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The determinants of banking crises: Further evidence

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ABSTRACT

This paper employs a new dataset of 36 EU and OECD countries for the period 1961–2012 to test the importance of economic inequality in banking crises and to find new determinants of them. We estimated a panel logit model with population-averaged results, capturing the most relevant crisis determinants in the literature. By analyzing the impact of inequality on the risk of a banking crisis, we found a new transmission channel of inequality to a financial recession via deficit and obtained a significant and robust positive impact of inequality on the bank crisis probability. We also found evidence that distance to USA, France and Japan decreases the likelihood of a financial crisis. Finally, and contrary to the theory, we found a new determinant that increases the likelihood of a crisis: the accumulated experience of VAT.

Keywords: Banking Crisis, Inequality, Geographical Distance, VAT experience, Post-Keynesian Economics

JEL Classification: G01, H62, H25, I32, E12

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1. Introduction

Many papers have analyzed theoretically the post-Keynesian view that considers the influence of inequality on financial crises (Claessens and Perotti, 2007; Rajan, 2010; Kumhof and Rancière, 2011; inter alia), but none of them have tested the impact of inequality as a determinant of banking crises using a multivariate logit model. Regarding the link between inequality and banking crises, Morelli and Atkinson (2015) state that "the overall evidence is far from being conclusive and there are several reasons to shed further light on this important research topic". As far as we are aware, this is the first paper to apply this methodology to test the influence of inequality on financial crises. The multivariate logit model has been used in the literature to test the post-Keynesian view and to find new determinants of the probability of a financial crisis. We also use that methodology to explain determinants and transmission channels of a crisis.

In this paper we aim to shed new light on the topic. To further our knowledge, we employ a new dataset of 36 EU and OECD countries for the period 1961–2012 to study the importance of inequality on banking crises and its determinants. We estimated a panel logit probability model with population-averaged results, capturing the most relevant crisis determinants in the literature. We analyzed the impact of economic inequality on the risk of a banking crisis, studying new transmission channels of inequality to a financial recession. We also used a geographical distance variable different from those used before and tested the importance of the Value Added Tax (VAT) experience as a new determinant of the likelihood of a banking crunch. A high explanatory model of banking crises is achieved. We found a significant and robust impact of inequality and the new variable variant of distance on the bank crisis probability. Inequality increases the likelihood of a crisis, and the distance variable decreases this risk. We also found a new channel of inequality interaction affecting the probability of a banking crisis. Finally, we found that the VAT experience is also a significant and robust factor that increases the financial crunch risk.

The paper is divided into six sections. The second section contains the literature review of the topic and the third explains data and methodology, using a multivariate logit panel data model. The empirical results are provided in the fourth section. The main results are the corroboration of the post-Keynesian view by a significant and robust

positive impact of inequality on the likelihood of a banking crisis, the presence of a transmission channel of inequality to the banking crunch via deficit, and the robust and significant influence of VAT experience on the dependent variable. We also observed that it is not only the geographical distance from the United States (USA) that reduces the likelihood of a financial crisis, as Ye and Han (2010) show, but also the geographical distance from the sum of the bilateral distances to the USA, Japan and France. The fifth section discusses the results and, finally, the sixth section provides conclusions and final remarks.

2. Literature review

Recently, several studies have aimed to explain banking crises. Boudriga and Ghardallou (2012) provide a good review of the literature of banking crisis determinants. Gavin and Haussmann (1996) provide theoretically a seminal study of the main factors that trigger a banking crisis, related to liberalization, banking competition, regulation of deposit interests, information, macroeconomic volatility, capital assets ratio, bank liquidity, monetary policy and lending booms.

A relevant analysis of banking crises is carried out by Demirguc-Kunt and Detragiache (1998). They estimate the probability of banking crises using a multivariate logit model. To capture adverse macroeconomic shocks, they use the rate of growth of real GDP, the external terms of trade and the real short-term interest rate. High short-term real interest rates affect bank balance sheets adversely if banks cannot increase their lending rates quickly enough. Financial liberalization may increase banking sector fragility since risk taking and fraud are more likely. They introduce the ratio of credit to the private sector to GDP to capture financial liberalization, in addition to the real interest rate. Another proxy they use is lags of the change in real credit. Inflation is introduced as a measurement for macroeconomic mismanagement. Furthermore, the rate of depreciation of the exchange rate is used to test if bank crises are driven by excessive foreign risk exposure. In addition, they introduce the ratio of M2 to foreign exchange reserves as a predictor of balance of payment crises. Government surplus as a percentage of GDP is used to capture the financial needs of the public administration. They provide two reasons: first, a high surplus involves postponing measures to strengthen bank balance sheets, and second, a failure to control the budget deficit is an impediment to successful

financial liberalization, which creates problems for banks. The last relevant variable is the ratio of bank cash and reserves to bank assets.

Other studies that incorporate new variables, such as Beck et al. (2006), find that bank concentration increases banking crisis probability. Hardy and Pazarbasioglu (1999) also include consumption and investment variables. They find that a consumption boom in the years prior to a crisis can be a good indicator of banking crises. These authors state that "banking crises are associated with a sharp decline in the real effective exchange rate, but an appreciation in this rate often precedes a crisis". The arguments they give are that adverse terms of trade shock and a real exchange rate appreciation affect the competitiveness of the economy and lead to a deterioration in the profitability of the corporate sector. The correction of that phenomenon by a depreciation of the exchange rate leads to losses for corporations indebted in foreign currency.

Rose and Spiegel (2009) include exports GDP ratio as a factor of a financial crisis, but without strong evidence. Büyükkarabacak and Valev (2010) differentiate private credit from household and enterprise credit. Ye and Han (2010) show that financial contagion decreases with geographical distance from the United States, which was the center of the 2008 subprime mortgage crisis, and that the closer the distance to that center, the greater the effect. Boudriga and Ghardallou (2012) find that deterioration in competitiveness is associated with an increased risk of problems in the banking sector.

The importance of inequality on banking crises has been theoretically explained by Claessens and Perotti (2007), Rajan (2010) and Kumhof and Rancière (2011) who propose that an increment in inequality led to a credit boom and finally to a financial crisis in the USA at the beginning of the 21st century as it did in the 1920s. Atkinson and Morelli (2011) find that income inequality and banking crises seem not to be linked. The results of Bordo and Meissner (2012) also suggest there is no significant relationship between inequality and credit booms. Stockhammer (2013), based on post-Keynesian theory, identifies channels by which inequality has contributed to crises[1].

Finally, the literature that relates the experience of VAT with a financial crisis (Gale and Harris, 2011) states that VAT leads to a deficit reduction, and these authors affirm,

[1] First, an increase in inequality leads to a decrement in aggregate demand since poorer countries have high propensities to consume. Second, international financial deregulation leads to larger current account deficits and for a longer period. Third, rising inequality leads to a higher household debt. Fourth, higher inequality raises the propensity to speculate and, therefore, risk taking and the probability of a crisis.

based on Burman et al. (2010) and others, that "investors' fears about future deficits can reach a tipping point and trigger a financial crisis".

3. Data sample and methodology

We aim to explain the variable *crisis*. Our dependent variable, *crisis*, is available in the World Bank and represents a dummy variable that equals one if the country is experiencing a banking crisis and zero if it is not. We estimated the equations using a population-averaged panel logit probability model, as Büyükkarabacak and Valev did (2010)[2].

$$\text{logit } \Pr\left(Y_{it} = 1 \mid X_{it}\right) = \alpha^* + \beta^* X_{it} \qquad [1]$$

Where Y_{it} represents the dependent variable *crisis*, X_{it} the explanatory variables, β^* the change in the logit of the proportion with $Y = 1$ for an increase in X of a unit and α^* is the constant.

The main advantage of the population-averaged method to the others is that it allows us to use the Huber/White/Sandwich estimator of variance. This estimator reduces the impact of outliers and generates valid standard errors. Robust standard errors are obtained by the generalized estimating equations (GEE) method.

Table 1. Countries and years in the sample.

Years: 52	*Countries: 36*
1961-2012	Australia, Austria, Belgium, Bulgaria, Canada, Chile, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Iceland, Israel, Italy, Japan, Korea, Luxembourg, Latvia, Mexico, Lithuania, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Turkey, United Kingdom, United States.

The explanatory variables used in this paper are the main determinants of banking crises that do not present multicollinearity problems, in addition to our objective variables. The main determinants of financial crises used in this paper are: *gdppc*, which is the Gross Domestic Product (GDP) per capita variation rate; *terms*, measured as the

[2] As these authors state, for a detailed description of the population-averaged model, see Zeger et al. (1988), Neuhuas et al. (1991), and Wooldridge (2002). We also estimated our equations using a random effects logit model. Our estimated coefficients are similar to those of the population-averaged model.

capacity to import fewer exports of goods and services in constant prices; *lnc2*, the real growth of domestic credit lagged two periods; *exch*, official exchange rate (national currency unity per US$, average for a period); *surplus*, public cash surplus or deficit is revenue (including grants) minus expense, minus net acquisition of nonfinancial assets; *liquid*, which is measured by the share of liquid bank reserves in total bank assets; *lerner*, which is the Lerner index, a measurement of banking competition that compares output pricing and marginal costs (that is, the markup) in the banking market: an increase in the Lerner index indicates a deterioration in the competitive conduct of financial intermediaries; *infl*, which is inflation, measured as the annual variation of the cost of a shopping basket for a customer[3]. Tables 1 and 2 show the main characteristics of the variables.

Table 2. Summary statistics.

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
crisis	1,872	0.40385	0.49080	0.00000	1.00000
gdppc	1,587	2.65145	3.62974	-31.17752	17.55749
terms	1,527	7.04E+11	6.09E+12	-3.58E+13	6.97E+13
lnc2	1,485	24.92688	2.34787	18.61231	31.19756
exch	1,489	87.25574	237.40600	0.00001	1,909.43900
surplus	575	-1.54559	4.35130	-29.42016	20.00958
liquid	425	7.83940	9.14341	0.22961	60.94282
lerner	535	0.18510	0.11775	-1.60869	0.50311
infl	1,518	11.16206	39.33546	-4.47994	1,058.37400
exp	1800	9.265556	11.61388	0	44
dist	1,872	9.84431	0.24965	9.65257	10.67034
gini2	428	29.43027	10.21554	0.28300	56.21000

Our objective variables are *gini2*, which is the Gini index lagged two periods, measuring the extent to which the distribution of income (or, in some cases, consumption expenditure) among individuals or households within an economy deviates from a perfectly equal distribution; *surplusgini2*, which represents interaction of the variables *surplus* and *gini2*, used in the robustness check; and *dist*, which is the logarithm of the aggregated bilateral distance of a country to the USA, France and

[3] Other variables were used as the ratio of M2 (monetary mass) to the total of reserves (including gold, US$ in current prices), or financial depth, but these variables present multicollinearity problems and were eliminated from the model.

Japan. The variable *exp* reflects the VAT experience of a country lagged two years, which is the accumulation of years since a country adopted VAT.

We lagged the real growth of domestic credit (Beck et al., 2006), the VAT experience and the measure of inequality (the Gini coefficient) for two periods, to minimize simultaneity problems (Büyükkarabacak and Valev, 2010). Data were obtained from the World Bank Database, except *gini2*, which the author obtained from Eurostat and OECD Database, *exp*, obtained from different sources, and *distance*, obtained from the GeoDist Database (Mayer and Zignago, 2011).

In Table 3 we can see the expected sign of the coefficients of our variables, based on the arguments in section 1. The variable *surplusgini2* shows a new transmission channel of the effect of inequality on a banking crisis: we supposed that a higher inequality leads to a higher deficit to the government, due to redistribution policies. This higher deficit influences positively on the probability of a financial crisis, due to the crowding out effect on the finance of enterprises. Consequently, we expected a negative sign of the variable.

Panel data were used, specifically, an unbalanced panel from the year 1961 to 2012 from 36 countries, all the EU (27) and OECD countries with the exceptions of Switzerland, Cyprus, Romania and Malta. Tables 1 and 2 give some basic information about data and variables.

Table 3. Expected signs of the variable coefficients.

Variable	Sign	Variable	Sign	Variable	Sign
gdppc	-	*surplus*	-	*exp*	-
terms	+	*liquid*	+	*dist*	-
lnc2	+	*lerner*	-	*gini2*	+
exch	+	*infl*	+	*surplusgini2*	-

Correlations among independent variables used in the model are shown in Table 4. Variables with a high correlation were not included in the models and hence, in the matrix. Some variables were omitted due to a high correlation with other variables. Avoiding these variables, the highest correlation is the correlation between *lnc2* and *liquid*, with a value of 0.48. This correlation is below 0.5, so it can be said that there are no multicollinearity problems.

Table 4. Correlation matrix of independent variables.

	gdppc	*terms*	*lnc2*	*exch*	*surplus*	*liquid*	*lerner*	*infl*	*cons*	*dist*	*gini2*
gdppc	1										
terms	0.09	1									
lnc2	-0.44	-0.24	1								
exch	-0.01	-0.38	0.08	1							
surplus	0.27	0.05	-0.11	0.02	1						
liquid	0.27	0.07	-0.48	0.10	-0.21	1					
lerner	0.12	0.03	0.09	0.07	0.28	-0.13	1				
infl	0.21	0.09	-0.40	0.05	0.08	0.22	0.06	1			
exp	-0.21	-0.11	0.06	0.18	0.34	-0.24	-0.01	-0.19	1		
dist	-0.06	-0.18	0.19	0.17	-0.05	-0.09	-0.01	0.04	-0.26	1	
gini2	0.06	-0.06	-0.09	0.01	-0.35	0.06	0.19	0.15	-0.05	0.18	1

4. Empirical results

The main findings of the paper are summarized in Tables 5 and 6, which show the effects of the variables on the likelihood of a banking crisis.

Table 5. Estimated models (a).

Dependent variable: *lnloan*	**(I) Complete model "a"**		**(II) Definitive model "a"**		**(III) Check model "a"**	
	Coefficient	*p-value*	*Coefficient*	*p-value*	*Coefficient*	*p-value*
gdppc	-0.295**	0.04	-0.138	0.136	-0.181*	0.096
terms	-2.51E-13*	0.076				
lnc2	3.918***	0.002	2.041*	0.053	1.728**	0.03
ex	0.039***	0.003	0.021**	0.023	0.015**	0.041
surplus	3.700**	0.011	2.020***	0.008	-0.142	0.626
liquid	0.384***	0.002	0.195**	0.04	0.164**	0.031
lerner	-51.983***	0.001	-30.127**	0.026	-22.07***	0
infl	0.845***	0.001	0.441*	0.058	0.240	0.185
dist	-211.931***	0.003	-113.882**	0.019	-88.233**	0.03
gini2	0.457***	0	0.306***	0	0.319	0.025
surplusgini2	-0.134**	0.02	-0.071**	0.01		
constant	1946.953***	0.003	1046.545**	0.018	804.677**	0.032
No observations	106		107		107	
Wald	No data		2046.04		348	
Wald p-value	No data		0		0	

* Significance level of 10%, ** significance level of 5%, *** significance level of 1%.

The models were estimated following the population-averaged panel logit probability model and using robust standard errors obtained by the generalized estimating equations (GEE) method, as we stated in section 2.

Table 6. Estimated models (b).

Dependent variable: *lnloan*	**(IV) Complete model "b"**		**(V) Definitive model "b"**		**(VI) Check model "b"**	
	Coefficient	*p-value*	*Coefficient*	*p-value*	*Coefficient*	*p-value*
gdppc	-0.284**	0.043				
terms	-1.91E-13	0.244				
lnc2	3.649***	0.002	1.807*	0.075	1.487**	0.022
ex	0.032*	0.073	0.011**	0.011	0.006**	0.033
surplus	3.688***	0.01	2.078**	0.027	-0.243	0.404
liquid	0.368***	0.002	0.177*	0.074	0.147*	0.053
lerner	-49.48***	0	-28.107*	0.07	-20.293***	0.004
infl	0.833***	0	0.453	0.127	0.259*	0.086
exp	0.068	0.677	0.140*	0.07	0.123*	0.073
dist	-179.443*	0.066	-63.160***	0.004	-50.398***	0.004
gini2	0.425***	0.001	0.240***	0	0.346*	0.064
surplusgini2	-0.134**	0.017	-0.076**	0.028		
constant	1636.975*	0.075	557.216***	0.003	438.696***	0.006
No observations	106		107		107	
Wald	No data		2011.6		91.25	
Wald p-value	No data		0		0	

* Significance level of 10%, ** significance level of 5%, *** significance level of 1%.

Models (II) and (V) are the definitive logit models estimated, and they have good econometric properties, as joint significance of the parameters, based on a p-value of the Wald test that equals to zero. Models (III) and (VI) are the robustness check models, which also have good statistical properties. Models (I) and (IV) are the complete models, which use all the financial crisis determinants in the literature that do not suffer multicollinearity problems but the econometric properties are not available.

In models "a", we tested the post-Keynesian thesis that inequality increases the risk of a banking crisis, we incorporated our new determinant *dist*, and we found a new transmission channel that triggers a banking crisis, all in an explanatory model of financial crisis. Model (II) was estimated on the base of model (I), consecutively eliminating non-significant variables to obtain a simpler and more explanatory model,

and keeping interest variables in the successive estimations. Model (III) conducted a robustness test for *gini2* and *dist* by eliminating the variable *surplusgini2*.

Models "b" incorporated another new determinant of the banking crisis, the VAT experience (*exp*). Model (IV) was similar to model (I), with the exception of the incorporation of variable *exp*. The methodology of models "b" was also similar to models "a", with the difference that the check model (VI) analyzed the robustness of the results of model (V), but with model (V) we can also test the robustness of the variable *surplusgini2*, thanks to model (II) and the variable *exp*.

5. Discussion

Definitive models (II) and (V) and check models (III) and (VI) are used to interpret the results. A significant and robust positive influence of inequality, measured by the Gini index, on the banking crisis risk can be observed. This result confirms the expectations of Stockhammer (2013) and others that developed the idea of a positive impact of economic inequality on financial crises, corroborating the post-Keynesian theory. Furthermore, model (II) shows an expansion mechanism of the inequality effect to trigger a banking crisis, which is robust with model (V). The channel is via deficit (measured as surplus): interaction between inequality and surplus leads to a reduction in the risk of a banking crisis. This means that a country with high inequality has a higher probability of falling into a crisis when the government has a public deficit than in other cases. This can be interpreted using the following arguments: a country with high inequality will need more public expenditure in the future, and having a high deficit in the present means that public debt increases will be more likely in the future. Consequently, this increment in public debt will lead to a crowding out effect (a contraction of available credit for private enterprises due to the expansion of public debt, achieving a lower capacity of investment in the country). This effect and the increment in the risk of a public default would probably trigger a banking crisis.

As we can see, comparing models (II) and (III) and remembering that model (III) includes the effect of *surplus* without *surplusgini2*, the results shows a negative relation between *surplus* and the probability of a crisis, as the theory predicted (model III), although it is not statically significant. Taking into account the above-mentioned transmission channel (model II), the surplus has a positive and significant impact on the

likelihood of a banking crisis. This can be interpreted by stating that in countries without or with less inequality, an increment in deficit benefits the banking system because it encourages the expansion of the economy and there is no or less risk of a default than in a higher inequality country. The overall surplus effect, considering both kinds of countries, reduces the banking crisis risk, but results in non-significant effect.

The third main contribution of this paper is the fact that not only does the geographical distance to the USA reduce the probability of a crisis, but the distance to other developed countries, such as France and Japan, also dispels the risk of a banking crunch. All the other variables appearing in these models have the expected sign, and all of them are significant and robust with the exceptions of GDP per capita growth and inflation.

The fourth and last contribution is the consideration of VAT experience as a new determinant of banking crises. Furthermore, in contradiction of theory expectations, we find that this variable increases the probability of a crisis (model V), being a robust result (model VI). We argue that this sign is positive because a country with more experience in VAT is also an economy more open to trade (Desai and Hines, 2005), and, consequently, a country more exposed to financial shocks.

Other relevant variables with a robust and significant effect with the expected sign on the likelihood of a financial crisis are: lending growth lagged two years, with a positive impact as mentioned by Demirguc-Kunt and Detragiache (1998), Hardy and Pazarbasioglu (1999) and Boudriga and Ghardallou (2012); the exchange rate with a positive sign (that is, the depreciation of the national currency is associated with a banking crisis in the current period), as Demirguc-Kunt and Detragiache (1998) and Hardy and Pazarbasioglu (1999) found; the banks' liquidity with a positive effect, as mentioned by Boudriga and Ghardallou (2012); and the lack of banking competition, with a negative sign as Gavin and Haussmann (1996) predicted.

6. Concluding remarks

This paper provides further evidence on banking crises determinants. We analyzed the impact of inequality on banking crunches, studied transmission channels of inequality to financial crises, empirically tested the impact of the VAT experience as a new banking

crisis determinant and measured the influence of geographical distance to developed countries on the risk of a banking crisis.

Using a large sample of countries, we found a robust significance of the positive influence of inequality on banking crises, corroborating previous theoretical frameworks and arguments. We observed a transmission channel of inequality to financial crises via deficit. A negative significant and robust effect of the interaction between public surplus and inequality was obtained. Taking into account this transmission channel, the surplus has a positive, robust and significant impact on the likelihood of a banking crisis. Compared with the literature, we obtained a significant, robust and positive influence of the VAT experience on the probability of a crisis. Finally, we also found that geographical distance to developed countries in general (France, Japan and the USA), not only the USA, leads to a reduction in the risk of a financial crunch.

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