profitability may suffer.

Banks can hoard liquid assets by lowering lending (Cornett *et al.*, 2011) or increasing deposits (Acharya & Naqvi, 2012).

Ashraf (2020) discovers that EPU has a favourable effect on bank liquid asset holdings and offers evidence that banks lower lending and attract larger deposits in response to increased EPU.

Banks may also hoard liquidity by offering less credit when EPU is high since higher uncertainty may affect enterprises and projects that they would otherwise support (Berger *et al.*, 2022).

## 2.5 Bank risk

Banks have a variety of risks, which can be exacerbated or mitigated by uncertainties in the economic, regulatory, and financial contexts.

Wu *et al.* (2020) discover consistent and substantial evidence for a negative relationship between economic uncertainty and our indices of bank stability, implying that increased economic uncertainty increases bank risk. Uncertainty has the greatest impact on banks' returns and volatility of returns, and the effect of nominal uncertainty appears to be more pronounced than the effect of actual uncertainty. They also discover data that sheds light on how economic uncertainty translates into financial risk. Their findings imply that unfavourable consequences of economic uncertainty appear in the financial sector, particularly the banking market, since uncertainty may impede the efficiency of loan distribution, increasing bank vulnerability. Furthermore, financial policymakers have always been wary of the severity of economic cycles, which are often measured by the pace of growth of real production and the level of inflation, because they are intimately connected to the volatility of financial stability.

Their findings, however, highlight the importance of the usually neglected "second moment shocks," in which the volatility of unforeseen innovations in economic conditions adds considerably to the development of financial risks. The option value of waiting, search-for-yield methods, and bank herding behaviours are significantly responsible for the economic uncertainty and bank risk nexus.

## 2.6 Uncertainty in banking

The volatility of high frequency time series, such as (bank) stock prices, is frequently used to quantify uncertainty. The benefit of this strategy is that it enables the analysis of short-run changes in uncertainty. The downside is that it only applies to publicly traded institutions. As a measure of banking uncertainty, we utilize the cross-sectional dispersion of bank-level shocks to growth rates in total assets.

Empirical uncertainty is frequently quantified using (lagged) stock price volatility as a measure of historical volatility (Bloom, 2007). This method is founded on high-

frequency market data. Similarly, implied volatility metrics are based on market data such as stock option prices (Stein & Stone, 2013). However, such high-frequency market data are not available to all organizations for many applications of relevance. This is true in the financial industry. Reliable market statistics on bank share prices are difficult to get in nations where many banks are not publicly traded and/or stock exchanges are small. As a result, we require a measure of uncertainty that may be estimated using lower frequency balance sheet or profitability data.

Bloom *et al.* (2018) proposes using information on the cross-sectional dispersion of (productivity) shocks as an alternative to measures of uncertainty based on the volatility of high frequency data. If the distribution of shocks expands, dispersion increases: the future becomes more unclear on average across all enterprises. Increased shock cross-sectional dispersion might thus be viewed as increased uncertainty. These authors demonstrate, using empirical data from U.S. manufacturing businesses, that cross-sectional dispersion obtained from firm-level data may be used to explain differences in business cycle movements.

Because bank profitability can be influenced by a variety of variables other than lending rate shocks, Dang and Nguyen (2022) utilize the dispersion of shocks to total asset growth as a surrogate for asset-side shocks. These asset-side shocks can be connected to loan demand shocks, but they can also capture other variables impacting bank asset volume.

## 2.7 Profitability

Profitability is an important metric for assessing a bank's financial health and performance. It is usually evaluated by examining several financial measures and ratios. A variety of factors impact bank profitability, including interest revenue, non-interest income, costs, risk management, and economic circumstances.

Empirical research has shown that bank-specific variables or internal factors (e.g., Rjoub *et al.*, 2017; Singh & Sharma, 2016)) as well as industry-specific and country-level variables or external factors (Athanasoglou *et al.*, 2008; Mirzaei *et al.*, 2013) have an influence on bank profitability.

The banking system is a key sector for every economy, and the functioning of the banking sector has a considerable impact on economic growth (Menicucci & Paolucci,

2016). As a result, some academics are motivated to perform diverse empirical research to analyze the primary factors of bank profitability.

Menicucci and Paolucci (2016) looked at how the characteristics of individual banks affected the profitability of European banks between 2009 and 2013. Their empirical results revealed that while higher loan loss provisions have a negative impact on profitability, bank size and capital adequacy ratio have positive effects.

When Borroni *et al.* (2019) examined the factors that affect banks' profitability for a sizable sample of European banks over the years 2009–2017, they found that both bank-specific (such as size and cost income) and macroeconomic (such as GDP and inflation) factors have a significant impact on banks' profitability.

Although there is a large amount of empirical work on the general impact of uncertainty, there is little proof that there is a connection between uncertainty and bank profitability from the viewpoint of financial institutions.

For the first time, Alessandri and Bottero (2020) thoroughly analyse bank profitability in the context of banking uncertainty.

The available literature is working in two opposed directions about the potential effects of uncertainty on the interest revenue from lending operations. The real option theory, which asserts that incomplete information and uncertainty may increase the likelihood of banks making poor decisions, has an impact on the first one (McDonald & Siegel, 1986; Pindyck, 1986). Therefore, banks may adopt an "await-and-see" approach, which would temporarily restrict the growth of their asset portfolio. They would also strive to give priority to more creditworthy clients or better manage their present debtors during these uncertain times (Wu *et al.*, 2020). As a result, this technique may enhance banks' interest revenue in relation to their assets.

There are at least two key processes that are significant when there is a negative correlation between uncertainty and net interest income. According to earlier writers, banks may hoard cash during periods of economic uncertainty to safeguard themselves against potential financial shocks and choose to put off investments (Berger *et al.*, 2022). The returns and profit margins of liquid assets may eventually decline if they are held in a large buffer. Additionally, shifts in the economy's volatility may have an impact on the costs of bank deposits and loans.

When there's economic uncertainty, businesses and people may postpone purchases and investments (Bloom *et al.*, 2013), which lowers bank lending rates (Hartzmark, 2016). Since they believe they are more vulnerable to adverse shocks, depositors may

also demand banks provide them with greater deposit rates (Valencia, 2017). Together, these two factors might significantly reduce interest income for banks.

We formulate the following hypotheses considering the material mentioned above:

**Hypothesis 1a.** Banking uncertainty increases profitability.

**Hypothesis 1b.** Banking uncertainty decreases profitability.

## CHAPTER III - DATA AND METHODOLOGY

### 3.1 Model specification and variables

To understand the potentially uncertainty effect in the major income components that contribute to bank profitability, the dependent variable is calculated using the formula 1:

$$ROA = \frac{Net\ interest\ income}{Total\ assets} \quad (1)$$

where *ROA* stands for return on assets.

In terms of measuring uncertainty, Buch *et al.* (2015) defend that, to capture uncertainty in the banking industry, the best metric is the cross-sectional dispersion of shocks to bank-level variables. This is based on the underlying principle that future outcomes become less predictable as uncertainty increases. We use a two-step approach to measure it.

In the first step, we use the equation (2) as follows to find bank-year-specific shocks for each variable chosen, in particular total assets. We use the dispersion of shocks to total asset growth as a proxy for bank risk, as in Buch *et al.* (2015), because it captures the effects of all asset side factors of a bank. Logarithmic scales are used to respond to skewness towards large values, which occurs when one or a few points are significantly larger than most of the data.

$$\begin{aligned} & Total\ Assets\ Growth\ Rate_t \\ & = \log(Total\ Assets_{i,t}) - \log(Total\ Assets_{i,t-1}) \end{aligned} \quad (2)$$

where *i* represents the bank in year *t*.

Since our dataset is built by banks from different countries and with different macroeconomic schemes, we run equation (3), a simple fixed effects regression model (where the intercept of the regression can vary freely across individuals and/or groups), which allows to control for any individual-specific effect that do not vary across time. By doing this, we are avoiding any omitted variable bias.

$$Total\ Assets\ Growth\ Rate_{i,t} = \beta_0 + \beta_1 Z_{i,t} + \varepsilon_{i,t} \quad (3)$$

where *i* represents the bank in year *t* and *Z* is those omitted variables.

Since the unobserved variables are assumed to be constant over time (only varying from bank to bank or from country to country), we can rewrite equation (3) by combining  $\beta_0$  and  $\beta_1 Z_{i,t}$ , obtaining  $\alpha_i$  as the fixed effect for bank or country *i*, as in equation (4):

$$\text{Total Assets Growth Rate}_{i,t} = \alpha_i + \varepsilon_{i,t} \quad (4)$$

where  $i$  represents the bank in year  $t$ .

After controlling for the individual and country specific effects, we collect the residuals of the variable at the bank level ( $\varepsilon_{i,t}$ ).

Now that we have the bank-specific shocks, we follow Buch *et al.* (2015) and compute banking uncertainty at the country level using the cross-sectional dispersion of all shocks, considering the standard deviation (SD) of bank-specific residuals, as shown in the formula (5):

$$\text{Uncertainty}_t = SD(\varepsilon_{i,t}) \quad (5)$$

where  $i$  represents the bank in year  $t$ .

Increased banking uncertainty can be interpreted as an increase in the cross-sectional dispersion of shocks to bank-level variables. Buch *et al.* (2015) show that after generating uncertainty measures in banking from bank-level data, this uncertainty changed over time and grew throughout the crisis period. Wu *et al.* (2020) perform tests using this banking-market-specific uncertainty in a future study based on the technique given by Buch *et al.* (2015). Both Buch *et al.* (2015) and Wu *et al.* (2020) findings are consistent with the literature, which shows that other types of uncertainty have a negative impact on bank lending and bank risk (Bordo *et al.*, 2016; Chi & Li, 2017; Danisman *et al.*, 2020; Gozgor *et al.*, 2019; Hu & Gong, 2019; Louri & Karadima, 2019; Nguyen *et al.*, 2020)

As control variables, we focus on bank-specific variables, such as loan loss provisions, capital, size, liquidity, and loan growth.

### 3.2 Data

From 2004 through 2020, we use bank-level panel data from 597 commercial banks in 28 countries. The data for the analysis is obtained from the Bureau van Dijk's Bankscope database that gives information in a consistent format, enabling comparisons between banks from other nations (Pasiouras *et al.*, 2006). The remaining variables are created using our own formula. We winsorize all bank level variables at the 1% and 99% levels to guarantee that outliers do not influence the results.

Table 1, presented next, exhibits our sample's descriptive statistics, such as the mean, standard deviation, minimum, and maximum values. In 2015, Loan loss provisions and Loan growth faced their lowest values: 0,575% and 1%, respectively, and *ROA* had a

negative value, according to our database. A negative *ROA* indicates that the company's net income was negative or that its losses surpassed its earnings during the period being assessed. However, it's essential to consider the industry and economic context when interpreting negative *ROA*. When a bank makes loans or provides credit to people or organizations, there is always the possibility that some borrowers will default on their loans. Banks develop loan loss provisions to limit this risk and guarantee financial stability. These provisions are funds set aside from the bank's profits as a reserve to cover prospective losses on loans judged to be at risk of default. Making predictions about potential credit losses based on historical data and economic forecasts is necessary for estimating the required loan loss reserves. However, precisely forecasting future credit losses is difficult, especially during times of economic uncertainty or quick changes in market circumstances. Incorrect estimates can result in overestimation or underestimation of provisions, damaging the financial statements of a bank.

Table 1 - Descriptive Statistics

	Mean	SD	Min	Max	Calculation
<i>Bank income components and overall return measures</i>					
Loan loss provisions	0.004	0.011	-0.145	0.575	Loan loss provisions/Total assets (%)
ROA	0.019	0.098	-1.289	6.963	Pre-tax profits/Total assets (%)
<i>Bank-level control variables</i>					
Capital	0.178	0.216	-0.791	1.000	Equity/Total assets (%)
Liquidity	0.173	0.219	0.000	1.259	Liquid assets/Total assets (%)
Size	6.739	1.003	3.109	9.512	Natural logarithm of total assets
Loan growth	-7.809	616.301	-53035.330	1.000	Annual percentage change of gross loans (%)
Uncertainty	0.076	0.053	0.000	0.323	Banking uncertainty measure derived from the dispersion of shocks to Total Assets Growth Rate

From 2004 through 2020, the study sample comprises bank-level panel data from 597 commercial banks in 28 countries. To eliminate the effect of extreme outliers, all bank-level variables are winsorized at the 2.5th and 97.5th percentiles. Please see subsection 3.1 for particular computation stages and procedures for banking uncertainty metrics.

The pairwise correlation coefficients between variables are shown in Table 2. The correlation coefficients between uncertainty and *ROA* are, as predicted, positive. These findings confirm Markowitz (1952) belief that the greater the risk, the greater the return. This is also supported by the negative correlation between the values of loan loss provisions and loan growth.

Table 2 - Correlation coefficients matrix

	1	2	3	4	5	6	7
1 ROA	1.000						
2 Uncertainty	0.005	1.000					
3 Loan loss provisions	-0.096	-0.011	1.000				
4 Capital	0.161	0.048	-0.039	1.000			
5 Liquidity	0.067	-0.056	-0.051	0.183	1.000		
6 Size	-0.054	-0.093	0.021	-0.457	0.037	1.000	
7 Loan growth	-0.001	0.009	0.004	-0.071	-0.021	0.010	1.000

If the correlation coefficient between two independent variables is close to +1 (e.g., 0.80 or higher), it indicates a strong positive linear relationship between them. This strong positive correlation might point to multicollinearity. Knowing this, multicollinearity is not a worry for these results.

## CHAPTER IV - RESULTS

In the presence of a dynamic panel data model with a lagged dependent variable as a regressor, the strict exogeneity assumption is likely to be violated (the probability of the lagged dependent variable being correlated with the error term is high), rendering estimates from methods such as OLS, Random Effects, and/or Fixed Effects inconsistent and biased. Therefore, we employ the Arellano and Bover (1995) and Blundell and Bond (1998) two-step system GMM as the estimate technique, ensuring consistency and efficiency in the results. As in our study, this estimation technique is recommended for panel data sets with many nations and a small temporal dimension (Roodman, 2009). The autocorrelation and heterogeneity in panel data, the inconsistency brought on by endogeneity, and the bias resulting from omitted variables in cross-sectional estimations are additional issues that this approach is particularly well adapted to address (Bond *et al.*, 2001). According to Blundell and Bond (1998), the system GMM also offers better instruments and performs better than the Standard/Difference-GMM from Arellano and Bover (1995). In our model we investigate the relationship between uncertainty and banks' profitability. Following that, the final model is written as follows:

$$\begin{aligned}
 ROA_{i,t} = & \alpha + \beta_1 ROA_{i,t-1} + \beta_2 Uncertainty_{i,t} \\
 & + \beta_3 Loan\ Loss\ Provisions_{i,t} + \beta_4 Size_{i,t} + \beta_5 Capital_{i,t} \quad (6) \\
 & + \beta_6 Loan\ Growth_{i,t} + \beta_7 Liquidity_{i,t}
 \end{aligned}$$

where  $i$  represents the bank in year  $t$ .

The estimation findings are shown in Table 3. As result of the model, the coefficients on uncertainty measures are negative and statistically significant. According to this finding, banks' profitability declines in response to increased banking uncertainty, which is consistent with Hypothesis 1b. Financial institutions may face a number of difficulties as a result of heightened banking uncertainty, including less lending activity, higher loan loss provisions, stricter credit criteria, and market-related concerns. In order to retain profitability in ambiguous situations, banks must adapt to these circumstances by managing risk effectively, optimizing their processes, and changing their business plans.

If the uncertainty measure increases by one standard deviation (0.053), the dependent variable (Return on Assets) reduces economically by 0.00053 (0.010\*0.053) percentage points.

In Table 3 is also possible to evaluate the relationship between profitability and other variables. Loan loss provisions affect the dependent variable negatively, whilst size, capital, liquidity, and loan growth affect positively.

Table 3 - Banking uncertainty and ROA

	Coefficient	P> z
Dependent variable	0.066	0.000
Uncertainty	-0.010	0.001
Loan loss provisions	-0.946	0.000
Size	0.026	0.000
Capital	0.201	0.000
Liquidity	0.150	0.000
Loan Growth	0.000	0.000
Constant	-0.205	0.000
Observations	6791	
Banks	597	
Instruments	143	
AR(1) test		0.0096
AR(2) test		0.3949
Hansen test*		-

\* Hansen test was not used since there is no exogenous variables.

The Return on Assets (ROA) metric is the dependent variable. The two-step system GMM estimator is used by the dynamic panel models to generate all findings. For a definition of each variable, see Table 1. The serial correlation is tested using the AR(1)/AR(2) test, and the p-values are provided.

Loan loss provisions are an important part of responsible risk management and financial stability in the banking industry. They are an important safeguard against potential credit losses, but they also have a direct impact on a bank's profits in a variety of ways. When a bank makes provisions for loan losses, it affects its reported profits for the time. Earnings can be significantly reduced, especially when there is an economic downturn or increased uncertainty, which increases the probability of loan defaults. The loan loss provisions monies are deducted from the bank's net revenue. As a result, there is less profit available to give as dividends to shareholders or to spend in the bank's activities. Loan loss provisions can also have an impact on important financial measures that are used to evaluate a bank's performance. These ratios may fall when earnings fall owing to provisions, which might be alarming to investors and analysts. However, while loan loss provisions may have a detrimental impact on profitability in the short term, they play a critical role in sustaining a bank's financial health and long-term stability. They are a proactive tool to manage possible credit losses, assisting in the prevention of larger

financial shocks and ensuring that a bank stays viable and resilient even during economic downturns or periods of uncertainty.

The influence of bank size on profitability is complex and varies based on a variety of factors such as the bank's business strategy, market circumstances, regulatory environment, and risk management skills. While bigger banks may benefit from economies of scale and diversity, they also confront constraints that can have an impact on profitability. Smaller banks may have possibilities to succeed in specific areas and create strong client connections, but they may lack some of the benefits of larger banks.

A bank's lending activities are supported by capital. A bank with a strong capital foundation may provide loans to borrowers and earn interest and fees on such loans. This lending capability is a major source of revenue and profit for banks. Profitability requires the efficient use of capital. Banks that efficiently deploy their capital to productive lending and investment operations can achieve better returns on equity (ROE), a key profitability statistic.

In the financial markets, liquidity functions as a safeguard against unanticipated shocks or short-term disruptions. It helps a bank to withstand financial storms without resorting to asset fire sales or costly borrowing. This part of liquidity management that mitigates risk can assist safeguard a bank's profitability by avoiding losses associated with forced asset sales or unfavorable financing arrangements during a crisis. However, striking a balance in liquidity management is critical. Excess liquidity might result in underused assets and inferior returns. As a result, while liquidity can boost profitability, it must be handled well to maximize profits without jeopardizing safety and stability.

Increasing loan growth is often regarded as a good driver of bank profitability. When a bank expands its lending portfolio, it earns more interest revenue on the loans it extends. All else being equal, interest income is a main source of revenue for banks, and faster loan growth can lead to better profitability.

The autoregressive (AR) test is used to evaluate the efficacy of instruments. This approach allows us to test the hypothesis of existing first/second order serial correlation in the error term in both the difference regression and system difference-level regression (the differenced error term is allowed to be first-order serially correlated, but the error term in the second-order serial correlation will violate the GMM measure's assumption). AR (1) value indicates that there is a small connection between the present value and the prior time step value. However, the impact of the prior value is minimal because the parameter is near to zero. On the other hand, the AR(2) test is the Arellano and Bond test

for the second order serial correlation in the error term and its value of 0.3949 indicates a positive correlation, meaning that the previous value and the actual value are associated. The absence of second-order serial correlation is reflected in the null hypothesis, which should not be rejected.

## CHAPTER V - CONCLUSION

The study investigates how bank profitability responds to uncertainty shocks. Using annual bank-level data from OECD countries from 2004 to 2020, we create uncertainty measures specifically for the banking industry by estimating the cross-sectional dispersion of shocks to bank-level variables. The two-step method GMM offers various advantages, especially when dealing with dynamic panel data models or models with endogeneity difficulties. It can efficiently adjust for endogeneity and unobserved heterogeneity within the panel data framework. This method also addresses the serial correlation issue, which is frequent in dynamic panel data models, by incorporating lagged values of endogenous variables as instruments, accounting for serial correlation.

With our method, we seek to cast full light on the influence of banking uncertainty on bank profitability, and the findings reveal a few significant trends, which are detailed next. According to our empirical findings, loan loss provisions have a negative influence on bank profitability, although size, capital, liquidity, and loan growth have a positive effect. When banks set aside funds for loan loss provisions, their reported profits are reduced since the provision expenditure is removed from the bank's income statement, lowering net income. The size of a bank has no intrinsic negative or positive impact on its profitability. It is determined by several factors, including the bank's ability to leverage its scale, operational efficiency, risk management techniques, market circumstances, and regulatory environment. Profitability, rather than being exclusively driven by size, is ultimately decided by the bank's capacity to efficiently manage these components and react to changing conditions. Capital is an important component of a bank's overall financial health and profitability. It protects against losses, aids risk management, and boosts market confidence. While enough capital is required for profitability, proper capital deployment and risk management are also critical in achieving long-term and positive returns for a bank. Liquidity is an important aspect in determining a bank's overall profitability. It helps the bank to manage risks, capitalize on opportunities, and preserve market trust. Effective liquidity management is critical for increasing a bank's profitability while maintaining its financial stability. Loan growth may be a driver of profitability for banks if it is handled properly, with a focus on credit quality, efficient operations, and consideration of the general economic and interest rate situation.

The findings suggest that regulatory agencies should pay more attention to uncertainty and performance in the banking sector, and that bank managers should carefully consider

the consequences of uncertainty, as the negative effects outweigh any positive effects on bank profitability. Along the same lines, bank supervision should be strengthened in order to carefully monitor bank performance's response to uncertainty, especially among banks with a high degree of risk, in order to mitigate the negative repercussions of banking uncertainty. A structure to assist high-risk banks is required, as their income is more influenced by uncertainty.

Finally, this work may lead to further investigations. To begin, it may be interesting to examine other potential variables influencing bank profitability, both numerically and qualitatively. Furthermore, including other metrics of uncertainty may lead to some other interesting conclusions. While analyzing the impact on bank profitability, we leave other types of uncertainty for future research.

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