The influence of monetary and fiscal policy frameworks on the expected cost of systemic banking crises.

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First Draft

Abstract

After the recent financial crisis that has shaken the world economy, a large number of empirical analyses have been produced to assess the determinants of divergences in crisis severity across countries. However very little attention has been paid on the policy framework as a potential factor to explain cross-country differences. The aim of this paper is to fill this lack of literature. Monetary and fiscal policy frameworks can be seen as constraints for the policymakers. Before the crisis, they limit time-inconsistency problems and provide a stabilising effect for the real economy, whereas in the aftermath of the crisis, policy rules lead to a loss of flexibility. Using data on systemic banking crises provided by Laeven and Valencia (2013), we investigate the link between a large set of policy framework features and the expected cost of banking crises. Through our measures of expected crisis severity, we jointly consider the impact of each potential determinants on the probability and on the intensity of banking crises. Our results suggest that monetary and fiscal policy frameworks matter to explain differences in the expected cost of banking crises.

1 Introduction

Work in progress.

2 Related Literature

There is a wide body of empirical literature dealing with banking crises, which can be devided into two categories. First, papers have emphasized the determinants of the occurrence of banking crisis. In their seminal article, Demirgüç-Kunt and Detragiache (1998) explore the impact of domestic macroeconomic evironment on the probability of systemic banking crises in a sample of 65 developed and developing countries between 1980 and 1994, using a multivariate logit model. They find that weak performances in terms of economic growth and inflation and weak institutions promotes the emergence of banking crises, as well as high interest rate and deposit insurance. Also using a probit model, Eichengreen and Rose (1998) focus their analysis on developing countries. The sample covers more than one hundred countries as it also includes economies which have not suffered from a crisis. In addition to domestic determinants, results suggest that external financial conditions matter for developing countries. In particular increasing interest rate in OECD coutries is one of the main factors that trigger banking crisis in emerging economies. Glick and Hutchison (2000) are particularly interested in the link between currency and banking crisis and their determinants. In a sample of 90 industrial and developing countries for the period 1975-1997, they find a robust relationship between financially liberalized emerging economies and twin crisis. Moreover frequency statistics also show causality from banking sector distress to currency crises => il ne faut pas mentionner ce dernier résultat car il suggère un biais de causalité inverse avec la dummy crise de change. The analysis lead by Eichengreen and Arteta (2002) surveys the literature of banking crisis in emerging markets and reassess the robustness of the determinants of the likelihood of crisis. It appears that a rapid expansion in domestic credit, an increasing bank liabilities-to-reserves ratio and deregulation threaten bank stability. On the other hand, they can not find robust evidence of a particular link between the exchange-rate regime, the institutional environment or the deposit insurance and banking crises. In the same line Domac and Martinez Peria (2003) investigate the impact of exchange rate regime on the probability of banking crisis using a logit model. The result based on sample of heterogenous countries from 1980 to 1997 highlights that fixed exchange rate diminishes the likelihood of banking crises. Santor (2003) studies the impact of contagion effects, paying particular consideration to potential issues of sample selection. In order to ensure that the characteristics of countries which have experienced a crisis are similar to those of the control group, propensity score matching methodology is used. In this way, each crisis country-year is associated to its nearest neighbour from the non-crisis countryyear based on their level of financial liberalization, thus making the control group comparable to the crisis observations. The empirical results then highlight that banking crisis spreads from a country to the others belonging to its own group, i.e. having comparable propensity score. More recently, using a random coefficient logit model to take into account country heterogeneity in a sample including

110 countries from 1970 to 2007, Klomp (2010) demonstrates that credit growth, real interest rate, financial globalization and M2-to-foreign exchange reserves ratio are positively correlated with a high probability of banking crisis, while GDP growth is negatively linked to the latter. In addition, to our knowledge this paper is the first that distinguish the causes of systemic and non-systemic crises. Studies have also explored the relevance of financial imbalances to explain the outbreak of banking crisis. For example the empirical ivestigation conduced by Čihák and Schaeck (2010) are focused on prudential ratios as potential determinants of banking crisis. The results show that capital to risk-weighted assets, bank return on equity, NPLs to total loans and corporate leverage are the more consistent prudential ratios to explain the likelihood of the crisis in the 100 heterogenous countries of the sample between 1994 and 2007. In the same vein Lainà et al. (2015) also consider financial soundness as explanatory variables in a sample of 11 EU members using quarterly data from 1980 to 2013. High loans-to-deposits ratio, high house prices and excessive credits (in terms of growth rate or deviation from trend) are the best factors to explain the probabbility of crisis according to their results. Other empirical papers investigate the role of financial liberalization. For instance, Noy (2004) find that financial liberalization threats the banking sector stability by increasing the probability of crisis, but only in the short run. However this result appear uncertain as financial liberalization is only proxied by a dummy variable capturing the existence of a deposit interest rate ceiling which constitutes a poor measure of the multidimensional nature of liberalization. For its part Caballero (2015) considers liberalization from the perspective of banks' interconnection and adopts an original measure of financial integration based on network statistics. Results obtained through a count data model over the 1980–2007 period suggest that interconnection in the banking system increases the incidence of banking crises while prudential supervision reduces the occurrence crises. Finally, Papi et al. (2015) explore the impact of IMF interventions on banking crisis, using standard probability model, propensity score matching and instrumental variables. It appears that countries which benefited from IMF lending programs have a lower probability to experience a future crisis. Second, a growing literature have examined the potential variables that could explain cross-country differences in terms of crisis incidence. Instead of adopting a binary dependent variable as in the papers on the crisis occurence, the literature focus on the aftermaths of banking crises computes continue variables to capture the cumulative cost of each crisis in empirical investigations. First of all, there is no consensus in the literature which aims to explain the cross-country variation in the cost of banking crises. Frankel and Saravelos (2012) clame that the heterogeneity of the results comes from differences in the definition retained for measuring the cost of crisis (from the simply gdp growth rate to the difference between forecast and effective GDP) and from the alternative econometrics appraoch retain in the litterature. Most of the studies conclude that larger amount of foreign exchange reserves reduce the cost of banking crisis (see e.g. De Gregorio et al., 2004; Feldkircher, 2014). However, Obstfeld et al. (2009) and Obstfeld et al. (2010) show that excessive reserves (expresse in purcentage of M2) is not suitable, and then cast some doubt on the impact of foreign reserves on the cost of crisis. Credit-to-GDP stock and the growth rate of credit are often significant

in the empirical analysis, but as mentioned by Wilms et al. (2014) their impact is uncertain. Using the credit-to-GDP ratio, Angkinand (2009) finds that a higer value raise the intensity of the banking crisis whereas the results obtained by Detragiache and Ho (2010) and Giannone et al. (2011) lead to the opposite conclusion. In the same way, we can not reach any consistent opinion when the credit growth is considered. Following Dwyer and Tan (2014) and Fouejieu (2013) a rapid credit growth is seen as detrimental for the economy, but conversely Furceri and Zdzienicka (2012b) do not sustain the previous finding. The current account also have a significant and recurring influence on the cost of crisis in the literature. Its implications for the economy is clear: acurrent account account deficit leads to a higher deficit (see e.g. Honohan and Klingebiel, 2003; Angkinand and Willett, 2008; Abiad et al., 2009). According to Frankel and Saravelos (2012), the most commonly significant determinants of the cost of crisis are the foreign exchange reserves, the real exchange rate, the credit growth rate, the GDP (level or growth rate) and the current account, respectively. The recent survey leads by Kauko (2014) also adds asset prices and structural factors of banking sector in the set of variables which have the stronger explanatory power. Despite the huge number of potential determinants for the cost of banking crisis which have already been explored in the literature, it is pretty surprising to see that monetary and fiscal discipline have gained relatively little attention. In this context, our study intends to fill this lack of literature. In addition, as mentioned earlier, the vast majority of the previous works on this topic has been focused on either the occurence or the cost of the banking crisis. To the best of our knowledge, very few studies have been interested on both simultaneously (e.g. some specifications in Angkinand, 2009). However, from a policy perspective, the key issue is to reduce the global outcome of the crises and not only the occurence or the intensity. In order to move in this direction, we investigate using a panel data approach, the potential impact of monetary and fiscal discipline on the expected cost of banking crisis. As a potential determinant can affect in an opposite way the occurence and the cost of the crisis, our approach allows to directly assess an overall impact for each factors.

3 Data and Methodology

This section is dedicated to the data and the methodology we used in our empirical study. We also present some preliminary results obtained with the control variables.

3.1 Measuring Expected Cost of Banking Crisis (ECBC)

First, we need to define our measures of ECBC. In recent studies on the cost of financial crises, several measures of cost emerged, mainly based on a cumulative output loss approach (see e.g. Abiad et al., 2009; Angkinand, 2009; Cecchetti et al., 2011; Feldkircher, 2014). As we adopt a panel approach, we construct measures of annual cost of banking crisis, derive from the cumulative measures commonly used in the litterature. The general form of our measures

can be describe as follow :

$$y_{i,t} = \begin{cases} y^*_{i,t} & \text{when a banking crisis occurs} \\ 0 & \text{otherwise} \end{cases} \tag{1}$$

where $y^*_{i,t}$ represents one of our three measures of annual losses.

Information about the timing of the banking crises came from the updated version of the systemic banking crises database developped by Laeven and Valencia (2013). They identify the start and end dates of the crises on the basis of financial distress and policy intervention on the banking system criteria. As we mentioned above, we retain three measures of the cost of banking crisis in our analysis, both expressed in percentage of GDP trend. The fisrt two, namely "$loss\_5years$" and "$loss\_all$" gauge the total output loss of the crisis which is the most prominent concept used in the literature to assess the severity of the crises. For each crisis year, the output loss is simply computed as the gap between an extrapolation of the pre-crisis trend ($extrapol(HP)_{i,t}$) and the GDP index ($GDP_{i,t}$)[1], in accordance to the following formula:

$$y^*_{i,t} = \frac{extrapol(HP)_{i,t} - GDP_{i,t}}{extrapol(HP)_{i,t}} \tag{2}$$

The difference between the two output loss calculation stems from the extrapolation methods. For "$loss\_5years$", we follow the methodology describes in Wilms et al. (2014). We compute a linear extrapolation of the trend during the crisis, using the average growth rate of the trend in the five that preceded the banking crisis. However Laeven and Valencia (2013) calculate the average growth rate of the trend on a longer pre-crisis period, particularly to offset a potential boom in activity before the crisis which can lead to overestimate the extrapolated trend. In the same vein, we construct "$loss\_all$" with the crisis trend extrapolate with the average trend growth rate computed from the first observation we have to the last year before the crisis start. In particular, according to Abiad et al. (2009) and Furceri and Mourougane (2012), banking crises lower potential output. Unfortunately, sufficient data (especially on capital stock) are not available to analyse changes in potential output due to the crises For this reason, we use the trend loss as a proxy of potential loss. "$trend\_loss$" is defines as follow:

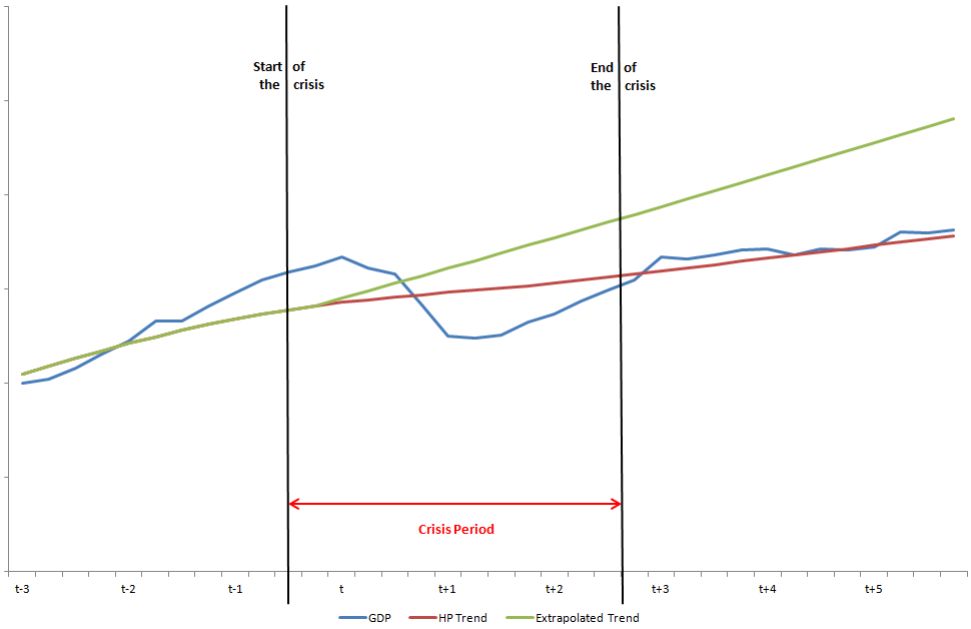
$$y^*_{i,t} = \frac{extrapol(HP)_{i,t} - HP_{i,t}}{extrapol(HP)_{i,t}} \tag{3}$$

with $extrapol(HP)_{i,t}$ is the real GDP trend extrapolated from the 5-years average growth rate previously used and $HP_{i,t}$ corresponds to the value obtained with HP filter apply on all available data for each country

Figure 1 illustrates the computation of the two measures of output loss and these of the trend loss. The black vertical lines mark the beginning and end of the banking crisis. The blue,

[1]The gap may be negative given that each crisis year is not necessarily associated with losses. When that happens, the loss is set equal to zero for the respective year

Figure 1: Illustration of Output Loss and Trend Loss



the red and the green lines indicate real GDP, HP trend and extrapolated trend respectively. Measures of output loss consists merely to take the difference between the green line (the extrapolated trend) and the blue line (the real GDP) during the crisis period[2]. In the same way, we compute the trend loss as the difference between the green line and the red line (i.e. the difference between the extrapolated trend and the current trend).

3.2 Methodology

This sub-section presents our empirical strategy. As mentioned above, we focus our study on the ECBC, this means that we considered jointly the probability and the cost of banking crisis. To this end, we use panel data approach and not only the banking crisis years as most of the empirical analyses already performed. Our sample covers 67 developed and emerging countries from 1970 to 2012. To assess the ECBC and its potential determinants, we can not used standard panel regression. First, our dependent variables of ECBC are left-censored to zero. In addition, at least 90% of observations in our sample are affected by the censure. To deal with large proportion of zero in the dependent variables, we employ a Poisson regression model approach. This methodology is commonly used in the literature on international trade, where many amount of bilateral trade are also equal to zero. According to Silva and Tenreyro (2011), the Poisson pseudo-maximum likelihood (PPML) estimator perform well even when the proportion of zeros is very large. The main criticism of this methodology arises from Wooldridge (2015). Theoretically, Poisson model is based on the underlying assumption that the variance of the dependent variable is equal to the mean. In most of cases, including our, we note an overdispersion problem because the variance observed is larger than the one assumed

[2]One notes that real GDP exceeds the extrapolated trend at the beginning of the crisis. In this case, the negative loss obtained is then censored to zero.

in the standard Poisson model. To tackle this issue, we estimate our model with random-effects Poisson pseudo-maximum likelihood estimator. Using random-effects presents several advantages. Besides solving the overdispersion problem, it allows to eliminate unobserved time-invariant heterogeneity at the country level whereas the traditional country-fixed effects are not efficient, involving a selection bias as some countries did not experience banking crisis. The random-effects estimators have been already used in the literature on banking crisis (see for instance the empirical analysis lead by Klomp, 2010). Therefore, we estimate the parameters of the following equation:

$$y_{i,t} = \exp\left(\beta_0 + \sum_{k=1}^{K} \beta_k X_{k,i,t-1} + \xi_i + \delta_t + \epsilon_{i,t}\right) \qquad \text{with} \quad \Xi \sim \Gamma(\alpha, \theta) \tag{4}$$

where $y_{i,t}$ is alternatively one of our three measures of ECBC previously defined. $X_{k,i,t-1}$ denotes our independent variables. It contains 9 control variables (we will get back on them in the next sub-section) and the interest variables included one by one. All the explanatory variables are lagged to capture the impact of pre-crisis conditions and to limit a potential simultaneity bias. The term ξ_i represents the random effects previously mentioned whereas δ_t is the time-fixed effects capturing the impact of global shocks that may affect all countries in a giving year.

3.3 Preliminary results

This paper aims to highlight the link between monetary and fiscal policies' framework and the ECBC. However we also need to control for potential other factors that might explain the severity of banking crisis. We retain nine control variables that often appear statistically significant in the recent empirical literature. The control variables are divided into four categories. First we include real gdp per capita, inflation rate and credit-to-GDP ratio in our baseline specification, controling for macroeconomic and financial caracteristics. Both are taken from the World Development Index (WDI) database. First, GDP per capita captures the institutional quality and the level of economic development. According to Claessens et al. (2005), strong institutions are associated with better post-crisis recovery. But on the other side, recent empirical articles (e.g. Frankel and Saravelos, 2012) show developed countries have been more affected by the recent crisis than developing countries. This suggests that the expected sign of GDP per capita is uncertain. About the inflation rate, there is a consensus in all the relevant literature: price volatility is correlated with bigger decline in output. The main reason argued by Angkinand (2009) is that high pre-crisis inflation reflects poor macroeconomic policy, and in some cases, raises the likelihood of banking crisis (see Demirgüç-Kunt and Detragiache, 1998; Noy, 2004; Klomp, 2010, for empirical evidences). In addition, one can suspect that mismanagement in monetary policy also harm in the aftermath of the crisis, and according to (Abiad et al., 2009), central banks have greater space for monetary easing when inflation is low. All in all, we expect to find a positive coefficient associated with the inflation rate. Then, following for instance Abiad et al. (2009), Angkinand (2009) and Cecchetti et al. (2011), we also control for the size of the banking sector. Obviously, the more the banking sector is important,

the more losses should be high when a banking crisis occured. That is why the variable is intended to have a positive impact on ECBC. As Abiad et al. (2011), we measure the level of financial intermediation using the credit-to-GDP ratio. In the second set of controls, we take into account two kinds of vulnerability. The measure of financial vulnerability selected is the credit-to-GDP gap. It is probably the most accepted indicator of excess credit growth. Capture credit boom is vitally important as a singificant part of the empirical literature indicates that excessive credits lead to distress on the banking sector (see e.g. Borio and Lowe, 2002, 2004; Borgy et al., 2009; Dell'Ariccia et al., 2012; Schularick and Taylor, 2012; Giese et al., 2014; Aikman et al., 2015). Regarding the ECBC we note that financial vulnerability is a key player to explain differences in output losses. Cecchetti et al. (2009) demonstrate that banking crises are more costly when they have been preceeded by credit boom. In addition, Costa Navajas and Thegeya (2013) highlight the negative link between financial soundness and the probability of banking crisis, and financial instability reduces economic growth as shown by Creel et al. (2015). We also deal with macroeconomic vulnerability through the level of public debt as a percentage of GDP, taken from the database constructed by Abbas et al. (2010). We assume that countries with higher pre-crisis debt have less fiscal space during the crisis, and then limits government ability to provide fiscal stimulus to react to shocks. In addition, recent empirical studies like Blanchard et al. (2010), Carvalho Filho (2011) and Tsangarides (2012) confirm that the most indebted countries have faced the most severe downturns. Following them, we expect a negative impact of the debt to GDP ratio on the ECBC. Third, whether the banking crises are accompanied by currency crisis or other banking crisis around the world. Controlling for the crisis caracteristics takes the form of two variables. The first is a counting variable for the number of simultaneous banking crisis in the world. Crises are considered as simultaneous when according to Laeven and Valencia (2013), their starting dates are within the range of one year or less. The second is a dummy variable proposed by Reinhart and Rogoff (2009) which takes the value of one when a domestic currency crisis occured. Both variables are expected with a negative sign. Since following Detragiache and Ho (2010), an important number of simultaneous crises leads to spillover effects from foreign countries by restraining factors that lessen the crisis severity, as export demand or foreign direct investment. Turning to currency crises, Gourinchas and Obstfeld (2012) justify that a currency crisis deepens banking crises, explaining that significant depreciation can lead depositors to convert their savings in foreign currency in order to maintain their purchasing power. Moreover, domestic currency depreciation, especially for developping counties, mechanically raises the real debt burden denominated in foeign currency and thus fall banks solvency or equivalently the creditworthiness of their clients. As developed by Kaminsky and Reinhart (1999) it seems that "twin crises" are associated with larger output losses, and other empirical studies (see e.g. Hoggarth et al., 2002; Abiad et al., 2009; Angkinand, 2009) have reached the same outcome. Finally, the last set of control variables includes the policy responses to the crisis. We consider fiscal and monetary responses which are supposed to sustain economic recovery in the aftermath of the crisis. A priori, a negative impact is expected on the measures of ECBC. To gauge fiscal response we

can not simply consider government spendings because of the automatic stabilizers, spendings are endogenous to the losses. However as highlighted by Furceri and Zdzienicka (2012a) and Baldacci et al. (2009), this issue can be solve by consdering solely discret fiscal policy. Discret government spendings are estimated using the method proposed in Ambrosius (2017)[3]. We also control for the cleaning up afterward performed by monetary policy. As the recent crisis has shown the limits of traditional monetary policy and the need for new instruments, we can not consider the interest rate as a good proxy of monetary response. We then retain the level of central bank assets to capture conventional and unconventional monetary policy together. The policy response vaiables are lagged, like the other controls, to take into account the transmission delay of the policy and to limit the simultaneous bias with the monetary response

Table 1: Preliminary results with control variables: Signs and significance.

	loss_5years	loss_all	trend_loss
GDP per capita	0.001	0.002**	0.003**
	(0.001)	(0.001)	(0.001)
Inflation	0.005***	0.004***	0.002**
	(0.001)	(0.001)	(0.001)
Bank credit / GDP	0.028***	0.027***	0.029***
	(0.002)	(0.001)	(0.002)
Credit-to-GDP gap	0.719***	0.692***	0.574***
	(0.190)	(0.162)	(0.212)
Public Debt / GDP	0.025***	0.027***	0.027***
	(0.002)	(0.001)	(0.002)
Simultaneous crisis	0.002	0.002	0.002
	(0.006)	(0.005)	(0.006)
Currency crisis	0.824***	0.571***	0.835***
	(0.081)	(0.070)	(0.087)
Discret. gov. consumption	-3.412***	-2.044***	-1.731***
	(0.473)	(0.379)	(0.510)
CB assets	0.002	-0.006	0.008
	(0.005)	(0.004)	(0.006)
Constant	-3.043***	-2.934***	-3.680***
	(0.354)	(0.321)	(0.379)
$\ln(\hat{\alpha})$	1.532***	1.408***	1.598***
	(0.186)	(0.181)	(0.185)
Observations	2,193	2,193	2,193
Number of countries	67	67	67
Crisis observations	212	212	212
Year FE	YES	YES	YES

Notes: *, **, and *** denote significance at the 10%, 5% and 1% level, respectively. α is the rate parameter of the Gamma distribution used for the random effects. $\ln(\hat{\alpha})$ is the logarithm of the estimated value of the previous parameter. When the coefficient is significant il implies that random effects correct the overdipersion issue of the Poisson estimators.

[3]When we estimate discret government spendings, we also include public debt and interest rate variations as regressors.

Table 1 presents the results obtained when we consider only the control variables to explain our three measures of ECBC. Seven of the nine variables appear significant with the expected sign with respect to the existing literature. Regarding the number of simultaneous crises and the growth rate of central bank asset, both remain unsignificant. Firstly, high GDP per capita and inflation level seem to amplify the crisis severity, as well as the size of banking sector, captured by the credit-to-GDP ratio. Secondly, financial and macroeconomic vulnerabilities go hand-in-hand with larger losses as shown by the positive coefficicent estimated for the credit-to-GDP gap and the debt to GDP ratio. Turning to crisis caracteristics, our finfings suggests that currency crisis strongly increases the ECBC, but a large number of simultaneous banking crises is not significant, and does not explain the severity of each banking crisis. Obviously, the fiscal response is negative and extremely significant. We find that fiscal support lessens the cost of the crisis. Surprisingly, monetary response is not significant. However this result is in line with Borio and Zabai (2016) who find that unconventional monetary policy "*have succeeded in influencing financial conditions even though their ultimate impact on output and inflation is harder to pin down.*"

4 Results

4.1 Monetary Policy Framework and Arrangement

4.1.1 Inflation Targeting

Table 2: Results: Impact of Inflation Targeting on the ECBC.

	Partial Adoption of IT			Fully-Fledged Adoption of IT		
	loss_5years	loss_all	trend_loss	loss_5years	loss_all	trend_loss
Inflation Targeting	-0.381***	-0.511***	-0.207	-1.371***	-1.616***	-1.268***
	(0.139)	(0.129)	(0.159)	(0.187)	(0.180)	(0.205)
GDP per capita	0.002*	0.003***	0.004***	0.002	0.003**	0.003**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Inflation	0.004***	0.003***	0.002**	0.004***	0.002***	0.002*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Bank credit / GDP	0.032***	0.032***	0.034***	0.033***	0.032***	0.034***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Credit-to-GDP gap	0.494**	0.496***	0.240	0.402**	0.415**	0.126
	(0.195)	(0.166)	(0.219)	(0.195)	(0.167)	(0.219)
Public Debt / GDP	0.026***	0.028***	0.029***	0.026***	0.029***	0.029***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Simultaneous crisis	0.002	0.002	0.002	0.002	0.003	0.003
	(0.006)	(0.005)	(0.006)	(0.006)	(0.005)	(0.006)
Currency crisis	0.829***	0.543***	0.803***	0.834***	0.552***	0.824***
	(0.082)	(0.071)	(0.090)	(0.082)	(0.071)	(0.090)
Discret. gov. consumption	-3.705***	-2.190***	-1.970***	-3.809***	-2.308***	-2.142***
	(0.487)	(0.385)	(0.520)	(0.486)	(0.384)	(0.520)
CB assets	-0.004	-0.011**	0.002	-0.009	-0.014***	-0.005
	(0.006)	(0.004)	(0.007)	(0.006)	(0.005)	(0.007)
Constant	-3.060***	-2.951***	-3.851***	-2.812***	-2.754***	-3.490***
	(0.369)	(0.338)	(0.403)	(0.370)	(0.339)	(0.400)
$\ln(\hat{\alpha})$	1.615***	1.521***	1.701***	1.608***	1.522***	1.666***
	(0.185)	(0.180)	(0.184)	(0.186)	(0.180)	(0.185)
Observations	1,723	1,723	1,723	1,723	1,723	1,723
Number of countries	67	67	67	67	67	67
Crisis observations	204	204	204	204	204	204
Year FE	YES	YES	YES	YES	YES	YES

Notes: *, **, and *** denote significance at the 10%, 5% and 1% level, respectively.
α is the rate parameter of the Gamma distribution used for the random effects. $\ln(\hat{\alpha})$ is the logarithm of the estimated value of the previous parameter. When the coefficient is significant il implies that random effects correct the overdipersion issue of the Poisson estimators.

A priori, one might consider that inflation targeters outperformed non-targeters during banking crises. At a general level, Svensson (1999) has shown that inflation targeting improves the transparency of monetary policy and, by extension its credibility. Based on this reasoning, inflation targeters should be able to restore economic activity after financial shocks better than their peers. Recently, Walsh (2009) adds that explicit price target commitment allowed to deal with recent banking crisis and was not accompanied by a higher output instability than in non-targeter countries. In the same line Woodford (2012) theoretically demonstrates that inflation

targeting regime can achieve price stabilization in the long run, while ensuring activity and financial stabilization in the short run. Aside from surpassing non-targeters regarding to the monetary response after the crisis, IT should also lean against ex-ante financial vulnerabilities. Regarding the recent financial crisis, Carvalho Filho (2011) also argues that thanks to a better anchoer of inflation expectations, a credible price target reduces the risk of falling into deflation and liquidity trap. At the onset of the crisis, it also allows central bank to pursue sharply monetary policy easing without compromising price stabilization. Carvalho Filho (2011) notices that IT countries have lowered their nominal interest rate more than other countries during a crisis. Our empirical analysis confirms this intuition. We measure the impact of inflation targeting on ECBC through two binary variables. The first corresponds to a partial adoption of IT framework. It takes the value of 1 when a country in a giving year has at least partially adopt IT as monetary policy regime, and zero otherwise. Mishkin and Schmidt-Hebbel (2007) define the partial IT as the non-fulfillment of all preconditions of the IT adoption. In the situation where all the conditions are simultaneously met, the country is considered as a fully-fledged inflation targeter. Thus the second binary variable is more restrictive than the first in the sense that it takes the value of 1 only when a country has adopt the fully fledged IT framework. For each country, the starting date of IT adoption (partial and fully-fledged) is based on the classification proposed by Leyva (2008). In our results, IT regime appears to lower the ECBC. That is even more true with the fully-fledged IT, as it is shown by its negative and strongly significant coefficient with the three measures of ECBC. Recent empirical studies also lead to the same result (e.g Carvalho Filho, 2010, 2011; Roger, 2009, 2010; Barnebeck Andersen et al., 2015).

4.1.2 Central Bank Independence

At this time, no consensus has emerged on the link between CBI and ECBC. On the one hand, we can expect that a high level of CBI reduces the cost of banking crisis. In a recent empirical study, Klomp and de Haan (2009) highlight a positive relation between the level of CBI and financial stability. This is because independance from the political authorities increases the credibility and the effectivness of monetary policy, allows central bankers to react quicker and stronger to financial distress before the crisis and during the aftermath when the crisis has occured. Moreover, Klomp and de Haan (2009) clame that a potential time inconsistency problem exists between financial stability and government policy-making, similar to the well-known time inconsistency problem leading to inflation bias in monetary policy. Independent central bank with a strong commitment against financial imbalances appear to be a solution to solve this issue and to reduce financial instability in the pre-crisis period. However, on the other hand, Berger and Kißmer (2013) challenge the previous view. In a theoretical article, they demonstrate that a goal conflict emerges between financial and price stability. Furthermore, independent central bank may suffer from so-called paradox of credibility. According to Borio and Lowe (2002), credible central banks can achieve low inflation level. In this context, financial operators underestimate the probability of banking crisis and take more than a reasonable

Table 3: Results: Impact of Inflation Targeting in OECD countries vs. non OECD countries

	OECD countries		non OECD countries	
	loss_5years	loss_all	loss_5years	loss_all
Interest variable	-0.505**	-0.885***	-22.286	-22.089
	(0.246)	(0.232)	(9,468.674)	(7,964.255)
GDP per capita	-0.003*	-0.003**	0.066***	0.055***
	(0.002)	(0.001)	(0.010)	(0.009)
Inflation	0.038***	0.023***	0.005***	0.002***
	(0.007)	(0.005)	(0.001)	(0.001)
Bank credit / GDP	0.026***	0.028***	0.025***	0.019***
	(0.003)	(0.002)	(0.003)	(0.003)
Credit-to-GDP gap	1.917***	1.838***	-0.275	0.200
	(0.507)	(0.434)	(0.237)	(0.205)
Public Debt / GDP	0.019***	0.018***	0.025***	0.030***
	(0.003)	(0.003)	(0.003)	(0.002)
Simultaneous crisis	0.003	0.004	-0.007	-0.004
	(0.006)	(0.006)	(1,476.918)	(1,217.452)
Currency crisis	0.302	0.254	0.891***	0.488***
	(0.186)	(0.161)	(0.099)	(0.085)
Discret. gov. consumption	0.901	0.230	-5.311***	-3.493***
	(1.287)	(1.068)	(0.553)	(0.447)
CB assets	-0.006	-0.001	0.002	-0.014**
	(0.015)	(0.013)	(0.008)	(0.006)
Constant	-1.087	-0.727	-28.383	-27.342
	(0.772)	(0.681)	(23,363.213)	(19,727.235)
$\ln(\hat{\alpha})$	0.696***	0.767***	2.347***	2.039***
	(0.267)	(0.266)	(0.271)	(0.256)
Observations	724	724	999	999
Number of countries	28	28	39	39
Crisis observations	90	90	114	114
Year FE	YES	YES	YES	YES

Table 4: Results: Impact of Central Banks' Independence on the ECBC.

	De jure index of CBI (CWN)			*De facto* index of CBI (TOR)		
	loss_5years	loss_all	trend_loss	loss_5years	loss_all	trend_loss
Index of CBI	1.784***	1.644***	0.624*	-0.025	0.776***	-0.102
	(0.296)	(0.259)	(0.329)	(0.189)	(0.153)	(0.227)
GDP per capita	0.001	0.001	0.003**	0.001	0.003***	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Inflation	0.004***	0.002***	0.003***	0.005***	0.003***	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Bank credit / GDP	0.037***	0.036***	0.038***	0.034***	0.030***	0.034***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Credit-to-GDP gap	0.847***	0.995***	0.185	0.449**	0.744***	0.316
	(0.216)	(0.186)	(0.252)	(0.204)	(0.177)	(0.233)
Public Debt / GDP	0.029***	0.032***	0.033***	0.023***	0.025***	0.027***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Simultaneous crisis	0.004	0.005	0.005	-0.000	0.000	0.001
	(0.006)	(0.005)	(0.006)	(0.006)	(0.005)	(0.006)
Currency crisis	0.775***	0.531***	0.661***	0.872***	0.641***	0.839***
	(0.091)	(0.079)	(0.100)	(0.083)	(0.071)	(0.091)
Discret. gov. consumption	-4.351***	-2.735***	-2.094***	-4.081***	-2.440***	-2.176***
	(0.527)	(0.423)	(0.584)	(0.499)	(0.400)	(0.561)
CB assets	-0.008	-0.012***	-0.006	0.002	-0.012**	-0.000
	(0.006)	(0.005)	(0.007)	(0.006)	(0.005)	(0.007)
Constant	-4.694***	-4.574***	-4.733***	-2.884***	-2.903***	-3.772***
	(0.426)	(0.386)	(0.459)	(0.371)	(0.337)	(0.400)
$\ln(\hat{\alpha})$	1.609***	1.527***	1.696***	1.620***	1.511***	1.709***
	(0.187)	(0.181)	(0.187)	(0.188)	(0.182)	(0.187)
Observations	1,635	1,635	1,635	1,668	1,668	1,668
Number of countries	66	66	66	66	66	66
Crisis observations	192	192	192	199	199	199
Year FE	YES	YES	YES	YES	YES	YES

Notes: *, **, and *** denote significance at the 10%, 5% and 1% level, respectively.
α is the rate parameter of the Gamma distribution used for the random effects. $\ln(\hat{\alpha})$ is the logarithm of the estimated value of the previous parameter. When the coefficient is significant il implies that random effects correct the overdipersion issue of the Poisson estimators.

amount of risks. So that suggests a high level of CBI could exacerbate financial vulnerabilities and therefore raise the ECBC. Nevertheless, CBI could also have no repercussions on the cost of crisis. In their seminal article, Alesina and Summers (1993) acknowledged that CBI enhances price stability but failed to find any impact from CBI on economic activity. More recently, Bordo (2010) in an historical approach of CBI find no support for one or the other hypothesis. We consider two proxies of CBI to check wether it is a major determinant of ECBC. The first is the well-known CWN index developed by Cukierman et al. (1992) and recently updated by Garriga (2016). This measure is a *de jure* index of CBI because it is based on legal statute of central banks. It is one of the most frequently used measure in the litterature. As independence is a pluri-dimensional concept, the CWN index offers the advantage of taking into account different elements of independence. Formally, it is constructed as a weighted average of 4 sub-components which include organic independence, monetary policy final objectives, monetary policy formulation and limitations of lending to government. We also consider a *de facto* index of CBI, based on nonlegal informations, namely the TOR index. TOR is defined as the turnover rate of central bankers, interpreted as an inverse proxy of CBI. It is computed from information on the term in office of central bank governors developed by Dreher et al. (2008). In our empirical analysis, our measures of CBI sustain the view developed by Berger and Kißmer (2013). When coefficients are significant, there are always associated with a positive sign. However in two third of the cases, the coefficients of the de facto index appeared non-significant. Overall, CBI seems to increase crisis severity, but results do not appear robust to the change of ECBC measure, in particular with the *de facto* index.

4.1.3 Trilemma Indexes

We turn now to the trilemma indexes as interest variables. This label refers to the Mundell's incompatibility triangle. Central banks have the possibility to reach simultaneously two desirable features among three, namely monetary independence (vis-à-vis the rest of the world), exchange rate stability, and financial openness. The central bank position in the trilemma is given by the three variables construted by Aizenman et al. (2013). Monetary independence index is based on the correlation between the interest rate of a given country and the policy rate of the reference central bank[4]. Then for a given country, the exchange rate stability index is computed from the standard deviation of the exchange rate of the local currency against the currency of the reference country. Finally, the level of financial openness is captured by the Chinn-Ito index (Chinn and Ito, 2006, 2008). This index is a *de jure* measure of financial integration based on the legal restriction on the capital account. All of the trilemma indexes are normalized between 0 and 1, where 1 represents the highest level of independence, the highest level of exchange rate stability and the highest level of financial openness respectively. Concerning our empirical investigation, independent monetary policy from other countries appears to increase the ECBC. As argue by Aizenman and Ito (2014), divergence in monetary policy

[4]The reference central bank is defined as the central bank that the domestic monetary policy is most closely linked

Table 5: Results: Impact of Trilemma Indexes on the ECBC.

	Monetary independence			Financial openness		
	loss_5years	loss_all	trend_loss	loss_5years	loss_all	trend_loss
Interest variable	0.951***	0.676***	0.433*	-0.931***	-1.549***	-0.971***
	(0.237)	(0.202)	(0.261)	(0.208)	(0.183)	(0.221)
GDP per capita	0.003**	0.003**	0.003**	0.002**	0.003***	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Inflation	0.004***	0.003***	0.003***	0.005***	0.003***	0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Bank credit / GDP	0.031***	0.030***	0.031***	0.029***	0.029***	0.030***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)
Credit-to-GDP gap	0.615***	0.641***	0.450**	0.774***	0.777***	0.646***
	(0.194)	(0.166)	(0.217)	(0.190)	(0.163)	(0.213)
Public Debt / GDP	0.026***	0.028***	0.028***	0.026***	0.028***	0.028***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)
Simultaneous crisis	0.001	0.002	0.003	0.002	0.002	0.003
	(0.006)	(0.006)	(0.006)	(0.006)	(0.005)	(0.006)
Currency crisis	0.767***	0.514***	0.797***	0.771***	0.486***	0.782***
	(0.083)	(0.071)	(0.089)	(0.082)	(0.070)	(0.088)
Discret. gov. consumption	-3.462***	-2.029***	-1.654***	-3.187***	-1.877***	-1.486***
	(0.478)	(0.383)	(0.512)	(0.472)	(0.373)	(0.506)
CB assets	-0.001	-0.009**	0.005	-0.002	-0.010**	0.002
	(0.006)	(0.004)	(0.006)	(0.005)	(0.004)	(0.007)
Constant	-3.748***	-3.449***	-4.062***	-2.566***	-2.190***	-3.230***
	(0.392)	(0.353)	(0.417)	(0.372)	(0.338)	(0.396)
$\ln(\hat{\alpha})$	1.660***	1.508***	1.631***	1.569***	1.479***	1.646***
	(0.187)	(0.182)	(0.187)	(0.185)	(0.179)	(0.184)
Observations	2,029	2,029	2,029	2,138	2,138	2,138
Number of countries	66	66	66	67	67	67
Crisis observations	206	206	206	212	212	212
Year FE	YES	YES	YES	YES	YES	YES

Notes: *, **, and *** denote significance at the 10%, 5% and 1% level, respectively.
α is the rate parameter of the Gamma distribution used for the random effects. $\ln(\hat{\alpha})$ is the logarithm of the estimated value of the previous parameter. When the coefficient is significant il implies that random effects correct the overdipersion issue of the Poisson estimators.

vis-à-vis the rest of the world can generate uneasiness of the financial markets, and thus raises the probability of banking crisis. To the best of our knowledge, this is the only study which consider this variable as a potential determinant of the probability of crisis or the cost of the crisis. However the authors consider an aggregate version of the three trilemma indexes, and not only the monetary independence measure as we did. The second result of this section is about the exchange rate stability, the variable emerges with significant and negetive sign in all of our regressions. Our finding can be sum up as follow : the more volatile the exchange rate is, the higher the ECBC is. We do not detail this outcome here, because of the next subsection is entirely dedicated to the exchange rate regime. Regarding the last variable of trilemma, namely the level of financial openness, our results suggest that the deeper financial system is integrated, the weaker the ECBC is. Calvo et al. (2008) explain that financial openness makes the risk of "sudden stop" in capital flows less likely. In addition, in recent empirical papers, results validate this explanation, showing that countries with fewer regulation on foreign capital flows have easily access to alternative sources of capital (see e.g. Abiad et al., 2009; Detragiache and Ho, 2010). Nevertheless, other studies conflict with our finding. For instance, Giannone et al. (2011) and Berkmen et al. (2012) sustain that interconneted financial systems can lead to spillover effetcs when a crisis occurs and the generates output losses, especially in emerging countries.

4.1.4 Exchange Rate Regime

Many studies have already emphasised the benefits of fixed exchange rate. Three main arguments have raised. First, according to Eichengreen and Hausmann (1999), under flexible exchange rate, countries indebted in foreign currency are likely to experiment an increase of real debt burden if the domestic currency collapses. Fixed regime helps to avoid this issue and improve the attractivness of local investment by limiting the currency exposure for the foreign investors. Second, following Eichengreen and Rose (1998) fixed exchange rate regime also imposes market discipline for the conduct of monetary policy. In order to avoid to put the exchange parity at risk, policymaking must be sterilized. As a consequence in the long run, monetary authorities become as well more credible. Third, in emerging countries, fixed exchange rate finally protects local market from imported inflation and financial instability through the exchange rate channel (see e.g. Calvo and Reinhart, 2002). To test the exchange rate regime mechanism on the ECBC, we have first retained two *de jure* variables. These variables are taken from the classification of exchange rate regime proposed by Reinhart and Rogoff (2004) and recently extended by Ilzetzki et al. (2011). Both measures increase as the exchange rate become more flexible. These indicators have the merit of distinguishing among a wider variety of regime. The first variable, namely the fine classification index, includes 15 modalities, whereas the coarse index has braoder categories and includes only 6 modalities. We obtain similar results with both indicators. All the estimated coefficients are positve and significant which means that fixed exchange rate implies smaller ECBC. These results are in line with those obtain in the previous subsection, when we consider the exchange stability as

Table 6: Results: Impact of *De jure* Exchange Rate Regime on the ECBC.

	De jure exchange rate regime (fine)			*De jure* exchange rate regime (coarse)		
	loss_5years	loss_all	trend_loss	loss_5years	loss_all	trend_loss
Exchange Rate Regime	0.067***	0.047***	0.073***	0.170***	0.141***	0.172***
	(0.012)	(0.010)	(0.014)	(0.037)	(0.032)	(0.043)
GDP per capita	0.003***	0.003***	0.005***	0.002*	0.002**	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Inflation	0.005***	0.004***	0.001	0.004***	0.003***	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Bank credit / GDP	0.028***	0.027***	0.029***	0.027***	0.026***	0.028***
	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)
Credit-to-GDP gap	0.946***	0.818***	0.766***	0.938***	0.838***	0.745***
	(0.195)	(0.165)	(0.217)	(0.197)	(0.166)	(0.217)
Public Debt / GDP	0.023***	0.026***	0.025***	0.023***	0.026***	0.025***
	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Simultaneous crisis	-0.000	0.001	0.000	0.001	0.001	0.001
	(0.006)	(0.005)	(0.006)	(0.006)	(0.005)	(0.006)
Currency crisis	0.721***	0.502***	0.720***	0.747***	0.512***	0.754***
	(0.084)	(0.072)	(0.091)	(0.083)	(0.071)	(0.090)
Discret. gov. consumption	-3.105***	-1.859***	-1.367***	-2.979***	-1.761***	-1.290**
	(0.478)	(0.380)	(0.514)	(0.485)	(0.383)	(0.518)
CB assets	-0.001	-0.007*	0.006	0.001	-0.007	0.008
	(0.005)	(0.004)	(0.007)	(0.005)	(0.004)	(0.006)
Constant	-3.516***	-3.248***	-4.239***	-3.298***	-3.155***	-3.969***
	(0.363)	(0.329)	(0.395)	(0.355)	(0.323)	(0.383)
$\ln(\hat{\alpha})$	1.551***	1.426***	1.646***	1.507***	1.390***	1.591***
	(0.186)	(0.181)	(0.185)	(0.187)	(0.182)	(0.185)
Observations	2,192	2,192	2,192	2,192	2,192	2,192
Number of countries	67	67	67	67	67	67
Crisis observations	212	212	212	212	212	212
Year FE	YES	YES	YES	YES	YES	YES

Notes: *, **, and *** denote significance at the 10%, 5% and 1% level, respectively.
α is the rate parameter of the Gamma distribution used for the random effects. $\ln(\hat{\alpha})$ is the logarithm of the estimated value of the previous parameter. When the coefficient is significant il implies that random effects correct the overdipersion issue of the Poisson estimators.

Table 7: Results: Impact of *De facto* Exchange Rate Regime on the ECBC.

	Exchange Rate Stability			Dummies Exchange Rate Regime		
	loss_5years	loss_all	trend_loss	loss_5years	loss_all	trend_loss
Exchange rate stability	-1.236***	-0.972***	-1.253***			
	(0.142)	(0.122)	(0.158)			
Dummy E.R. fixed				0.660***	0.845***	0.684***
				(0.120)	(0.105)	(0.133)
Dummy E.R. floating				0.904***	0.906***	0.623***
				(0.104)	(0.095)	(0.122)
GDP per capita	0.004***	0.003***	0.005***	-0.002*	-0.002*	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Inflation	0.004***	0.003***	0.001	0.003***	0.002***	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Bank credit / GDP	0.029***	0.029***	0.031***	0.030***	0.030***	0.034***
	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Credit-to-GDP gap	0.315	0.414**	0.241	0.383*	0.435**	0.076
	(0.192)	(0.164)	(0.219)	(0.202)	(0.174)	(0.227)
Public Debt / GDP	0.021***	0.025***	0.024***	0.020***	0.025***	0.024***
	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.003)
Simultaneous crisis	-0.004	-0.001	-0.002	3.165***	3.056***	2.203***
	(0.006)	(0.006)	(0.006)	(1.101)	(0.859)	(0.393)
Currency crisis	0.744***	0.521***	0.720***	0.912***	0.580***	0.857***
	(0.083)	(0.071)	(0.089)	(0.088)	(0.075)	(0.096)
Discret. gov. consumption	-3.273***	-1.919***	-1.437***	-3.083***	-1.790***	-1.707***
	(0.472)	(0.377)	(0.508)	(0.482)	(0.388)	(0.527)
CB assets	0.000	-0.010**	0.004	0.006	-0.004	0.008
	(0.005)	(0.004)	(0.006)	(0.007)	(0.005)	(0.008)
Constant	-2.444***	-2.436***	-3.094***	-83.180***	-80.330***	-58.855***
	(0.359)	(0.329)	(0.387)	(27.497)	(21.451)	(9.793)
$\ln(\hat{\alpha})$	1.589***	1.454***	1.676***	1.742***	1.573***	1.625***
	(0.189)	(0.183)	(0.187)	(0.196)	(0.185)	(0.189)
Observations	2,152	2,152	2,152	1,590	1,590	1,590
Number of countries	66	66	66	67	67	67
Crisis observations	207	207	207	170	170	170
Year FE	YES	YES	YES	YES	YES	YES

Notes: *, **, and *** denote significance at the 10%, 5% and 1% level, respectively.
α is the rate parameter of the Gamma distribution used for the random effects. $\ln(\hat{\alpha})$ is the logarithm of the estimated value of the previous parameter. When the coefficient is significant il implies that random effects correct the overdipersion issue of the Poisson estimators.

interest variable. At this point, we have turned a blind eye to arguments in favour of flexible exchange rate regime. However, a rich literature sustains the proeminence of floating exchange rate. To begin, fixed exhange rate provides a kind of implicit guarantee against currency risk which amplifies the risk of moral hazard on local fiancial sector and creates an incentive to borrow foreign currencies. In addition, peg exchange rate suffers from a lack of credibility in the long run and increase the debt burden all the more so the initial incentive have been strong (see e.g. Eichengreen and Hausmann, 1999; Domac and Martinez Peria, 2003). Domac and Martinez Peria (2003) also argue that exchange rate stability imposes a duty for the central bank to be focusing to maintain the exchange rate parity. Thus, in the onset of banking crisis, the central bank will not be able to fulfill its lender-of-last-resort mission, and so can not prevent economy from bank run. On the contrary, a floating exchange rate allows the monetary authorities to stabilize economic growth during the crisis. Then, in a flexible regime context, Lane and Milesi-Ferretti (2011) also mention that when a banking crisis comes with exchange rate depreciation, we can expect a boost in the volume of exports which translates into a better of the economic activity in crisis period. Finally, as we have mentioned earlier, Barnebeck Andersen et al. (2015) indicate that combining a flexible exchange rate regime with inflation targeting restores simultaneously the credibility (thanks to IT) and some margin for monetary policy. All in all, we can suspect a non-linear realtionship between the ECBC and the exchange rate regime. To test this hypothesis, we include in the same regression two binary variables proposed by Habermeier et al. (2009). We consider dummy variables capturing fixed and flexible exchange rate regime, hence both estimated coefficicents must be interpreted in regards to intermediate exchange rate regime. The outcome suggest a U-shapep link between output losses and exchange rate regime. As all coefficients are positive and significant, extreme exchange rate regimes appear as the most costly. Such case has already be mentioned in the literature. According to Eichengreen and Hausmann (1999): "It follows that both fixed and flexible exchange rates are problematic." In the same vein, Domac and Martinez Peria (2003) provide explanations to sustain this view. In their empirical analysis, they find that on the one hand the floating increase the probability of banking crisis, because of the volatility induced by flexible exchange rate in the financial sector. On the other hand fixed regimes are associated with higher cost in the aftermath of the crisis, as central bank has its hands tied and can not take the stabilization measures needed. Other empirical analyses arrive to a quite similar conclusion (see e.g. Tsangarides, 2012; Lane and Milesi-Ferretti, 2011). Given that we consider the expected cost of crisis and not only the probability nor the cost of banking crisis, our findings are consistent with the recent literature. Intermediate exchange rate regime keep benefits of both extreme regime without all their disadvantages.

4.1.5 Central Banks'Preferences

To our knowledge, this paper is the first to explore the link between central banks'conservatism (CBC) and the expected cost of banking crisis (ECBC). First we need to gauge the level of CBC, to this end we have selected the CONS index developed by Levieuge and Lucotte (2014).

Table 8: Results: Impact of Central Banks' Preferences on the ECBC.

	CONS_W			CWN_OBJ		
	loss_5years	loss_all	trend_loss	loss_5years	loss_all	trend_loss
Index of CBC	0.346**	-0.070	0.429***	1.507***	1.081***	0.222
	(0.136)	(0.121)	(0.151)	(0.214)	(0.187)	(0.240)
GDP per capita	-0.001	-0.001	0.000	0.003***	0.003***	0.003**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Inflation	0.006***	0.004***	0.003***	0.006***	0.004***	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Bank credit / GDP	0.028***	0.026***	0.029***	0.033***	0.031***	0.032***
	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Credit-to-GDP gap	0.623***	0.588***	0.475**	0.860***	0.989***	0.554**
	(0.194)	(0.169)	(0.218)	(0.204)	(0.178)	(0.236)
Public Debt / GDP	0.025***	0.026***	0.026***	0.029***	0.030***	0.031***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Simultaneous crisis	0.001	0.004	0.002	0.001	0.003	0.005
	(0.006)	(0.005)	(0.006)	(0.006)	(0.005)	(0.006)
Currency crisis	0.803***	0.708***	0.801***	0.751***	0.508***	0.682***
	(0.082)	(0.073)	(0.088)	(0.089)	(0.077)	(0.095)
Discret. gov. consumption	-3.314***	-2.693***	-1.506***	-3.889***	-2.412***	-1.558***
	(0.474)	(0.399)	(0.518)	(0.505)	(0.412)	(0.555)
CB assets	-0.001	-0.006	0.010	-0.004	-0.009**	0.001
	(0.006)	(0.005)	(0.007)	(0.006)	(0.004)	(0.007)
Constant	-2.708***	-2.332***	-3.406***	-4.689***	-4.152***	-4.229***
	(0.351)	(0.322)	(0.372)	(0.421)	(0.372)	(0.442)
$\ln(\hat{\alpha})$	1.238***	1.119***	1.318***	1.642***	1.502***	1.596***
	(0.190)	(0.187)	(0.189)	(0.188)	(0.182)	(0.188)
Observations	1,699	1,699	1,699	2,038	2,038	2,038
Number of countries	62	62	62	66	66	66
Crisis observations	203	203	203	200	200	200
Year FE	YES	YES	YES	YES	YES	YES

Notes: *, **, and *** denote significance at the 10%, 5% and 1% level, respectively.
α is the rate parameter of the Gamma distribution used for the random effects. $\ln(\hat{\alpha})$ is the logarithm of the estimated value of the previous parameter. When the coefficient is significant il implies that random effects correct the overdipersion issue of the Poisson estimators.

This indicator is a *de facto* index based on the Taylor curve and computed the degree of conservatism from the volatility of output gap relative to the volatility of inflation on a five-years rolling window. We use the shock-adjusted version of the CBC index, named CONS_W. CONS_W is normalized between 0 and 1, where 1 represents the highest level of CBC. The level of CBC is significant with the output loss_5years and the trend_loss, in both cases the estimated coefficient is positive. We also consider a *de jure* proxy of CBC, which is a subcomponent extracted from the CWN index of central banks' independence constructed by Cukierman et al. (1992). This subcomponent, called CWN_OBJ, captures the importance that is given by the central bank statute to the pursuit of price stability relative to the other objectives. It is also normalized between 0 and 1, with 1 corresponding to the case where price stability is the sole/main objective of monetary policy. As for CONS_W, we find a positive link between CWN_OBJ and the measures of losses. Consequently hawkish monetary policy exacerbate the ECBC. At least two reasons could explain that a higher level of CBC implies higher ECBC. First, Levieuge et al. (2017) demonstrate that conservatism increases the banking sector vulnerability[5]. By giving too much emphasis on price stabilization, central banks neglect financial instability and let imbalances skyrocket on the banking sector. These financial imbalances then trigger banking crises or raise the output loss during the crisis (see e.g. Cecchetti et al., 2009; Čihák and Schaeck, 2010; Frydl, 1999; Furceri and Zdzienicka, 2012b). Secondly, during the acute phase of the crisis, one wonders if conservative central banks would be able to turn away from its primary goal of price stability. We could expect that a dovish central bank responds to the crisis faster and more aggressively than a hawkish central bank. That is why low level of conservatism limits output loss during the ougoing of the crisis. We find some support for this hypothesis in our sample, the correlation between the CONS index and our monetary response is negative and strongly significant (-0.2449***). In addition when we only consider the crisis years, the correlation raises to -0.2766 (always significant at the 1% level of confidence).

4.2 Fiscal Rules

4.2.1 Direct Impact of Fiscal Rules

The effect of implementing fiscal rule(s) takes us back to the debate about "rules versus discretion". Broadly speaking (see Kydland and Prescott, 1977; Walsh, 2003, for an overview of this debate), discretionary policy is particularly efficient for a quick activity stabilization after a major shock. Then we can expect that the stabilization bias of pure discretion mitigates the negative impact of the crisis. However discretionary fiscal policy can suffer from a deliberate diversion to electoral purposes or a time-inconsistency issue. Then in that case, the lack of credibility of the policymaker leads to rise imbalances and so the likelihood of the crisis. Sim-

[5]The empirical analysis conduct in Levieuge et al. (2017) shows that the level of CBC positively affect among other the credit-to-GDP. Considering both the level of CBC and the credit-to-GDP gap can lead to misspecification in the model. However, our results are robust to the withdrawal of the credit-to-GDP gap from the control variables.

Table 9: Results: Impact of Fiscal Rules on the ECBC.

	Expenditure Rule			Revenue Rule		
	loss_5years	loss_all	trend_loss	loss_5years	loss_all	trend_loss
Fiscal Rule	-1.605***	-1.835***	-2.000***	-0.865***	-0.708***	-0.792***
	(0.201)	(0.181)	(0.225)	(0.291)	(0.235)	(0.275)
GDP per capita	-0.000	0.001	0.003	-0.004***	-0.002**	-0.002
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)
Inflation	-0.001	-0.001	-0.000	0.002	0.002***	0.003*
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
Bank credit / GDP	0.051***	0.054***	0.044***	0.050***	0.050***	0.042***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Credit-to-GDP gap	2.079***	2.024***	1.204***	2.215***	2.022***	1.341***
	(0.365)	(0.296)	(0.397)	(0.361)	(0.291)	(0.386)
Public Debt / GDP	0.051***	0.049***	0.041***	0.050***	0.045***	0.038***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Simultaneous crisis	0.034***	0.030***	0.020***	0.030***	0.024***	0.017***
	(0.006)	(0.006)	(0.007)	(0.006)	(0.006)	(0.007)
Currency crisis	1.305***	0.552***	0.998***	1.126***	0.469***	0.815***
	(0.141)	(0.109)	(0.140)	(0.134)	(0.106)	(0.133)
Discret. gov. consumption	-2.688***	-0.163	-2.052**	-1.435*	0.504	-0.732
	(0.826)	(0.564)	(0.870)	(0.803)	(0.547)	(0.824)
CB assets	0.087***	0.054***	0.041***	0.087***	0.049***	0.042***
	(0.011)	(0.009)	(0.011)	(0.011)	(0.009)	(0.011)
Constant	-4.918***	-4.651***	-4.595***	-4.640***	-4.302***	-4.079***
	(0.585)	(0.518)	(0.571)	(0.599)	(0.504)	(0.545)
$\ln(\hat{\alpha})$	1.932***	1.918***	1.914***	1.779***	1.672***	1.629***
	(0.215)	(0.208)	(0.231)	(0.212)	(0.207)	(0.224)
Observations	977	977	977	977	977	977
Number of countries	45	45	45	45	45	45
Crisis observations	130	130	130	130	130	130
Year FE	YES	YES	YES	YES	YES	YES

Notes: *, **, and *** denote significance at the 10%, 5% and 1% level, respectively.
α is the rate parameter of the Gamma distribution used for the random effects. $\ln(\hat{\alpha})$ is the logarithm of the estimated value of the previous parameter. When the coefficient is significant il implies that random effects correct the overdipersion issue of the Poisson estimators.

Table 10: Results: Impact of Fiscal Rules on the ECBC.

	Budget Balance Rule			Debt Rule		
	loss_5years	loss_all	trend_loss	loss_5years	loss_all	trend_loss
Fiscal Rule	-0.165	-0.455***	-0.440**	-1.818***	-2.174***	-2.122***
	(0.187)	(0.162)	(0.213)	(0.231)	(0.196)	(0.241)
GDP per capita	-0.003**	-0.001	-0.001	0.001	0.002	0.002
	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Inflation	0.001	0.002***	0.002	0.002	0.002**	0.003*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Bank credit / GDP	0.049***	0.049***	0.041***	0.050***	0.053***	0.040***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)
Credit-to-GDP gap	2.170***	1.949***	1.249***	2.003***	1.847***	0.987**
	(0.364)	(0.294)	(0.391)	(0.377)	(0.304)	(0.408)
Public Debt / GDP	0.049***	0.045***	0.039***	0.050***	0.047***	0.037***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)
Simultaneous crisis	0.029***	0.024***	0.016**	0.025***	0.021***	0.012*
	(0.006)	(0.006)	(0.007)	(0.006)	(0.006)	(0.007)
Currency crisis	1.128***	0.458***	0.816***	1.135***	0.450***	0.832***
	(0.134)	(0.106)	(0.133)	(0.135)	(0.106)	(0.135)
Discret. gov. consumption	-1.644**	0.406	-0.939	-1.366*	0.430	-0.763
	(0.803)	(0.545)	(0.830)	(0.802)	(0.535)	(0.832)
CB assets	0.083***	0.042***	0.033***	0.058***	0.025***	0.006
	(0.011)	(0.009)	(0.011)	(0.012)	(0.009)	(0.012)
Constant	-4.711***	-4.335***	-4.103***	-4.693***	-4.185***	-3.503***
	(0.586)	(0.498)	(0.539)	(0.587)	(0.526)	(0.568)
$\ln(\hat{\alpha})$	1.780***	1.687***	1.676***	1.768***	1.781***	1.680***
	(0.212)	(0.209)	(0.228)	(0.220)	(0.215)	(0.234)
Observations	977	977	977	977	977	977
Number of countries	45	45	45	45	45	45
Crisis observations	130	130	130	130	130	130
Year FE	YES	YES	YES	YES	YES	YES

Notes: *, **, and *** denote significance at the 10%, 5% and 1% level, respectively.
α is the rate parameter of the Gamma distribution used for the random effects. $\ln(\hat{\alpha})$ is the logarithm of the estimated value of the previous parameter. When the coefficient is significant il implies that random effects correct the overdipersion issue of the Poisson estimators.

Table 11: Results: Impact of Fiscal Rules on the ECBC.

	Existence of Rule(s)			Number of Rules		
	loss_5years	loss_all	trend_loss	loss_5years	loss_all	trend_loss
Fiscal Rule	-1.088***	-1.571***	-1.448***	-0.591***	-0.690***	-0.769***
	(0.174)	(0.157)	(0.194)	(0.079)	(0.067)	(0.087)
GDP per capita	-0.002	-0.001	-0.001	0.000	0.002	0.003
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Inflation	0.000	0.001	0.001	0.001	0.001	0.002
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)
Bank credit / GDP	0.051***	0.054***	0.044***	0.050***	0.053***	0.042***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Credit-to-GDP gap	1.915***	1.710***	0.831**	2.013***	1.831***	0.983**
	(0.369)	(0.299)	(0.405)	(0.369)	(0.297)	(0.401)
Public Debt / GDP	0.051***	0.048***	0.040***	0.052***	0.049***	0.041***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)
Simultaneous crisis	0.032***	0.028***	0.019***	0.030***	0.026***	0.016**
	(0.006)	(0.006)	(0.007)	(0.006)	(0.006)	(0.007)
Currency crisis	1.169***	0.470***	0.836***	1.225***	0.497***	0.911***
	(0.136)	(0.107)	(0.136)	(0.138)	(0.107)	(0.138)
Discret. gov. consumption	-1.874**	0.121	-1.308	-1.931**	0.261	-1.302
	(0.804)	(0.543)	(0.845)	(0.810)	(0.540)	(0.849)
CB assets	0.065***	0.028***	0.009	0.069***	0.035***	0.015
	(0.011)	(0.009)	(0.012)	(0.011)	(0.009)	(0.011)
Constant	-4.382***	-3.777***	-3.437***	-4.711***	-4.316***	-3.795***
	(0.576)	(0.509)	(0.551)	(0.580)	(0.518)	(0.561)
$\ln(\hat{\alpha})$	1.806***	1.762***	1.760***	1.853***	1.841***	1.826***
	(0.214)	(0.210)	(0.230)	(0.218)	(0.213)	(0.236)
Observations	977	977	977	977	977	977
Number of countries	45	45	45	45	45	45
Crisis observations	130	130	130	130	130	130
Year FE	YES	YES	YES	YES	YES	YES

Notes: *, **, and *** denote significance at the 10%, 5% and 1% level, respectively.
α is the rate parameter of the Gamma distribution used for the random effects. $\ln(\hat{\alpha})$ is the logarithm of the estimated value of the previous parameter. When the coefficient is significant il implies that random effects correct the overdipersion issue of the Poisson estimators.

ilarly, rules for fiscal policy solve the previous issue by limiting potential ex-ante imbalances. Nevertheless rules can theoreticaly under-perform in comparison with discretion, in the stabilization phase after the crisis, as the government has its hands tie by the rule. To gauge the impact of fiscal rules on the ECBC, we use the database developped by Schaechter et al. (2012) (details and update are provided in Budina et al., 2012; Bova et al., 2015; Lledó et al., 2017). We consider four types of fiscal rules. Each rule are captured by a binary variable which takes the value of 1 if a country follow a particular rule in a given year and 0 otherwise. First, "expenditure rules" are defined as a limit on government spending. Second, "revenue rules" are rules which aim to improve taxes efficiency. Third, "budget balance rules" correspond to constraint on public deficit. Fourth, "debt rules" imply the existence of limit or target for the debt ratio. Moreover, we also consider two additional variables also taken from Schaechter et al. (2012). We use a dummy variable taking the value 1 if in a given year a country operates under at least one fiscal rule and zero if not. We also include a compting variable compiling the number of fiscal rules which prevailed simultaneously. All in all, each strategy has benefits and disadvantages. Following fiscal rules appears desirable ex-ante to reduce the probability of crisis whereas ex-post discretionary policy is relevant to clean up the mess afterwards. Our empirical analysis aims to discover which effect prevails over the other. Results are firmly in favour of rules. Regardless of the variable used, rules are estimated to have a negative and significant effect on the cost of banking crisis.

4.2.2 Interaction between Monetary and Fiscal Policies' Frameworks

5 Conclusion

Work in progress.

Table 12: Results: Interaction between Monetary and Fiscal Policies' Frameworks

	Existence of Rule(s)		Number of Rules			
	loss_5years	loss_all	loss_5years	loss_all	Sample	
CONS_W	2.727***	1.890***	2.618***	1.626***	Observations	823
	(0.285)	(0.232)	(0.278)	(0.224)	Numb. countries	42
Interaction with Fiscal Rules	-2.069***	-2.617***	-1.013***	-1.151***	Crisis obs.	121
	(0.257)	(0.228)	(0.118)	(0.099)	Year FE	YES
CWN_OBJ	3.525***	3.399***	3.428***	3.192***	Observations	952
	(0.445)	(0.352)	(0.441)	(0.343)	Numb. countries	45
Interaction with Fiscal Rules	-0.885***	-1.121***	-0.423***	-0.464***	Crisis obs.	129
	(0.226)	(0.205)	(0.108)	(0.095)	Year FE	YES
Partial Adoption of IT	2.222***	1.766***	2.726***	2.015***	Observations	977
	(0.261)	(0.214)	(0.290)	(0.222)	Numb. countries	45
Interaction with Fiscal Rules	-3.069***	-3.776***	-1.634***	-1.855***	Crisis obs.	130
	(0.301)	(0.280)	(0.149)	(0.139)	Year FE	YES
Fully-Fledged Adoption of IT	1.313***	0.694**	1.675***	0.888***	Observations	977
	(0.310)	(0.271)	(0.319)	(0.273)	Numb. countries	45
Interaction with Fiscal Rules	-2.697***	-3.229***	-1.431***	-1.595***	Crisis obs.	130
	(0.335)	(0.316)	(0.169)	(0.161)	Year FE	YES
Index of CBI (CWN)	4.385***	5.297***	4.731***	5.012***	Observations	952
	(0.551)	(0.473)	(0.544)	(0.444)	Numb. countries	45
Interaction with Fiscal Rules	-1.493***	-2.156***	-0.828***	-0.896***	Crisis obs.	129
	(0.295)	(0.272)	(0.133)	(0.113)	Year FE	YES
Monetary independence	1.383***	0.672*	1.823***	0.965***	Observations	949
	(0.443)	(0.351)	(0.464)	(0.362)	Numb. countries	44
Interaction with Fiscal Rules	-2.027***	-3.109***	-1.329***	-1.746***	Crisis obs.	125
	(0.380)	(0.352)	(0.198)	(0.178)	Year FE	YES
Exchange rate regime (fine)	0.066***	0.046**	0.088***	0.056***	Observations	977
	(0.022)	(0.018)	(0.023)	(0.019)	Numb. countries	45
Interaction with Fiscal Rules	-0.179***	-0.227***	-0.104***	-0.131***	Crisis obs.	130
	(0.020)	(0.018)	(0.010)	(0.010)	Year FE	YES
Exchange rate regime (coarse)	0.196***	0.193***	0.198***	0.165***	Observations	977
	(0.073)	(0.060)	(0.074)	(0.060)	Numb. countries	45
Interaction with Fiscal Rules	-0.564***	-0.727***	-0.333***	-0.420***	Crisis obs.	130
	(0.071)	(0.063)	(0.037)	(0.034)	Year FE	YES

Notes: *, **, and *** denote significance at the 10%, 5% and 1% level, respectively.

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