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Increased Uncertainty, Credit Supply, and Non-Performing Loans in the Eurozone

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Abstract: This paper examines the role of economic uncertainty in the Eurozone countries by analyzing the credit supply and the evolution of non-performing loans following the 2008 global financial crisis. The discussion centers on how greater economic uncertainty restricts credit supply and increases the number of non-performing loans. Quarterly data for the Eurozone countries are studied for the period 2005 to 2016. To test the aforementioned hypothesis, an index of economic uncertainty for the Eurozone countries is calculated. Panel data analysis is performed using fixed effects estimation. This approach allows for individual heterogeneity, with different intercepts across countries and quarterly time dummies to control for time-specific effects that are common to all countries in the sample. The primary conclusions of the analysis are as follows: (1) When economic uncertainty increases, total gross loans decrease, and the number of non-performing loans increases. (2) When uncertainty increases, loans to deposit-takers, other domestic sectors, and general government decrease, while loans to financial corporations increase as a means of supporting the financial sector. (3) The most vulnerable Eurozone economies play a prominent role in these overall effects. In these economies, the effects of the recent global financial crisis are most pronounced, with uncertainty increasing significantly over the study period.

Keywords: credit crisis; Eurozone; loan supply; non-performing loans; uncertainty index

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1. Introduction

The effects of uncertainty on economic activity vary, but their primary consequence is to shape behaviors and actions that deviate from the framework of rationalization and maximization of wealth and prosperity. Uncertainty also affects the development of modern production models. A sharp increase in uncertainty due to political or economic shocks may have a direct, strong, and enduring impact on the economy (Alexopoulos and Cohen, 2008;

Baker et al., 2011). Output, employment, productivity, and investment decline in response to an unexpected increase in uncertainty (Petrakis et al., 2014).

These consequences have led to considerable debate regarding banks' lending behavior during economic crises (Djiogap and Ngomsi, 2012; Ladime et al., 2013; Micco and Panizza, 2006; Olokoyo, 2011; Swamy and Sreejesh, 2012). Banks' credit policy decisions are determined by variables that relate directly to bank operations. Such variables include size and capitalization, as well as macroeconomic variables such as GDP and monetary policy (Djiogap and Ngomsi, 2012; Ladime et al., 2013), which worsen substantially when uncertainty is high. It has also been observed that non-performing loans (NPLs) are an inevitable consequence of an abundant credit supply in times of economic growth (Balgova et al., 2016).

The decline in bank lending during crises can be attributed to one of two reasons. The first is the reduction in credit supply, perhaps due to greater uncertainty, information asymmetry, and moral hazard. The second reason relates to changes in demand for credit. During recessions and crises, economic conditions are unfavorable, so profitable investments are scarce, and the risk of unemployment for consumers is high (Bernanke and Gertler, 1995). Thus, under conditions of high uncertainty and economic recession, the credit supply and, consequently, the evolution of NPLs are likely to be affected.

This paper assesses how greater economic uncertainty reduces credit supply and increases the number of NPLs. It is examined whether uncertainty was a critical factor for the Eurozone economies after the recent global financial crisis. In particular, it is studied how uncertainty—which is inherent in economic policymaking and decision making—drives credit supply in the Eurozone economies and how uncertainty affects NPLs. The goal is to build a new measure of economic uncertainty for all Eurozone countries.

This paper enriches the literature by contributing to the debate on the degree to which uncertainty affects economic performance in the Eurozone countries. To the best of our knowledge, this is the first objective economic uncertainty index for all Eurozone economies. This economic uncertainty index offers a more complete measure than variables that express uncertainty, because these variables are indications rather than measures of uncertainty. This is also the first time that a measure of economic uncertainty has been linked to credit supply and the evolution of NPLs for the Eurozone countries in the midst of the crisis. In this paper, the effects of uncertainty on credit supply are separated according to the category of credit supply. The impact of uncertainty on each category is examined. The economic uncertainty index offers a useful, reliable tool to address the role of uncertainty in economic activity and provide guidance to help policymakers design better economic policies and address uncertainty.

The structure of this article is as follows: Section 2 presents the theoretical background, Section 3 describes the data and method, Section 4 presents and discusses the empirical results, and Section 5 presents the conclusions.

2. Literature Review

2.1. The Effects of Economic Uncertainty on Economic Outcomes

Following a financial crisis, numerous factors lead to greater uncertainty and risk in the economy (Furceri and Mourougane, 2009). Such factors include lower demand for goods and lower capital investment. Thus, some major challenges surround the measurement of uncertainty, its evolution during economic cycles, and its impact on economic activity (Petrakis et al., 2014).

The effects of uncertainty on economic outcomes are particularly acute and may have direct, dynamic, and enduring economic consequences (Alexopoulos and Cohen, 2008; Baker et al., 2011). Many researchers report that uncertainty negatively affects economic outcomes through political factors (Bonn and Pfeifer, 2011; Fernandez-Villaverde et al., 2011; Pastor and Veronesi, 2011a, 2011b) over both the short and long term (Driver and Moreton, 1991). In contexts of high uncertainty, investments and decision making by firms are also negatively affected (Bhagat and Obreja, 2011; Chen et al., 2011; Dixit and Pindyck, 1994; Durnev, 2010). These negative effects may lead to economic recession (Belke and Goecke, 2005; Bloom, 2009). Meanwhile, uncertainty may affect

consumption in the economy (Alexopoulos and Cohen, 2009; Bernanke, 1983; Romer, 1990) and push employees to seek higher wages, which negatively affects employment, investments, and GDP (Belke and Goecke, 2005; Blackburn and Pelloni, 2005). Bloom (2009) argues that the suspension of investment and employment decisions because of uncertainty may lead to economic recession.

Bloom et al. (2011) conclude that uncertainty has had a major impact on the US economy. An increase in political uncertainty between 2006 and 2011 has prompted large, sustained negative effects on economic outcomes in the US. They also conclude that uncertainty has counter-cyclical effects on the industry sector. These effects entail macroeconomic and microeconomic shocks of uncertainty on economic activity. In the UK, Denis and Kannan (2013) found that uncertainty significantly affected economic activity by suppressing industrial production and GDP by 0.6% and 0.3%, respectively.

Petrakis et al. (2014) examined the extent to which uncertainty inhibited the effective functioning of the Eurozone economies, especially after the recession of 2008. They concluded that negative events affected economic activity. In particular, negative uncertainty disturbances had substantial effects on the economic activity and production of the manufacturing sector in the peripheral Eurozone countries. Empirical analysis showed that the effects of uncertainty disturbances fell after 5 months for Portugal, 7 months for Spain, 8 months for Germany, 10 months for Greece, and 13 months for Italy.

The impact of uncertainty may also be due to other factors, such as a rise in funding costs (Fernandez-Villaverde et al., 2011; Gilchrist et al., 2010; Pastor and Veronesi, 2011a, 2011b), an increase in society's uncertainty avoidance (Panousi and Papanikolaou, 2012), and an intensification of the agency problem (DeMarzo and Sannikov, 2006; Narita, 2011).

2.2. Economic Crises, Uncertainty, Credit Supply, and Non-Performing Loans

No empirical study has examined the relationships between high uncertainty and changes in credit supply and the number of NPLs. Most studies have linked credit supply to business cycles (Aggelopoulos et al., 2016; Asea and Blomberg, 1998; Calomiris and Mason, 2003; Holmstrom and Tirole, 1997; Keeton, 1999; Lown and Morgan, 2006; Nehls and Schmidt, 2004; Peek and Rosengren, 2000). Studies have focused on the level of financial development in relation to business cycles (Bernanke and Lown, 1991; Borio et al., 2013, 2014; Rogoff, 2015) or the effect of changes in macroeconomic aggregates on credit supply (Bayoumi and Melander, 2008; Black and Strahan, 2002; Cappiello et al., 2010; Ciccarelli et al., 2010; De Bondt et al., 2010; Lown and Morgan, 2002; Lown et al., 2000; Swiston, 2008).

Other studies have linked credit supply to financial crises. Economic crises are usually accompanied by reductions in bank lending (Cornett et al., 2011; Del Prete et al., 2017; Dihn et al., 2013). For example, in the recent global financial crisis, banks not only reduced credit to domestic (Cetorelli and Goldberg, 2012; Ivashina and Scharfstein, 2009) and international borrowers (Herrmann and Mihaljek, 2010; Popov and Udell, 2012; Takats, 2010), but also set stricter credit standards (Asea and Blomberg, 1998; Ivashina and Scharfstein, 2009) and tightened credit control and the monitoring of their portfolios (De Haas and Van Horen, 2009).

During the period before the recent global financial crisis, there was a significant increase in credit supply (Baron and Xiong, 2017; Demirguc-Kunt and Detragiache, 2002; English and Reid, 1994; Kaminsky et al., 1998; Kaminsky and Reinhart, 1999; Lopez-Salido et al., 2016; Schularick and Taylor, 2012; Weinberg, 1995). In general, there was also broader growth in financial markets, mainly because of new technologies in the financial sector (Panopoulou, 2005; Rinaldi and Sanchis-Arellano, 2006).

However, this increase in credit supply during periods of economic growth usually leads to problems in the financial sector because credit is supplied without due care. Therefore, credit supply to individuals and legal entities with weak creditworthiness tends to increase (Greenwood and Hanson, 2013; Keeton, 1999). The credit expansion of economies is usually guided by overoptimism about the future of the financial system (Kindleberger, 1978; Minsky, 1977). Long periods of economic prosperity tend to increase this overoptimism. This fuels credit expansion, which

may destabilize the financial system and the economy (Baron and Xiong, 2017), leading to banking crises, housing crises, and economic recessions (Borio and Lowe, 2002; Lopez-Salido et al., 2016; Mian and Sufi, 2009; Schularick and Taylor, 2012).

When the financial system becomes threatened by credit risk, which is due to the credit expansion that leads to financial crisis and recession, the economy reacts by adopting tighter credit standards and imposing stricter credit controls (Ivashina and Scharfstein, 2009; Takats and Upper, 2013). Credit supply therefore falls, and credit demand drops as individuals and firms seek to reduce rather than increase their debt when revenues are limited (Ashcraft and Campello, 2007; Chatelain et al., 2003; Gertler and Gilchrist, 1994). Credit supply changes substantially after a financial crisis (Blalock et al., 2005; Desai et al., 2004; Eichengreen et al., 2001; Tomz and Wright, 2005).

An increase in the number of NPLs is a direct, inevitable consequence of financial crises (Balgova and Plekhanov, 2016). At the time of the recent global financial crisis, individuals and firms in most European countries had debts that they could not repay (Aiyar et al., 2015a, 2015b). Accordingly, the number of NPLs increased because of both the broader macroeconomic scenario and the prevailing conditions in banking institutions.

Numerous studies have linked the emergence of NPLs to economic growth (Beck et al., 2013, 2015; Fofack, 2005; Jimenez and Saurina, 2006; Khemraj and Pasha, 2009; Salas and Saurina, 2002; Skarica, 2014; Ozili, 2015). This link is because the positive GDP growth rate usually entails greater income, which improves the debtors' ability to repay debts, so the number of NPLs decreases. Conversely, when the economy is in decline (shrinking or negative GDP growth), the level of bad debt rises (Borio et al., 2001).

Besides GDP growth, other macroeconomic factors also seem to increase the number of NPLs. Such factors include unemployment (Bofondi and Ropele, 2011; Klein, 2013; Louzis et al., 2012; Nkusu, 2011; Skarica, 2014), inflation (Beck et al., 2015; Klein, 2013; Skarica, 2014), management quality (Louzis et al., 2012), credit expansion (Klein, 2013), stock prices, exchange rates, lending rates (Beck et al., 2015), income tax, the production gap (Anastasiou et al., 2016), and risk (Espinoza and Prasad, 2010).

Factors that relate to the banking system itself are also responsible for the evolution of NPLs. One such factor is capital adequacy, as measured by the equity-to-assets ratio (Klein, 2013). Banks with low capital adequacy are motivated to provide credit at higher risk, which increases the probability of NPLs, whereas high capital adequacy and tight credit control reduce the number of NPLs (Boudriga et al., 2009). Other factors include maturity, credit costs, the size of banks (Rajan and Dhal, 2003), and financial development in general. Loans in foreign currency and exchange rates play a role as well (Tanasković and Jandrić, 2015).

The emergence of NPLs also affects macroeconomic performance. Studies have shown that a high number of NPLs reduces credit as a percentage of GDP, slows down economic growth, increases unemployment (Aiyar et al., 2015a; Aiyar et al., 2015b; Espinoza and Prasad, 2010; Klein, 2013; Nkusu, 2011), and undermines trust in the market (Cucinelli, 2015; Jorda et al., 2013; Kwan and Eisenbeis, 1995; Peek and Rosengren, 2000, 2005). In addition, a high number of NPLs burdens bank balances and hinders bank profitability because capital requirements restrict the creation of new credit. The problem is that having a high number of NPLs occupies bank capital that could otherwise be used to increase borrowing. A high number of NPLs thus negatively affects credit supply.

3. Method and Data

To explore the relationships between uncertainty and credit supply and between uncertainty and the number of NPLs, we used an unbalanced panel of quarterly data for 19 Eurozone countries (see Table A1 in Appendix A) for the period 2005 to 2016. The study period was chosen because of the availability of data on credit supply and NPLs from the IMF financial soundness indicators (FSIs) database. To examine the effects of economic uncertainty on credit supply and NPLs, we employed the following baseline estimation equation:

$$Y_{it} = a_i + \beta\, UI_{it} + \ \lambda_t + u_{it}, \tag{1}$$

where i denotes the Eurozone country ($N_{max} = 19$) and t the quarter ($t_{max} = 48$). The dependent variable, Y, is a vector of variables that represent the loan supply and NPLs; α_i is a set of country-specific fixed effects that capture the influence of unobserved country-specific time-invariant heterogeneity; UI is an economic uncertainty index; and λ_t is a set of time dummies that control for quarter-specific effects that are common to all countries.

The analysis was based on fixed effects estimation, which allows for individual heterogeneity. Thus, different intercepts were used across countries, and estimation was performed using ordinary least squares. As mentioned earlier, we included quarterly time dummies to account for time-specific effects that were common to all countries in the sample. We employed a cluster-robust approach for standard errors to control for within-cluster correlation and heteroskedasticity.

To construct the economic uncertainty index, daily data for national stock market high capitalization indexes were used for the countries in this study. Following Petrakis et al. (2014), daily data for each index were converted to monthly data. Then, as a proxy for global uncertainty, a global stock market index was calculated that was based on the daily prices of the world's major stock markets (US, Canada, Mexico, Brazil, Eurozone, UK, Japan, China–Hong Kong, and India) as a weighted average of each country's annual GDP at current prices. The source for the GDP data was the IMF World Economic Outlook Database April 2017. Table A2 (see Appendix A) presents the indexes that were used for each country, as well as major world stock indexes that were used to construct a global stock market index. All stock index data were obtained from the Reuters Datastream.

An overall uncertainty indicator was created for each country by computing a rolling-window 30-day standard deviation of the main stock index returns. To isolate country-specific shocks, the monthly average of this uncertainty index (UI) was regressed on its global counterpart and the residuals were labeled as a country-specific UI. These monthly data were then transformed to quarterly data. The quarterly pattern of these indicators shows the quarterly economic UI evolution from 2005 to 2016. Table 1 presents descriptive statistics for the stock market indexes that were used in the analysis.

The dataset for credit supply and NPLs was based on the IMF Financial Soundness Indicators (FSIs).[1] The country sample and the study period were determined by the availability of these data. The variables were total gross loans, supply of loans to residents and non-residents, NPLs as a percentage of total gross loans, and NPLs net of provisions to capital.[2] The supply of loans to residents was separated into loans to deposit-takers, financial corporations, non-financial corporations, other domestic sectors, the central bank, and the general government. The data for NPLs as a percentage of total gross loans were taken from the World Bank for Germany and from TheGlobalEconomy.com for Finland. Data availability differed by country. Data availability is summarized in Table A3 (see Appendix A). Table 2 provides descriptive statistics for the variables, considered as panel data.

To examine the specific effects of economic uncertainty on loan supply and NPLs by country, the following estimation equation was employed. This equation is the same as Equation (1), but not in panel form. Equation (2) was estimated separately for each country using simple ordinary least squares:

$$Y_t = a_t + \beta\, UI_t + u_t, \tag{2}$$

where t denotes the quarter ($t_{max} = 48$). The dependent variable, Y, is a vector of variables that represent loan supply and NPLs for each country, and UI is an economic uncertainty index for each country. Equation (2) was analyzed by employing ordinary least squares time series regression.

[1] The data for NPLs net of provisions to capital were taken from the World Bank for Germany and from TheGlobalEconomy.com for Finland.

[2] This variable was calculated by taking the value of NPLs less the value of specific loan provisions as the numerator and capital as the denominator. Capital was measured as total capital and reserves on the sector balance sheet.

Table 1 Descriptive statistics on the stock market indexes.

	Obs.	Median	Average	SD	Min.	Max.
AS51 Index	2972	4936.34	4936.39	674.33	3145.50	6828.70
BEL20 Index	3020	3073.52	3056.05	705.87	1527.27	4756.82
CYSMFTSE Index	2927	341.99	440.48	481.44	32.59	1891.48
TALSE Index	2961	677.53	692.92	182.06	244.99	1049.39
HEX25 Index	2966	2467.26	2520.68	548.87	1189.09	3647.13
CAC Index	3020	4206.77	4231.64	748.88	2519.29	6168.15
DAX Index	3001	6947.72	7304.25	2008.58	3666.41	12,374.73
FTASE Index	2916	7164.10	10,110.08	8361.08	1141.30	28,412.30
ISEQ Index	2989	4817.42	5024.97	2016.11	1916.38	9968.48
FTSEMIB Index	2997	21,184.60	24,204.03	8426.89	12,362.51	44,364.00
RIGSE Index	2940	438.25	472.78	128.39	203.16	764.50
VILSE Index	2940	438.25	472.78	128.39	203.16	764.50
LUXXX Index	2979	1454.61	1525.48	378.98	804.39	2578.24
MALTEX Index	2914	3507.05	3856.13	775.31	2643.38	6641.87
AEX Index	3020	391.34	389.73	76.16	199.25	561.90
PSI20 Index	3020	7107.76	7387.82	2241.11	4260.13	13,702.00
SBITOP Index	2941	823.96	988.66	488.14	501.27	2674.69
SKSM Index	2904	278.26	300.74	95.58	178.65	507.98
IBEX Index	3011	10,204.90	10,357.68	2011.83	5956.30	15,945.70
SPX Index	2945	1362.21	1469.61	371.15	676.53	2241.35
SPTSX60 Index	2942	728.02	728.49	97.61	458.13	900.98
MEXBOL Index	2947	35,020.74	33,320.06	9948.44	11,739.99	48,694.90
IBOV Index	2902	53,813.51	52,083.34	11,744.81	23,609.97	73,516.81
SX5E Index	3021	3020.69	3098.87	577.24	1809.98	4557.57
UKX Index	2975	5912.15	5867.51	723.99	3512.09	7103.98
NKY Index	2845	13,500.46	13,311.56	3515.54	7054.98	20,868.03
HSI Index	2911	21,354.66	20,693.64	3590.87	11,015.84	31,638.22
BSE SENSEX Index	2883	17,622.45	17,845.68	6047.09	6102.74	29,681.77

Table 2 Descriptive statistics of the basic variables of the analysis.

	Obs.	Median	Average	SD	Min.	Max.
Uncertainty index	912	235.41	238.40	339.55	−1196.45	1103.51
Total gross loans	629	368,248.73	1,035,974.42	1,565,715.59	5421.16	7,009,210.00
Loans to residents	622	229,970.27	692,868.58	1,137,959.72	4925.66	5,384,266.72
Loans to deposit-takers	577	9820.04	40,242.25	63,762.97	12.82	261,183.53
Loans to financial corporations	622	5377.14	52,668.79	110,462.34	28.56	497,283.40
Loans to non-financial corporations	613	113,481.00	305,379.58	507,238.90	1946.49	1,919,547.66
Loans to other domestic sectors	613	3949.19	24,865.75	62,945.46	0.00	567,333.51
Loans to central bank	622	12,731.50	104,000.39	286,058.85	0.00	1,418,531.60
Loans to general government	577	45,673.27	172,098.20	272,923.40	2586.84	1,131,705.69
Loans to non-residents	613	88,017.31	302,294.07	422,959.48	0.00	1,779,849.15
NPL to total gross loans	565	5.53	8.55	8.66	0.15	47.75
NPL net of provisions to capital	588	26.99	39.78	47.74	−12.00	413.56

Note: NPL: non-performing loan.

4. Empirical Results and Discussion

Figure 1 presents the economic uncertainty index for each country in the study. The plot is indicative of the rise of uncertainty following the recent global financial recession. The black line reflects the evolution of the uncertainty index for all Eurozone countries as the weighted average of individual countries based on their GDP. This line shows that in the years before the crisis, uncertainty was low for the whole Eurozone, but this situation was reversed from 2009 onward.

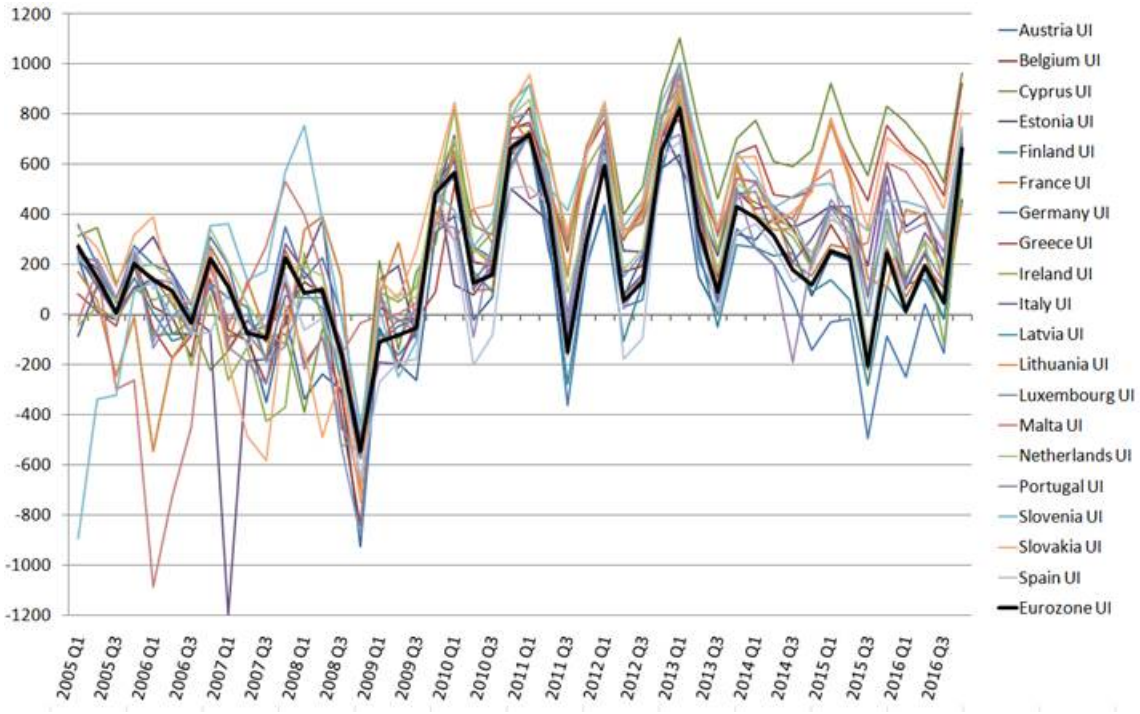

Figure 1 The increase of uncertainty index (UI) by country after the onset of the 2008 global financial crisis. *Notes*: Values less than 0 indicate low economic uncertainty; values greater than 0 indicate high uncertainty. The thick black line represents the weighted average of the Eurozone countries based on their GDP level.

The quarterly pattern of uncertainty shows the evolution of economic uncertainty since 2005. There were sharp, country-specific uncertainty shocks around the dates of major political and economic turbulence. Since the onset of the crisis, most Eurozone economies have been hit by a series of uncertainty shocks.

The next phase of our analysis was to examine the effects of uncertainty on credit supply and the number of NPLs. Table 3 provides evideshance of these effects. The data in Table 3 are based on alternative specifications of Equation (1) for the panel of the 19 Eurozone countries between 2005 and 2016 using fixed effects and cluster-robust standard errors.

Table 3 shows the impact of uncertainty on credit supply and the evolution of NPLs. Regressions show that uncertainty was significantly and negatively linked to total gross loans, loans to residents, and loans to non-residents and positively and significantly linked to evolution in NPLs as a percentage of total loans and evolution in NPLs net of provisions of capital. Regarding loans to residents, there was a negative and significant relationship between uncertainty and loans to deposit-takers and loans to other domestic sectors, and a positive relationship between uncertainty and loans to financial corporations.

Table 3 Fixed effects method using simple standard errors.

Dependent Var.	Uncertainty	*N*	R^2	*F*-stat
Total gross loans	49.45 ** (−2.10)	629	0.031	9.79 ***
Loans to residents	−30.64 * (−1.62)	622	0.015	4.59 *
Loans to deposit-takers	−8.44 * (−1.85)	622	0.018	5.47 ***
Loans to financial corporations	5.97 *** (2.80)	577	0.015	4.33 **
Loans to non-financial corporations	−5.55 (−1.22)	577	0.002	0.76
Loans to other domestic sectors	−21.28 ** (−2.02)	613	0.009	2.82 *
Loans to central bank	−2.33 (−0.49)	613	0.019	5.78 ***
Loans to general government	2.99 (0.71)	622	0.086	28.52 ***
Loans to non-residents	−22.95 ** (−1.95)	613	0.028	8.57 ***
NPL to total gross loans	0.003 *** (3.99)	565	0.135	42.69 ***
NPL net of provisions to capital	0.019 *** (4.10)	588	0.081	25.25 ***

Notes: *t*-statistics in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% significance levels, respectively. All estimates were carried out using the fixed effects method allowing for country and quarter-specific effects and using cluster-robust standard errors.

Next, to illustrate the effect of uncertainty on credit supply and the evolution of NPLs by country, Table 4 shows the correlations between the economic uncertainty index and the country-dependent variables.

The correlation matrix provides several significant indications of the effect of uncertainty on credit supply and the evolution of NPLs by country. For most countries, there were strong negative or positive correlations with uncertainty. This result holds for all variables, with the exception of loans to the central bank (significant negative correlation for Greece) and loans to general government (negative correlation for Estonia and positive correlation for Ireland and Spain). Separate estimates of Equation (2) illustrate how uncertainty affected each country (Tables A4–A22 in Appendix A).

Estimation of Equation (2) for Austria (Table A4 in Appendix A) revealed no significant impact of uncertainty on credit supply or the evolution of NPLs. Data for Austria spanned the period from Q1 2010 to Q4 2016 (Table A3 in Appendix A). During this period, the uncertainty index followed a marginally downward trend, as did credit supply. However, these small changes did not lead to statistically significant results, despite the upward trend of NPLs from 2010 onward, a substantial increase in 2014, and a decline from 2015 onward. Austria is one country in which economic uncertainty did not increase during the recent global financial crisis; it actually decreased slightly.

Table 4 Correlation of each dependent variable with UI by country.

	Total Gross Loans	**Residents**	**Deposit-Takers**	**Financial Corporations**	**Non-Financial Corporations**	**Other Domestic Sectors**	**Central Bank**	**General Government**	**Non-Residents**	**NPL to Total Gross Loans**	**NPL Net of Provisions to Capital**
Austria	0.170	0.214	0.226	0.098	0.111	−0.242	0.002	−0.130	0.106	−0.119	−0.217
Belgium	**−0.465**	−0.239	**−0.607**	**0.325**	−0.127	**0.537**	−0.092	−0.095	**−0.305**	**0.513**	**0.430**
Cyprus	−0.252	**0.605**	−0.106	**0.633**	0.299	**0.693**	0.206	0.113	**−0.463**	**0.447**	**0.466**
Estonia	**−0.507**	**−0.499**	−0.118	**−0.570**	**−0.500**	**−0.494**	0.194	**−0.456**	**−0.586**	−0.265	**−0.422**
Finland	0.212	0.171	−0.244	0.283	0.099	0.192	0.081	0.003	0.252	**0.531**	**0.503**
France	0.058	**−0.469**	−0.152	−0.208	−0.117	–	–	−0.161	–	−0.122	**−0.424**
Germany	−0.206	−0.136	−0.182	0.224	−0.208	−0.220	0.019	0.070	**−0.532**	**0.571**	–
Greece	**−0.321**	0.015	**−0.681**	**0.779**	−0.036	**0.375**	**−0.461**	−0.011	**−0.562**	**0.641**	**0.521**
Ireland	**0.485**	**0.511**	**0.430**	**0.578**	**0.542**	**0.497**	−0.148	**0.457**	**0.441**	0.017	**0.489**
Italy	0.196	**0.346**	**−0.701**	0.020	0.170	**0.476**	−0.133	−0.033	0.063	**0.461**	**0.502**
Latvia	**0.336**	0.294	0.254	**−0.315**	0.294	**0.321**	0.000	0.061	−0.019	0.273	0.224
Lithuania	**−0.648**	**−0.648**	−0.180	**−0.475**	**−0.573**	**−0.549**	−0.194	0.099	0.000	**0.439**	0.191
Luxembourg	**−0.388**	−0.299	−0.251	0.037	−0.225	0.040	−0.084	−0.141	−0.103	**−0.621**	**−0.530**
Malta	**0.575**	**0.640**	−0.037	**0.568**	**0.622**	**0.693**	0.244	0.255	0.258	0.031	**0.308**
Netherlands	−0.090	0.247	**−0.566**	0.192	**0.332**	0.119	0.232	0.271	**−0.363**	**0.497**	**0.436**
Portugal	−0.049	−0.045	0.050	−0.126	−0.105	−0.026	−0.110	0.258	−0.053	0.106	0.158
Slovakia	−0.068	−0.057	0.041	0.051	0.042	−0.068	0.000	0.098	−0.131	−0.025	−0.188
Slovenia	**0.471**	**0.465**	**0.462**	**0.473**	**0.447**	**0.447**	−0.261	−0.060	**0.340**	0.033	0.287
Spain	0.188	−0.086	0.156	–	–	**−0.315**	−0.029	**0.414**	**0.348**	**0.389**	**0.337**

Note: Bold is used to indicate in correlations above 0.3 or below −0.3.

For Belgium (Table A5 in Appendix A), there was a significant negative relationship between uncertainty and total gross loans, loans to deposit-takers, and loans to non-residents, and a significant positive relationship between uncertainty and loans to financial corporations, loans to other domestic sectors, and the two NPL variables. The data for Belgium spanned the period from Q4 2006 to Q3 2016 (Table A3 in Appendix A). Uncertainty increased between 2008 and 2010, and decreased between 2013 and 2016. Meanwhile, credit supply decreased between 2008 and 2009 and remained stable between 2012 and 2016. NPLs increased substantially between 2008 and 2014. This observation explains the positive relationship with uncertainty.

For **Cyprus** (Table A6 in Appendix A), there was a significant negative relationship between uncertainty and loans to non-residents and a significant positive relationship between uncertainty and loans to residents, loans to financial and non-financial corporations, loans to other domestic sectors, and both NPL variables. The data for Cyprus spanned the period from Q4 2008 to Q1 2016 (Table A3 in Appendix A). The relationships resulting from estimation of Equation (2) are explained by the increase in uncertainty between Q4 2008 and 2013 and the decrease in uncertainty between 2013 and 2016. Credit supply rose between 2008 and 2010, decreased between 2011 and 2012, and fell between 2013 and 2016. NPLs increased substantially from 2008 onward.

For **Estonia** (Table A7 in Appendix A), there was a significant negative relationship between uncertainty and total gross loans, loans to residents, loans to financial and non-financial corporations, loans to other domestic sectors, loans to general government, loans to non-residents, and NPLs net of provisions to capital. The data for Estonia spanned the period from Q4 2008 to Q4 2016 (Table A3 in Appendix A). During this period, uncertainty increased significantly. These findings are explained by a significant decrease in all types of credit supply from 2011 onward, a substantial increase in NPLs between 2008 and 2010, and a substantial decrease in NPLs from 2011 onward.

For Finland (Table A8 in Appendix A), there was a significant negative relationship between uncertainty and loans to deposit-takers and a significant positive relationship between uncertainty and loans to financial corporations and between uncertainty and loans to non-residents. Data for Finland spanned the period from Q1 2005 to Q3 2016. During this period, credit supply increased steadily. Uncertainty declined between 2005 and 2008, increased between 2009 and 2013, and declined from 2014 onward. NPLs fell to low levels (less than 1% of total loans) but increased substantially between 2007 and 2009 and between 2014 and 2016.

As in the case of Austria, for France (Table A9 in Appendix A), there was no significant impact of uncertainty on credit supply or on the evolution of NPLs. The main problem with France was the availability of data on credit supply. Total gross loans data spanned the period from Q2 2010 to Q4 2013, data on total loan breakdowns spanned the period from Q2 2010 to Q2 2012, and data on NPLs spanned the period from Q2 2010 to Q4 2016 (Table A3 in Appendix A). During this period, uncertainty in the French economy fluctuated substantially. Uncertainty increased between 2010 and Q1 2011, decreased in Q2 and Q3 2011, increased in Q4 2011 and Q1 2012, and decreased for the rest of 2012. Similar fluctuations also occurred in credit supply, which decreased between 2010 and Q2 2011, increased between Q4 2011 and Q2 2012, decreased for the rest of 2012, increased in Q1 and Q2 2013, and decreased for the rest of 2013. NPLs as a percentage of total loans increased substantially between 2010 and 2013 but declined from 2014 onward.

Estimation of Equation (2) for Germany (Table A10 in Appendix A) revealed a significant negative effect of uncertainty on loans to non-residents. Data for Germany spanned the period from Q4 2008 to Q4 2016 (Table A3 in Appendix A). During this period, the uncertainty index followed a marginally downward trend between 2009 and 2015 but then rose in 2016. Credit supply continued to rise between Q4 2010 and Q3 2012, and remained stable thereafter. NPLs were consistently low (2%–4% of total loans). Germany is another country where economic uncertainty fell during the recent global financial crisis.

For Greece (Table A11 in Appendix A), there was a significant negative relationship between uncertainty and total gross loans, loans to deposit-takers, loans to central bank, and loans to non-residents. There was a significant positive relationship between uncertainty and loans to financial corporations, loans to other domestic sectors, and the two NPL variables. Data for the Greek economy spanned the period from Q3 2008 to Q4 2016. During this period, uncertainty rose steadily. Credit supply rose until Q2 2010, but after the first economic adjustment program was

signed in May 2010, lending declined steadily until Q4 2016. Efforts to support the domestic economy through fiscal adjustment programs were obvious because, despite the increase in uncertainty, loans to non-financial corporations and other domestic sectors increased. NPLs increased substantially from 2008 onward. This observation explains their positive relationship with uncertainty.

Estimation of Equation (2) for Ireland (Table A12 in Appendix A) revealed a significant positive relationship between uncertainty and all dependent variables except loans to central bank and NPLs to total gross loans. These positive relationships are explained by the data availability for Ireland. These data spanned the period from Q1 2010 to Q3 2016 (Table A3 in Appendix A). During this period, Ireland made a major recovery effort, especially after 2013. Although the situation in the banking sector has not been fully restored (there was a decline in loans throughout the study period), uncertainty fell following Ireland's successful exit from the adjustment program by the end of 2013 and during the subsequent positive climate. NPLs increased substantially while the economic adjustment programs were in force (2010–2013), but fell considerably between 2014 and 2016.

For Italy (Table A13 in Appendix A), there was a significant negative relationship between uncertainty and loans to deposit-takers, and a significant positive relationship between uncertainty and loans to residents and loans to other domestic sectors. The data for Italy spanned the period from Q4 2005 to Q2 2007 and from Q2 2008 to Q2 2016 (Table A3 in Appendix A). During this period, credit supply was relatively steady, with a small increase until 2010 and a small decrease from 2011 to 2015. Uncertainty had increased significantly by 2013, and it decreased slightly from 2014 to 2016. NPLs in Italy increased substantially from 2008 onward. This observation explains their positive relationship with uncertainty.

Estimation of Equation (2) for the economy of **Latvia** (Table A14 in Appendix A) revealed a significant positive relationship between uncertainty and total gross loans. The data spanned the period from Q1 2011 to Q4 2016. During this period, uncertainty and credit supply declined. The year 2011 marked a return to high growth rates after three years of recession. Accordingly, uncertainty and NPLs fell from 2011 onward.

For Lithuania, there was a significant negative relationship between uncertainty and total gross loans, loans to residents, loans to financial and non-financial corporations, and loans to other domestic sectors. Data for Lithuania spanned the period from Q4 2008 to Q3 2016 (Table A3 in Appendix A). Uncertainty increased substantially until Q1 2013 and then declined, while credit supply declined until Q1 2015 and rose thereafter. NPLs increased substantially in 2009 and 2010 and declined sharply from 2011 onward. NPLs did not share a significant relationship with uncertainty.

For Luxembourg (Table A16 in Appendix A), there was a significant negative relationship between uncertainty and total gross loans, loans to residents, and the two NPL variables. The data for Luxembourg spanned the period from Q1 2009 to Q4 2016 (Table A3 in Appendix A). During this period, uncertainty did not change substantially, although it increased between 2009 and 2012 and declined between 2013 and 2016. Credit supply evolved in the opposite way over the same period. A negative relationship between NPLs and uncertainty was observed. This finding is attributable to the study period. Data on NPLs spanned the period from 2009 to 2013—a period in which Luxembourg managed to reduce NPLs substantially, despite an increase in uncertainty between 2009 and 2012.

Malta is another country whose economy was not significantly affected by the recent global financial crisis. Estimation of Equation (2) for Malta (Table A17 in Appendix A) revealed a significant positive relationship between uncertainty and total gross loans, loans to residents, loans to financial and non-financial corporations, loans to other domestic sectors, loans to central banks, loans to non-residents, and NPLs net of provisions to capital. Data for Malta spanned the whole study period (2005 to 2016) (Table A3 in Appendix A). During this period in Malta, the credit supply to the economy steadily increased, while uncertainty increased until 2011 and then remained stable. Despite fluctuations, the number of NPLs remained low during this period. NPLs accounted for 12.0% of total loans in 2005, 5.0% in 2008, 9.5% in 2014, and 5.7% in 2016.

For the Netherlands (Table A18 in Appendix A), there was a significant negative relationship between uncertainty and loans to deposit-takers and between uncertainty and loans to non-residents. There was also a significant positive relationship between uncertainty and loans to non-financial corporations, loans to central banks, and the two NPL

variables. Data for the Netherlands spanned the period from Q1 2008 to Q4 2016 (Table A3 in Appendix A). Uncertainty increased substantially until 2012 and then began to decline. Meanwhile, credit supply declined until 2010 and increased from 2011 onward and between 2014 and 2016. NPLs increased substantially between 2008 and Q1 2010 and continued to grow more slowly until 2014. In 2015, NPLs began to decline.

Estimation of Equation (2) for Portugal (Table A19 in Appendix A) revealed no significant effect of uncertainty on credit supply or the evolution of NPLs. The data for Portugal were annual between 2005 and 2007 and quarterly from Q4 2008 to Q3 2016 (Table A3 in Appendix A). During this period, uncertainty in the Portuguese economy increased steadily, while credit supply declined from 2010 onward. NPLs during this period increased substantially.

As with Portugal, for Slovakia (Table A20 in Appendix A), there was no significant effect of uncertainty on credit supply or the evolution of NPLs. Data for Slovakia spanned the period from Q1 2011 to Q4 2016 (Table A3 in Appendix A). During this period, uncertainty in the Slovak economy was relatively low, while credit supply increased in 2011 and then remained relatively stable. NPLs decreased marginally from 2011 onward.

Slovenia is another country whose economy was not significantly affected by the recent global financial crisis. Estimation of Equation (2) for the Slovenian economy (Table A21 in Appendix A) revealed a significant positive relationship between uncertainty and total gross loans, loans to residents, loans to deposit-takers, loans to financial and non-financial corporations, loans to other domestic sectors, and loans to non-residents. Data for Slovenia spanned the period from Q4 2010 to Q4 2016. During this period, uncertainty fell. Credit supply declined from 2012 onward. NPLs in Slovenia increased substantially from 2010 to 2013, and declined from 2014 onward.

Finally, estimation of Equation (2) for Spain revealed a significant negative relationship between uncertainty and loans to other domestic sectors and a significant positive relationship between uncertainty and loans to general government, loans to other domestic sectors, and the two NPL variables. Data for Spain spanned the period from Q4 2005 to Q4 2016 (Table A3 in Appendix A). Uncertainty decreased between 2006 and 2008, but increased substantially during the crisis (after 2009). Credit supply increased until 2009 and decreased thereafter. NPLs increased substantially between 2008 and 2013 and declined from 2014 onward.

5. Conclusions

Using quarterly data that spanned the period from Q1 2005 to Q4 2016 for the Eurozone economies, the empirical analysis shows strong links between uncertainty and credit supply and between uncertainty and the evolution of NPLs. In particular, when uncertainty in the economy increases, total gross loans (to residents and non-residents) decrease. Conversely, the number of NPLs increases. The opposite relationships occurs when uncertainty decreases. Regarding loans to residents, loans to deposit-takers decrease with increasing uncertainty, as do loans to other domestic sectors and loans to the general government. In contrast, loans to financial corporations share a positive relationship with an increase in uncertainty, highlighting efforts to support the financial sector during periods of high uncertainty.

Regarding the effect of uncertainty on country-by-country credit supply, the analysis shows that countries that experienced the most pronounced effects of the crisis (i.e., Estonia, Finland, Greece, Italy, Portugal, and Spain), along with Belgium, Lithuania, Luxembourg, and the Netherlands, reduced credit supply when uncertainty rose and increased credit supply when uncertainty fell. Other countries (i.e., Cyprus, Ireland, Latvia, Malta, and Slovenia) increased credit supply when uncertainty rose and reduced credit supply when uncertainty fell. This finding implies that these countries use lending as a tool to tackle uncertainty. When uncertainty declines, they cease to use this tool. Finally, for the economies of Austria, Germany, France, and Slovakia, the level of uncertainty either remained stable or declined during the recent crisis. Thus, for these countries, there was no significant relationship with credit supply.

Country-by-country examination of the effect of uncertainty on the evolution of NPLs showed that in Belgium, Cyprus, Greece, Ireland, Italy, Lithuania, Malta, the Netherlands, and Spain, a rise in uncertainty was accompanied by a rise in the number of NPLs. Likewise, a decline in uncertainty was accompanied by a decline in the number

of NPLs. In Estonia and Luxembourg, when uncertainty increased, the number of NPLs decreased, and when uncertainty decreased, the number of NPLs increased. Finally, in Austria, Finland, France, Germany, Latvia, Slovakia, and Slovenia, uncertainty generally declined during the recent crisis and had no effect on the evolution of NPLs.

The empirical results lead to several important conclusions. These conclusions are relevant not only to policymakers and governments of the Eurozone economies, but also to any organization or individual with an interest in the effects of uncertainty on economies and economic outcomes. For governments to reduce uncertainty in their economies, they need to scrutinize the directions they follow in the future. Policymakers should avoid hasty decisions during crises. Instead, they should focus on building the resilience of households, communities, businesses, the financial system, and the economy as a whole. They must build appropriate economic institutions that can reduce uncertainty and increase confidence. In addition, macroeconomic government policy plays a unique, key role in managing risk and uncertainty at the national level. Macroeconomic policies contribute to the management of external sector or systemic domestic factors. A stable external environment and a strong macroeconomic policy framework not only explain low uncertainty in an economy, but also reduce the likelihood of a recession. Finally, if businesses and households do not invest, governments may need to stimulate the economy by investing themselves.

The first limitation of this study refers to the availability of credit supply data. Poor data availability for certain countries in certain years meant that the study period varied for different economies. The IMF's financial soundness indicators provided insufficient data for all Eurozone countries. Data for some countries were available only for some quarters, while for other countries, data were available for the whole study period.

Future research could use the uncertainty index that is presented in this paper as an indicator of economic uncertainty in relation to other macroeconomic variables. Furthermore, it would be of interest to examine the relationship between uncertainty in different economies and type of credit supply such as mortgage lending, consumer credit, and so forth.

Appendix A

Table A1 List of countries and abbreviations.

Country	Abbreviation
Austria	AT
Belgium	BE
Cyprus	CY
Estonia	EE
Finland	FI
France	FR
Germany	DE
Greece	GR
Ireland	IE
Italy	IT
Latvia	LV
Lithuania	LT
Luxembourg	LU
Malta	MT
Netherlands	NL
Portugal	PT
Slovak Republic	SK
Slovenia	SI
Spain	ES

Table A2 Stock indexes by country.

Stock Indexes by Eurozone Country	
Austria	AS51 Index
Belgium	BEL20 Index
Cyprus	CYSMFTSE Index
Estonia	TALSE Index
Finland	HEX25 Index
France	CAC Index
Germany	DAX Index
Greece	FTASE Index
Ireland	ISEQ Index
Italy	FTSEMIB Index
Latvia	RIGSE Index
Lithuania	VILSE Index
Luxembourg	LUXXX Index
Malta	MALTEX Index
Netherlands	AEX Index
Portugal	PSI20 Index
Slovenia	SBITOP Index
Slovakia	SKSM Index
Spain	IBEX Index
Major World Stock Markets Indexes	
USA	SPX Index
Canada	SPTSX60 Index
Mexico	MEXBOL Index
Brazil	IBOV Index
Eurozone	SX5E Index
UK	UKX Index
Japan	NKY Index
China–Hong Kong	HSI Index
India	BSE SENSEX Index

Table A3 Availability of data by country.

	Uncertainty Index	Total Gross Loans	Loans to Residents	Loans to Deposit-Takers	Loans to Financial Corporations	Loans to Non-Financial Corporations	Loans to Other Domestic Sectors	Loans to Central Bank	Loans to General Government	Loans to Non-Residents	NPL to Total Gross Loans	NPL Net of Provisions to Capital
Austria	2005q1–2016q4						2010q1–2016q4					
Belgium							2006q4–2016q3					
Cyprus							2008q4–2016q1					
Estonia							2008q4–2016q4					
Finland						2005q1–2016q3					2005–2012 yearly data	2005q1–2016q3
France		2010q2–2013q4		2010q2–2012q2			-	-	2010q2–2012q2	-	2010q2–2016q4	
Germany						2008q4–2016q4					2005–2015 yearly data	-
Greece							2008q3–2016q4					
Ireland							2010q1–2016q3					
Italy					2005q4–2007q2, 2008q2–2016q2						2005q4–2016q2	
Latvia							2011q1–2016q4					
Lithuania			2008q4–2016q3	2008q4–2014q2, 2015q2–2016q3		2008q4–2016q3		2008q4–2012q3, 2015q2–2016q3	2008q4–2016q3	-	2008q4–2016q3	
Luxembourg						2009q1 2016q4					2009q1–2013q4	
Malta							2005q1–2016q4					
Netherlands							2008q1–2016q4					
Portugal					2005q4, 2006q4, 2007q4, 2008q4–2016q3						2007q4, 2008q4, 2009q4–2016q3	
Slovenia							2010q4–2016q4					
Slovakia							2011q1–2016q4					
Spain			2005q4–2016q4		-	-			2005q4–2016q4			

Table A4 The effects of uncertainty on loan supply and NPLs in Austria.

Dependent var.	Uncertainty	*N*	R^2	*F*-stat
Total gross loans	33.83 (0.88)	28	0.028	0.77
Loans to residents	22.49 (1.12)	28	0.045	1.25
Loans to deposit-takers	26.97 (1.18)	28	0.051	1.39
Loans to financial corporations	0.69 (0.50)	28	0.009	0.25
Loans to non-financial corporations	1.26 (0.57)	28	0.573	0.32
Loans to other domestic sectors	−5.90 (−1.27)	28	0.058	1.62
Loans to central bank	0.03 (0.01)	28	0.000	0.00
Loans to general government	−0.57 (−0.67)	28	0.016	0.44
Loans to non-residents	11.34 (0.54)	28	0.011	0.29
NPL to total gross loans	−0.01 (0.54)	28	0.014	0.37
NPL net of provisions to capital	−0.01 (−1.13)	28	0.047	1.28

Notes: *t*-statistics in parentheses.

Table A5 The effects of uncertainty on loan supply and NPLs in Belgium.

Dependent var.	Uncertainty	N	R^2	F-stat
Total gross loans	−163.66 *** (−3.24)	40	0.216	10.50 ***
Loans to residents	−31.42 (−1.52)	40	0.057	2.31
Loans to deposit-takers	−71.17 *** (−4.71)	40	0.368	22.14 ***
Loans to financial corporations	9.38 ** (4.43)	40	0.105	4.48 **
Loans to non-financial corporations	−4.49 (−0.79)	40	0.016	0.62
Loans to other domestic sectors	39.33 *** (3.92)	40	0.288	15.38 ***
Loans to central bank	−0.62 (−0.57)	40	0.008	0.32
Loans to general government	−3.85 (−0.59)	40	0.009	0.35
Loans to non-residents	−132.24 ** (−1.97)	40	0.092	3.88 **
NPL to total gross loans	0.01 *** (3.69)	40	0.263	13.59 ***
NPL net of provisions to capital	0.01 *** (2.93)	40	0.184	8.61 ***

Notes: *t*-statistics in parentheses; ** and *** denote significance at the 5% and 1% significance levels, respectively.

Table A6 The effects of uncertainty on loan supply and NPLs in Cyprus.

Dependent var.	Uncertainty	N	R^2	F-stat
Total gross loans	−16.47 (−1.38)	30	0.063	1.89
Loans to residents	13.60 *** (4.02)	30	0.365	16.16 ***
Loans to deposit-takers	−0.25 (−0.56)	30	0.011	0.32
Loans to financial corporations	1.55 *** (4.32)	30	0.401	18.70 ***
Loans to non-financial corporations	1.62 * (1.66)	30	0.089	2.74 *
Loans to other domestic sectors	9.88 *** (5.08)	30	0.479	25.83 ***
Loans to central bank	0.72 (1.11)	30	0.042	1.24
Loans to general government	0.07 (0.60)	30	0.012	0.36
Loans to non-residents	−30.08 *** (−2.76)	30	0.214	7.64 ***
NPL to total gross loans	0.02 *** (2.67)	30	0.199	6.97 ***
NPL net of provisions to capital	0.17 *** (2.79)	30	0.217	7.77 ***

Notes: *t*-statistics in parentheses; * and *** denote significance at the 10% and 1% significance levels, respectively.

Table A7 The effects of uncertainty on loan supply and NPLs in Estonia.

Dependent var.	Uncertainty	N	R^2	F-stat
Total gross loans	−212.52 *** (−3.27)	33	0.256	10.70 ***
Loans to residents	−193.99 *** (−3.20)	33	0.248	10.26 ***
Loans to deposit-takers	−0.03 (−0.66)	33	0.014	0.44
Loans to financial corporations	−7.49 *** (−3.86)	33	0.324	14.91 ***
Loans to non-financial corporations	−88.23 *** (−3.21)	33	0.249	10.32 ***
Loans to other domestic sectors	−93.45 *** (−3.16)	33	0.243	9.99 ***
Loans to central bank	0.00 (1.10)	33	0.037	1.21
Loans to general government	−4.78 *** (−2.85)	33	0.207	8.13 ***
Loans to non-residents	−18.52 *** (−4.02)	33	0.343	16.19 ***
NPL to total gross loans	−0.01 (−1.53)	33	0.071	2.34
NPL net of provisions to capital	−0.017 *** (−2.59)	33	0.178	6.72 ***

Notes: *t*-statistics in parentheses; *** denotes significance at the 1% significance level.

Table A8 The effects of uncertainty on loan supply and NPLs in Finland.

Dependent var.	Uncertainty	N	R^2	F-stat
Total gross loans	44.29 (1.46)	47	0.045	2.12
Loans to residents	22.38 (1.16)	47	0.029	1.35
Loans to deposit-takers	−1.84 * (−1.69)	47	0.059	2.86 *
Loans to financial corporations	6.03 ** (1.98)	47	0.080	3.91 **
Loans to non-financial corporations	1.61 (0.66)	47	0.009	0.44
Loans to other domestic sectors	14.44 (1.31)	47	0.037	1.73
Loans to central bank	2.14 (0.54)	47	0.006	0.30
Loans to general government	0.01 (0.02)	47	0.000	0.00
Loans to non-residents	21.90 * (1.74)	47	0.063	3.04 *
NPL to total gross loans	0.01 (1.53)	8	0.281	2.36
NPL net of provisions to capital	0.01 (0.54)	44	0.007	0.29

Notes: *t*-statistics in parentheses; * and ** denote significance at the 10% and 5% significance levels, respectively.

Table A9 The effects of uncertainty on loan supply and NPLs in France.

Dependent var.	Uncertainty	N	R^2	F-stat
Total gross loans	−8.82 (−0.15)	15	0.002	0.02
Loans to residents	−226.83 (−1.40)	9	0.219	1.97
Loans to deposit-takers	−16.46 (−0.41)	9	0.023	0.17
Loans to financial corporations	−11.52 (−0.56)	9	0.043	0.32
Loans to non-financial corporations	−50.77 (−0.31)	9	0.013	0.10
Loans to other domestic sectors	-	-	-	-
Loans to central bank	-	-	-	-
Loans to general government	−24.25 (−0.43)	9	0.026	0.19
Loans to non-residents	-	-	-	-
NPL to total gross loans	0.01 (0.38)	27	0.005	0.14
NPL net of provisions to capital	−0.01 (−0.49)	27	0.009	0.24

Notes: *t*-statistics in parentheses.

Table A10 The effects of uncertainty on loan supply and NPLs in Germany.

Dependent var.	Uncertainty	N	R^2	F-stat
Total gross loans	−347.28 (−1.17)	33	0.042	1.37
Loans to residents	−197.53 (−0.76)	33	0.018	0.58
Loans to deposit-takers	−63.50 (−1.03)	33	0.033	1.07
Loans to financial corporations	29.76 (1.28)	33	0.050	1.64
Loans to non-financial corporations	−54.12 (−1.18)	33	0.043	1.39
Loans to other domestic sectors	−126.60 (−1.26)	33	0.048	1.58
Loans to central bank	7.44 (0.11)	33	0.001	0.01
Loans to general government	9.47 (0.39)	33	0.005	0.15
Loans to non-residents	−167.41 *** (−3.50)	33	0.283	12.26 ***
NPL to total gross loans	0.01 (1.40)	11	0.178	1.95
NPL net of provisions to capital	-	-	-	-

Notes: *t*-statistics in parentheses; *** denotes significance at the 1% significance level.

Table A11 The effects of uncertainty on loan supply and NPLs in Greece.

Dependent var.	Uncertainty	N	R^2	F-stat
Total gross loans	−47.05 * (−1.92)	34	0.103	3.69 *
Loans to residents	1.48 (0.09)	34	0.000	0.01
Loans to deposit-takers	−8.33 *** (−5.26)	34	0.463	27.66 ***
Loans to financial corporations	3.04 *** (7.02)	34	0.606	49.23 ***
Loans to non-financial corporations	−1.01 (−0.20)	34	0.001	0.04
Loans to other domestic sectors	12.56 ** (2.29)	34	0.140	5.23 **
Loans to central bank	−4.07 *** (−2.94)	34	0.213	8.65 ***
Loans to general government	−0.68 (−0.06)	34	0.000	0.00
Loans to non-residents	−48.54 *** (−3.84)	34	0.315	14.76 ***
NPL to total gross loans	0.02 *** (4.26)	34	0.361	18.13 ***
NPL net of provisions to capital	0.07 *** (3.34)	34	0.271	11.18 ***

Notes: *t*-statistics in parentheses; *, **, and *** denote significance at the 10%, 5%, and 1% significance levels, respectively.

Table A12 The effects of uncertainty on loan supply and NPLs in Ireland.

Dependent var.	Uncertainty	N	R^2	F-stat
Total gross loans	304.65 *** (2.77)	27	0.234	7.67 ***
Loans to residents	191.77 *** (2.97)	27	0.261	8.83 ***
Loans to deposit-takers	73.97 ** (2.38)	27	0.184	5.66 **
Loans to financial corporations	20.38 *** (3.54)	27	0.334	12.53 ***
Loans to non-financial corporations	47.81 *** (3.22)	27	0.293	10.38 ***
Loans to other domestic sectors	28.90 *** (2.86)	27	0.246	8.19 ***
Loans to central bank	−2.62 (−0.75)	27	0.022	0.56
Loans to general government	23.37 *** (2.57)	27	0.209	6.61 ***
Loans to non-residents	112.87 ** (2.46)	27	0.194	6.05 **
NPL to total gross loans	0.01 (0.08)	27	0.001	0.01
NPL net of provisions to capital	0.03 *** (2.80)	27	0.238	7.84 ***

Notes: *t*-statistics in parentheses; *, **, and *** denote significance at the 10%, 5%, and 1% significance levels, respectively.

Table A13 The effects of uncertainty on loan supply and NPLs in Italy.

Dependent var.	Uncertainty	N	R^2	F-stat
Total gross loans	79.71 (1.23)	40	0.038	1.52
Loans to residents	57.65 ** (2.27)	40	0.119	5.18 **
Loans to deposit-takers	−31.07 *** (−6.06)	40	0.491	36.74 ***
Loans to financial corporations	1.87 (0.12)	40	0.001	0.02
Loans to non-financial corporations	19.18 (1.06)	40	0.029	1.13
Loans to other domestic sectors	70.70 *** (3.34)	40	0.226	11.13 ***
Loans to central bank	−2.13 (−0.83)	40	0.017	0.69
Loans to general government	−0.89 (−0.21)	40	0.001	0.04
Loans to non-residents	22.04 (0.39)	40	0.004	0.15
NPL to total gross loans	0.01 *** (3.36)	43	0.215	11.27 ***
NPL net of provisions to capital	0.04 *** (3.63)	43	0.243	13.20 ***

Notes: *t*-statistics in parentheses; *, **, and *** denote significance at the 10%, 5%, and 1% significance levels, respectively.

Table A14 The effects of uncertainty on loan supply and NPLs in Latvia.

Dependent var.	Uncertainty	N	R^2	F-stat
Total gross loans	1.93 * (1.67)	24	0.112	2.80 *
Loans to residents	2.03 (1.44)	24	0.086	2.08
Loans to deposit-takers	0.10 (1.23)	24	0.064	1.52
Loans to financial corporations	−0.27 (−1.56)	24	0.099	2.42
Loans to non-financial corporations	1.00 (1.44)	24	0.086	2.09
Loans to other domestic sectors	1.19 (1.59)	24	0.103	2.53
Loans to central bank	-	-	-	-
Loans to general government	0.01 (0.29)	24	0.003	0.08
Loans to non-residents	−0.09 (−0.09)	24	0.001	0.01
NPL to total gross loans	0.01 (1.33)	24	0.074	1.77
NPL net of provisions to capital	0.016 (1.08)	24	0.051	1.16

Notes: *t*-statistics in parentheses; *, **, and *** denote significance at the 10%, 5%, and 1% significance levels, respectively.

Table A15 The effects of uncertainty on loan supply and NPLs in Lithuania.

Dependent var.	Uncertainty	N	R^2	F-stat
Total gross loans	−4.27*** (−4.66)	32	0.419	21.71***
Loans to residents	−4.27*** (−4.66)	32	0.419	21.71***
Loans to deposit-takers	−0.16 (−1.00)	32	0.032	1.00
Loans to financial corporations	−0.04*** (−2.96)	32	0.225	8.74***
Loans to non-financial corporations	−1.75*** (−3.83)	32	0.328	14.66***
Loans to other domestic sectors	−1.98*** (−3.59)	32	0.301	12.91***
Loans to central bank	−0.42 (−1.08)	32	0.037	1.17
Loans to general government	0.083 (0.54)	32	0.009	0.30
Loans to non-residents	-	-	-	-
NPL to total gross loans	0.01 (1.55)	32	0.074	2.40
NPL net of provisions to capital	0.01 (0.20)	32	0.001	0.04

Notes: *t*-statistics in parentheses; *, **, and *** denote significance at the 10%, 5%, and 1% significance levels, respectively.

Table A16 The effects of uncertainty on loan supply and NPLs in Luxembourg.

Dependent var.	Uncertainty	N	R^2	F-stat
Total gross loans	−31.14 ** (−2.31)	32	0.150	5.31 **
Loans to residents	−24.07 * (−1.72)	32	0.089	2.95 *
Loans to deposit-takers	−15.71 (−1.42)	32	0.063	2.02
Loans to financial corporations	0.59 (0.20)	32	0.001	0.04
Loans to non-financial corporations	−2.15 (−1.27)	32	0.051	1.61
Loans to other domestic sectors	0.56 (0.22)	32	0.001	0.05
Loans to central bank	−6.50 (−0.46)	32	0.007	0.21
Loans to general government	−0.10 (−0.78)	32	0.019	0.61
Loans to non-residents	−7.09 (−0.57)	32	0.010	0.32
NPL to total gross loans	−0.01 *** (−3.36)	20	0.385	11.30 ***
NPL net of provisions to capital	−0.01 ** (−2.65)	20	0.280	7.03 **

Notes: *t*-statistics in parentheses; *, **, and *** denote significance at the 10%, 5%, and 1% significance levels, respectively.

Table A17 The effects of uncertainty on loan supply and NPLs in Malta.

Dependent var.	Uncertainty	N	R^2	F-stat
Total gross loans	3.38 *** (4.77)	47	0.331	22.76 ***
Loans to residents	3.00 *** (5.65)	48	0.409	31.93 ***
Loans to deposit-takers	−0.01 (−0.25)	48	0.001	0.06
Loans to financial corporations	0.20 *** (4.68)	48	0.322	21.91 ***
Loans to nonfinancial corporations	0.67 *** (5.38)	48	0.386	29.00 ***
Loans to other domestic sectors	1.59 *** (6.52)	48	0.480	42.56 ***
Loans to central bank	0.43 * (1.70)	48	0.059	2.90 *
Loans to general government	0.11 * (1.79)	48	0.065	3.21 *
Loans to non-residents	0.38 * (1.81)	48	0.066	3.27 *
NPL to total gross loans	0.01 (0.21)	48	0.001	0.04
NPL net of provisions to capital	0.01 ** (2.19)	48	0.094	4.81 **

Notes: *t*-statistics in parentheses; *, **, and *** denote significance at the 10%, 5%, and 1% significance levels, respectively.

Table A18 The effects of uncertainty on loan supply and NPLs in the Netherlands.

Dependent var.	Uncertainty	N	R^2	F-stat
Total gross loans	−31.11 (−0.53)	36	0.008	0.28
Loans to residents	56.15 (1.49)	36	0.061	2.22
Loans to deposit-takers	−21.93 *** (−4.00)	36	0.320	16.02 ***
Loans to financial corporations	13.66 (1.14)	36	0.037	1.31
Loans to non-financial corporations	14.85 ** (2.05)	36	0.110	4.22 **
Loans to other domestic sectors	7.67 (0.70)	36	0.014	0.49
Loans to central bank	36.66 (1.39)	36	0.054	1.94
Loans to general government	5.28 * (1.64)	36	0.073	2.70 *
Loans to non-residents	−87.23 ** (−2.27)	36	0.132	5.17 **
NPL to total gross loans	0.01 *** (3.34)	36	0.247	11.17 ***
NPL net of provisions to capital	0.01 *** (2.83)	36	0.190	8.00 ***

Notes: *t*-statistics in parentheses; *, **, and *** denote significance at the 10%, 5%, and 1% significance levels, respectively.

Table A19 The effects of uncertainty on loan supply and NPLs in Portugal.

Dependent var.	Uncertainty	N	R^2	F-stat
Total gross loans	−18.36 (−0.74)	36	0.016	0.55
Loans to residents	−4.84 (−0.26)	35	0.002	0.07
Loans to deposit-takers	0.88 (0.29)	35	0.002	0.08
Loans to financial corporations	−1.14 (−0.73)	35	0.016	0.53
Loans to non-financial corporations	−5.37 (−0.61)	35	0.011	0.37
Loans to other domestic sectors	−0.93 (−0.15)	35	0.001	0.02
Loans to central bank	−0.57 (−0.63)	35	0.012	0.40
Loans to general government	2.29 (1.53)	35	0.066	2.34
Loans to non-residents	−2.28 (−0.30)	35	0.003	0.09
NPL to total gross loans	0.01 (0.56)	30	0.011	0.32
NPL net of provisions to capital	0.01 (0.85)	30	0.025	0.71

Notes: *t*-statistics in parentheses; *, **, and *** denote significance at the 10%, 5%, and 1% significance levels, respectively.

Table A20 The effects of uncertainty on loan supply and NPLs in Slovakia.

Dependent var.	Uncertainty	N	R^2	F-stat
Total gross loans	−1.59 (−0.32)	24	0.004	0.10
Loans to residents	−1.26 (−0.27)	24	0.003	0.07
Loans to deposit-takers	0.01 (0.19)	24	0.001	0.04
Loans to financial corporations	0.02 (0.24)	24	0.002	0.06
Loans to non-financial corporations	0.11 (0.20)	24	0.002	0.04
Loans to other domestic sectors	−1.43 (−0.32)	24	0.004	0.10
Loans to central bank	-	-	-	-
Loans to general government	0.03 (0.46)	24	0.009	0.21
Loans to non-residents	−0.33 (−0.62)	24	0.017	0.38
NPL to total gross loans	−0.01 (−0.12)	24	0.001	0.01
NPL net of provisions to capital	−0.01 (−0.90)	24	0.035	0.81

Notes: *t*-statistics in parentheses; *, **, and *** denote significance at the 10%, 5%, and 1% significance levels, respectively.

Table A21 The effects of uncertainty on loan supply and NPLs in Slovenia.

Dependent var.	Uncertainty	N	R^2	F-stat
Total gross loans	15.16 ** (2.56)	25	0.222	6.56 **
Loans to residents	14.26 ** (2.52)	25	0.216	6.34 **
Loans to deposit-takers	2.31 ** (2.50)	25	0.213	6.25 **
Loans to financial corporations	1.52 ** (2.58)	25	0.224	6.64 **
Loans to non-financial corporations	10.56 ** (2.39)	25	0.199	5.73 **
Loans to other domestic sectors	0.71 ** (2.40)	25	0.199	5.75 **
Loans to central bank	−0.70 (−1.30)	25	0.068	1.69
Loans to general government	−0.15 (−0.29)	25	0.003	0.08
Loans to non-residents	0.89 * (1.73)	25	0.115	3.00 *
NPL to total gross loans	0.01 (0.16)	25	0.001	0.03
NPL net of provisions to capital	0.04 (1.44)	25	0.082	2.06

Notes: *t*-statistics in parentheses; *, **, and *** denote significance at the 10%, 5%, and 1% significance levels, respectively.

Table A22 The effects of uncertainty on loan supply and NPLs in Spain.

Dependent var.	Uncertainty	N	R^2	F-stat
Total gross loans	198.84 (1.26)	45	0.035	1.58
Loans to residents	−63.28 (−0.57)	45	0.007	0.32
Loans to deposit-takers	14.40 (1.04)	45	0.024	1.08
Loans to financial corporations	-	-	-	-
Loans to non-financial corporations	-	-	-	-
Loans to other domestic sectors	−222.97 ** (−2.18)	45	0.099	4.74 **
Loans to central bank	−1.50 (−0.19)	45	0.001	0.04
Loans to general government	146.78 *** (2.98)	45	0.171	8.91 ***
Loans to non-residents	-	-	-	-
NPL to total gross loans	0.01 *** (2.77)	45	0.151	7.68 ***
NPL net of provisions to capital	0.02 ** (2.35)	45	0.113	5.52 **

Notes: *t*-statistics in parentheses; *, **, and *** denote significance at the 10%, 5%, and 1% significance levels, respectively.

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