Impact of Macroeconomic and Institutional Factors on Banks Assets' Quality: Results from Stress Tests Exercises

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Abstract

The economic crisis put financial and banking sector on the viewfinder of regulators and policymakers all across EU and the rest of the world. Indeed, the improvement of the quality of banks' balance sheet has proved crucial for economic stability and growth.

In this paper, we use several panel specifications to provide an innovative viewpoint of the impact of macroeconomic and institutional factors on quality of banks loans portfolio, using the variability along the geographical dimension, based on European stress tests and transparency exercises. Our results about macroeconomic and institutional factors are consistent with the relative literature, controlling for individual banks dimension.

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Keywords: Macro stress testing, defaulted assets, banking sector, macroeconomic conditions.

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I. Introduction

During the last two decades, the banking and financial sectors have experienced worldwide major transformations and it is unequivocal among economists researchers and academics that the banking sector plays an important role on economic activity. A sound, deep and efficient banking and financial sector is better able to withstand negative shocks and therefore would contribute to the financial system stability. Conversely, besides idiosyncratic factors, banking performance may be influenced by macroeconomic context.

Indeed, banking performance determinants can widely be separated into three main sub-groups: economic determinants (the macroeconomic situation but also the microeconomic context), individual factors (quality of management, prudential ratios, past performance…) and institutional determinants (such as the quality, the independence or the efficiency of the legal framework). The role played by economic determinants is widely analyzed in banking literature, but calculations do not necessarily control for all relevant factors and may be biased due to omitted variables.

The problematic of this article is to review the findings from literature on the influence of economic factors on banking performance, using a detailed database that should enable to control for other factors, especially the ones linked to individual banks. Using data from macroeconomic stress tests[1] from the European Banking Authority (EBA) and a panel specification with fixed effects we quantify the impact of the macroeconomic situation on the quality of banks' loans portfolio (proxied by Defaulted Asset ratio, DA hereafter). The micro level of the dataset and the nature of data allow us to control for bank and country specific factors. This is one of the main contributions of the present paper to the literature.

[1] To have a review of stress test methodologies, see Sorge (2004) or more recently IMF (2012) or Borio, Drehmann and Tsatsaronis (2012). For an overview of national authorities' framework, one can see Foglia (2009).

We consider here total loans of banks detailed by destination countries in to run our panel specification. The database also enables to cover European Union countries plus Norway for banks of origin (except countries for which banks are too small to fit the criteria of the EBA). Besides, the panel specification allows controlling for unobserved effects from the bank of origin. Indeed, the characterization of idiosyncratic factors is crucial because individual heterogeneity can lead to biases in estimations and contribute to a misinterpretation of the relationship between variables[3].

Our results are in line with previous results on this topic and highlight that macroeconomic variables such as the output gap, the unemployment rate, or the inflation rate play a role in the quality in banks loans portfolio. The findings also underline the significant impact of credit market regulation.

Our article is organized as follows: the second section describes related literature, in a third section the dataset used is described and mains findings of the econometric framework are found in the fourth section. While the robustness of our findings is discussed in the fifth section, the sixth section concludes.

[3]To have more information on bias in panel analysis one can refer to Hsiao (2007) or Buddelmeyer et al. (2008) for example.

II. Literature

It is clear and unequivocal in the literature that banking performance has economic determinants. Berger and De Young's (1997) study was one on the first on this topic. They wanted to test, thanks to Granger-causality techniques, four hypotheses ("bad luck" "bad management" "skimping" and "moral hazard") to study the relationship between loan quality, cost efficiency and bank capital. Along the same lines Louzis et al. (2012) have resumed these hypotheses to test the macroeconomic and bank specific determinants of NPLs (Non-Performing Loans). They improved the Granger causality-framework by applying GMM and dynamic panel estimators. Both these empirical studies retained the "bad management" hypothesis.

Macroeconomic factors that may have an influence are quite numerous a priori. As in De Bock and Demyanets (2012), Jakubik and Reininger (2013) and Beck et al. (2013), we expect that a drop in the economic activity leads to deterioration a quality of banks' loan portfolio and thus an increase in the defaulted asset (DA, calculated as DA assets divided by total assets) ratio. It may also reflect other effects.

Inflation could have either a positive or a negative sign. Indeed, on the one hand we could expect that a high inflation that reduces debt servicing helps to deleveraging and therefore leads to reduce DA ratio[4]. Moreover, as Phillip's curve suggests, a high inflation is associated with low unemployment, this latter being positively correlated to DA ratio. Hence inflation could be, on this assumption negatively associated with NPL ratio. On the other hand, in a Keynesian model, at least in a short-run, wages are sticky; a high inflation could then weaken the deleveraging capacity of borrowers (Klein 2013). The overall effect of inflation is thus undetermined (Nkusu2011).

Unemployment is expected to be positively linked to the DA ratio. Indeed, a rise of unemployment could weaken ability to service debt by reducing real income and could be consequently associated positively to DA ratio (Nkusu (2011) and Klein (2013)).

As regards the impact of institutional constraints, Haselmann et al. (2010) for example, studied the effect of legal change on the lending behaviour of banks in Central Eastern

[4]The definition of Defaulted assets is the same as NPLs, namely a past due that exceeds 90 days. However this threshold could be higher for several asset classes for which it is 180 days (for corporates and retail exposure).

European countries thanks to a difference to difference methodology. Their results highlight a positive link between formal legal changes and lending. They also documented that foreign banks benefit more from legal changes than national banks. Unlike Haselmann et al. (2010) our aim is less to focus on volume of loans than quality of loans. Yet, their main specifications will be considered as a reference and improved on some aspects, using the variability of banks portfolio quality depending on counterpart countries, controlling for structural banks' characteristics.

III. Dataset used

The main dataset used in this article, which refers to data of balance sheet of banks, comes from the annual dataset of the EBA [5] European Banking Authority). The scope of consolidation is the perimeter of the banking group as defined by the CRR/CRD IV. We notice that insurance activities are not included in balance sheet data.

In 2014 the EU-wide stress test exercise is carried out on a sample of 123 banks covering at least 50%[6] of the national banking sector in each EU Member State and Norway, as expressed in terms of total consolidated assets as of end of 2013.

There is not any stress test for 2015; the EBA provides instead a transparency exercise. Unfortunately, transparency exercises do not focus exactly on the same data which will not allow any temporal comparison. Following a wide-ranging exercise in 2014, the EBA decided to focus on a more homogeneous sample of large banks, to ensure greater comparability while ensuring a significant coverage of EU banking assets. The 2016 EU- wide stress test exercise is carried out on a sample of 51 banks from 15 EU and EEA countries. The sample is supposed to cover 70% of the banking sector in the Eurozone, in each non-Eurozone EU member State and in Norway and, to be included, banks should have a minimum of EUR 30 bn[7] in terms of total consolidated assets. This may reflect the will of regulators to frame systemic financial institutions activity.

[5] To get more information on the dataset, see the EBAs methodological notes for 2014 and 2016 respectively. https://www.eba.europa.eu/documents/10180/669262/Methodological+Note.pdfhttps://www.eba.europa.eu/documents/10180/1259315/2016+EU-wide+stress+test-Methodological+note.pdf

[6] http://www.eba.europa.eu/documents/10180/669262/FAQs+on+EU-wide+stress+test.pdf/2ab790e8-ca25-43ce-9041-8fa86277e7ba

[7] This threshold is consistent with the criterion used for inclusion in the sample of banks reporting supervisory reporting data to the EBA, as well as with the ECB-Banking Supervision definition of a significant institution.

The data provided by the EBA brings us information about granular credit risk of individual banks of the sample. In order to have a proxy for the quality of bank loans portfolio we use the ratio of Defaulted Assets which is computed as the ratio of the defaulted exposure divided by the total exposure of a considered bank to a specific country on a specific year. An asset is qualified as defaulted if its past due is above 90 days.

Other variables come from IMF (World Economic Outlook (WEO) and International Financial Statistics (IFS)) and from Fraser Institute (see table hereafter).

Table: Main macroeconomic and legal variables used

Variable Name	**Variable Description**	**Data Source**
GDP growth rate (k,t-1)	Growth rate of the Gross Domestic Product on current prices for home country k of bank i	W.E.O
GDP growth rate (j,t-1)	Growth rate of the Gross Domestic Product on current prices for country of destination of bank i	W.E.O
Output Gap (j,t-1)	Output Gap in percentage of GDP	W.E.O
Inflation (j,t)	The annual percent change in consumer prices	W.EO
Domestic credit to GDP (j,t)	Domestic credit to the private sector by financial corporations	I.F.S
Credit Market regulation (j,t)	Composite Index on Credit market regulation. It reflects conditions in the domestic credit market. A first sub-component (ownership of banks) record the ownership of banks, the two lasts sub-component (private sector credit and interest rate control) indicate the extent to which credit is applied to the private sector and whether controls on interest rate interfere with the loan market	Fraser Institute
Property Rights (j,t)	It records the level of the legal framework related to property rights. Higher value this is associated with efficient legal system that enhances economic activity.	Fraser Institute
Administrative Requirements (j,t)	Sub component of Business regulation index, this sub-index records to which extent administrative requirements inhibit economic activity	Fraser Institute
Start a business (j,t)	This other component of Business regulation records the regulatory costs needed to start an economic activity	Fraser Institute

Creditor Participation (j,t)	This index records in which extent creditors are included in court decisions	Doing Business
Unemployment Rate (j,t)	Correspond to the growth rate of the Unemployment rate	W.E.O
Costs to Resolve Insolvency (j,t)	The estimated cost of the insolvency proceeding for the study case, reported as a percentage of the value of the insolvency estate, borne by all parties. Costs include court/bankruptcy authority costs, attorney fees, bankruptcy administrator fees, accountant fees, notification and publication fees, assessor or inspector fees, asset storage and preservation costs, auctioneer fees, government levies and other associated insolvency costs.	Doing Business

The correlation matrix of main macroeconomic explanatory variables is as follows:

	GDPk(-1)	GDPj(-1)	Output gap(-1)	Unemployment rate	Inflation	Domestic credit to GDP	Credit Market Regulations
GDPk(-1)	1.00						
GDPj(-1)	0.40	1.00					
Output gap(-1)	0.15	0.60	1.00				
Unemployment rate	-0.25	-0.59	-0.87	1.00			
Inflation	0.20	0.49	0.19	-0.20	1.00		
Domestic credit to GDP	0.05	-0.26	-0.42	0.46	-0.04	1.00	
Credit Market Regulations	0.04	-0.05	0.07	-0.15	-0.20	-0.34	1.00

The correlation matrix of main institutional explanatory variables is as follows:

	GDPk(-1)	GDPj(-1)	Output Gap(j,t-1)	Property Rights(j,t)	Credit Market Regulation(j,t)	Start a Business(j,t)	Administrative requirement (j,t)
GDPk(-1)	1.00						
GDPj(-1)	0.40	1.00					
Output Gap	0.15	0.60	1.00				
Property Rights (j,t)	0.37	0.34	0.55	1.00			
Credit Market Regulation (j,t)	0.08	-0.10	0.01	-0.14	1.00		
Start a Business (j,t)	-0.05	0.10	0.13	-0.03	-0.01	1.00	
Administrative requirement (j,t)	0.23	0.45	0.53	0.85	-0.28	-0.09	1.00

Most macroeconomic variables in countries of destination (GDP, output gap, unemployment rate, inflation) are quite highly correlated and thus specifications mixing them altogether (last columns of tables of results) should be read keeping in mind they are partly collinear.

As regards credit market regulations, the only correlation that is sizeable is with domestic credit to GDP with a negative coefficient, which is logical since increased regulations should deter granting of credit, all things being equal.

For institutional variables the matrix of correlation highlights no excessive correlation except for the administrative requirement and the index related to property rights (0.85). It is not surprising given that administrative requirements are somewhat encompassed by the property right index through intellectual property rights for example.

IV. Econometric results

The main reference specification is taken from Haselmann et al. (2010), using bank-level data:

$$y_{j,t} = \alpha_t + \alpha_i + \gamma.X_{j,t} + \delta.CreditorRights_{j,t-1} + \varepsilon_{j,t} \quad (1)$$

Where i indexes banks, j indexes countries, and t indexes years. The logarithm of loans is denoted by $y_{i,t}$. The year fixed effects and the bank fixed effects are given respectively by α_t and α_i. The set of control variables is referred to as $X_{i,t}$. Bank-specific control variables are the logarithm of assets, as well as the solvency and liquidity ratio. In order to control for the macroeconomic environment a bank operates in, they include the lending and deposit rate, GDP, inflation rate, measures for the size and concentration of the credit markets, as well as the market share of each bank. $CreditorRights_{j,t-1}$ is their legal variable. Their variable of interest is δ. It captures the sensitivity of the dependent variable to the legal change.

Our specification uses the following regression, with $Y_{i,t}$ the defaulted asset ratio, α_t and α_k time and country of origin of the bank fixed effects respectively, $X_{i,t}$ the main macroeconomic factors, are used separately or together. In a more restrictive specification that enables to control for banks' dimension, α_i fixed effects are added, controlling for banks individual factors. Moreover, data granularity allows us to control for asset classes dimension controlling for portfolio composition effects for robustness concerns.

$$Y_{i,j,t} = \alpha_t + \alpha_k(+\alpha_i) + \gamma.X_{j,t} + \delta.CreditMarketRegulations_{j,t} + \varepsilon_{i,j,t} \quad (2)$$

Since the period is short compared to the cross-country dimension, banks characteristics should not evolve much over time and thus including banks fixed effects should capture most individual banks' dimensions.

This particularity of our data is not unique, in macroeconomic studies, individual dimension is often larger that time dimension. This characteristic is not neutral.

Indeed, the choice of the model is dependent on dataset structure and sample characteristics (Hausman (1978)). When time dimension is low for example, as it is often the

case in macro-econometric studies, there may be rather important differences between panel estimators. If the sample is chosen in a non-randomly way, then the statistical inference is conditional to the sample and this is likely the fixed effect model that must be retained. On the opposite, if the sample is drawn randomly among a large population, the inference is no longer conditional, and we can generalize the estimates to the whole population and retain random effects.

About the sample selection one can doubt that the sample chosen by the EBA to carry stress test exercises is drawn randomly, even if it would be the case, the rather important coverage of data nuances the conditional inference. However, the computation needs to estimate numerous coefficients (as many as fixed effects) that lower the degree of freedom of parameters estimated and could lead to biased estimations and lower robustness of results.

While fixed effects specifications introduce correlation between individual effects and explanatory variables, the random effect specification postulates the exogeneity of individual heterogeneity. The Hausman (1978) test is displayed in annex A. This test is based on the null hypothesis that individual unobserved characteristics are not correlated to explanatory variables. This test thus considers random effect under the null hypothesis. The rejection of Hausman test at 5% level of confidence lead us to reject the null hypothesis and consider the fixed effects specification (p-value=0.0208). However, as this test is based on several restrictive assumptions on data structure, we performed random effects model to robustness issues. Results of robustness checks are presented in the following section.

Our findings highlight that although explanatory variables are not systematically significant, signs of coefficients associated with interest variables are as expected both by theoretical assumptions and related literature. Moreover, unlike Haselmann et al. (2010) we control for numerous fixed effects that, while controlling for unobserved characteristics, should also lower significance of coefficients. The sign of GDP growth rate lagged by one period is in accordance with previous studies (Nkusu (2011) and Klein (2013)) that highlight a positive impact of economic activity on loan quality by a positive income effect. The output gap is also negatively correlated to DA ratio even if the coefficient is not significant. By a negative income effect, the unemployment rate is positively correlated to DA ratio, results being significant at 5% level when controlling for origin country and time fixed effects (Table 1.1) and at 10% level when controlling for origin country, bank characteristics and time fixed effects. Inflation is found, negatively correlated to DA ratio. We notably find that credit market regulation play an important role in asset quality for European bank (Table 1.1 and 1.2). Namely an increase of

credit market regulation index by one would decrease the DA ratio by near 0.015 point. We can notice that this effect is relatively robust to the addition of fixed effects, when controlling for origin country and time fixed effects the increase of credit market regulation index by one point would decrease DA ratio by 0.0146 point and 0.0143 point when controlling for origin country, time and bank characteristics.

Table 1: Influence of macroeconomic and regulation factors with time and country of origin of banks fixed effects

	Dependent variable: defaulted asset rate in country j on year t of bank i from country k						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
GDP growth rate (k,t-1)	0.0006	-0.0007	0.0000	0.0004	0.0009	-0.0001	0.0006
	(0.0016)	(0.0012)	(0.0017)	(0.0011)	(0.0012)	(0.0011)	(0.0015)
GDP growth rate (j,t-1)	-0.0005						0.0004
	(0.0011)						(0.0024)
Output gap (j,t-1)		-0.0023*					-0.0011
		(0.0013)					(0.0031)
Unemployment rate (j,t)			0.0010**				0.0003
			(0.0004)				(0.0009)
Inflation (j,t)				-0.0012			-0.0076
				(0.0032)			(0.0048)
Domestic credit to GDP (j,t)					0.0000		-0.0000
					(0.0000)		(0.0001)
Credit market regulation (j,t)						-0.0074**	-0.0146***
						(0.0037)	(0.0033)
Constant	0.0485***	0.0392***	0.0358***	0.0518***	0.0449***	0.1181***	0.1921***
	(0.0095)	(0.0120)	(0.0096)	(0.0143)	(0.0147)	(0.0325)	(0.0376)
Year (t) fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country of origin (k) fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank (i) fixed effects	No	No	No	No	No	No	No
R^2	0.043	0.056	0.045	0.052	0.054	0.070	0.085
RMSE	0.114	0.063	0.115	0.073	0.074	0.082	0.067
N	3564	1743	3576	1738	1692	2188	1314

Note: Robust standard errors are clustered at country of destination*time level and are in parenthesis.
***, ** and * indicate respectively significance at the 1%, 5% and 10% levels.
The number of observations in the estimates depends on data availability.

Table 2: Influence of macroeconomic and regulation factors with time, country of origin of banks and banks fixed effects

	Dependent variable: defaulted asset rate in country j on year t of bank i from country k						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
GDP growth rate (k,t-1)	0.0011	-0.0015	0.0003	0.0010	0.0017	0.0001	0.0008
	(0.0021)	(0.0015)	(0.0022)	(0.0011)	(0.0012)	(0.0010)	(0.0012)
GDP growth rate (j,t-1)	-0.0006						0.0003
	(0.0012)						(0.0021)
Output gap (j,t-1)		-0.0022*					-0.0002
		(0.0014)					(0.0027)
Unemployment rate (j,t)			0.0009*				0.0005
			(0.0005)				(0.0009)
Inflation (j,t)				-0.0017			-0.0082*
				(0.0032)			(0.0042)
Domestic credit to GDP (j,t)					0.00009*		0.0000
					(0.00005)		(0.0001)
Credit market regulation (j,t)						-0.0072**	-0.0143***
						(0.0036)	(0.0027)
Constant	0.0135*	0.0112	0.0053	0.0125	-0.0032	0.0912**	0.1881***
	(0.0081)	(0.0080)	(0.0104)	(0.0077)	(0.0085)	(0.0356)	(0.0337)
Year (t) fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country of origin (k) fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank (i) fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.079	0.138	0.081	0.114	0.119	0.119	0.176
RMSE	0.114	0.062	0.115	0.073	0.074	0.082	0.066
N	3564	1743	3576	1738	1692	2188	1314

Note: Robust standard errors are clustered at country of destination*time level and are in parenthesis.
***, ** and * indicate respectively significance at the 1%, 5% and 10% levels.
The number of observations in the estimates depends on data availability.

V. Robustness checks

To ensure the robustness of our results we performed alternatives specifications. We first run random effects specification that lead to widely same results as fixed effects specification. Namely for credit market regulation, the coefficient associated to this variable is equal to 0.146 and 0.0143 in fixed effects specifications (respectively models (7) of table 1. and 2.) and is equal to 0.168 and 0.163 in random effect models (respectively model (7) in table 1.1 and 2.1). The effect of credit market regulation is found to be robust to the addition of fixed effects and to alternative specifications. We also run alternative specifications with other variables related to institutional and legal framework. We find that the costs associated with introducing a new product or to start an entrepreneurship activity are positively and significantly correlated to a lower loan quality. Namely an increase of administrative requirements would increase the DA ratio from 0.0008 to 0.02 point depending on specifications (Table 2.2 models (4) to (6)). In a similar way costs associated to start a business activity are positively associated with a lower loan quality. An increase of costs to start a business index would increase DA ratio from broadly 0.02 to 0.03 point depending on fixed effects. We also performed alternative model where error components term is clustered in an i*j dimension (i.e on each year we have bank-country pairs). Results presented in table 2.2 model (4) to (6) are in line with previous ones available on the same table on model (1) to (3). Some aspects related to insolvency framework have been introduced to give a larger scope of legal and institutional variables. Results presented in table 2.3 would suggest that insolvency regimes aspects are important when discussing rigorously about the impact of institutional framework on loan quality. Namely we find that the costs of insolvency procedure are positively associated to DA rates. If the costs of procedure increase, a firm that is already financially distress would be penalized by this additional cost and is more likely to get into bankrupt. On this opposite, the participation of creditor in court procedure seems to be negatively associated with DA rates, a one-point increase on this index would imply a reduction a DA ratio by (0.01%). This results would suggest that creditor friendly institutional frameworks are associated with higher loan quality These effects are robust to fixed effects addition.

The results of robustness checks seem to highlight that our main results are robust to the econometric specification (FE or RE), to the addition of numerous fixed effect, to alternative variables, with institutional variables inducing more rigidities having unfavorable effects on assets quality, and to the error component structure.

Table 1.1: Influence of macroeconomic and regulation factors with time and country of origin of banks fixed effects

Dependent variable: defaulted asset rate in country j on year t of bank i from country k random effects regressions							
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
GDP growth rate (k,t-1)	0.0022	0.0015	0.0011	0.0009	0.0022	0.001	0.004
	(0.0022)	(0.0019)	(0.0022)	(0.00187)	(0.002)	(0.001)	(0.002)
GDP growth rate (j,t-1)	-0.0024**	-0.004**	-0.001	-0.0025	-0.00202	-0.00210	-0.002
	(0.0012)	(0.0016)	(0.001)	(0.0015)	(0.00155)	(0.00125)	(0.002)
Output Gap (j,t-1)		-0.00244**					0.0007
		(0.00124)					(0.002)
Unemployment rate (j,t)			0.00147**				0.00066
			(0.000544)				(0.0009)
Inflation (j,t)				0.000126			-0.0053
				(0.00306)			(0.0053)
Domestic credit to GDP (j,t)					0.00444		-0.000049
					(0.00558)		(0.00009)
Credit market regulation (j,t)						-0.0111***	-0.0168***
						(0.00350))	(0.004)
Constant	0.0830***	0.0868***	0.0714***	0.0847***	0.0851***	0.191***	0.252***
	(0.0117)	(0.0195)	(0.0137)	(0.0168)	(0.0174)	(0.0342)	(0.054)
Year (t) fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country of origin (k) fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank (i) fixed effects	No	No	No	No	No	No	No
R^2	0.09	0.14	0.09	0.13	0.14	0.07	0.18
N	3564	1848	3549	1868	1813	2295	1401

Note: Robust standard errors are clustered at country of destination*time level and are in parenthesis.

*****, **, and * indicate respectively significance at 1%, 5% and 10% levels.**

Table 2.1: Influence of macroeconomic and regulation factors with time, country of origin of banks and banks fixed effects

Dependent variable: defaulted asset rate in country j on year t of bank i from country k random effects regressions							
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
GDP growth rate (k,t-1)	0.0036	0.0024	0.003	0.0033	0.00473*	0.00473*	0.0060**
	(0.0027)	(0.0023)	(0.001)	(0.00239)	(0.00263)	(0.0026)	(0.027)
GDP growth rate (j,t-1)	-0.002**	-0.004**	-0.0014	-0.00284*	0.0022	-0.0028***	-0.0022
	(0..001)	(0.0015)	(0.0013)	(0.00155)	(0.00158)	(0.0011)	(0.002)
Output Gap (j,t-1)		0.0005			0.0001		0.0006
		(0.0014)			(0.00006)		(0.0026)
Unemployment rate (j,t)			0.0011**				0.0006
			(0.00056)				(0.0008)
Inflation (j,t)				0.00093			-0.006
				(0.0032)			(0.0049)
Domestic credit to GDP (j,t)					0.00010		-0.00001
					(0.0006)		(0.00008)
Credit market regulation (j,t)						-0.0115***	-0.0163***
						(0.03)	(0.0391)
Constant	0.0554**	0.0715**	0.0457*	0.0565*	0.0433	0.159***	0.222***
	(0.0219)	(0.0264)	(0.0231)	(0.0221)	(0.0251)	(0.036)	(0.0510))
Year (t) fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country of origin (k) fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank (i) fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.09	0.14	0.09	0.13	0.14	0.13	0.18
N	3564	1848	3549	1868	1813	2295	1401

Note: Robust standard errors are clustered at country of destination*time level and are in parenthesis.

*****, **, and * indicate respectively significance at 1%, 5% and 10% levels.**

Table 2.2 Robustness check with other legal and institutional indicators

Dependent variable: defaulted asset rate in country j on year t of bank i from country k fixed effect estimations						
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
GDP growth rate (k,t-1)	0.00484**	0.00522**	0.00559**	0.00484*	0.00522*	0.00559*
	(0.00203)	(0.00213)	(0.00214)	(0.00240)	(0.00238)	(0.00240))
GDP growth rate (j,t-1)	-0.00563*	-0.00629**	-0.00647**	-0.00563**	-0.0062***	-0.0064***
	(0.00296)	(0.00308)	(0.00306)	(0.00181)	(0.00183)	(0.00185)
Output Gap (j,t-1)	0.000271	0.000127	0.0000844	0.000271	0.000127	
	(0.00350)	(0.00371)	(0.00360)	(0.00219)	(0.00195)	-0.00278
						(0.00650)
Property Rights (j,t)	-0.00519	-0.00211	-0.002			0.00834*
	(0.00656)	(0.00845)	(0.0087)			(0.00447)
				-0.00519	-0.00211	
				(0.00759)	(0.00649)	
Administrative Requirements (j,t)	0.00847	0.00780	0.0083	0.00847*	0.00780*	0.0264* *
	(0.00604)	(0.00617)	(1.31)	(0.00498)	(0.00447)	(0.0104)
Start a business (j,t)	0.030*	0.0269*	0.026*	0.0307***	0.0269***	0.127
	(0.016)	(0.01)	(0 .015)	(0.0113)	(0.0103)	(0.123)
Constant	-0.196	-0.122	-0.127	-0.196	-0.122	
	(0.176)	(0.173)	(0.17)	(0.116)	(0.117)	
Year (t) fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Country of origin (k) fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Bank (i) fixed effects	No	Yes	Yes	No	Yes	Yes
Asset Class fixed effects	No	No	Yes	No	No	Yes
Cluster structure for error component term	j*t	j*t	j*t	i*j	i*j	i*j
R^2	0.072	0.161	0.170	0.070	0.161	0.177
RMSE	0.090	0.090	0.089	0.092	0.090	0.090
N	1679	1679	1679	1679	1679	1679

Note: Robust standard errors are clustered at country of destination*time level and are in parenthesis.

*****, **, and * indicate respectively significance at 1%, 5% and 10% levels.**

Table 2.3 Regressions with aspects of insolvency regimes

Dependent variable: defaulted asset rate in country j on year t of bank i from country k fixed effect estimations			
	(1)	(2)	(3)
GDP growth rate (k,t-1)	0.00108	-0.000774	-0.00106
	(0.00242)	(0.00172)	(0.00185)
GDP growth rate (j,t-1)	-0.0000117	0.000207	-0.0000447
	(0.00124)	(0.00117)	(0.00123)
Unemployment Rate (j,t)	0.00310*	0.00493***	0.00578***
	(0.00171)	(0.00165)	(0.00162)
Costs to Resolve Insolvency (j,t-1)		0.00365***	0.00462***
		(0.000864)	(0.000760)
Creditor Participation (j,t)			-0.0161*
			(0.00980)
Constante	-0.0229*	-0.0825***	-0.0833**
	(0.0127)	(0.0172)	(0.0283)
Year (t) fixed effects	Yes	Yes	Yes
Country of origin (k) fixed effects	Yes	Yes	Yes
Bank (i) fixed effects	Yes	Yes	Yes
R^2	0.11	0.12	0.12
RMSE	0.10	0.107	0.10
N	3539	3206	2976

Note: Robust standard errors are clustered at country of destination*time level and are in parenthesis.

****, **, and * indicate respectively significance at 1%, 5% and 10% levels.*

VI. Conclusions

The aim of this paper is to study macroeconomic and institutional determinants of loan quality for European banking sector from 2013 to 2016 thanks to a novel granular panel dataset provided by the EBA. Unlike Haselmann et al. (2010) we control for numerous unobserved characteristics linked to banks, origin countries and period. The results, in line with previous studies on this topic, highlight the relative importance of legal and more broadly institutional factors on bank loan quality of European banks. Further research should focus each aspect independently to investigate on underlying mechanisms of loan quality formation. Standard economic determinants, although somewhat less significant, record expected correlation with loans quality and the costs associated to a legal system are found to reduce loan quality. These findings could be relevant for policy purposes on banking regulation.

Annex A. Econometric Framework

Table A.1 Hausman Test for Random versus Fixed Effects Panel Specification for k and t fixed effects.

	Coefficients			
	Fixed Effects	Random Effects	Coefficient difference	Standard Errors difference
GDP growth rate (k,t-1)	0.015	0.004	0.011	0.007
GDP growth rate (j,t-1)	-0.008	-0.002	-0.006	0.006
Output Gap (j,t-1)	-0.006	0.0007	-0.007	0.0097
Unemployment rate (j,t)	-0.021	0.00066	-0.022	0.0117
Inflation(j,t)	0.024	-0.005	0.030	0.012
Domestic credit to GDP (j,t)	0.0008	-0.00004	0.0009	0.0017
Credit market regulation (j,t)	0.0992	-0.016	0.11	0.0507
	Test: H_0: difference in coefficients not systematic			
	$\chi^2(8) = 19.57$			
	Prob> $\chi^2 = 0.0208$			

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