Macroeconomic Determinants of MIR Rate: Evidence from the Euro area

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Abstract

The objective of this study is to examine the determinants of MIR rate in the Euro area for the period 2003Q1-2015Q3. By employing Fixed Effects, Random Effects and Dynamic OLS (DOLS) as econometric methodologies, I examine if the MIR rate is affected by the following macroeconomic factors: unemployment rate, inflation rate, GDP growth, political stability index and wages as % to GDP. All of these factors found to exert great significance to MIR rate and thus they have to be taken into consideration when macro-prudential policies are designing.

Keywords: *MIR rate; Interest margin; DOLS estimation; Euro area; European Central Bank*.

JEL classification: C33, C51, E40, E43, E58, G2.

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I. A Brief Literature Review

Saunders and Schumacher (2000) studied the determinants of the net interest margin taking as sample banks from both the EU and the USA for the period 1988-1995. They found that the major determinants of the net interest margin are capital to asset ratio, implicit interest payments, market power, opportunity cost and interest rate volatility. Brock and Suarez (2000) stated that bank spreads in the 1990s are influenced by inflation and GDP growth.

Almeida and Divino (2015) examined for the period 2001-2012 the determinants of the banking spread in the Brazilian economy. Almeida and Divino (2015) found that administrative expenses, the Herfindahl-Hirschaman index and the total output measured by the GDP, are the main factors of the interest rate spread in Brazil.

Perera and Wickramanayake (2016) examined for the period 1996-2010 the determinants of commercial bank retail interest rate adjustments having as sample 122 countries. According to their findings, commercial bank retail interest rate is affected by both macroeconomic-governance and financial factors. Other studies which have attempted to identify the factors that affect the interest rate adjustments are these of Mojon (2000); Sander and Kleimeier (2004); Wang and Lee (2009); Mishra *et al.,* (2010); Gigineishvili (2011).

Islam and Nishiyama (2016) investigated the factors of bank net interest margins for the period 1997-2012 for the following counties: Bangladesh, India, Nepal and Pakistan. They found that inflation rate and economic growth significantly influence the interest margins in a negative manner.

Other studies that have examined which macroeconomic variables affect interest rate margins are (Cottarelli and Kourelis, 1994; Sander and Kleimeier, 2004; Égert *et al.,* 2007) who tested the inflation rate as potential determinant, (Sander and Kleimeier,

2006; Égert *et al.,* 2007; Claeys and Vennet, 2008) who examined the economic growth as potential determinant, (Cottarelli and Kourelis, 1994; Mojon, 2000; Sander and Kleimeier, 2006; Claeys and Vennet, 2008; Wang and Lee, 2009) who investigated if interest rate volatility influences interest rate margins adjustments.

Another recent study is this of Louri and Migiakis (2015) who studied which variables affect the margins that the Euro-area non-financial corporations (NFCs) pay for their bank loan for the period 2003-2014. In particular, Louri and Migiakis (2015) examined the determinants of bank lending margins for distressed and non-distressed Euro-area countries and their major finding is that prudence of banks' management and market concentration are two significant factors that positively affect the bank lending margins in the Euro-area.

The theme of the MIR rate is relatively new in the literature. In particular, as far as I know, Anastasiou, Louri and Tsionas (2016)[1] is the only study which first utilized the theme of the MIR rate examining it as a potential determinant of the European Non-performing loans.

II. Data Issues and Description of Variables

In the present study, I explore some macroeconomic determinants as potential factors that influence the MIR margin. MIR is a new type of interest rate-margin derived from the ECB Data Warehouse for the period 2003Q1-2015Q3. MIR rate (or margin) is defined as the difference between interest rates on consumer loans without guarantee or collateral and consumer loans with guarantee or collateral. This difference-margin comprises information about the assessment of borrowers' credit risk. As a

[1] According to Anastasiou, Louri and Tsionas (2016), MIR interest rate margin found to be a crucial determinant of European NPLs (positively affecting them).

consequence, a greater (lower) MIR rate implies that we have borrowers with lower (higher) credibility. A rise of MIR rate will also signify that borrowers will have to undergo greater net-costs due to the fact that such borrowers are "riskier". At this point it has to be noted that MIR rate captures only a narrow section of borrowers, since it does not capture those who take out mortgages or corporate borrowers. As far as I know this is the first empirical study which examines some macroeconomic factors as potential variables that affect MIR rate.

From figures 1 and 2 we can observe a pictorial presentation of the evolution of MIR rate in the Euro area countries for the period 2003Q1-2015Q3. In order to have more presentable plots, I plotted the MIR rate for two distinct country groups, country group A and B, where in country group A (B) belong the countries which are characterized as core (periphery) Euro-area countries.

*******Insert Figures 1 and 2 here*******

The macroeconomic variables that were employed as explanatory variables are specified as follows:

unemp: *unemp* stands for unemployment rate. Data for unemployment rate were collected from OECD. A country with high unemployment rate suggests that more people are unable to meet their debt obligations and hence this country will typically have more risky borrowers with less collateral. Thus, *unemp* is expected to have a positive sign.

growth: This variable denotes the GDP growth rate. I collected data from OECD. GDP growth rate is expected to have a negative sign, since an economy with high growth rate is expected to have less risky-borrowers. GDP Growth rate directly influences the supply and the demand of loans and deposits and therefore the activities of banks. Kunt

et al., (1999) and Tarus *et al*., (2012) found an inverse relationship between economic growth rate and bank interest margins.

inflrat: *inflrat* stands for inflation rate. Because of lack of data, I utilized the percentage change of CPI as a proxy for the inflation rate, also collected from OECD. Inflation rate is expected to has either a positive (Demirguc-Kunt and Huizinga, 1998) or a negative sign (Boyd et al. 2001; Abreu and Mendes, 2003; Islam and Nishiyama, 2016).

politic_stab: *politic_stab* is an index obtained from Datastream Professional and denotes the political stability of a country. The higher the index is, the greater political stability prevails in the country. A more political stable country is expected to have less risky-borrowers than other countries which are political unstable and thus *politic_stab* is expected to have a negative sign. As far as I know this is the first empirical study which examines the variable *politic_stab* as a potential macroeconomic determinant of interest rate margin.

wage: As *wage,* I utilized wage as % to GDP. As *wage* increases borrowers will have greater income and probably more collateral. Thus, borrowers with higher wage will seem more credible to banks and thus a lower MIR rate is expected. So, *wage* coefficient is expected to be negative. As far as I know this is the first empirical study which examines the variable *wage* as a potential macroeconomic determinant of interest rate margin.

From table 1 we can see a correlation matrix of all of our variables. From the correlation matrix, we observe that are not recorded any extreme correlations between the variables.

*******Insert Table 1 here*******

In table 2 they are available both the sources from which I took the data and the expected signs of the variables.

*******Insert Table 2 here*******

In table 3 I provide the descriptive statistics for all the variables and in table 4 the descriptive statistics of all the variables for each country. The countries that I included in my analysis are the following: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Lithuania, Luxembourg, Netherlands, Portugal, Slovakia, Slovenia and Spain.

*******Insert Tables 3 and 4 here*******

III. Econometric Methodology

In the present study, I utilized quarterly data for 15 Euro-area countries for the period 2003Q1-2015Q3. I have an unbalanced panel dataset which includes 732 observations.

As a first step, I examined the variables for unit roots existence. I tested for unit roots with the Augmented Dickey-Fuller (ADF) test. ADF test, which was firstly proposed by Dickey and Fuller (1979), has as a null hypothesis that all panels contain a unit root. From table 5 we perceive that all of our variables found to be stationary at level.

*******Insert table 5 here*******

Given that i, t, *unemp, inflrat, growth, politic_stab* and *wage* denote country, time, unemployment rate, inflation rate, GDP growth rate, political stability and wage % GDP respectively, I employ the following econometric model:

$$mir_{it} = a + \beta_1 unemp_{it} + \beta_2\, inflrat_{it} + \beta_3 growth_{it} + \beta_4 politic\_stab_{it} + \beta_5 wage_{it} + u_{it}$$

The above econometric specification was estimated with Fixed Effects, Random Effects and DOLS estimation. The reason why I employ DOLS as an alternative estimation method is twofold. Firstly, because I want to examine if there is a long-run relationship between *mir* and the macroeconomic explanatory variables which I employed, and secondly for robustness check of the Fixed Effects and the Random Effects results.

Below I make a short presentation of the DOLS estimation method.

Panel DOLS estimates

To estimate the long-run relationship between variables there is a variety of estimators. These include within-group and between-group fully modified OLS (FMOLS) estimators and dynamic OLS (DOLS) estimators. FMOLS (DOLS) is a non-parametric (parametric) approach to dealing with correlation. In DOLS methodology lags and leads are included in order to deal with both the problems of the existence or absence of cointegration and the irrespectively order of integration. In our case 2 leads and lags were introduced.

Stock and Watson (1993) developed the dynamic OLS (DOLS) model which allows variables to be integrated of alternative orders. Stock and Watson (1993) suggested a parametric approach for estimating long-run equilibria in systems that might comprise variables with different order of integration but still cointegrated. Last but not least, after Monte Carlo simulations they found that DOLS is more favorable, especially in small samples.

Their basic model was the following:

$$y_t = \beta_0 + \beta_1 x_t + \sum_{i=-p}^{p} c_i \Delta x_{t-i} + e_t \ ,$$

where $\hat{\beta}_1$ is the dynamic OLS estimator and it is asymptotically normally distributed.

Kao and Chiang (2000), Mark and Sul (2003), and Pedroni (2001) proposed extensions of the Saikkonen (1992) and Stock and Watson (1993) DOLS estimator to panel data settings. Panel DOLS involves augmenting the panel cointegrating regression equation with cross-section specific lags and leads Δx_{it} to eliminate the asymptotic endogeneity and serial correlation. Pedroni (2001) has suggested a between-dimension, group-means panel DOLS estimator that incorporates corrections for endogeneity and serial correlation parametrically. Pedroni (2001) used the following regression model which includes lead and lag dynamics:

$$y_{it}=\alpha_i+\beta_i x_{it}+\sum_{j=-K_I}^{K_I}\gamma_{ik}\Delta x_{i,t-k}+e_{it}$$

where

$$\hat{\beta}_{i,DOLS}=\left[N^{-1}\sum_{i=1}^{N}\left(\sum_{t=1}^{T}z_{it}z_{it}^{'}\right)^{-1}\left(\sum_{t=1}^{T}z_{it}\bar{y}_{it}\right)\right]_1 \quad (*)$$

and z_{it} is the $2(k+1)\times 1$ vector of regressors $z_{it}=\left\{\left(x_{it}-\bar{x}_i\right),\ \Delta x_{it-k,\ldots\ldots}\Delta x_{it+K}\right\}$; $\tilde{y}_{it}=y_{it-}\bar{y}_i$; the subscript 1 outside the brackets in (*) indicate that only the first element of the vector is taken to obtain the pooled slope coefficient.

Mark and Sul (2003) have developed a new DOLS estimator which allows for simultaneous dependence between cross-sectional and time series. According to their study, the possible endogeneity can be eliminated by projecting u_{it} into the lags and leads

$u_{it} = \sum_{s=-p_i}^{p_i} \delta_{i,s} \Delta x_{i,t-s} + u_{it}^{*} = \delta_i z_{it} + u_{it}^{*}$, where u_{it}^{*} is the projection error and is orthogonal to all leads and lags of $\Delta x_{i,t}$.

Finally, Kao and Chiang (2000) found that DOLS estimator is asymptotically unbiased and normally distributed, even in the present of endogenous regressors.

IV. Estimation Results

After the estimation of my model both with the Fixed Effects and the Random Effects approach (Wooldridge, 2010), I provide the corresponding results in tables 6 and 7 respectively. Tables 6 and 7 include the estimated coefficients with their corresponding robust standard errors after the Fixed Effects and Random Effects estimation method respectively. At that point it has to be noted that the probability value of the Hausman test found to be equal to 0.000 rejecting the null hypothesis and thus Fixed Effects found to be a more appropriate method than the Random Effects method. However, I also provide the estimation results from the Random Effects approach in order to give an extra robust econometric evidence.

*******Insert Tables 6 and 7 here*******

All the variables found to exert a great significance on the MIR rate. Also, all variables found to have the proper sign as we expected. Specifically, regarding the Fixed Effects approach, the coefficient of unemployment rate found to be positive and equal to 0.116. Variables *growth, politic_stab* and *wage* found to exert a great negative impact on MIR rate with estimated coefficients equal to -0.225, -1.470 and -0.334 respectively. Inflation rate found to be significant and positive supporting the study of

Demirguc-Kunt and Huizinga (1998). The same results have been found with the Random Effects approach regarding the signs and the statistical significance.

Concerning the DOLS methodology, the estimated long-run coefficients with their corresponding standards errors can be found at table 8.

*******Insert Table 8 here*******

The results from DOLS method confirm the corresponding results of both the Fixed and the Random Effects method, apart from the result of the variable *inflrat*.

In general, all the variables found to have a great impact on the MIR rate and also all the variables found to have the expected signs. In particular, the long-run estimated coefficients of *unemp, growth, politic_stab* and *wage* found to be equal to 0.170, -0.595, -1.311 and -0.701 respectively.

As a consequence, the results are robust to alternative econometric specifications. Nevertheless, the sign of *inflrat* was not found to be compatible with the corresponding sign of the Fixed (and Random) Effects approach. In the DOLS estimation method, variable *inflrat* found to negatively affect the MIR rate and thus this result provides further support of the findings of Boyd et al. (2001), Abreu and Mendes (2003) and Islam and Nishiyama (2016).

V. Conclusions

The objective of this study is to examine the causes of MIR rate in the euro area for the period 2003Q1-2015Q3. By employing Fixed Effects, Random Effects and Dynamic OLS (DOLS) as econometric methodologies I found that MIR rate is explained by the following macroeconomic factors: unemployment rate, inflation rate, GDP growth political stability index and wages as % to GDP. All of these factors found to exert great significance to MIR rate. The estimation results with Fixed Effects, Random Effects and DOLS are very similar and thus my results provide strong robust econometric evidence. Such findings can be helpful when designing macro-prudential policies. Moreover, such findings could be useful for economic policy makers (in particular for monetary authorities).

In terms of directions for future research, other extra independent variables could be employed-tested such as tax on personal income, corruption index, business cycle and money supply. Because of lack of data and a potential multicollinearity problem, I could not delve into the literature and examine further potential factors that affect MIR rate. However, a step as such could broaden the horizon for a further research.

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Tables

Table 1: Correlation Matrix						
	mir	**unemp**	**inflrat**	**growth**	**politic_stab**	**wage**
mir	1.000	-	-	-	-	-
unemp	0.074	1.000	-	-	-	-
inflrat	0.235	-0.301	1.000	-	-	-
growth	-0.126	-0.166	0.130	1.000	-	-
politic_stab	-0.241	-0.201	-0.017	0.220	1.000	-
wage	-0.295	-0.095	-0.051	0.119	0.522	1.000
Notes: unemp, inflrat, growth, politic_stab and wage stand for unemployment rate, inflation rate, GDP growth rate, political stability and wage %GDP respectively.						

Table 2: Data Sources and Expected Signs	
Panel A: Data Sources	
mir	ECB DATA WHAREHOUSE
unemp	OECD
inflrat	OECD
growth	OECD
politic_stab	DATASTREAM
wage	DATASTREAM
Panel B: Expected Signs	
unemp	(+)
inflrat	(+)/(-)
growth	(-)
politic_stab	(-)
wage	(-)
Notes: unemp, inflrat, growth, politic_stab and wage stand for unemployment rate, inflation rate, GDP growth rate, political stability and wage %GDP respectively.	

Table 3: Descriptive Statistics				
Variable	**Mean**	**Std. Dev.**	**Min**	**Max**
mir	4.044	1.141	1.630	7.200
unemp	10.318	4.817	1.800	29.100
inflrat	0.596	0.498	-1.709	7.762
growth	0.322	0.941	-12.399	7.352
politic_stab	5.324	0.658	4.070	6.717
wage	33.706	5.882	22.300	48.900
Notes: unemp, inflrat, growth, politic_stab and wage stand for unemployment rate, inflation rate, GDP growth rate, political stability and wage %GDP respectively.				

Table 4: Descriptive Statistics by Country							
Country	**stats**	**mir**	**unemp**	**inflrat**	**growth**	**politic_stab**	**wage**
Austria	**mean**	3.489	4.782	0.478	0.438	6.075	39.151
	min	2.100	3.100	-0.305	-1.988	5.909	37.200
	max	5.490	6.000	1.506	2.010	6.447	41.700
Belgium	**mean**	3.936	7.919	0.464	0.440	6.061	36.850
	min	2.440	6.200	-0.577	-2.093	5.662	35.700
	max	5.490	9.400	1.604	1.635	6.383	38.500
Finland	**mean**	3.107	8.712	0.462	0.426	6.550	38.954
	min	1.630	5.600	-0.673	-6.892	6.214	36.500
	max	5.590	13.300	1.537	3.090	6.717	45.200
France	**mean**	3.813	9.709	0.414	0.374	5.857	37.460
	min	2.420	6.700	-0.366	-1.582	5.595	35.800
	max	5.370	29.100	1.219	1.242	6.178	39.200
Germany	**mean**	4.261	8.191	0.356	0.316	6.000	41.631
	min	2.680	4.800	-0.487	-4.454	5.682	36.600
	max	5.590	18.800	1.088	2.026	6.317	48.900
Greece	**mean**	5.749	14.062	0.717	0.218	4.747	25.422
	min	4.620	7.400	-1.709	-4.770	4.369	22.300
	max	7.200	28.000	2.160	3.066	5.001	28.600
Ireland	**mean**	4.193	8.177	0.489	1.095	5.894	36.412
	min	2.940	3.700	-0.898	-4.071	5.604	31.900
	max	6.360	15.400	1.676	6.211	6.133	40.900
Italy	**mean**	3.899	9.410	0.647	0.119	4.696	27.840
	min	2.200	5.700	-0.187	-2.910	4.256	26.500
	max	6.520	13.700	1.824	1.556	5.042	29.400
Lithuania	**mean**	3.504	11.775	0.772	1.068	4.716	31.850
	min	1.780	3.900	-1.541	-12.399	4.070	29.600
	max	5.520	18.500	4.370	4.835	5.193	35.600
Luxembourg	**mean**	3.939	4.709	0.534	0.655	6.183	42.374
	min	2.590	1.800	-1.187	-5.709	5.905	38.700
	max	5.570	7.300	1.620	5.291	6.464	46.000

Netherlands	**mean**	4.575	4.373	0.495	0.460	6.283	39.550
	min	3.310	2.000	-0.617	-3.315	6.028	37.400
	max	6.470	8.200	1.763	1.762	6.543	43.100
Portugal	**mean**	4.364	9.111	0.723	0.300	5.291	37.085
	min	2.790	4.000	-0.724	-2.300	5.059	33.900
	max	6.360	18.400	3.204	2.229	5.473	38.900
Slovakia	**mean**	.	14.828	1.110	0.908	4.890	29.500
	min	.	8.700	-0.569	-9.225	4.649	27.100
	max	.	19.900	7.762	7.352	5.125	33.000
Slovenia	**mean**	3.881	7.182	1.050	0.621	5.138	43.595
	min	2.780	4.200	-1.288	-4.518	4.873	41.500
	max	6.030	11.200	3.395	3.633	5.428	45.900
Spain	**mean**	3.753	15.840	0.660	0.517	5.624	38.114
	min	2.380	8.000	-0.683	-1.597	5.069	36.200
	max	5.880	27.100	1.747	1.592	6.279	40.500

Notes: unemp, inflrat, growth, politic_stab and wage stand for unemployment rate, inflation rate, GDP growth rate, political stability and wage %GDP respectively.

Table 5: ADF Unit root tests

VARIABLES	P_values	Statistics
mir	0.000	-19.048
unemp	0.000	-18.997
inflrat	0.000	-41.629
growth	0.000	-42.621
politic_stab	0.000	-16.763
wage	0.000	-20.584

Notes: (a) ADF test has as a null hypothesis that there is unit root, (b) unemp, inflrat, growth, politic_stab and wage stand for unemployment rate, inflation rate, GDP growth rate, political stability and wage %GDP respectively, (c) The null hypothesis of unit root is rejected at the 1% significance level for all variables.

Table 6: Estimation Results with Fixed Effects, 2003Q1-2015Q3	
VARIABLES	**mir**
$unemp_{it}$	0.116*** (0.009)
$inflrat_{it}$	0.231*** (0.035)
$growth_{it}$	-0.225*** (0.023)
$politic\_stab_{it}$	-1.470*** (0.163)
$wage_{it}$	-0.334*** (0.037)
Constant	24.110*** (1.882)
Diagnostics	
Observations	732
Number of countries	15
R^2	0.350

Notes: (a) *, **, *** denote statistical significance at the 10, 5, and 1 percent level respectively, (b) numbers in parentheses denote robust standard errors, (c) unemp, inflrat, growth, politic_stab and wage stand for unemployment rate, inflation rate, GDP growth rate, political stability and wage %GDP respectively.

Table 7: Estimation Results with Random Effects, 2003Q1-2015Q3	
VARIABLES	**mir**
$unemp_{it}$	0. 087***
	(0.008)
$inflrat_{it}$	0. 301***
	(0.038)
$growth_{it}$	-0. 165***
	(0. 019)
$politic\_stab_{it}$	-0. 512***
	(0. 097)
$wage_{it}$	-0. 109***
	(0. 015)
Constant	11.233***
	(0.457)
Diagnostics	
Observations	732
Number of countries	15
R^2	0.285

Notes: (a) *, **, *** denote statistical significance at the 10, 5, and 1 percent level respectively, (b) numbers in parentheses denote robust standard errors, (c) unemp, inflrat, growth, politic_stab and wage stand for unemployment rate, inflation rate, GDP growth rate, political stability and wage %GDP respectively.

Table 8: Estimation Results with DOLS, 2003Q1-2015Q3	
VARIABLES	**mir**
$\mathbf{unemp_{it}}$	0.170*** (0.009)
$\mathbf{inflrat_{it}}$	-0.246*** (0.118)
$\mathbf{growth_{it}}$	-0.595*** (0.065)
$\mathbf{politic\_stab_{it}}$	-1.311*** (0.118)
$\mathbf{wage_{it}}$	-0.701*** (0.030)
Diagnostics	
Observations	691
Number of countries	15
$\mathbf{R^2}$	0.652

Notes: (a) *, **, *** denote statistical significance at the 10, 5, and 1 percent level respectively, (b) numbers in parentheses denote robust standard errors, (c) unemp, inflrat, growth, politic_stab and wage stand for unemployment rate, inflation rate, GDP growth rate, political stability and wage %GDP respectively.

Figures

Figure 1: The evolution of MIR rate in Euro area countries – Country Group A (2003Q1-2015Q3)

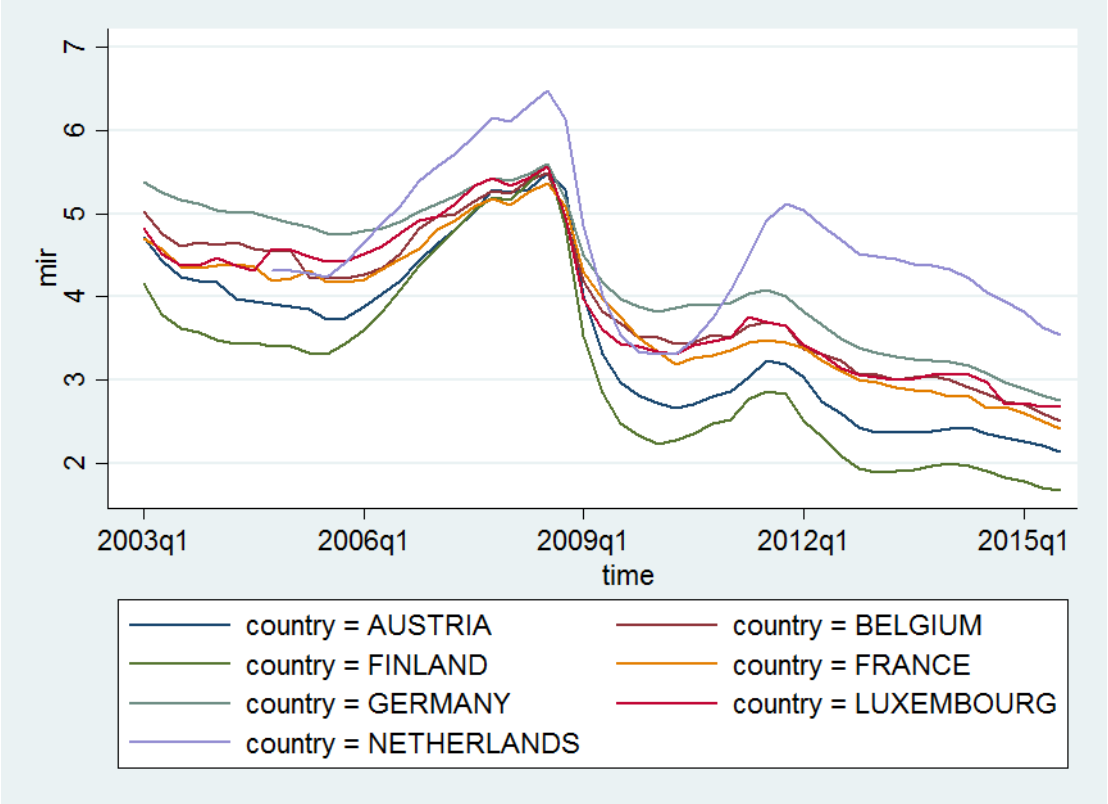

Figure 2: The evolution of MIR rate in Euro area countries – Country Group B (2003Q1-2015Q3)