

Bank interest rate pass-through in the eurozone : monetary policy transmission during the boom and since the financial crash

First draft

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Christophe Blot¹
Fabien Labondance²

Abstract:

The aim of this paper is to understand how the financial crisis has affected the interest rate pass-through in the eurozone between market rates and bank interest rates. We applied a SUR-ECM model. This methodology allows testing for the homogeneity of the pass-through of the euro area countries. The main results of this investigation are the following. First, not surprisingly, we show that the financial turmoil since august 2007 has affected drastically the interest rate passe-through in the eurozone. Second, the pass-through since the crisis is less complete that in the previous period studied. Third, the heterogeneity between the eurozone members has increased.

Jel Classification: E43, G21

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¹ Observatoire Français des Conjonctures Economiques (OFCE), christophe.blot@ofce.sciences-po.fr

² Facultés Universitaire Catholique de Mons (FUCaM), Louvain School of management (LSM) and Université de Grenoble (UPMF), fabien.labondance@fucam.ac.be (Corresponding Author,)

I. Introduction

Since the beginning of the stage three³ of the European monetary process, the European Central Bank (ECB) has to implement a “one size fits all” monetary policy. It must be based on the monetary and economic conditions of the euro area as a whole. Despite the economic and monetary integration process, member state’s banking system remains very specific. This heterogeneity influences drastically the monetary policy transmission. Regarding the Optimal Currency Area (OCA) theory developed by Mundell (1961) and invoked by Mongelli (2008) to deal with the question of the viability of the euro area. One main argument, called “OCA meta-properties”, is the homogeneity of monetary policy transmission process. Numerous studies have been dealing with this issue (Angeloni, Kashyap, & Mojon, 2003) and the main conclusion is that it exists important cross-countries differences in the interest rate pass-through. But it also appears that since 1999, this pass-through is quicker and tends to be more homogeneous between the euro area members.

In this paper, our purpose is not simply to study the influence of the monetary union on the pass-through, but rather to understand if the subprime crisis had modified it. Our problematic is to investigate if the interest rate pass-through in 11 euro zone countries is influenced by the subprime crisis and how?

Banks play an important role in the transmission of monetary policy⁴, especially in the euro area where borrowers rely more heavily on the banking systems to raise funds. For a comparison, loans to the private sector granted by banks amounted to 145 % of GDP in 2007 in the euro area against 63 % of GDP in the United States. It is meaningful for central banks, since it involves that the transmission of monetary policy strongly hinges on the speed and the size of the pass-through from policy-controlled interest rates to the bank interest rates. It may also be the source of heterogeneity in the transmission of the common monetary policy, since despite overall financial integration, credit markets are much less integrated in the euro area compared to stock, bond and money markets (Jappelli and Pagano, 2008). Despite the convergence, which has been realized in the run-up to EMU, heterogeneity is supposed to remain pervasive as differences in the banking systems across EMU countries stem not only from differences in regulation or in the concentration of the

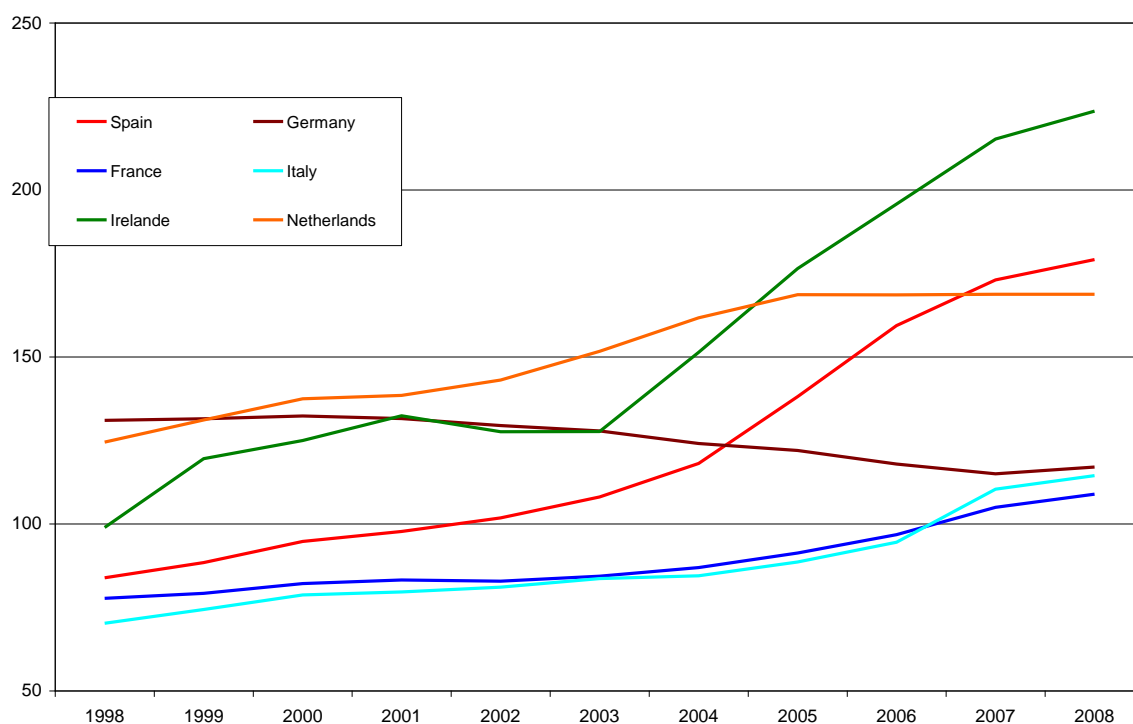
³ Stage one of Economic and Monetary Union (EMU) started in 1990. It was characterized by the set up of the free movement of goods, persons, services and capital within EU Member States. Stage Two started with the establishment of the European Monetary Institute (EMI), in 1994. It was a technical phase in order to prepare the creation of the single currency: enforcement of fiscal discipline and enhanced convergence of the economic and monetary policies of the EU Member States. Stage Three, the 1 January 1999, is the final stage of EMU. It started with the irrevocable fixing of the conversion rates of the currencies of the 11 Member States initially participating, and with the introduction of the euro as the single currency. It is also since this date that the ECB has been responsible for conducting the single monetary policy in the eurozone.

⁴ See ECB (2008) for an excellent review of the literature on the role of banks in the transmission of monetary policy.

banking industry but also from the local and private nature of the information. The intrinsically asymmetric nature of information in credit markets is then a strong restraint against complete convergence.

Since 1999, there were signs illustrating the potential role of an asymmetric transmission in monetary policy. Differences in the developments in the housing markets were for example striking. Prices have more than doubled in nominal terms between 2000 and 2007 in France or in Spain whereas they only increased by 3.5 % in Germany during the same period. At the same time, a surge in loans granted by the MFI (monetary and financial institutions) to residents has been observed notably in Spain and Ireland whereas it was much more muted in France and in Italy (chart 1). It even decreased in Germany where it went from 132 % of GDP in 2000 to 115 % in 2007. These differences inevitably raise a first question that will be dealt by this paper: are these cyclical differences, at least partly, due to monetary policy? As banks play a central role in the transmission of monetary policy, this issue will be dealt by focusing on the bank interest rate pass-through. Following, Sorensen and Werner (2006), we estimate a SUR-ECM model to test the heterogeneity of the transmission of monetary policy across EMU countries.

Chart 1 : Loans to residents in % of GDP



Source: Eurostat

Since August 2007, the world has been through one of the most dramatic financial turmoil. The origins of the crisis may be found in the US subprime market but it then

sprawled over the whole financial system. The panic gained the banking system since banks were directly or indirectly the final holders of toxic assets. The financial net worth of borrowers and lenders have sharply decreased, which could potentially impact on the transmission of monetary policy. The literature of the credit channels highlights the importance of asymmetric information and agency problems which may have precisely become more acute with the deep financial shock. A second issue of this paper is then to investigate whether the financial shock may have triggered a break in the transmission of monetary policy in the euro area. And, as banks of the euro area might have been differently affected, depending on their direct exposure to toxic assets and depending on the structural characteristics of national banking systems.

The main results of this investigation are the following. First, not surprisingly, we show that the financial turmoil since august 2007 has affected drastically the interest rate passé-through in the eurozone. Second, the pass-through since the crisis is less complete than in the previous period studied. Third, the heterogeneity between the eurozone members has increased.

The remainder of the paper is organized as follows. Section 2 provides a short review on the literature related to the bank interest pass-through. This section will lead us to formulate research questions which will structure our results. Data and econometric methodology are presented in section 3 whereas results are detailed in the section 4. And finally we will conclude.

2. Overview of the literature and research questions

Numerous studies have been conducted on the subject of monetary transmission pass-through in the euro area, but none, to our knowledge, since the subprime crisis. The vast literature on the bank interest rate pass-through has relied on two closed approaches. The first approach specifically deals with the issue of the monetary policy transmission channels⁵. ECB (2009) reminds indeed that policy-controlled interest rates are first transmitted through money market and bond rates. The changes in these market rates are then passed-through the retail bank interest rates. It must be noticed that the degree of this pass-through is itself related to the monetary policy stance through its impact on the values of collateral and on the credit risk assessment made by banks and through the effects of monetary policy on the health of the banking system. The second approach is interested in the price-setting behavior of banks. It highlights the issues of monopolistic competition in the banking industry.

⁵ Cottarelli and Kourelis (1994) presented one of the first analysis on that issue.

This paper is clearly oriented on monetary policy transmission since we aim at analyzing the degree of heterogeneity among eurozone countries in the transmission of the common monetary policy and a possible change in the heterogeneity that would come from the financial turmoil. Nevertheless, the two approaches are strongly related since they both rely on the following marginal cost pricing model equation:

$$(1) \quad br_{i,t} = \gamma_0 + \gamma_1 mr_{i,t}$$

where $br_{i,t}$ is the interest rate set by the bank in a country (i) at the date (t). The Parameter (γ_0) is a constant markup and (γ_1) is the degree of pass-through, which will be less than one if banks have a market power. Papers interested in the competition issues will use market rates – money market or bond market rates - at different maturities as the exogenous variables whereas the exogenous variable ($mr_{i,t}$) is a variable closely related with policy-controlled interest rates when the focus is on the transmission of monetary policy. The policy-controlled interest rates cannot indeed be used directly as they change only infrequently (de Bondt, 2005). The exogenous variable is therefore a money market rate, which may be considered as a proxy for the policy rate (Kwapil and Scharler, 2006). Concerning euro area, the EONIA (Euro overnight index average) rate may be the best indicator of monetary policy stance as it is the rate that the ECB tries to influence through its refinancing operations and through the marginal facilities (de Bondt, 2005). But EURIBOR⁶ rates could also be alternative indicators since short-term contracts are sometimes indexed on these rates and since de Bondt (2005) has showed that monetary policy fully controls money market rates up to three months. In normal times, EONIA and EURIBOR rates move fairly together but with the financial market turbulences, this relationship has been impaired. The empirical analysis provided in this paper will consider the EONIA rate as the rate which is the most closely related to the ECB policy-rate. A robustness analysis will yet focus on the 3-month EURIBOR rate.

Starting from this simple pricing equation, empirical analysis have mainly followed two methods for estimating the pass-through from market rates to bank interest rates. Sander and Kleimeier (2004) for euro area Member states and de Bondt (2002 and 2005) at the euro area level estimated VAR models. The main advantage of this approach relies on the simulation of impulse-reaction functions. The second and widely used approach consists in estimating error-correction models⁷ (univariate or VECM). Equation (1) is supposed to be a long-term relationship and the estimated ECM model will show the adjustment dynamics of the bank interest rates towards the stationary equilibrium. By this way, we may appraise separately the short-term and the long-term pass-through in the following estimated equation:

⁶ Bernoth and von Hagen (2004) found indeed that the 3-month euribor is a good indicator of monetary policy stance.

⁷ See among others Mojon (2000), de Bondt (2002), Sander and Kleimeier (2004), de Bondt and alii (2005) Marotta (2008).

$$(2) \quad \Delta br_{i,t} = \alpha (\gamma_0 + \gamma_1 m r_{i,t-1}) + \beta_0 + \sum_k \rho_k \Delta br_{i,t-k} + \sum_j \theta_j \Delta m r_{i,t-j}$$

where the short-term adjustment of bank interest rate to policy or market rates is captured by the parameters (θ_j).

Finally, Sorensen and Werner (2006) provided a new and stimulating approach by estimating a SUR-ECM model. The main advantage of this panel approach is that it allows testing for the homogeneity of the pass-through of the euro area countries.

A summary of the main results of this literature is provided in appendix I. No clear conclusion emerges concerning the degree of the pass-through in the eurozone since analyses are based on different empirical models and are applied to different countries as well as different sample periods. But, general conclusions relative to lending rates may nevertheless be drawn. First, it is generally shown that lending rates are sticky in the short run; immediate pass-through are less than one. This sluggishness may come from customer switching costs or menu costs leading to short-term nominal rigidities. In the long run, pass-through are higher and may be complete or not according to the country and the credit market which is considered. It is argued that these heterogeneities in the degree of pass-through are related to the legal and financial structures⁸. It is for example assumed that higher competition in the banking system – through indicators such as size of banks and concentration of the banking system - or from external finance – related to the availability of nonbank sources of finance - would increase the pass-through (Mojon, 2001). Affinito and Farabullini(2006) also highlight the importance of individual banks' characteristics such as the health of banks - liquidity and capitalization situation - as well as the way banks refinance their lending activity⁹ would also impair the transmission of monetary policy. Thereby, differences among eurozone Member states would be due to the heterogeneity of the national banking systems.

It must also be stressed that the empirical results depend precisely on the models which are estimated. The monetary policy and the cost-of-funds approaches deliver different results (Sander and Kleimeier, 2004). Degrees of pass-through are generally higher with the second approach since long-term bank interest rates would be more highly correlated with long-term bond market rates than with money market rates (de Bondt and alii, 2005). It means that the incomplete pass-through would mainly result from the imperfect transmission of policy and money market rates along the yield curve. Hofmann (2006) addressed this point and found that a long-run restriction, which imposes a complete pass-through from the short-term money

⁸ See Cottarelli and Kourelis (1994), Cechetti (1999) and Mojon (2001).

⁹ See Weth (2002) for the case of German banks and Affinito and Farabullini (2006) who investigate the factors behind heterogeneities in the Italian banking sector.

market rate to the long-term government rate, was not rejected by the data for the four largest Euro area countries.

Finally, the pass-through may also change over time. First, it has often been argued that the pass-through depends on the interest rate cycle. Concerning loan rates, it is expected to be faster when policy-controlled rates are increasing than when they are decreasing. These cyclical asymmetries have been confirmed by Mojon (2001) and Sander and Kleimeier (2004). Otherwise, as the degree of pass-through hinges on the architecture of the financial system, it is subject to structural breaks, especially in the euro area where the transition period in the run up to EMU may have led to a convergence of the legal and financial structures. The presence of one break has either been postulated – it was then supposed to occur in 1999¹⁰ - or endogenously determined. Sander and Kleimeier (2004) estimated a supremum F (supF) test for the “monetary approach” model and found that breaks generally occurred before the adoption of the single currency. For example, breaks occurred in 1994 and 1995 in the different Belgian credit markets. It was later for Germany since breaks were identified between 1996 and 2000. They also show that the size and the speed¹¹ of the pass-through have increased after the breaks implying a convergence process in the euro area. Based on beta and sigma convergence analyses, Vajanne (2007) confirmed an increased integration. Finally, a recent analysis carried by Marotta (2009) found that several breaks in the long-run pass-through have occurred during the transition period. It is shown that the long-run pass-through has decreased in the last period – after the last break – except for France and Ireland. The adjustment speed has increased in all EMU countries but Portugal.

Firstly, in this paper, we will also consider the possibility that a break occurred in July 2007 because of the financial turmoil (Melvin & Taylor, 2009). The reasons underlying such a break in the transmission channels are related to the financial position of borrowers and lenders. Besides the interest rate channel, the transmission of monetary policy hinges on credit channels highlighting the role of asymmetric information and a well established result in the literature is that agency problems are amplified in bad times. This is the case for borrowers since, everything else equal, the external finance premium – and notably the bank interest rate - goes up when their financial wealth is decreasing. Furthermore, Kato, Ui and Watanabe (1999) have shown in a simple model of the bank loan market that monetary policy becomes less effective when the borrowers’ net worth is decreasing. The credit supply curve becomes steeper and the pass-through of cuts in the policy-controlled interest rate is weaker. But with the subprime crisis, the financial situation of the lenders – the banking system – must be taken into account since it has incurred severe losses and faced a stronger capital constraint. The lending channel precisely stress that the health of banks influences the transmission of monetary policy. It can be first argued that that the effects of monetary policy may be smaller when banks are constrained by regulatory requirements. Even if monetary policy is eased, banks

¹⁰ See de Bondt (2002) or de Bondt and alii (2005).

¹¹ Focusing on the business lending rates in the four largest eurozone countries, Hofmann (2006) reached the same conclusion in terms of adjustment’s speed for except for Germany.

cannot expand credits since they can hardly raise new equity. But at the same time, van den Heuvel (2002) argued that an expansionary monetary policy will alleviate the capital constraint by improving bank profits and will then become more efficient. The consequences of the finance turmoil on the bank interest rate pass-through should then be tested. The first research question would then be the following:

1) Does the financial crisis affect the pass-through in the euro area?

With this question, the idea is to show that this crisis represent a structural break for the interest rate pass-through in the euro area. The determination of such structural breaks in the period before the crisis is often decided exogenously with the beginning of the European Central Bank (ECB) in 1999 (De Bondt, Mojon, & Valla, 2005; Coffinet, 2005). But other studies also find structural breaks endogenously. This the case of Sander & Kleimeier (2004) who determine a single break endogenously for each european countries analysed. They show that structural breaks in the long-run relationship between market rates and retail rates generally occur before 1999. Marotta (2009) extended these analysis in postuling the existence of not one but multiple unknown breaks determined endogenously. He foud some multiple structural breaks for some countries indicating that national banking system are adjusting progressively to the new monetary policy regime. Nevertheless, none studies, to our knowledge, have tested the impact of the subprime crisis which is certainly the most important economic event that euro area has faced (Blot, Le Bayon, Lemoine, & Lévassieur, 2009). The first issue in this research project is then to determine the impact of the crisis over the interest rate pass-through.

One of the main results of the literature dealing with cross-countries interest rate pass-through comparison is the heterogeneity. This showed by Mojon (2000), Heinemann & Schüler (2002), Graeve, De Jonghe, & Vander Vennet (2004), Gambacorta (2004), Sorensen & Werner (2006) and Sander & Kleimeier (2004). As banking systems of euro area countries were differently exposed to the subprime crisis, the heterogeneity of the transmission of monetary policy may have worsened. Therefore, the aim of this paper is to tackle with the two following issues:

2) Did the financial crisis modify the pass-through in the euro and did the financial crisis increase or mitigate the heterogeneity across EMU countries?

3. Data and Empirical Methodology

In this section, we provide details about the data used in this paper and about the empirical methodology which is conducted. Our purpose is to estimate the interest rate pass-through in the euro area countries and to be able to do some cross-country comparisons. We assume that these relationships are closely related over time especially because they are affected with common monetary shocks providing from the ECB decisions. But at the same time, we also want to test the heterogeneity in the transmission of monetary policy. We are using a panel data

technique, the seemingly unrelated regression (SUR), to take into account the common structure of shocks as well as the possible heterogeneities in the relationship between the policy-controlled rate and bank interest rates. This method has been recently extended by Kim (2004) or Moon and Peron (2005) to integrate the dynamic relationship in SUR-ECM model.

3.1 Data

A harmonized database is used in this paper contrary to previous works except Marotta (2008) who precisely found that empirical results might be sensitive to the choice of the database. Data are provided by the ECB and are called “MFI interest rate statistics”. It covers those interest rates which are applied by resident monetary financial institutions (MFIs, *i.e.* "credit institutions") to euro-denominated deposits and loans to households and non-financial firms which are residents of the euro area. More particularly, we focus on lending rates and we deal with four monthly main interest rates which are the interest rate for mortgage loans, consumer loans and loans to firms up to one million Euros and over one million Euros. These data are extracted from January 2003 to may 2010 for eleven euro area countries¹³ and for the euro area as a whole. Two exogenous variables are used to reflect the money market and the monetary policy impulses: the eonia and the three months euribor.

3.2 Empirical methodology

Our analysis is conducted with interest rates which are potentially non-stationary time series. This must be taking into account because of the spurious results that can induce. Tests for unit roots using panel data are relatively recent¹⁴ and provide sometimes mitigated results. In this paper, we apply six tests based on two different null hypothesis. The five first test, *i.e.* Levin Lin and Chu, Breitung, Im Pesaran and Shin Fisher ADF and Fisher –PP postulate the existence of a unit root as the null hypothesis. The rejection of this hypothesis indicates stationarity. The last test, based on hadri (2000) postulate as null hypothesis the stationnarity. The rejection of the null hypothesis indicates a unit root.

The results provided by these tests are presented in Table I. They clearly show that the hypothesis of a unit-root is not rejected whereas, the null hypothesis of stationarity in the case of the test performed by Hadri (2000) is rejected in all cases.

These results imply that we may work on spurious regressions. To deal with this propriety of non stationarity, we postulate a cointegration relationship between bank and market rates. Since variables are cointegrated, we analyze their relationship in an error correction model which allow us to quantify short term dynamics (with variables in first difference) and long term dynamics (with variables in level). Several methodologies have been proposed. Stock & Watson (1993) proposed a dynamic

¹³ Austria (AT), Belgium (BE), Finland (FI), France (FR), Germany (DE), Greece (GR), Irland (IE), Italy (IT), Spain (ES), Portugal (PT) and the euro area (ZE).

¹⁴ See Hurlin & Mignon, (2005) for a comprehensive survey.

OLS (DOLS) method which only estimate long-term dynamic. Recently, Mark, Ogaki, & Sul (2005) extended the DOLS method to panel cointegration and thus defined “a parametric method for estimating multiple cointegration regressions called the Dynamic Seemingly Unrelated Regression (DSUR)”¹⁵. DSUR methodology was applied by Moon & Perron (2005) for testing the purchasing power parity and it was also applied to monetary policy transmission by Sorensen & Werner (2006). Following Sorensen & Werner, we also estimate the equation (2) with this method. A SUR is used because of the link between the estimated equations in their error terms. This methodology estimates the parameters of the system, accounting for heteroskedasticity and contemporaneous correlation in the errors across equations. It seems that this is consistent with the fact that all bank interest rates in the eurozone are driven by structural variables but also by a unique monetary policy.

Table I : Unit root tests in panel data

	Snf inf Im	Snf sup Im	immo	conso
Ho: unit root, statistic and p-value				
Levin, Lin, Chu	0,19 (0,57)	2.13 (0,98)	-0,33 (0,37)	-0,12 (0,45)
Breitung	-0,99 (0,16)	1.10 (0,86)	-3,49 (0,00)	-1,27 (0,10)
Im, Pesaran and Shin	3,07 (0,99)	4.37 (1,00)	1,39 (0,91)	-0,35 (0,36)
Fisher-ADF	5,35 (0,99)	3.81 (1,00)	10,74 (0,97)	25,18 (0,19)
Fisher-PP	2,07 (1,00)	1.83 (1,00)	3,87 (1,00)	22,37 (0,32)
Ho: stationnarity, statistic and p-value				
Hadri	8,46 (0,00)	9.55 (0,00)	8,15 (0,00)	7,27 (0,00)

More precisely, we estimate the interest rate pass-through between the market rate ($im_{i,t}$) and the bank interest rate ($ib_{i,t}$) with the following equation

$$(3) \Delta ib_{i,t} = \alpha_i + \theta_i(ib_{i,t-1} - \beta_i im_{i,t-1}) + \gamma_i \Delta im_{i,t} + \tau_{i,1} \Delta im_{i,t-1} + \rho_{i,1} \Delta ib_{i,t-1} + \epsilon_{i,t}$$

The changes in bank interest rate ($\Delta ib_{i,t}$) are determined by adjustments towards long term equilibrium between bank interest rates and market rates. β_i measures the long term pass-through of monetary policy or market rates to the retail bank interest rate. In a perfect competitive environment, it is expected to be equal to unity. But banks do generally operate on oligopolistic markets and then have some

¹⁵ A similar methodology called SURECM was also proposed by Thompson, Sul, & Bohl (2002).

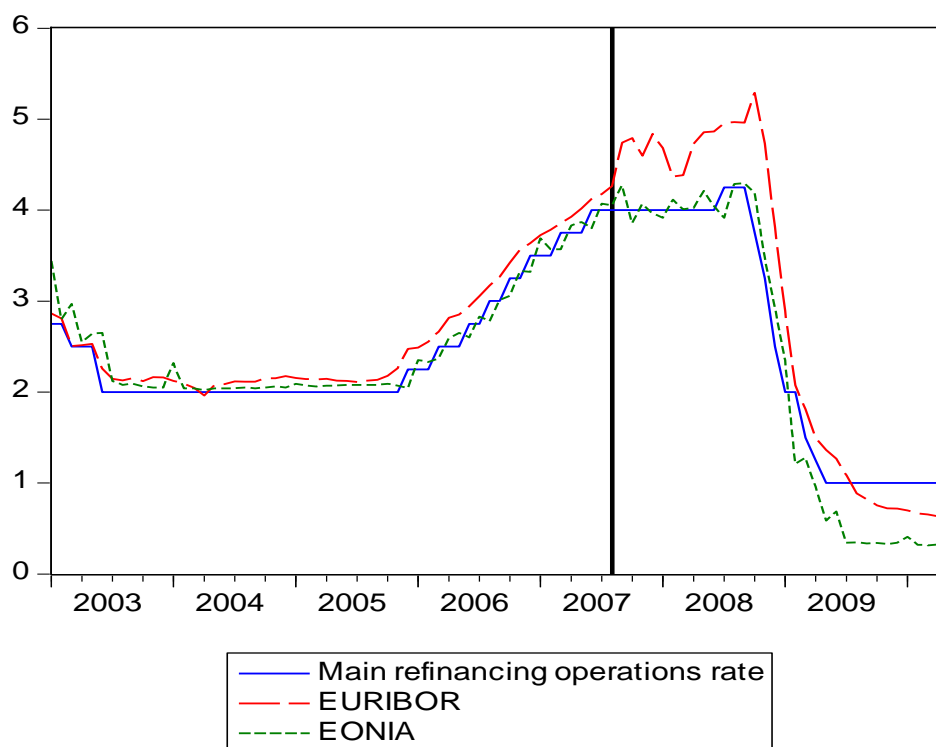
degree of market power. This market power result from the existence of switching costs – it is costly for customers to switch from one bank to another – and asymmetric information. Banks may be reluctant to raise interest rates to avoid attracting riskier borrowers. θ_i reflects the speed of adjustment to the long term equilibrium and $\gamma_i + \tau_i$ measures the short-term pass-through of market interest rates to retail bank interest rates.

this framework allows us to test the homogeneity of the coefficient across the countries analyzed and thus compare and quantify the degree of heterogeneity in the interest rate pass-through in the short-term, in the long-term and we are also able to compare the speed of adjustment.

3.3 Break

Before, analyzing in depth the heterogeneity of the pass-through in the EMU countries, we first consider the hypothesis that the transmission of the common monetary policy may have been impaired by the financial turmoil. This intuition is illustrated by the Chart II where we clearly see that the monetary regime has changed since august 2007.

Chart II : Evolution of the main refinancing operation rate, the eonia and the 3 months Euribor since 2003



Source I : ECB

The hypothesis is tested with a Chow test. The date of the break is here postulated since the beginning of the crisis is precisely defined. The test is applied for each market, for the SUR-ECM model, for each individual country and for the euro area as a whole. The Chow statistic indicates that the null hypothesis of no break is clearly rejected for the SUR-ECM models (table A). It is then necessary to disentangle the periods before and after the financial crisis when considering a multi-country model. When looking separately at each individual country, the break is also confirmed in most of cases and especially for lending interest rates applied to non financial companies. The null hypothesis of no break cannot be rejected for Italy and only in the market for loans above 1 million Euros. Concerning households, the evidence is more mixed since the break is not significant in half of countries. Neither for housing market rates nor for consumer credit rates, the null of no break is rejected in Germany, Italy, Belgium and Greece. Conversely, the break is significant in the two household's credit market in Spain, Ireland and Finland. But as, in the rest of the paper, the analysis mainly rests on the SUR-ECM models, we will postulate that a break occurred and we will estimate the models for the two sub-periods: the boom period from January 2003 to July 2007 and the crisis period starting in August 2007.

Table II : CHOW Break test in 2007m08

	<i>Housing loans</i>	<i>Consumers' loans</i>	<i>Business loans for NFC below 1 million €</i>	<i>Business loans for NFC above 1 million €</i>
Germany	1.20 (0.32)	1.33 (0.26)	4.81 (0.00)	6.92 (0.00)
France	3.31 (0.01)	1.39 (0.23)	2.24 (0.05)	2.38 (0.04)
Italy	1.45 (0.21)	0.91 (0.49)	3.41 (0.00)	1.34 (0.25)
Spain	2.75 (0.02)	3.04 (0.01)	3.97 (0.00)	5.67 (0.00)
Netherlands	2.10 (0.06)	NA	3.31 (0.01)	2.95 (0.01)
Belgium	1.41 (0.22)	0.64 (0.70)	3.68 (0.00)	4.38 (0.00)
Ireland	4.24 (0.00)	1.90 (0.09)	6.07 (0.00)	3.46 (0.00)
Portugal	3.27 (0.01)	0.84 (0.55)	4.01 (0.00)	2.52 (0.03)
Austria	1.06 (0.40)	2.29 (0.04)	3.75 (0.00)	4.81 (0.00)
Finland	2.85 (0.01)	3.81 (0.00)	3.70 (0.00)	2.71 (0.02)
Greece	1.39 (0.24)	0.28 (0.95)	2.66 (0.02)	NA
Euro area	1.34 (0.25)	1.97 (0.08)	4.64 (0.00)	4.96 (0.00)
SUR-ECM	192.74 (0.00)	110.21 (0.00)	73.76 (0.00)	12.21 (0.00)

Chow statistic (p-value). The null hypothesis is the absence of structural change. The break is estimated in July 2007. For each individual country and for the euro area as a whole, tests are implemented with univariate ECM estimated by OLS.

4. Results

The results presented examined the interest rate pass-through during two periods: before and after the financial crisis which affected drastically both European banking systems and the European monetary policy. We examine the results of our estimation for interest rate pass-through affecting firms and households. For each interest rate pass-through we'll discuss the results for the short term pass-through, long term pass-through and the speed of adjustment (in appendix II, Table A1 to A4). We then examine some equality tests results to assess the degree of heterogeneity within the eurozone (in appendix II, Table A5 to A48) and finally, we propose some simulations which illustrate the impact of the financial crisis over the pass-through process (in appendix II, Charts A1 to A4).

4.1 Firms

In this analysis, we have selected two market rates which provide information about loans condition applied by monetary institutions to non monetary institutions, i.e. firms. We focus our work on the market rates for loans up to one million euro and over one million euro. These time series are available since 2003 for all euro area countries, except Greece for the loans over one million euro.

The table A1 shows the results for the interest rate pass-through between the market rate and the rate apply to loans to non-financial corporations, up to 1 million Euros. The results are divided in two sub-periods: before and since the financial crisis. First, it appears that for the pass-through in the short term, some were ineffective in the boom period (France, Belgium, Portugal, Austria), but since the beginning of the financial crisis, this short-term relationship is effective and more important everywhere. Second, if we look at the long-term pass-through, it appears that before the crisis, some member states (Belgium, Ireland, Austria) completed the pass-through process with a transmission equal to the monetary impulse. Contrary to the effect on the short term pass-through, the financial crisis seems to have lowered the long-term one. Finally, the speed of adjustment parameter has increased since the financial crisis in five member states (Germany, Netherlands, Belgium, Austria, Finland), is still the same in two (Italy, Spain) and has decreased in the four others (France, Ireland, Portugal, Greece). This heterogeneity in the speed of adjustment is confirmed by the table A5 which shows the results of equality test between the member state's long-term pass-through before and after the beginning of the financial crisis. We have — combinations of equality or inequality of the pass-through between n member states of the eurozone. Before the crisis, we obtained 30 combinations where the pass-through were equal. Undoubtedly, the monetary policy process is more heterogeneous and less effective (Charts A1) after, even though it seems that before the crisis the pass-through examined has reached a good level of homogeneity in the euro zone.

The table A2 shows the results for the interest rate pass-through between the market rate and the rate apply to loans to non-financial corporations, over 1 million

Euros. The results are divided in two sub-periods: before and since the financial. Regarding the short-term and long term pass-through process we have broadly the same results that the ones examined previously. The short-term pass-through has increased since the financial crisis in all member states except one (Portugal) (Charts A2). But in the same time, the long-term pass-through has decreased and is total for none of the member states examined. On the subject of the speed of adjustment, it seems that in general, the crisis have increased it except for two where it remain the same (Portugal, Austria). Nevertheless, as it is shown in the table A6, the heterogeneity has also increased in the long run after the crisis.

4.2 Households

Results concerning the pass-through affecting the households are less clear than the one affecting the firms. Table A3 show the results between market rates and mortgage loans rates. It seems that in the short-term, the pass-through became less effective after the crisis. The same observation can be made for the long-term pass-through. The speeds of adjustment globally increase (except in Italy). Charts A3 confirm us that the pass-through has decrease since the financial crisis. In this context, equality tests presented in the table A7 are very interesting. Whereas during the boom period, 38 pass-through combinations were equal, it decreased to 12 since the beginning of the financial turmoil. The pass-through between market rates and mortgage loans rates was really affected by the crisis and worsened the heterogeneity between the banking systems.

Estimations about the pass-through between market rates and consumer loans are less powerful. It seems that these interest rates are less impacted by the monetary conditions than the others mentioned. Table A4 shows the results concerning the consumer loans interest rates pass-through. In the short-term term, the pass-through seems to be inexistent and it appears very weak in the long term and never completed (except in Finland). Nevertheless, the effects of the crisis are the same than for the others pass-through: it weakened the long-term pass-through (Charts A4), increase the speed of adjustment and increase the heterogeneity in the eurozone.

Table III recapitulate the main results for the four main interest rates examined here. We clearly see a before and an after subprime crisis in the average pass-through. It decreases after the crisis and the adjustment are more quickly incorporate.

Table III : Average short-term pass-through (weighted averages), average long term pass-through (weighted averages), average speed of adjustment (weighted averages) and standard deviation in parentheses for the four rates examined, during the boom and since the crisis

	Short-term		Long-term		Speed of adjustment	
	boom	crisis	boom	crisis	boom	crisis
consumer	-0,03	-0,01	0,28	0,24	-0,31	-0,47
	(0,50)	(0,46)	(0,42)	(0,32)	(0,19)	(0,15)
mortgage	0,21	0,09	0,72	0,49	-0,16	-0,27
	(0,14)	(0,12)	(0,19)	(0,25)	(0,17)	(0,14)
Loans to firms up to 1M euros	0,23	0,48	0,80	0,70	-0,34	-0,40
	(0,16)	(0,28)	(0,11)	(0,14)	(0,13)	(0,22)
Loans to firms over 1M euros	0,45	0,76	0,96	0,81	-0,52	-0,88
	(0,21)	(0,18)	(0,13)	(0,09)	(0,27)	(0,21)

5. Conclusion

The aim of this paper is to understand how the financial crisis has affected the interest rate pass-through in the eurozone between market rates and bank interest rates. We applied a SUR-ECM model which is a panel method where we can estimate the pass-through between market rates and bank interest rates. This methodology allows testing for the homogeneity of the pass-through of the euro area countries. The main results of this investigation are the following. First, not surprisingly, we show that the financial turmoil since august 2007 has affected drastically the interest rate passe-through in the eurozone. Second, the pass-through since the crisis is less complete that in the previous period studied. Third, the heterogeneity between the eurozone members has increased.

From an economic policy view point, these results show us how the eurozone is hard to manage in the way that is “optimality” regarding the “OCA meta-property” of homogeneity in the monetary transmission process is less effective since the financial crisis. A better economic governance seems appropriate to deals with these heterogeneities highlights by this study.

An interesting topic for future research on the topic would be to better understand what more precisely are the determinants of the pass-through in each member states of the eurozone.

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Appendix I: main findings in the literature

Studies	data	Time period	Econometric approach	Exogenous variable	Aggregation level	break	extensions	Main conclusions
Sorensen & Werner (2006)	6 banking interest rate (mortgage loans, consumer loans, short term and long term loans to enterprises, current account deposits and time deposits)	January 1999- June 2004	DSUR	Cost of funds approach	European individual country		Research of the potential explanations for the observed heterogeneity	High degree of heterogeneity of the pass-through of market interest rates to bank interest rates in the euro area. They explain this result with the degree of competition in the states' banking sector.
De Bondt, Mojon, & Valla (2005)	42 banking markets of the euro area; 5 different retail bank segments (retail bank rates on short and long term loans to firms, mortgage loans to households, consumer loans to households and time deposits)	April 1994- December 2002	ecm	Cost of funds approach	10 euro area countries and the euro area as a whole	1999		Retail rate depend on long term market interest rate
De Bondt (2005)	9 euro area retail bank interest rates on deposits and loans	January 1996- may 2001	Vecm	eonia	Euro area		Hypothesis of a change in the interest rate pass-through since the introduction of a common	The pass-through of official interest rate to money market interest rates up to three months is complete since 1999. The immediate pass-through is incomplete, but the introduction of the

							monetary policy in 1999.	euro accelerates it.
Sander & Kleimeier, (2004)	10 different loan and deposit rates	January 1993-october 2002	vecm	Cost of funds approach and money market (“monetary policy approach”)	10 euro area countries	Determination of breaks for each countries, generally before 1999	Determine structural changes in euro-zone banking during the “run-up” to the EMU	Structural breaks appear before the euro in 1999 and the pass-through is quicker after these breaks. Distinction between the two approaches. Still market imperfections which lead to heterogeneous pass-through.
Vajanne (2007)	6 different harmonized MFI interest rate	January 2003-december 2006					Examine the convergence of retail banking markets	Evidence for convergence in the interest rate.
Graeve, De Jonghe, & Vander Vennet (2004)	14 products in the Belgian banking market	January 1993-december 2002	ECM and panel data approach	Cost of fund	Micro level in Belgium		Determinants of heterogeneity	Evidence of heterogeneities over loans and deposits. It depends positively on the maturity of the product. EMU didn’t increase the competition.
van Leuvensteijn, Sorensen, Bikker, & van Rixtel	6 banking interest rate (mortgage loans, consumer loans, short term and long term loans to enterprises, current account deposits and	January 1994-march 2006	ECM and panel data approach	Cost of fund	8 euro area countries		Testing the relationship between competition and interest	Bank interest rates in more competitive markets respond more strongly to changes in market interest rates

(2008)	time deposits)						rate pass-through	
Marotta (2009)	NRIR short term business lending rates	January 1993-september 2003	ecm	Cost of fund	12 euro area countries	Several breaks around 1999	Implementing a search of multiple unknown breaks	Multiple unknown structural breaks are found. It suggests caution in associating structural changes to the introduction of the euro. Banking system are adjusting progressively and the estimated PT is on average less effective during the last break-free period.
Gambacorta (2004)	73 banks	march 1993-march 2001	Ecm and panel	Money market	Micro level in Italy		Analyzing a wide range of micro and macroeconomic data variables that have an effect on bank interest rates	Heterogeneity in the banking rates pass-through exists, but only in the short run.
Sander & Kleimeier (2002)	Lending rates from the IMF	January 1985-december 1998	ecm	Money market	15 EU countries			Monetary policy in the euro area is conducted under the conditions of an “asymmetric EMU”.
Heinemann & Schüler	NRIR three lending rates and two deposit rates	1995 m01-1990	ecm	Cost of fund	11 EU countries			Incomplete financial integration which leads to asymmetries in the PT

(2002)		m10						process
De Bondt (2002)	Euro area retail bank interest rates on the deposits and loans	1996 m01-2001 m05	ecm	Cost of fund	Euro area	Introduc tion of the euro	Sub sample with the introduction of the euro	The immediate PT is incomplete but quicker since the euro
Mojon (2000)	25 credit rates and 17 deposit rates		Ecm and panel	Money market	6 euro area countries		Focus on financial structure which contribute to national asymmetries in the interest rate channel	Heterogeneity in the PT
Coffinet (2005)	7 interest rates	1986 m01-2003 m09	ecm	Money market	Euro area and France	1999		The PT is quicker since the euro in France and in the euro area but this is not a shift of monetary regime.
Di Lorenzo & Marotta (2006)	Nrir	1993 m01-2004 m02	ecm	Cost of fund	Italy and Portugal	Two breaks in 1999	1999	EMU didn't strengthened PT

Appendix II: Empirical results

Table A1: PT for 11 euro area countries during the boom and the crisis period (eonia) for loans to non-financial corporations, up to 1 million Euros , short term, long term and adjustment coefficient (wald stat)

	Short-term		Long-term		Speed of Adjustment	
	boom	crisis	boom	crisis	boom	crisis
DE	0,2 (2,79)	0,59 (51,38)	0,78 (8,18)	0,69 (437)	-0,28 (11,19)	-0,57 (21,89)
FR	0,1 (0,31)	0,32 (15,78)	0,68 (9,56)	0,64 (30,59)	-0,29 (11,64)	-0,17 (8,62)
IT	0,28 (8,28)	0,44 (22,68)	0,84 (19,64)	0,79 (77,68)	-0,44 (39,35)	-0,43 (53,75)
ES	0,34 (11,61)	0,43 (23,33)	0,93 (2,88)	0,64 (136,4)	-0,37 (35,36)	-0,32 (42,34)
NL	0,37 (7,14)	0,41 (14,21)	0,84 (3,62)	0,46 (426)	-0,29 (10,13)	-0,41 (22,31)
BE	0,009 (0,004)	0,54 (22,47)	0,99 (0,009)	0,83 (72,37)	-0,18 (1,55)	-0,62 (32,62)
IE	0,51 (12,86)	1,04 (42,24)	1.01 (0,1)	0,78 (18,64)	-0,5 (26,64)	-0,3 (6)
PT	0,16 (1,24)	0,31 (4,02)	0,72 (62,19)	0,68 (35,89)	-0,63 (31,18)	-0,32 (11,37)
AT	0,28 (2,28)	0,38 (8,51)	0,97 (0,12)	0,82 (34,6)	-0,33 (14,59)	-0,63 (36,61)
FI	0,3 (3,55)	0,55 (16,54)	0,79 (11,44)	0,81 (63,41)	-0,51 (16,45)	-0,64 (30,61)
GR	0,51 (6,32)	1,16 (38,66)	0,79 (11,44)	0,988 (0,00004)	-0,51 (16,45)	0,08 (0,48)

Short-term: null hypothesis: coefficient = 0,

Long-term: null hypothesis : coefficient = 1,

Adjustment : null hypothesis : coefficient = 0,

In bold Short-term: short-term coefficients are null at the level of 10 %.(no pass-through in the short-term)

In bold long-term: long-term coefficients are equal to the unity at the level of 10 % (the pass-through is completed on the long term)

In bold speed of adjustment : coefficients are null at the level of 10 %

Table A2: PT for 10 euro area countries during the boom and the crisis period (eonia) for loans to non-financial corporations, over 1 million Euros , short term, long term and adjustment coefficient (wald stat)

	Short-term		Long-term		Speed of Adjustment	
	boom	crisis	boom	crisis	boom	crisis
DE	0,28 (3,18)	0,69 (28,36)	0,91 (4,44)	0,72 (510)	-0,63 (25,52)	-1,19 (60,72)
FR	0,71 (10,02)	1,05 (30,93)	1,06 (0,36)	0,88 (25,22)	-0,4 (15,79)	-0,82 (42,28)
IT	0,31 (1,84)	0,64 (15,07)	0,89 (3,31)	0,90 (11,38)	-0,56 (18,39)	-0,6 (34,5)
ES	0,34 (3,78)	0,65 (24,6)	1,26 (0,91)	0,87 (64,26)	-0,15 (1,39)	-0,87 (56,26)
NL	0,72 (6,41)	0,96 (56,61)	0,9 (0,02)	0,86 (120,36)	-0,57 (12,4)	-1,02 (43,18)
BE	0,5 (7,45)	0,66 (33,34)	1,13 (2,41)	0,93 (38,43)	-0,38 (9,59)	-0,95 (55,79)
IE	0,57 (6,68)	0,66 (20,28)	1,01 (0,04)	0,92 (25,85)	-0,604 (13,71)	-1,001 (38,72)
PT	0,95 (21,94)	0,41 (2,26)	0,85 (4,63)	0,67 (35,35)	-0,44 (8,75)	-0,49 (9,03)
AT	0,63 (17,48)	0,79 (18,86)	0,95 (3,67)	0,85 (40,7)	-0,78 (27,76)	-0,7 (21,49)
FI	0,62 (9,04)	0,79 (21,21)	0,97 (0,47)	0,88 (35,09)	-0,73 (24,32)	-0,88 (37,21)

Short-term: null hypothesis: coefficient = 0,

Long-term: null hypothesis : coefficient = 1,

Adjustment : null hypothesis : coefficient = 0,

In bold Short-term: short-term coefficients are null at the level of 10 %,(no pass-through in the short-term)

In bold long-term: long-term coefficients are equal to the unity at

the level of 10 % (the pass-through is completed on the long term)

In bold speed of adjustment : coefficients are null at the level of 10 %

Table A3: PT for 11 euro area countries during the boom and the crisis period (eonia) for mortgage loans short term, long term and adjustment coefficient (wald stat)

	short-terme		Long-terme		Ajustement	
	boom	crisis	boom	crisis	boom	crisis
DE	0.07 (0.53)	0.12 (5.02)	0.61 (2.49)	0.33 (1129.66)	-0.08 (5.43)	-0.32 (17.61)
FR	0.29 (14.50)	-0.03 (0.79)	0.58 (1.27)	0.33 (412.94)	-0.03 (2.17)	-0.17 (24.64)
IT	0.26 (9.64)	0.24 (12.05)	1.00 (0.00)	0.83 (12.75)	-0.37 (33.16)	-0.20 (21.11)
ES	0.45 (37.28)	0.00 (0.00)	1.00 (0.00)	0.80 (52.71)	-0.23 (13.06)	-0.38 (44.65)
NL	0.10 (0.78)	0.05 (1.33)	0.67 (4.53)	0.15 (1325.48)	-0.12 (12.03)	-0.19 (22.65)
BE	0.13 (2.09)	0.10 (3.76)	0.55 (12.84)	0.41 (302.76)	-0.10 (12.19)	-0.17 (17.98)
IE	0.13 (0.92)	0.08 (0.40)	0.90 (8.32)	0.60 (300.86)	-0.56 (17.26)	-0.52 (21.19)
PT	0.31 (7.77)	0.33 (7.17)	0.74 (38.84)	0.83 (35.06)	-0.42 (20.42)	-0.41 (31.25)
AT	0.34 (3.55)	0.04 (0.08)	0.73 (2.22)	0.67 (50.87)	-0.15 (7.40)	-0.39 (18.62)
FI	0.13 (1.45)	0.26 (4.83)	0.93 (0.92)	0.79 (85.15)	-0.29 (17.90)	-0.54 (52.37)
GR	-0.03 (0.07)	0.03 (0.12)	0.45 (2.05)	0.32 (145.30)	-0.06 (2.41)	-0.17 (6.81)

Short-term: null hypothesis: coefficient = 0,

Long-term: null hypothesis : coefficient = 1,

Adjustment : null hypothesis : coefficient = 0,

In bold Short-term: short-term coefficients are null at the level of 10 %,(no pass-through in the short-term)

In bold long-term: long-term coefficients are equal to the unity at the level of 10 % (the pass-through is completed on the long term)

In bold speed of adjustment : coefficients are null at the level of 10 %

Table A4: PT for 10 euro area countries during the boom and the crisis period (eonia) for consumer loans short term, long term and adjustment coefficient (wald stat)

	<i>short-terme</i>		<i>Long-terme</i>		<i>Ajustement</i>	
	boom	crisis	boom	crisis	boom	crisis
DE	0.02 (0.00)	0.07 (0.21)	0.06 (18.65)	0.25 (682.47)	-0.30 (6.25)	-0.69 (27.00)
FR	-0.20 (0.65)	-0.13 (2.19)	0.45 (8.95)	0.27 (460.13)	-0.21 (10.07)	-0.35 (30.91)
IT	-0.37 (1.46)	-0.32 (4.68)	-0.02 (32.68)	0.15 (722.57)	-0.27 (18.16)	-0.51 (17.06)
ES	1.17 (6.34)	-0.00 (0.00)	0.73 (6.71)	0.15 (81.68)	-0.71 (19.81)	-0.45 (14.90)
BE	-0.27 (0.61)	-0.05 (0.07)	0.21 (17.54)	0.51 (6.28)	-0.35 (7.37)	-0.19 (3.78)
IE	-0.47 (1.48)	1.28 (17.90)	0.41 (25.78)	0.25 (11.69)	-0.54 (25.37)	-0.25 (3.36)
PT	-0.66 (2.70)	-0.02 (0.01)	0.56 (5.28)	-0.48 (37.78)	-0.30 (17.39)	-0.28 (10.09)
AT	0.20 (3.75)	0.12 (1.43)	0.75 (7.09)	0.59 (144.84)	-0.19 (10.99)	-0.35 (23.44)
FI	0.01 (0.00)	0.29 (4.72)	1.36 (0.48)	0.66 (174.37)	-0.09 (4.78)	-0.53 (22.62)
GR	-0.18 (0.16)	-0.30 (2.35)	0.02 (2.17)	0.06 (231.66)	-0.10 (3.59)	-0.33 (7.22)

Short-term: null hypothesis: coefficient = 0,

Long-term: null hypothesis : coefficient = 1,

Adjustment : null hypothesis : coefficient = 0,

In bold Short-term: short-term coefficients are null at the level of 10 %,(no pass-through in the short-term)

In bold long-term: long-term coefficients are equal to the unity at the level of 10 % (the pass-through is completed on the long term)

In bold speed of adjustment : coefficients are null at the level of 10 %

Table A5: loans to non-financial corporations, up to 1 million Euros, Equality test on the long term PT between 11 euro zone countries during the boom (the bottom of the table) and since the crisis (top of the table); Chi-deux stat is mentioned and when the cell is gray-colored it means that the PT between those two countries are equal

	DE	FR	IT	ES	NL	BE	IE	PT	AT	GR	FI
DE		0,58	21,54	6,27	70,28	60,38	3,75	0,004	49,9	0,25	34,11
FR	0,81		5,03	0,15	8,47	9,87	3,42	0,25	7,96	0,33	8,25
IT	0,48	2,84		142	170	7,02	0,01	3,51	3,41	0,11	1,8
ES	3,48	6,94	12,65		23,64	73,67	12,69	1,99	62,93	0,38	42,23
NL	0,45	2,08	0,008	1,04		219	38,46	15,87	253	0,78	157
BE	1,51	2,47	0,76	0,1	0,63		1,28	6,98	0,93	0,07	0,76
IE	10,52	9,39	14,44	2,86	5,35	0,03		2,26	0,43	0,12	0,4
PT	0,4	0,27	6,21	17,47	1,92	2,14	31,3		5,94	0,26	4,69
AT	2,01	3,85	1,34	0,25	0,5	0,14	1,55	5,52		0,08	0,01
GR	0,002	0,86	0,77	4,46	0,46	1,43	13,45	0,89	2,27		0,08
FI	3,73	6,13	3,46	0,36	1,86	0,004	0,29	8,13	0,31	5,2	

Table A6: loans to non-financial corporations, over 1 million Euros, Equality test on the long term PT between 11 euro zone countries during the boom (the bottom of the table) and since the crisis (top of the table); Chi-deux stat is mentioned and when the cell is gray-colored it means that the PT between those two countries are equal

	DE	FR	IT	ES	NL	BE	IE	PT	AT	FI
DE		49,42	46,31	101,9	103,83	283	236	0,67	40,53	77,91
FR	2,73		0,75	0,13	0,42	5,38	3,98	13,26	1,9	0,01
IT	0,25	3,74		1,22	1,53	1,19	1,09	13,59	2,89	0,45
ES	0,35	0,71	2,15		0,31	27,06	9,35	11,59	1,27	0,17
NL	1,32	0,47	1,92	1,05		19,38	12,88	11,72	0,58	0,62
BE	8,61	0,43	7,93	0,25	2,71		0,02	19,18	12,11	6,28
IE	3,35	0,21	3,83	0,87	0,9	2,21		19,13	9,74	5,45
PT	0,79	3,27	0,23	2,46	2,58	10,61	5,39		9,68	11,47
AT	0,89	1,6	1,19	1,4	0,49	6,31	1,32	2,01		1,87
FI	1,76	0,88	1,62	1,19	0,09	3,96	0,56	2,57	0,2	

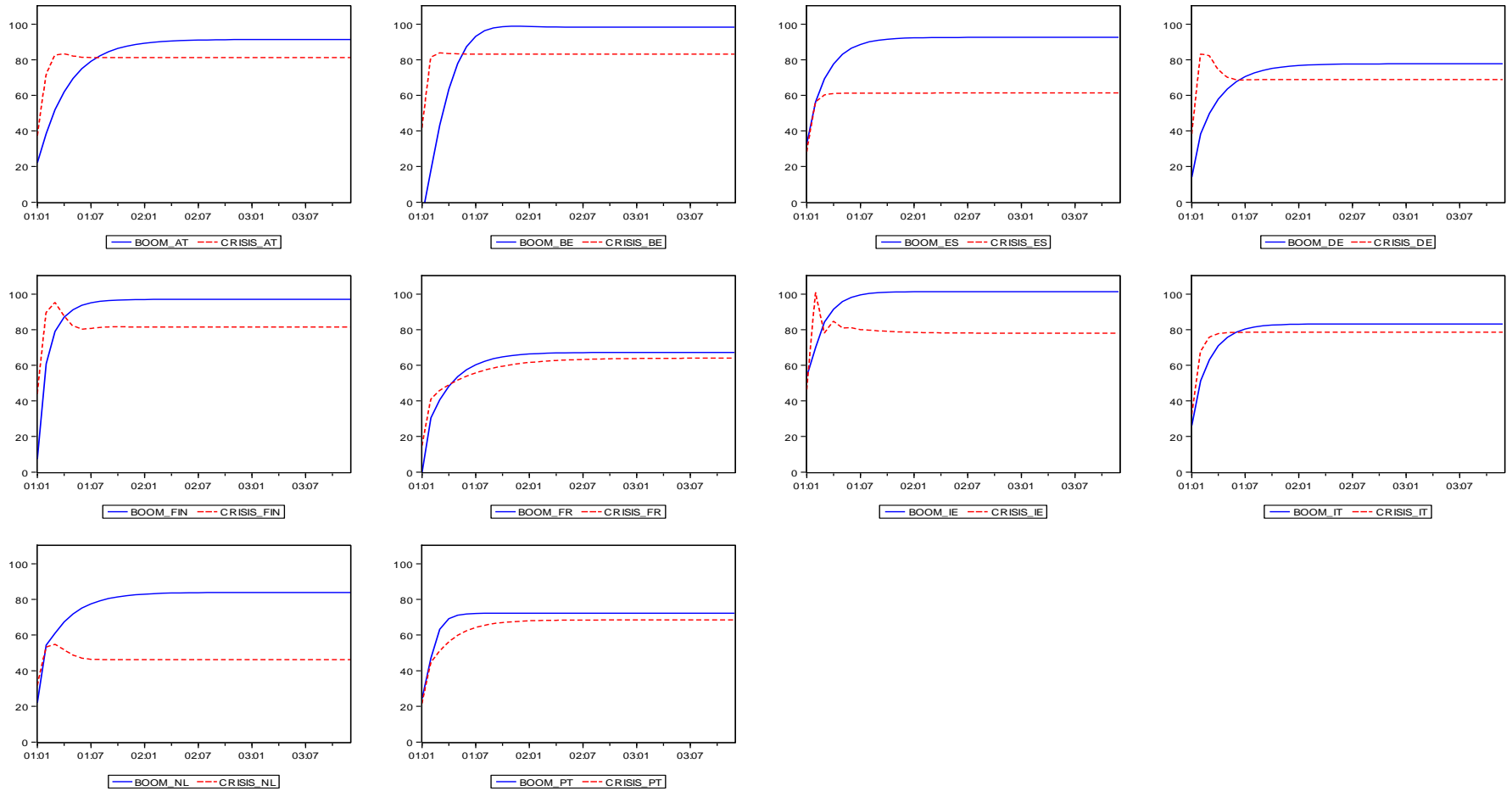
Table A7: Mortgage loans Equality test on the long term PT between 10 euro zone countries during the boom (the bottom of the table) and since the crisis (top of the table); Chi-deux stat is mentioned and when the cell is gray-colored it means that the PT between those two countries are equal

	DE	FR	IT	ES	NL	BE	IE	PT	AT	FI	GR
DE		0.03	146.29	239.29	71.74	9.27	84.70	301.14	44.74	383.81	0.00
FR	0.01		58.44	163.92	21.20	2.80	44.41	137.86	49.43	139.16	0.02
IT	2.72	1.27		0.43	220.38	79.02	24.45	0.01	5.55	1.12	50.66
ES	2.75	1.37	0.00		610.89	154.29	38.66	1.05	6.51	0.22	70.46
NL	0.05	0.06	5.66	5.83		62.54	215.71	453.84	102.48	601.54	12.23
BE	0.06	0.00	13.32	13.57	0.44		31.18	153.33	19.83	174.94	1.94
IE	1.39	0.74	7.22	5.80	2.44	8.10		43.19	1.50	52.36	20.92
PT	0.28	0.20	36.46	27.69	0.27	2.56	13.52		9.80	1.34	57.83
AT	0.16	0.15	2.08	2.17	0.06	0.61	0.79	0.01		5.77	20.90
FI	1.91	0.88	1.37	0.81	2.97	7.54	0.35	7.32	1.15		77.03
GR	0.15	0.06	2.13	2.15	0.32	0.07	1.36	0.60	0.39	1.47	

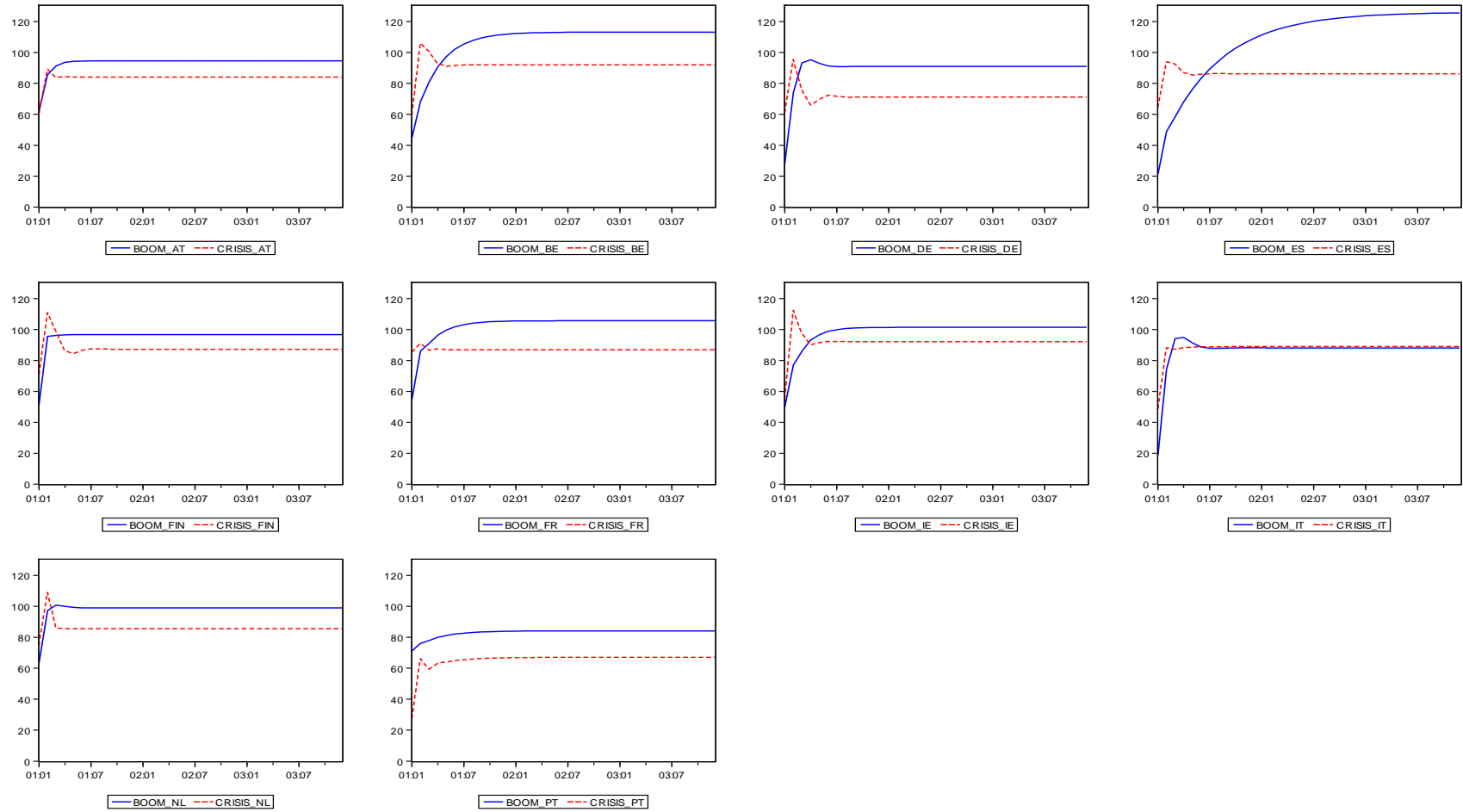
Table A8: consumer loans Equality test on the long term PT between 10 euro zone countries during the boom (the bottom of the table) and since the crisis (top of the table); Chi-deux stat is mentioned and when the cell is gray-colored it means that the PT between those two countries are equal

	DE	FR	IT	ES	BE	IE	PT	AT	FI	GR
DE		0.28	6.26	1.45	1.80	0.00	7.90	101.77	154.23	19.68
FR	2.25		8.57	2.33	1.47	0.01	5.47	68.04	95.18	17.95
IT	0.09	4.23		0.00	3.21	0.21	11.63	93.86	163.95	9.00
ES	6.52	1.71	19.71		2.82	0.21	9.34	25.44	26.92	4.29
BE	0.31	0.75	0.87	5.20		0.84	0.02	0.20	0.64	7.96
IE	4.02	0.03	6.05	4.09	0.87		1.10	2.68	3.53	2.11
PT	4.52	0.18	7.05	0.51	1.82	0.63		1.84	4.72	36.25
AT	9.48	2.16	17.72	0.04	7.84	5.96	0.90		3.83	73.68
FI	5.31	3.02	6.49	1.46	4.80	3.08	1.98	1.45		102.4
GR	0.00	0.38	0.00	1.04	0.08	0.37	0.69	1.23	2.59	

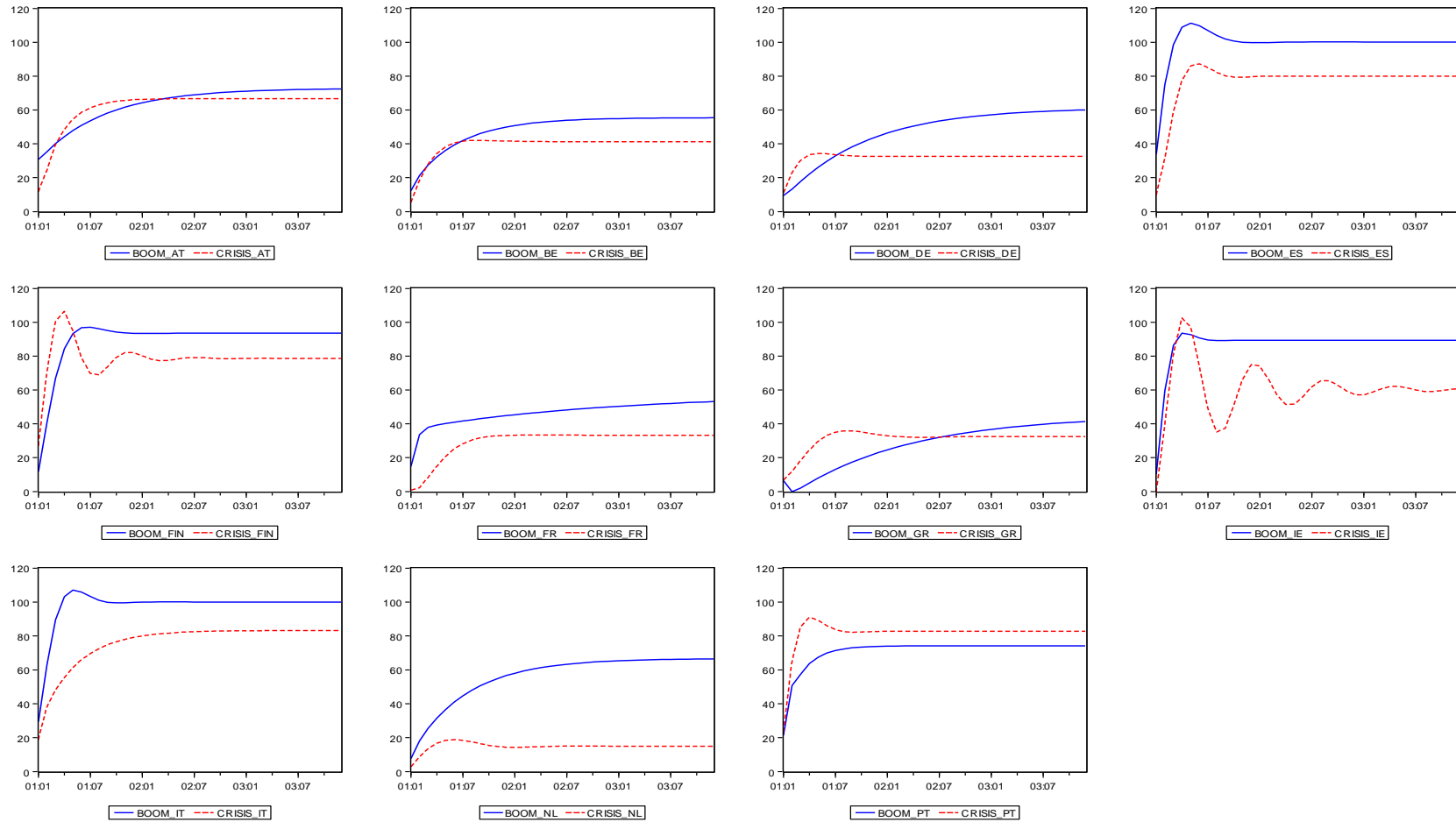
Charts A1 : simulation of the effect of an Eonia's impulse of 100 basis points on the interest rate for loans to firms up to 1 million Euros, during the boom and since the crisis in 10 euro zone countries



Charts A2 : simulation of the effect of an Eonia's impulse of 100 basis points on the interest rate for loans to firms over 1 million Euros, during the boom and since the crisis in 10 euro zone countries



Charts A3 : simulation of the effect of an Eonia's impulse of 100 basis points on the interest rate for mortgage loans, during the boom and since the crisis in 11 euro zone countries



Charts A4 : simulation of the effect of an Eonia's impulse of 100 basis points on the interest rate for consumer loans, during the boom and since the crisis in 10 euro zone countries

