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Determinants of Eurosystems Central Banks Provisions

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Abstract

Central bank provisions may be used as a measure of the perceived risk of the balance sheet composition by a central bank. We identify three possible sources that may change the size of the provisions. These are: The length of the balance sheet, the central bank revenues and measures of fiscal stress. Using data of the eleven founding members of the Eurosystem for the years 1999-2014 we are able to test each of the three determinants. We find that provisions are increased with the size of the balance sheet especially in the recent financial crisis. Moreover, provisions are increased at the cost of lower central bank revenues. While this holds for the pre-crisis period this relationship seems to collapse in the crisis period probably because of the more active collateral policy. Finally, central banks do not tend to lower provisions because of fiscal tensions. This is even more true in the crisis period.

Keywords: Provisions, Eurosystem, Panel Estimation

JEL-codes: E52, E58, C23

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1 Introduction

The financial crisis of 2008/09 and the following European debt crisis has forced the European Central Bank (ECB) to take extraordinary measures. The ECB did so by adjusting their refinancing operations to full allotment (ECB 2008), increasing the period of the refinance operations to up to four years (ECB 2014), the purchase of covered bonds in three programmes (ECB 2009, ECB 2011, ECB 2014a), asset-backed securities (ECB 2014a) and government bonds (ECB 2015), and the frequent lowering of collateral standards needed to take part in the refinancing operations (Belke 2015) among other things.¹ Taken together these measures either increased the balance sheet of the ECB or made the associated risk in the balance sheet more difficult to be correctly priced.

In such a situation the central banks of the Eurosystem, as would all other companies facing comparable circumstances, have to adjust provisions to this altering in the perceived risk. The result of higher risks should be represented in increased provisions made. In this way the level of provisions is an indicator of the central banks perceived risk associated with their balance sheet and may be used as an crisis indicator. However, a central bank is special in this case since it can by definition not run out of liquidity and could in principle also operate with negative equity as long as its credibility is not doubted. But in practice central banks try to avoid such a situation even though history has seen some episodes of certain central banks operating with negative equity.² The fear of running out of equity and possibly being dependent on fiscal recapitalization might be one reason why central banks increased their provisions in order to guarantee their independence.

Indeed the ECB and the central banks forming the Eurosystem increased their provisions substantially in the crisis. For example the ECB increased their provisions which mainly consists of risks to the exchange rate, interest rate, credit and gold prices from 2.6 billion Euro in 2000 to almost 7.7 billion Euro in 2014. From 2008 (the beginning of the crisis) to 2014 the amount rose by 3.6 billion Euro and almost doubled in this period. The national central banks of the Eurosystem (NCBs) show a similar tendency.³

Surprisingly, this change in the provisions of the ECB and the NCBs has not

¹See also Cour-Thimann and Winkler (2012) for the ECB's unconventional measures up to 2012.

²Several studies have investigated the issue of financial strength (i.e. negative equity) on the central banks target of delivering stable prices. See e.g. Klueh and Stella (2008), Adler et al. (2012) or Benecka et al. (2012).

³Note however, that the ECB as most NCBs are not allowed to increase the provisions indefinitely. For example the ECB itself can accumulated provisions and general reserves up to the level of the ECB's capital paid up by the NCBs (ECB 2015a). The above mentioned 7.7 billion Euro represented the ceiling of provisions allowed since they correspond to the capital paid up. Similar procedures apply to the NCBs.

been subject to research so far, even though it can be judged as the central banks perceived risk of their own balance sheet activities. This article tries to fill this gap by testing different hypothesis econometrically. Therefore, in section 2 three propositions will be developed, while section 3 explains the data used. In section 4 and 5 the econometric framework is presented and the results are shown. Section 6 finally concludes.

2 Possible determinants of provision adjustments

Why should central banks adjust their provisions? We can think of three determinants associated to the activities of the NCBs directly or with crisis responses of them. Each of them will be explained separately in the following.

Proposition 1: Provisions are adjusted with the size of the NCBs balance sheet

The NCBs can adjust their provisions because of the credit, interest rate, exchange rate and gold price risks. Each of the groups representing assets held by the NCBs in their balance sheet. Credit and interest rate risks may materialize in the asset positions concerning domestic operations, i.e. the provision of liquidity through the ECB refinancing operations of different maturities or through the newly introduced purchase programmes. In contrast exchange rate risks may stem from foreign reserves in the central banks balance sheet, which are quantitatively not as important as the domestic assets. Finally, gold is also an asset class in the central banks balance sheets and therefore also for risk associated to the price of gold provisions might be build. So the complete asset side of the central banks balance may be subject to risk necessitating the build-up of provisions, although credit risk should have a superior role in this respect since credit operations represent the majority of Eurosystems monetary policy. That is why even if the overall risk to the assets is unchanged provisions are suspected to increase once the size of the balance sheet increases because there are simply more assets which may be subject to losses. Therefore, we coin this type of provision changes the "normal" adjustment.

Proposition 2: Provisions are increased at the cost of reduced central bank revenues and vice versa

Provisions are build from central bank revenues. More precisely, the revenues

are cut if new provisions are build-up.⁴ So provisions and revenues are substitutes. As overall revenues (before provisions are build) should rise with the the size of the balance sheet, also the revenues handed over to the national governments should increase because of interest bearing asset held at the central bank in exchange for none interest bearing cash (seigniorage). However, this does only hold if the perceived risk of the assets remains unchanged. If the risk is rising for example by lower quality of assets in the balance sheet, then also the provisions should rise at the cost of lower revenues.⁵ Since this is only the case if the central bank itself judges the assets of their balance sheet to have become more risky, this type of provision change can be called the "risk" adjustment.

Proposition 3: Provisions are lowered (or not increased) because of the fiscal situation

Since provisions and central bank revenues are substitutes, central banks may wish to help their national governments by increasing their revenues especially in times of high fiscal debt. Therefore, also the level of the provisions can be interpreted as a measure of central bank independence.⁶ Central banks are completely independent in their provision policy if this measure is uncorrelated with fiscal variables like the deficit or the debt to GDP ratio. However, if a central bank reacts to rising fiscal tensions by lowering its provisions this may be judged as dependency of the central bank to fiscal authorities. Which of this interpretations is true for the Eurosystem is necessarily an empirical question.

3 Data

Since the ECB and the Eurosystem became operational in 1999 this is the natural starting point for our analysis. At this time the Eurosystem consists of 11 member

⁴See § 33 on the Statute of the European System of Central Banks and of the European Central Bank (European Union 2012).

⁵Of course the Eurosystem could adjust their haircuts on refinancing operations to account for the increased risk and in fact the ECB did so in the crisis, but on the one hand it is harder to find the correct haircut of an riskier asset than of a safe asset and on the other hand haircuts cannot be set too high in order to have a quantitative impact (see German Council of Economic Experts 2012) which is what the ECB wants.

⁶The discussion of central bank independence is all but new. See Alesina and Summers (1993) or Eijffinger and de Haan (1996) for the beginnings on this issue. See Demertzis et al (1999) for an application with respect to the ECB. To the best of our knowledge we are the first to use central bank provisions as a measure of independence.

countries.⁷ They form the group of founding countries of the Eurosystem. Therefore, we will restrict our panel analysis to these countries which at the beginning fulfilled the criteria to join the Euro and leave aside all other countries which became members of the Eurosystem after some time. This choice is even reinforced by the fact that only for the eleven founding members there existed a irreversible fixed exchange rate at the beginning of the EMU, making the data comparable since they are denominated in the same currency. The end of the sample period is chosen due to data availability which is in our case the year 2014. Moreover, we left aside the developments in the ECB provisions since those and their balance sheet represent only a tiny part of the Eurosystem and is not subject to a single country.

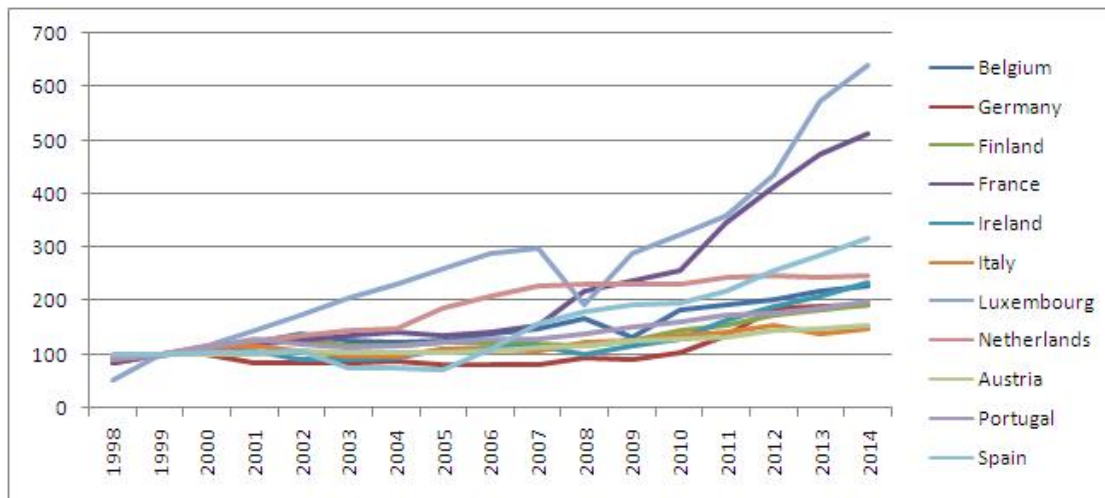


Figure 1: Provisions, sum of balance sheet positions provisions, reserves and capital, index 1999=100, source: Annual reports of the national central banks.

For those eleven founding members we collected data from the annual reports of the respective central banks: First, a measure of the provisions is needed. All NCBs under investigation provide a position called provisions in their annual reports, however, it does not seem to really measure the provisions for all of them since in a few countries this position remains almost unchanged or even decreases in the time of the financial and European debt crisis.⁸ But there are other positions on the liability side of the central banks balance sheets that may also incorporate

⁷These countries are: Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Portugal and Spain. Later on eight other countries joined the Euro Area which are Greece, Malta, Cyprus, Slovenia, Slovakia, Estonia, Latvia and Lithuania.

⁸See e.g. the annual reports of Belgium or the Netherlands.

provisions. These are the central bank reserves and the central bank capital. The extend to which one position is used differs widely among central banks but at least all of them have the same positions and all of them tend to use at least one of these positions for provision purposes. Therefore, we decided to add these three positions up to generate our measure of provisions. Doing so leads to the time series presented in Figure 1.

As becomes obvious from Figure 1 the provisions of the NCBs follow an upward trend. In the end of the sample period Luxembourg has increased this position by more than 500 percent while others like Austria and Italy increased their positions by only 50 percent. However, Italy is the country to have the overall largest stock of provisions in every single year with more than 41 billion Euro in the end of 2014.

The second measure needed to test proposition 1 is the length of the central banks balance sheets. The respective evolution of this variable is shown in Figure 2:

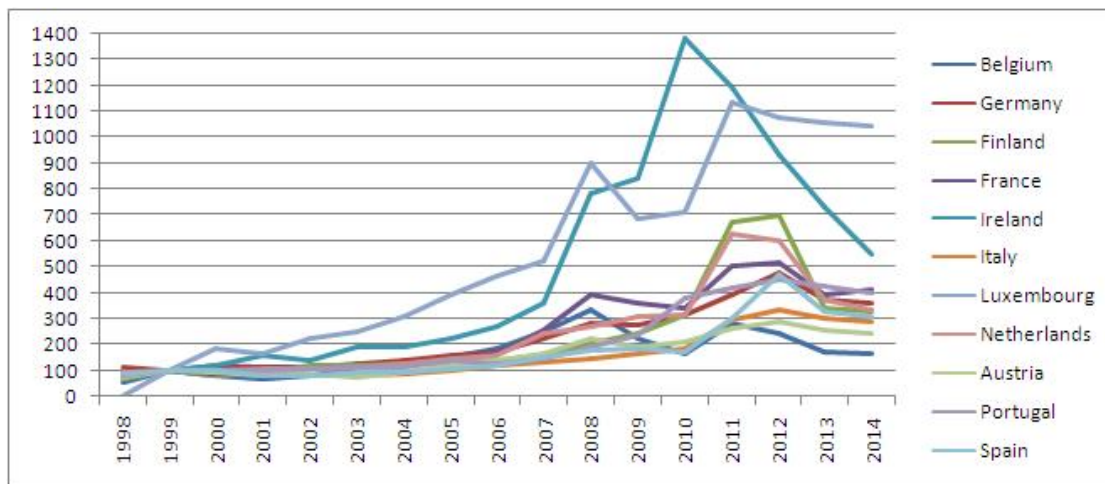


Figure 2: Balance sheet length, index 1999=100, source: Annual reports of the national central banks.

As for the provisions also the length of the balance sheet follows an upward trend. But the trend seems to reach its maximum in 2011 or 2012 for most of the countries. Thus it strongly coincides with the two three year tender operations of the ECB which lead to the largest consolidated balance sheet so far.⁹

Although central bank policy is made via the asset side of the balance sheet, i.e. refinancing operations in the case of the ECB, we might face estimation problems

⁹However, the QE-programme of the ECB introduced in January 2015 will most likely lead to an even larger consolidated balance sheet. But this period is not part of our sample.

since provisions and central bank revenues are part of the balance sheet on the liability side. But this is only the case when both positions represent a significant proportion of the overall balance sheet and are thus main drivers of the development of the balance sheet. In our sample the proportion of either provisions and revenues is however quite small. Provisions are on average 7.1 percent of the overall balance sheet although there are some countries in several years where provisions are more than 20 percent.¹⁰ With respect to the central bank revenues the proportions are even lower since revenues are flow variables. The mean proportion of the variable is about 0.7 percent with a maximum of 5 percent in Spain 2001.

The central bank revenues are shown in Figure 3. More specifically the evolution of revenues compared to the first revenue in the Eurosystem in 1999. Since revenues are paid out to the fiscal authorities every year there is by definition no stock of revenues. For this reason cumulative revenues indexed to start in 1999 would become quite large as time goes by. In Figure 3 it can be observed that especially Belgium and France seem to have higher revenue rates. But this effect is mostly due to the comparably low revenues of these countries in 1999. In general the highest revenues are found in the largest countries Germany, France, Italy, Spain and to some extent the Netherlands. Moreover, there is no clear indication that central bank revenues have in- or decreased over time.

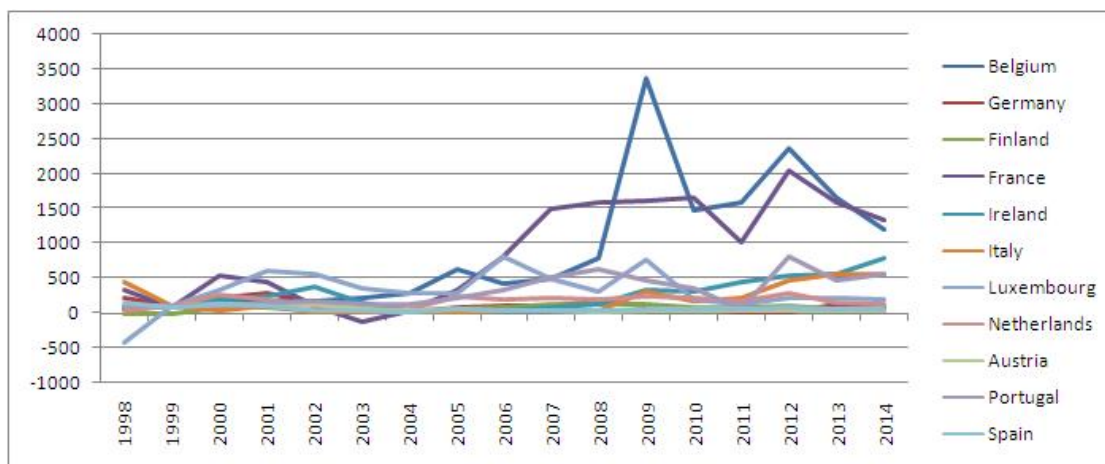


Figure 3: Revenues, index 1999=100, source: Annual reports of the national central banks.

Proposition 3 is tested for by using fiscal variables, i.e. whether the fiscal authorities face debt or financing problems. For this reason two different variables

¹⁰Finland had in 2000 the highest proportion of provisions with 33.6 percent, followed by Austria in 2003 with 21.8 percent and Italy in 2002 with 20.0 percent.

are used. First, the debt to GDP ratio and, second, the fiscal deficits. Since both variables are deflated by GDP they are both subject to the real-time-critique (Orphanides 2001, Orphanides and van Norden 2002). This means that real time data on the debt to GDP ratio and the fiscal deficit have to be used in order to simulate the true decision the NCBs were facing when making their decision upon provisions and revenues. As our measure of real time data we use always the published spring values by AMECO. Doing so leads to the time series presented in Figures 4 (debt to GDP ratio) and 5 (deficit). Note that no indexation is made in these Figures because the variables and critical values are well defined by the Maastricht treaty.

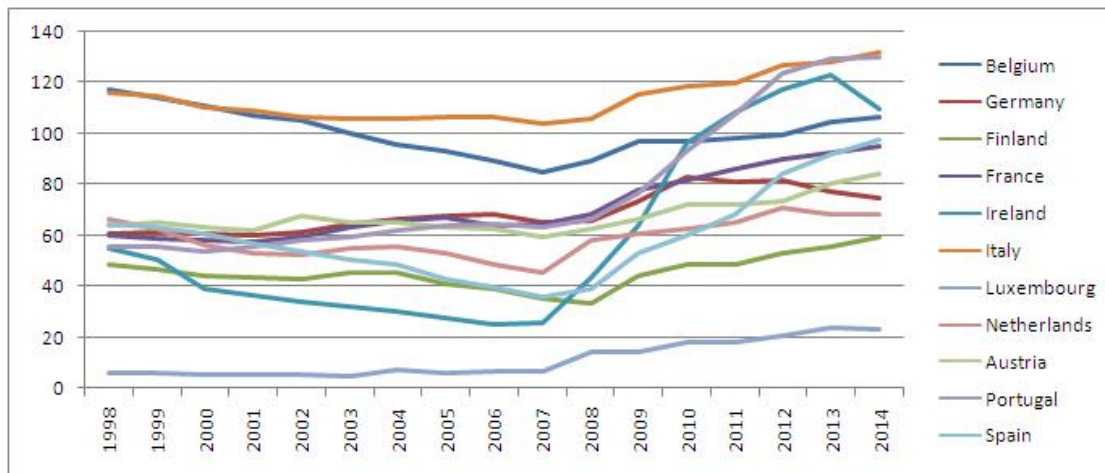


Figure 4: Debt to GDP ratios, real-time-data, source: AMECO.

For the debt to GDP ratio in Figure 4 the Maastricht treaty proposes it to be below 60 percent. With the introduction of the Euro most countries were at a value of about 60 percent while only two (Belgium and Italy) are clearly above this threshold.

This changes with the financial crisis starting in 2008-09 and the following European debt crisis which led to substantially higher ratios in almost all countries but especially in Portugal, Spain and Ireland. The latter two also had to recapitalize their national banking system. So the higher ratios are not solely driven by decreasing GDP but also by higher expenditures and/or higher funding costs.

A similar picture is revealed when looking at the fiscal deficits in Figure 5. According to the Maastricht treaty the deficit should not exceed 3 percentage points. Most of the countries complied to this rule before the financial crisis but exhibit significantly higher deficits thereafter. The largest deficit is recorded for Ireland in 2010 due to the banking recapitalization in this year. However, in 2013-

14 there is a clear tendency towards lower deficits which even comply with the Maastricht criterion.

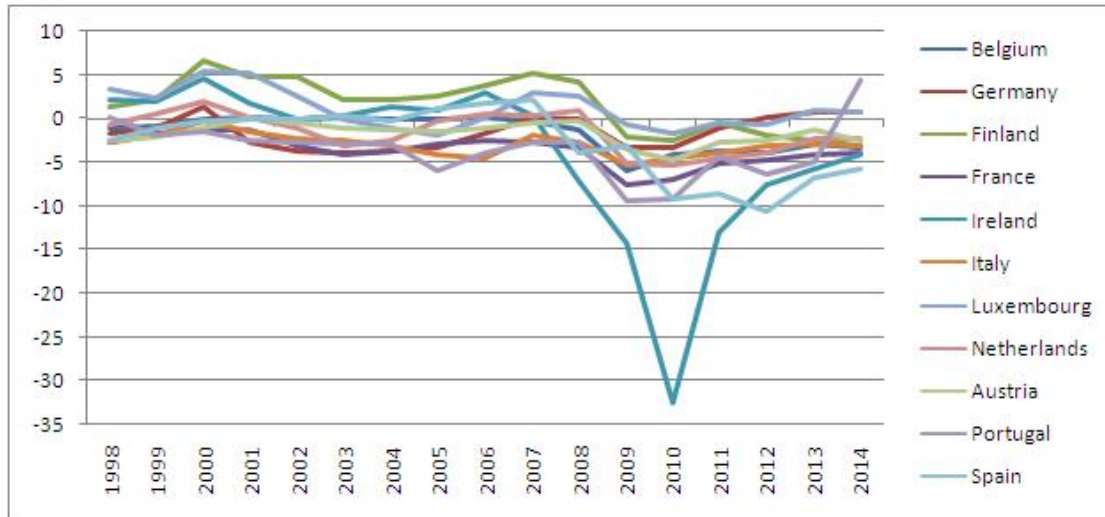


Figure 5: Deficits, real-time-data, source: AMECO.

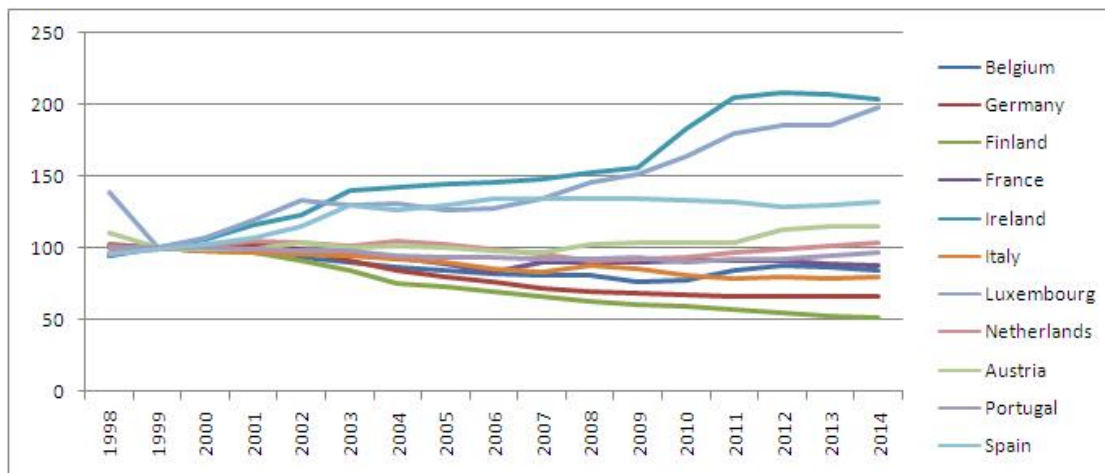


Figure 6: Staff, index 1999=100, full-time-equivalents, source: Annual reports of the national central banks.

Finally, we decided to add a variable covering the size of the central bank staff (Figure 6). We do so because the three positions representing our measure of provisions do in all cases also incorporate retirement provisions of the staff. So we

use the number of staff members in full-time equivalents to control for the influence of rising provisions because of increasing pension obligations due to a larger staff size. In general most of the central banks have reduced their staff size since the Euro is introduced. However, there are also two notable exceptions with Ireland and Luxembourg which double their staff in the sample period.

4 Empirical results

With these data we are able to estimate a balanced panel for the eleven founding members of the Eurosystem. As noted in the previous section we have six variables. However, two of them are flow variables (central bank revenues and fiscal deficits) while the remaining are stocks which seem to follow a positive trend in most cases. Therefore, we decided to take the yearly change in the stock variables. By definition the yearly change in the stock variable debt to GDP ratio is the fiscal deficit, so only the latter is used in the estimations. However, the threshold for the debt to GDP ratio according to the Masstricht-criteria will be used in a robustness check. Using yearly changes for the flow variables has also the nice side effect that all variables appear to be stationary¹¹ so the equations can be estimated using OLS. Adding all variables simultaneously to one panel equation leads to:

$$\begin{aligned}\Delta Provisions_{it} = & \alpha_{i0} + \alpha_1 \Delta BalanceSheet_{it} + \alpha_2 Revenue_{it} \\ & + \alpha_3 Deficit_{it} + \alpha_4 \Delta Staff_{it} + \epsilon_{it}\end{aligned}\tag{1}$$

Note that the equation is estimated using fixed effects thus a individual constant for each NCB i . Thus, no constant term over all countries is reported.¹² Moreover, Δ is the first difference operator of the stock variables Provisions, Balance Sheet and Staff.

With equation (1) all propositions can be tested: First, if the length of the balance sheet is associated with "normal" provision adjustments. Therefore, the coefficient is expected to be significantly positive. Second, the "risk" adjustment of provisions is associated with building up provisions instead of handing over revenues to the fiscal authorities. So the coefficient on revenues should be significantly negative if the central banks judge their assets to be more risky.

Third, it is expected that either rising debt to GDP ratios or deficits exhibit fiscal pressure, so the central banks might be forced to cut provisions and increase revenues. Thus, we would expect a significantly positive coefficient of the deficit

¹¹Results of the stationarity tests are available upon request.

¹²Individual fixed effects for each NCB are not reported but are available from the author upon request.

variable in equation 1. However, there may be a timing mismatch when the central banks have to decide on the provisions or revenues. They may not have an indication of the current debt to GDP ratio/deficit at this point of time. To account for this we made a cross-check by lagging the deficit by one period. Another robustness check is conducted since rising debt to GDP ratios or deficits are not always a problem, i.e. if the level is low. According to the Maastricht criteria the debt to GDP ratio should not exceed 60 percent while the deficit should not rise above 3 percent. We use these two thresholds to show whether the effects differ if fiscal authorities face serious constraints.

We test equation (1) using different specifications, i.e. testing different combinations of the four variables. The results of this procedure are presented in Table 1. Several insights can be drawn from the results in this table: First, the balance sheet coefficient exhibits the expected positive sign and is significantly different from zero although the coefficient is quite small. The estimates show that provisions are increased in a magnitude of 5.700-6.700 Euro when the balance sheet increases by 1 million Euro. Nevertheless, the results show robustly that proposition 1 is true, so the NCBs adjust their provisions with the length of the balance sheet, i.e. raise provisions when the balance sheet increases and vice versa.

Second, central bank provisions and revenues are substitutes as supposed by proposition 2. This is shown by the significantly negative coefficient on revenues. According to these estimates a 1 million Euro reduction in revenues increases provisions by about 220.000 to 270.000 Euro. So there is some risk adjustment present in the provision management of the NCBs. With this result we found a measure of perceived risk of their balance sheet by the NCBs of the Eurosystem.

Third, provisions seem to be mainly unaffected by the fiscal situation as shown by the mostly insignificant coefficients on the fiscal deficit variable. This underlines the independence of the central banks forming the Eurosystem from their national governments.¹³ Even more, the estimates on the (lagged) deficit point to a larger degree of independence since they are found to be consistently negative meaning provisions are even increased when fiscal deficits are rising. One possible explanation for this result may be that domestic government securities represent a significant part of the asset side of the central banks balance sheets (either in outright securities or as collateral) and higher deficits of the fiscal authority increase the default risk of these assets. So central banks increase provisions in response to this higher default risk.

¹³This finding is supported by Hughes Hallett and Lewis (2015) who find no direct response of the ECB towards the primary balance when estimating Taylor rules.

Table 1: Determinants of central bank provisions

	1	2	3	4	5	6	7	8
$\Delta BalanceSheet_{it}$	0.0067*** (0.0015)					0.0057*** (0.0015)	0.0057*** (0.0015)	0.0057*** (0.0015)
$Revenue_{it}$		-0.2207*** (0.0745)				-0.2613*** (0.0770)	-0.2642*** (0.0776)	-0.2707*** (0.0767)
$Deficit_{it}$			-9.5608 (22.8472)				-7.7960 (21.0946)	
$Deficit_{it-1}$				-32.9300 (22.9688)				-36.2145* (21.0034)
$\Delta Staff_{it}$					0.6740 (0.4383)	1.2270*** (0.4393)	1.2353*** (0.4411)	1.2700*** (0.4374)
$adj.R^2$	0.1243	0.0666	0.0177	0.0288	0.0307	0.1838	0.1794	0.1936
T	176	176	176	176	176	176	176	176

Notes: Estimation Method: Panel Least Squares; Sample Period: 1999-2014; Cross-section countries: Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Portugal and Spain; Dependent variable $\Delta Provisions_{it}$; */**/** signal significance at the 10%/5%/1% level.

Fourth, central bank provisions are also adjusted according to the staff size. In a nutshell, provisions rise by between 674.000 and 1.27 million Euro per full-time equivalent employee. These provisions cover i.e. the future pension costs associated with the rise in employment in the central bank.

The finding that proposition 3 does not hold, meaning central banks do not support their national governments, is possibly driven by the fact that governments do not need support in all situations but only when fiscal tensions are severe. Therefore, we conduct a robustness check adding as deficit variables two threshold variables which correspond to the Maastricht criteria: First, we define the variable $Deficit > 3_{it}$ representing the deficit if it is above 3 percent and zero otherwise. In the same vein we derive $Deficit > 60_{it}$ being a threshold variable taking the value of the deficit if the debt to GDP ratio is above 60 percent and zero otherwise. With this two threshold variables and their lagged values because of the timing problem mentioned above, we reestimate the equation. The results can be found in Table 2.

It is obvious from these results that the coefficients on the balance sheet, revenues and staff are almost unchanged so the conclusion drawn above remains valid. However, for the deficit variables not much has changed. We do still find mostly insignificantly negative coefficients with respect to these variables. Even more, for those three estimations where there is a significant relationship (equations 1, 2 and 7), it is also negative. So it seems that especially the central banks in countries with fiscal problems raise their provisions to be prepared for possible haircuts in their bond holdings.

5 Pre-crisis versus crisis results

The financial crisis changed central banks policies in many developed countries due to the zero lower bound on nominal interest rates and the necessary need for further quantitative or qualitative easing in this situation. The ECB is one of those central banks. Since the effects of these unconventional monetary policy measures are largely unknown by now, it is necessary to check whether there is also a shift in the determinants of provisions since those can be interpreted as a central bank measure of the perceived risk associated with their balance sheet. Therefore, we decided to divide the sample into two subsamples. The first covers the period before the financial crisis (1999-2007) while the second represents the crisis period (2008-2014). So both periods are almost of the same length with nine and seven years, respectively. The year 2008 is chosen as the beginning of the crisis period since in September 2008 Lehman Brother collapsed which marks a severe breakpoint in many economic variables not only in the US but also for the Euro Area.

Table 2: Alternative deficit measures

	1	2	3	4	5	6	7	8
$\Delta BalanceSheet_{it}$	0.0055*** (0.0015)	0.0054*** (0.0015)	0.0056*** (0.0014)	0.0056*** (0.0015)	0.0056*** (0.0015)	0.0056*** (0.0015)	0.0057*** (0.0015)	0.0055*** (0.0015)
$Revenue_{it}$	-0.2703*** (0.0774)	-0.2683*** (0.0771)	-0.2692*** (0.0767)	-0.2706*** (0.0770)	-0.2668*** (0.0776)	-0.2663*** (0.0778)	-0.2737*** (0.0767)	-0.2736*** (0.0769)
$Deficit_{it}$		73.8796 (49.0615)				24.4269 (48.6493)		
$Deficit_{it-1}$				-25.1615 (50.3210)				-3.3229 (48.9693)
$Deficit > 3_{it}$	-25.4314 (22.7474)	-97.7272* (53.0880)						
$Deficit > 3_{it-1}$			-37.1168* (22.2733)	-12.8989 (53.3316)				
$Deficit > 60_{it}$					-14.9611 (22.9030)	-38.8728 (52.8674)		
$Deficit > 60_{it-1}$							-42.7556* (22.7399)	-39.5011 (53.1088)
$\Delta Staff_{it}$	1.2624*** (0.4402)	1.2840*** (0.4387)	1.2703*** (0.4377)	1.2719*** (0.4388)	1.2468*** (0.4412)	1.2523*** (0.44423)	1.2751*** (0.4367)	1.2753*** (0.4381)
$adj.R^2$	0.1850	0.1914	0.1926	0.1889	0.1809	0.1770	0.1963	0.1913
T	176	176	176	176	176	176	176	176

Notes: Estimation Method: Panel Least Squares; Sample Period: 1999-2014; Cross-section countries: Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Portugal and Spain; Dependent variable $\Delta Provisions_{it}$; */**/** signal significance at the 10%/5%/1% level.

To account for these two subsamples equation (1) can be rewritten as follows:

$$\Delta Provisions_{it} = \alpha_{i0} + \left\{ \begin{array}{l} \alpha_{1b}\Delta BalanceSheet_{it_b} + \alpha_{2b}Revenue_{it_b} \\ + \alpha_{3b}Deficit_{it_b} + \alpha_{4b}\Delta Staff_{it_b} \\ \alpha_{1a}\Delta BalanceSheet_{it_a} + \alpha_{2a}Revenue_{it_a} \\ + \alpha_{3a}Deficit_{it_a} + \alpha_{4a}\Delta Staff_{it_a} \end{array} \right\} + \epsilon_{it} \quad (2)$$

Here the subscript b signals the response before the crisis and a the period after the crisis break in 2008. Since pre-crisis and crisis coefficients are estimated in one single equation it is possible to check for significant differences between both periods using Wald-tests. The results of those tests are reported simultaneously with the estimation results in Tables 3 and 4.

Several interesting insights are delivered when splitting the sample period in a pre-crisis and crisis period: First, the finding of a rise in the provisions in response to a balance sheet increase seems to be solely driven by the recent crisis period. Moreover, in this period the coefficient even rises in magnitude to about 0.0075. In contrast the pre-crisis estimate of the balance sheet length are found to be insignificant irrespectively of the chosen specification. So it is no surprise that in the majority of our specifications we find a significantly higher balance sheet coefficient after the crisis breakpoint as proofed by our Wald-tests. Thus, we have to conclude that proposition 1 holds only in the recent crisis period. This finding does not come as a surprise since before the crisis started the balance sheet expansion was rather smooth and only with the beginning of the crisis and the corresponding low policy rates the length of the balance sheet became a policy instrument which also altered the risk associated with it.

Second, the significantly negative coefficient on central bank revenues is mostly driven by the pre-crisis period although for the crisis period also a negative coefficient is found, it remains insignificant in the majority of cases. In fact, we find a significantly lower coefficient pre-crisis than in the crisis period. This is evidence that there is no additional risk adjustment in the crisis period. Even worse, this risk adjustment has been abandoned in the crisis even though the risk may have increased because of the lowering of the collateral constraints and the purchase programmes introduced. However, this seems to have not increased the additional risk from the central bank viewpoint probably because also haircuts have been increased in refinancing operations and market prices of asset bought in the purchase programmes are well below the face-value times the predicted default risk.

Third, we do not find any significant difference in the provisions building concerning the staff size. So the provisions build for future pension needs are independent of the crisis period as we would have expected.

Table 3: Pre-crisis and crisis estimates

	1	2	3	4	5	6	7	8
$\Delta BalanceSheet_{it_b}$	-0.0043 (0.0049)					-0.0025 (0.0049)	-0.0021 (0.0049)	-0.0014 (0.0049)
$\Delta BalanceSheet_{it_a}$	0.0075*** (0.0015)					0.0065*** (0.0015)	0.0063*** (0.0015)	0.0061*** (0.0015)
$Revenue_{it_b}$		-0.2834*** (0.0770)				-0.3178*** (0.0782)	-0.3233*** (0.0779)	-0.3265*** (0.0777)
$Revenue_{it_a}$		-0.0545 (0.0966)				-0.1184 (0.1042)	-0.1580 (0.1152)	-0.2028* (0.1119)
$Deficit_{it_b}$			132.6674** (55.1421)				105.8681** (52.1904)	
$Deficit_{it_a}$			-32.3591 (23.7906)				-4.9074 (24.9269)	
$Deficit_{it-1_b}$				97.8616* (55.1525)				66.5563 (54.3923)
$Deficit_{it-1_a}$				-51.6441** (23.6963)				-39.6432* (23.8359)
$\Delta Staff_{it_b}$					0.7046 (0.4568)	1.1453** (0.4532)	0.9940* (0.4588)	1.0462** (0.4663)
$\Delta Staff_{it_a}$					0.3929 (1.1574)	1.3946 (1.0639)	1.4067 (1.0893)	0.9880 (1.0888)
$\Delta BS_{it_b} = \Delta BS_{it_a}$	5.5746**					3.3171*	2.8574*	2.2140
$R_{it_b} = R_{it_a}$		6.9282***				5.1613**	2.8572*	1.6861
$D_{it_b} = D_{it_a}$			7.9644***				3.5873*	
$D_{it-1_b} = D_{it-1_a}$				6.7558**				3.2461*
$\Delta S_{it_b} = \Delta S_{it_a}$					0.0689	0.0492	0.1260	0.0025
$adj.R^2$	0.1480	0.0992	0.0577	0.0618	0.0251	0.2280	0.2382	0.2393
T	176	176	176	176	176	176	176	176

Notes: Estimation Method: Panel Least Squares; Sample Period: 1999-2014, 1999-2007 pre-crisis period (b), 2008-2014 crisis period (a); Cross-section countries: Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Portugal and Spain; Wald tests (F-statistics) for estimation differences in Balance Sheet (BS), Revenue (R), Deficit (D) and Staff (S); Dependent variable $\Delta Provisions_{it}$; */**/** signal significance at the 10%/5%/1% level.

Table 4: Crisis changes using different deficit measures

	1	2	3	4	5	6	7	8
$\Delta BalanceSheet_{it_b}$	-0.0024 (0.0049)	-0.0022 (0.0049)	-0.0016 (0.0049)	-0.0011 (0.0049)	-0.0009 (0.0049)	-0.0013 (0.0050)	0.0003 (0.0052)	0.0001 (0.0052)
$\Delta BalanceSheet_{it_a}$	0.0065*** (0.0015)	0.0064*** (0.0015)	0.0063*** (0.0015)	0.0060*** (0.0015)	0.0062*** (0.0015)	0.0062*** (0.0015)	0.0061*** (0.0015)	0.0061*** (0.0015)
$Revenue_{it_b}$	-0.3221*** (0.0794)	-0.3221*** (0.0794)	-0.3302*** (0.0784)	-0.3332*** (0.0780)	-0.3332*** (0.0783)	-0.3307*** (0.0786)	-0.3269*** (0.0776)	-0.3274*** (0.0780)
$Revenue_{it_a}$	-0.1300 (0.1175)	-0.1300 (0.1175)	-0.1823 (0.1124)	-0.2034* (0.1124)	-0.1696 (0.1157)	-0.1739 (0.1165)	-0.2056* (0.1117)	-0.2115* (0.1127)
$Deficit_{it_b}$		123.2315* (59.6088)				68.6068 (63.4295)		
$Deficit_{it_a}$		-27.2237 (86.4239)				-6.5233 (88.1298)		
$Deficit_{it-1_b}$				41.6389 (60.2447)				35.9538 (63.7451)
$Deficit_{it-1_a}$				-136.1556* (78.1376)				-23.2470 (75.5608)
$Deficit > 3_{it_b}$	35.7042 (84.2604)	-57.9545 (95.0569)						
$Deficit > 3_{it_a}$	-1.3622 (25.8168)	23.1560 (88.3962)						
$Deficit > 3_{it-1_b}$			99.7899 (86.7499)	65.7362 (95.1390)				
$Deficit > 3_{it-1_a}$			-27.4416 (24.4544)	104.1530 (79.7127)				
$Deficit > 60_{it_b}$					171.2284** (84.3659)	110.3552 (101.6325)		
$Deficit > 60_{it_a}$					-0.5160 (24.9140)	4.7138 (87.6742)		
$Deficit > 60_{it-1_b}$							126.7247 (88.8168)	96.0258 (104.2232)

Table 4: Continued

	1	2	3	4	5	6	7	8
$Deficit > 60_{it-1a}$							-37.4864 (24.3774)	-15.3344 (77.0584)
$\Delta Staff_{it_b}$	1.0942** (0.4757)	1.0495** (0.4727)	0.9859** (0.4841)	0.9528* (0.4842)	0.8582* (0.4747)	0.8595* (0.4761)	0.9198* (0.4879)	0.9089* (0.4912)
$\Delta Staff_{it_a}$	1.3862 (1.0979)	1.3944 (1.0953)	1.1095 (1.0925)	1.0133 (1.0884)	1.4014 (1.0867)	1.4227 (1.0922)	0.9751 (1.0874)	0.9795 (1.0939)
$\Delta BS_{it_b} = \Delta BS_{it_a}$	3.1145*	2.9188*	2.4577	1.9869	2.0155	2.1559	1.2080	1.2322
$R_{it_b} = R_{it_a}$	3.7948*	2.9625*	2.4100	1.8520	2.8403*	2.1559	1.6311	1.4597
$D_{it_b} = D_{it_a}$		2.0065				0.4133		
$D_{it-1_b} = D_{it-1_a}$				3.5875*				0.3478
$D3_{it_b} = D3_{it_a}$	0.1790	0.3857						
$D3_{it-1_b} = D3_{it-1_a}$			2.0335	0.0976				
$D60_{it_b} = D60_{it_a}$					3.9724**	0.5790		
$D60_{it-1_b} =$ $D60_{it-1_a}$							3.3381*	0.7398
$\Delta S_{it_b} = \Delta S_{it_a}$	0.0615	0.0864	0.0111	0.0027	0.2166	0.2304	0.0022	0.0036
$adj.R^2$	0.2191	0.2306	0.2313	0.2400	0.2383	0.2343	0.2416	0.2338
T	176	176	176	176	176	176	176	176

Notes: Estimation Method: Panel Least Squares; Sample Period: 1999-2014, 1999-2007 pre-crisis period (b), 2008-2014 crisis period (a); Cross-section countries: Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Portugal and Spain; Wald tests (F-statistics) for estimation differences in Balance Sheet (BS), Revenue (R), Deficit (D), Deficit>3 (D3), Deficit>60 (D60) and Staff (S); Dependent variable $\Delta Provisions_{it}$; */**/** signal significance at the 10%/5%/1% level.

Third, it seems that financial assistance for the national governments by their central banks ended in the wake of the financial crisis. Before we find significantly positive estimates with respect to the deficit in many cases.¹⁴ Afterwards the reverse is true. We find mostly negative coefficients which seem to drive the results for the whole sample period. This even reinforces our above mentioned interpretation that NCBs do not support their governments in the crisis but prepare for possible haircuts in the government bond holdings by increasing their provisions.

6 Conclusions

The provision policy of the NCBs in the Eurosystem may be used as a measure of the perceived risk the NCB themselves are revealing associated to their balance sheet. While controlling for effects which have nothing to do with changes in the risk of the balance sheet we are able to provide insights which are the driving factors behind the changes in provisions. First and foremost, this is the length of the balance sheet. This "normal" adjustment is a key driver of provision policy especially in the recent financial crisis. Before the crisis there is, however, no evidence of provision adjustments towards the length of the balance sheet mainly because the evolution of the balance sheet was quite smooth at that time.

Second, provisions are changed at the cost of lower central bank revenues. But this was mainly the case before the financial crisis started. At first sight this is a puzzling result since the risk associated with the asset of the NCBs balance sheets should have increased in the crisis due to a larger amount of lower rated bonds in it. But a closer look at the changes in central bank policy reveals that there may be a reasonable explanation for this. Before the crisis almost all collateral or bonds on the NCBs balance sheets were viewed as completely safe assets by the markets and thus there was no need for an active collateral policy in the eye of the ECB governing council. Therefore, it was the task of the NCBs to build up additional buffer because risk may be underrated by the markets. However, with the crisis there is now an active collateral policy by the ECB and haircuts are adjusted frequently. So there may no longer be the need for NCBs to build additional buffer.

Third, the financial crisis has made the NCBs even more independent from their fiscal authorities than before. While there is some evidence that before the crisis NCBs lowered their provisions in times of fiscal stress, this changes completely in the crisis period. In our opinion this is due to the fact that national bonds represent a significant proportion of the NCBs asset side of the balance sheet and

¹⁴Although, the estimates turn out to be mostly insignificant when the threshold variables of debt to GDP ratios above 60 percent and deficits above 3 percent are added (Table 4).

so NCBs simply cannot afford lower provisions when these bonds default risks have increased.

So all in all central bank provisions and their determinants can represent a central bank measure of risk. Besides market based indices these give an additional judgment of the respective central bank on their risk situation. Therefore, much more research in this area is needed for example to compare this measure with other risk indices. We leave this for future research.

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