

# **The role of non-performing loans in the transmission of monetary policy**

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## Research Question and Motivation

- High stock of Non-Performing Loans (NPLs) considered to be one of the most pressing problems in the European (and Euro area) banking system (see for instance recent discussion on the regulatory treatment of NPLs or ESRB (2017)).
- „...high NPLs also impair monetary transmission, as credit supply remains heavily influenced by the lending behavior of banks.“ (IMF Staff discussion note, 2015).
- Research questions:
  - Does the stock of NPLs affect lending rates for new loans beyond its effects on (currently observed) bank capital in the Euro area (see also Albertazzi et al., 2016)?
  
  - If yes, through which channel(s)?

## Potential channels through which NPLs might influence lending behavior

- NPLs might be considered an indicator for „anticipated falls in capital“ (Hernando and Villanueva, 2014); (net NPLs).
- NPLs might induce investors to demand higher risk premia for providing funds to the bank; either due to further future expected losses (net NPLs) or due to penalty for bad management (gross NPLs).
- NPLs might influence the „institutional memory“ (Berger and Udell, 2004); (gross NPLs).



Split NPLs into net NPLs and LL-reserves (both variables highly correlated, however effect seems to be separable).

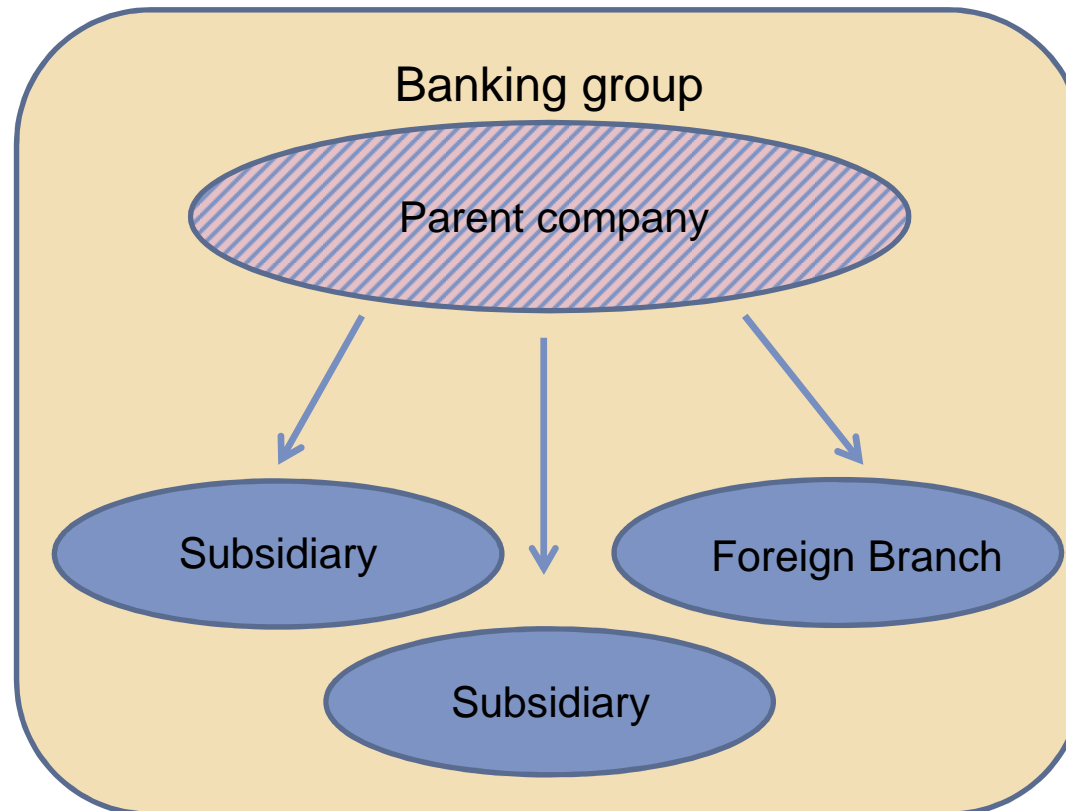
Check whether impact of Net-NPLs and LL-reserves on lending rates changes, when market funding costs are controlled for.

## Data I

- Data sources:
  - IMIR-data: information on lending rates
  - CSDB: information on single bank bonds, used to generate indicator for cost of market funding on the single bank level.
  - SNL (S&P Global Market Intelligence) / Bankscope (ORBIS Bank Focus): Information on NPLs, LL-reserves, regulatory capital and other balance sheet / P&L-statement items.
  
- Different levels of consolidation: single bank, or even single branch level (iMIR, CSDB), vs. banking group level (SNL, Bankscope).

## Data II

- IMIR:  SNL / Bankscope:  CSDB: 



- Costs of market funding for parent company are considered to be equivalent to costs for entire banking group.

## Data III

	<i>Single Banks (IMIR units)</i>					<i>Banking Groups</i>		
	<b>Total</b>	Parent Companies	Subsidiaries / Branches	Non-vulnerable*	Vulnerable**	<b>Total</b>	Non-vulnerable***	Vulnerable
2010	<b>81</b>	45	36	48	33	<b>57</b>	35	22
2011	<b>99</b>	52	47	60	39	<b>65</b>	40	25
2012	<b>115</b>	62	53	66	49	<b>73</b>	45	28
2013	<b>121</b>	64	57	73	48	<b>77</b>	49	28
2014	<b>123</b>	63	60	79	44	<b>75</b>	50	25
2015	<b>127</b>	65	62	80	47	<b>76</b>	50	26
2016	<b>119</b>	60	59	77	42	<b>69</b>	48	21
Cross-Sections (N)	<b>145</b>	76	69	91	54	<b>90</b>	58	32
Total observations (sum 2010-2016)	<b>785</b>	411	374	483	302	<b>492</b>	317	175

\*Non-vulnerable countries include: AT, BE, DE, EE, FI, FR, LT, LU, LV, MT, NL and SK;

\*\*Vulnerable countries include: CY, ES, GR, IE, IT, PT and SI

\*\*\* Non-vulnerable countries plus DK, GB and SE

# Results Lending rates I (without Funding Costs)

Dependent variable: Lending rate (loans to NFCs)

	FE_1	FE_2	Sys GMM_1	Sys GMM_2	FE_1	FE_2	Sys GMM_1	Sys GMM_2
LendingRate (-1)		0.343 ***	0.536 ***	0.562 ***		0.429 ***	0.553 ***	0.812 ***
<b>Gross_NPL_TA (-1)</b>	<b>0.037 ***</b>	<b>0.026 ***</b>	<b>0.035 ***</b>	<b>0.038 ***</b>	<b>0.009</b>	<b>-0.002</b>	<b>0.009</b>	<b>-0.030 **</b>
<b>Gross_NPL_TA(-1)*OIS</b>	<b>-0.013</b>	<b>-0.008</b>	<b>0.009</b>	<b>0.036 *</b>	<b>-0.006</b>	<b>-0.012</b>	<b>0.000</b>	<b>-0.017</b>
Tier1_Ratio (-1)	-0.003	-0.004	0.002	0.012	0.005	-0.001	-0.015 *	-0.033 **
Liq_Ratio (-1)	0.010	0.008	0.001	-0.005	-0.005	-0.004	-0.004 **	-0.022 ***
ROA (-1)	-0.005	-0.012	0.009	-0.010	-0.019	-0.029	-0.021	-0.065
GDP_growth					0.045 ***	0.021 **	0.003	0.001
Unemployment Rate					0.101 ***	0.046 *	0.020 ***	0.004
GovBond_Spread					0.114 ***	0.104 ***	0.079 ***	0.048 ***
Inflation					0.070	0.123 **	0.138 ***	0.128 ***
# Observations	778	778	778	778	725	725	725	725
# Cross Sectional Units	145	145	145	145	132	132	132	132
# Instruments			119	136			54	44
P_Hansen			1.0000	1.0000			0.0362	0.1849
P_AR2			0.8208	0.8988			0.8325	0.925
Year FE	No	No	No	No	Yes	Yes	Yes	Yes
Year*Country FE	Yes	Yes	Yes	Yes	No	No	No	No
Controls for IR-Fixation	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

**SysGMM\_1: Only LendingRate(-1) instrumented, instruments collapsed**

**SysGMM\_2: All banking-group specific variables instrumented, instruments collapsed, only lags 2-5 used as instruments**

## Results Lending rates II (without Funding Costs)

Dependent variable: Lending rate (loans to NFCs)

	FE_1	FE_2	Sys GMM_1	Sys GMM_2	FE_1	FE_2	Sys GMM_1	Sys GMM_2
Lending-Rate (-1)		0.340 ***	0.526 ***	0.606 ***		0.424 ***	0.537 ***	0.761 ***
<b>Net_NPL_TA(-1)</b>	<b>0.070 ***</b>	<b>0.051 ***</b>	<b>0.058 ***</b>	<b>0.158 ***</b>	<b>0.063 **</b>	<b>0.044 *</b>	<b>0.040 **</b>	<b>0.025</b>
<b>LL_Res_TA(-1)</b>	<b>-0.017</b>	<b>-0.010</b>	<b>0.003</b>	<b>-0.145 *</b>	<b>-0.060</b>	<b>-0.062 *</b>	<b>-0.035</b>	<b>-0.082</b>
<b>Net_NPL_TA(-1)*OIS</b>	<b>-0.017</b>	<b>-0.014</b>	<b>-0.031 **</b>	<b>-0.026</b>	<b>-0.044</b>	<b>-0.040 *</b>	<b>-0.053 ***</b>	<b>0.000</b>
<b>LL_Res_TA(-1)*OIS</b>	<b>-0.039</b>	<b>-0.011</b>	<b>0.101 **</b>	<b>0.029</b>	<b>0.057</b>	<b>0.029</b>	<b>0.100 **</b>	<b>-0.054</b>
Tier1_Ratio (-1)	-0.002	-0.004	0.002	0.011	0.004	-0.001	-0.016 **	-0.036 **
Liq_Ratio (-1)	0.008	0.007	0.002	-0.007	-0.004	-0.004	-0.004 *	-0.017 ***
ROA (-1)	-0.014	-0.016	0.005	-0.044	-0.025	-0.035	-0.027	-0.064
GDP_growth					0.046 ***	0.022 **	0.001	-0.001
Unemployment Rate					0.101 ***	0.046 *	0.023 ***	0.009
GovBond_Spread					0.119 ***	0.108 ***	0.078 ***	0.045 **
Inflation					0.069	0.122 **	0.136 ***	0.151 ***
# Observations	778	778	778	778	725	725	725	725
# Cross Sectional Units	145	145	145	145	132	132	132	132
# Instruments			121	146			56	54
P_Hansen			1.0000	1.0000			0.0336	0.2491
P_AR2			0.8391	0.8604			0.8158	0.8335
Year FE	No	No	No	No	Yes	Yes	Yes	Yes
Year*Country FE	Yes	Yes	Yes	Yes	No	No	No	No
Controls for IR-Fixation	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

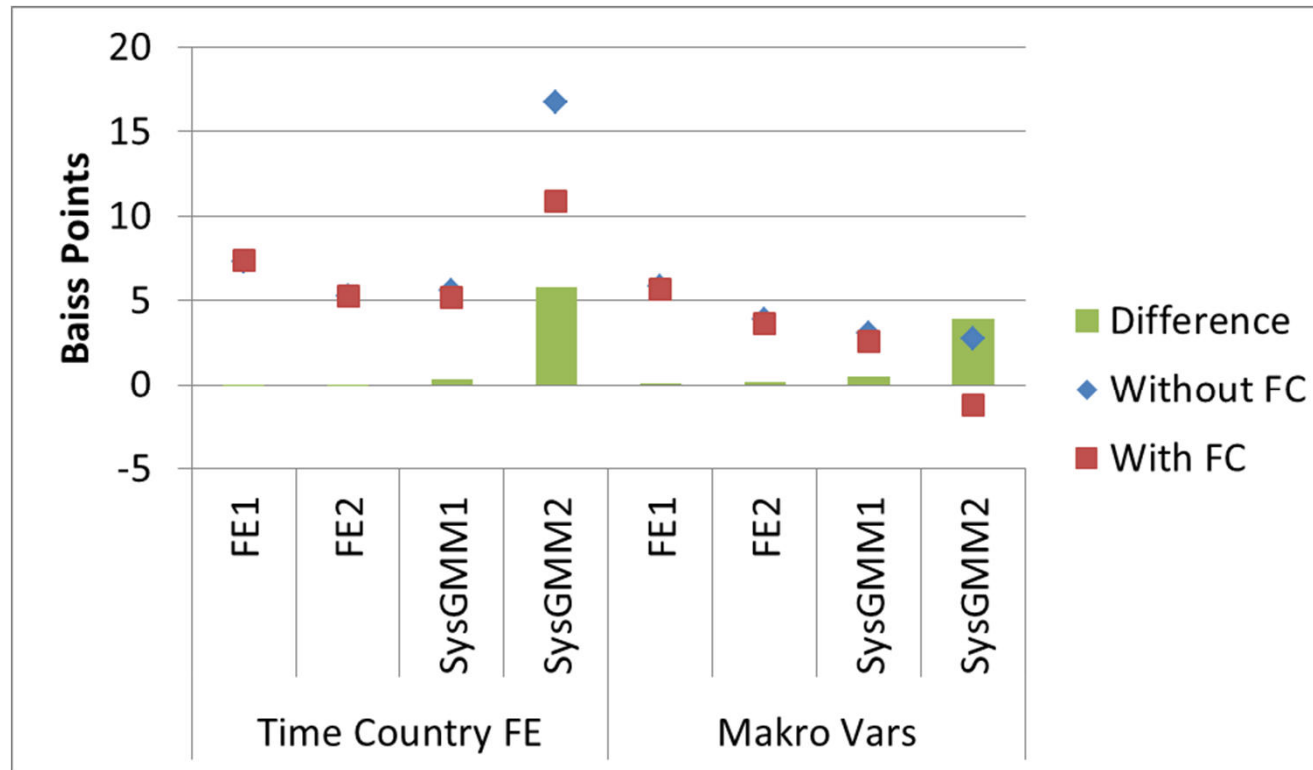
**SysGMM\_1: Only LendingRate(-1) instrumented, instruments collapsed**

**SysGMM\_2: All banking-group specific variables instrumented,  
instruments collapsed, only lags 2-5 used as instruments**



## Model with Funding Costs vs. Model without Funding Costs

- Net NPLs (effect of mean increase between 2009 and 2015; including interaction term, OIS-rate=sample mean)



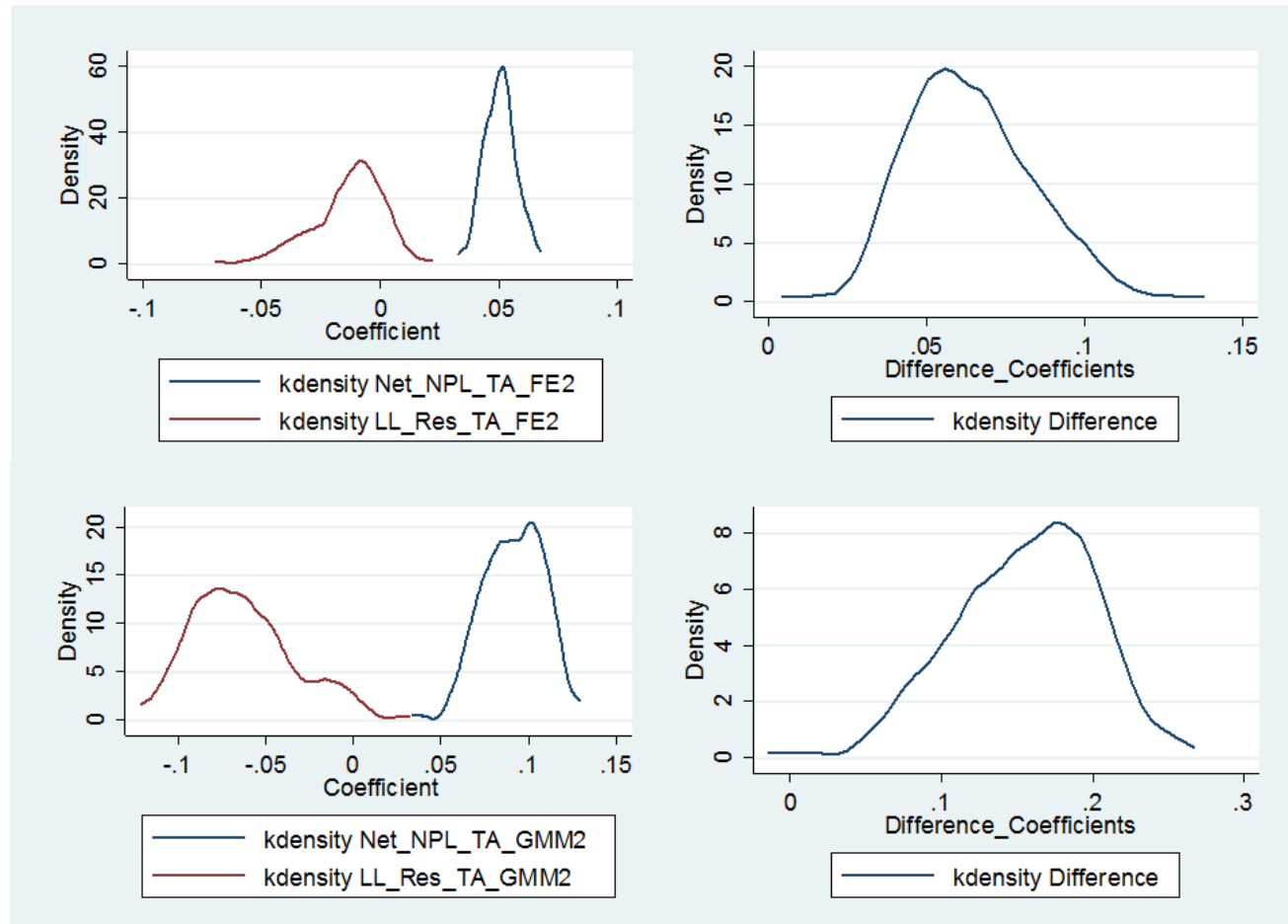
## Robustness (Model including Funding Costs) I

- Results for Coefficients referring to net NPLs and LL reserves largely robust to alternative model specifications.

Modell	Benchmark		Including provisions over gross loans for single bank		Loan rate spread		Leverage Ratio instead of Tier 1	
	Net_NPL_ TA (-1)	LL_Res_ TA (-1)	Net_NPL_ TA (-1)	LL_Res_ TA (-1)	Net_NPL_ TA (-1)	LL_Res_ TA (-1)	Net_NPL_ TA (-1)	LL_Res_ TA (-1)
<b>Year*country FE</b>	<b>N=778</b>		<b>N=609</b>		<b>N=778</b>		<b>N=735</b>	
FE_1	0.071 ***	-0.020	0.060 **	-0.021	0.068 ***	-0.022	0.058 ***	-0.005
FE_2	0.051 ***	-0.012	0.047 **	-0.016	0.051 ***	-0.018	0.043 ***	-0.002
SysGMM_1	0.054 ***	-0.014	0.067 ***	-0.026	0.039 ***	-0.010	0.057 ***	-0.001
SysGMM_2	0.099 **	-0.075	0.082 *	-0.070	0.022	0.033	0.093 *	-0.036
<b>Macro variables</b>	<b>N=725</b>		<b>N=575</b>		<b>N=725</b>		<b>N=692</b>	
FE_1	0.062 **	-0.062	0.065 **	-0.054	0.061 **	-0.065	0.036	-0.029
FE_2	0.042 *	-0.064 *	0.044	-0.057	0.041 *	-0.065 *	0.022	-0.039
SysGMM_1	0.034 **	-0.042 *	0.040 **	-0.040 *	0.036 ***	-0.049 ***	0.028 *	-0.023
SysGMM_2	-0.012	-0.037	-0.006	-0.027	0.026	-0.045	-0.003	-0.017

## Robustness (Model including Funding Costs) II

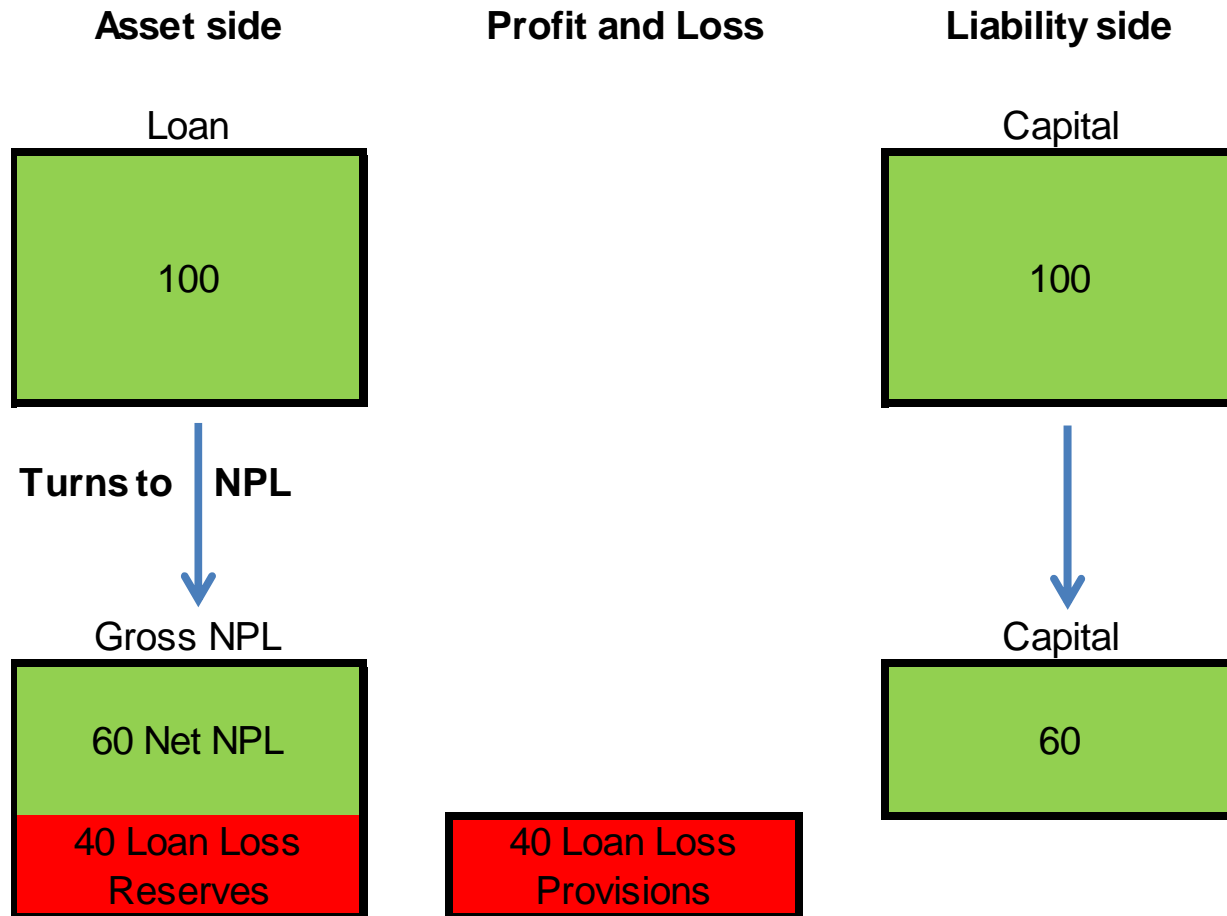
- Net NPLs and LL reserves highly correlated, however results not overly sensitive to variations of the sample (Year \* country FE)



## Conclusion

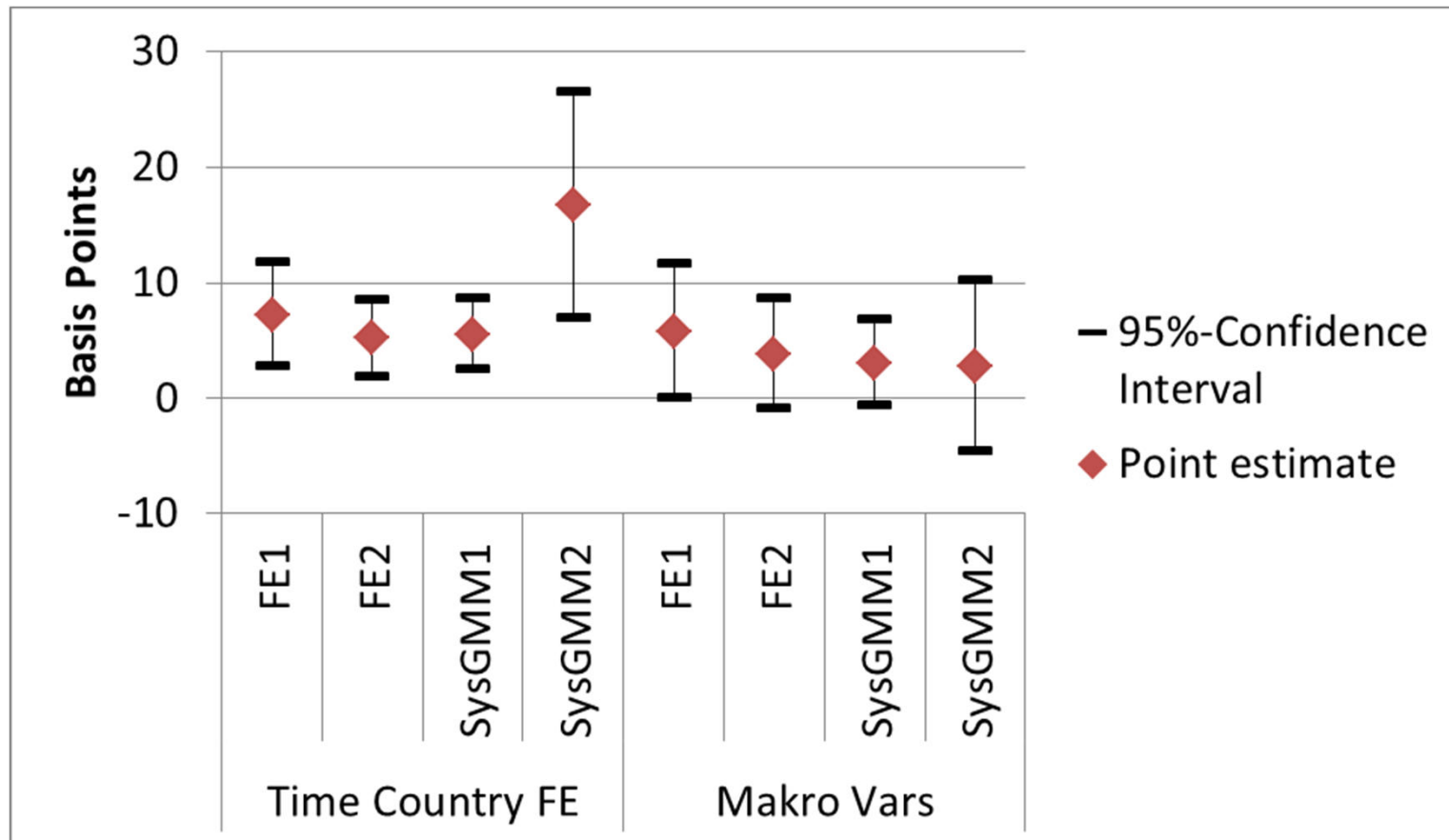
- In most specifications positive association between net NPLs and lending rates; LL-reserves tend to offset impact of net NPLs -> NPLs seem to be less relevant when adequately provisioned.
- Funding Costs do barely affect relation between net NPLs and lending rates -> fits into “anticipated further losses” story.
- Strength of pass-through from market- to lending-rates rather unaffected by NPLs, their effect comes through mark-up -> potential problem when further expansionary monetary policy stimulus cannot be easily achieved.
- Analysis on single bank level takes macroeconomic conditions as given; general equilibrium effects of NPLs might be stronger.

# Annex I: NPLs, Loan Loss Reserves, Provisions and Capital



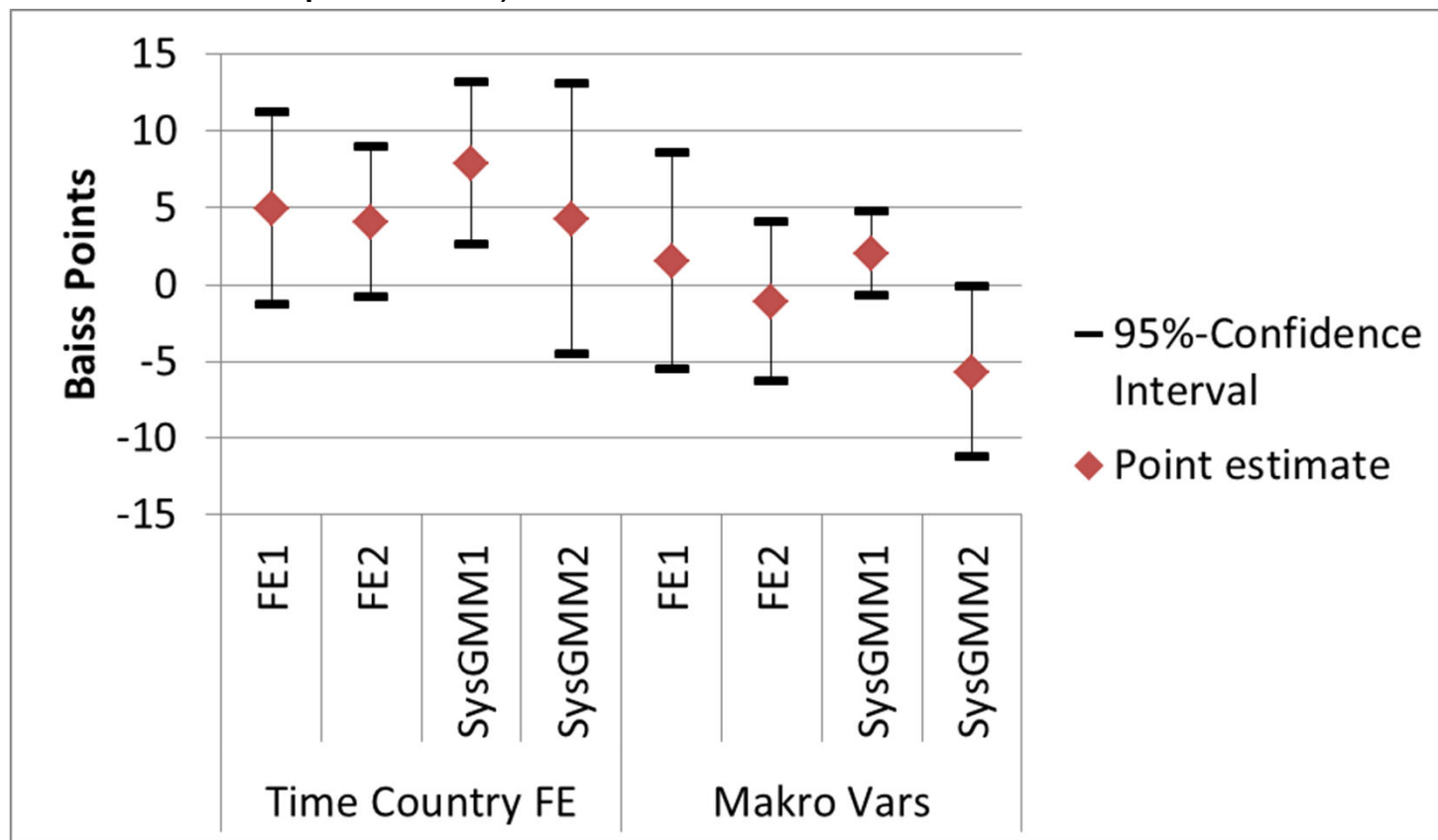
## Annex II: Results Lending rates III (without Funding Costs)

- Effect net NPLs (effect of mean increase between 2009 and 2015; OIS-rate=sample mean)



## Annex III: Results Lending rates IV (without Funding Costs)

- Effect net NPLs + LL Reserves (effect of mean increase between 2009 and 2015; Assumption: Coverage Ratio=45%; including interaction term, OIS-rate=sample mean)



## Annex IV; Results Funding Costs I

Dependent variable: Yield-to-maturity (YTM)\_Spread

	FE_1	FE_2	Sys GMM_1	Sys GMM_2	FE_1	FE_2	Sys GMM_1	Sys GMM_2
YTM-Spread (-1)		0.269 ***	0.904 ***	0.808 ***		0.240 ***	0.669 ***	0.624 ***
<b>Gross_NPL_TA (-1)</b>	<b>0.094 ***</b>	<b>0.087 ***</b>	<b>0.023 **</b>	<b>0.057 ***</b>	<b>0.075 **</b>	<b>0.071 **</b>	<b>0.021 **</b>	<b>0.050 ***</b>
Tier1_Ratio (-1)	0.007	0.003	0.002	0.016	-0.007	-0.012	-0.002	-0.026
Liq_Ratio (-1)	0.022 *	0.020 **	0.004 **	0.001	0.010	0.011	0.002	0.023
ROA (-1)	-0.076	-0.050	-0.004	-0.058	-0.086	-0.064	-0.061	-0.014
GDP_growth					-0.071 **	-0.059 **	-0.001	-0.023
Unemployment Rate					0.079	0.047	0.014	0.003
GovBond_Spread					0.269 ***	0.240 ***	0.112 **	0.156 **
Inflation					0.135	0.212 **	0.348 ***	0.343 ***
# Observations	603	603	603	603	613	613	613	613
# Cross Sectional Units	123	123	123	123	126	126	126	126
# Instruments			84	98			44	38
P_Hansen			1.0000	0.6133			0.1387	0.1263
P_AR2			0.7699	0.838			0.9879	0.9614
Year FE	No	No	No	No	Yes	Yes	Yes	Yes
Year*Country FE	Yes	Yes	Yes	Yes	No	No	No	No
Controls for Maturity	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

**SysGMM\_1: Only YTM-Spread (-1) instrumented, instruments collapsed**

**SysGMM\_2: All banking-group specific variables instrumented,  
instruments collapsed, only lags 2-5 used as instruments**



## Annex V; Results Funding Costs II

Dependent variable: Yield-to-maturity (YTM)\_Spread

	FE_1	FE_2	Sys GMM_1	Sys GMM_2	FE_1	FE_2	Sys GMM_1	Sys GMM_2
YTM-Spread (-1)		0.257 ***	0.887 ***	0.789 ***		0.225 ***	0.672 ***	0.640 ***
<b>Net_NPL_TA (-1)</b>	<b>-0.015</b>	<b>-0.014</b>	<b>-0.004</b>	<b>0.044</b>	<b>-0.092 **</b>	<b>-0.089 **</b>	<b>-0.025</b>	<b>-0.015</b>
<b>LL_Res_TA (-1)</b>	<b>0.266 ***</b>	<b>0.246 ***</b>	<b>0.106 **</b>	<b>0.080</b>	<b>0.328 ***</b>	<b>0.314 ***</b>	<b>0.133 ***</b>	<b>0.153 *</b>
Tier1_Ratio (-1)	0.001	-0.001	0.003	0.022	-0.010	-0.014	-0.001	-0.021
Liq_Ratio (-1)	0.015	0.014	0.003	-0.003	0.003	0.003	0.001	0.020
ROA (-1)	-0.074	-0.050	-0.001	-0.065	-0.074	-0.055	-0.042	-0.021
GDP_growth					-0.082 ***	-0.070 ***	0.001	-0.014
Unemployment Rate					0.086	0.056	0.002	-0.005
GovBond_Spread					0.286 ***	0.258 ***	0.113 **	0.158 **
Inflation					0.098	0.172 **	0.365 ***	0.374 ***
# Observations	603	603	603	603	613	613	613	613
# Cross Sectional Units	123	123	123	123	126	126	126	126
# Instruments			85	103			45	43
P_Hansen			1.0000	0.3470			0.1220	0.1217
P_AR2			0.751	0.8408			0.9989	0.916
Year FE	No	No	No	No	Yes	Yes	Yes	Yes
Year*Country FE	Yes	Yes	Yes	Yes	No	No	No	No
Controls for Maturity	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

**SysGMM\_1: Only YTM-Spread (-1) instrumented, instruments collapsed**

**SysGMM\_2: All banking-group specific variables instrumented,  
instruments collapsed, only lags 2-5 used as instruments**

# Annex VI: Results Lending Rates (with Funding Costs) I

Dependent variable: Lending rate (loans to NFCs)

	FE_1	FE_2	Sys GMM_1	Sys GMM_2	FE_1	FE_2	Sys GMM_1	Sys GMM_2
LendingRate (-1)		0.343 ***	0.540 ***	0.559 ***		0.433 ***	0.544 ***	0.772 ***
<b>Gross_NPL_TA (-1)</b>	<b>0.037 ***</b>	<b>0.026 ***</b>	<b>0.028 ***</b>	<b>0.026 **</b>	<b>0.007</b>	<b>-0.003</b>	<b>0.004</b>	<b>-0.028 *</b>
<b>Gross_NPL_TA(-1)*OIS</b>	<b>-0.013</b>	<b>-0.007</b>	<b>0.005</b>	<b>0.020</b>	<b>-0.005</b>	<b>-0.011</b>	<b>0.001</b>	<b>-0.019</b>
Tier1_Ratio (-1)	-0.004	-0.005	-0.006	-0.010	0.005	-0.001	-0.014 *	-0.034 **
Liq_Ratio (-1)	0.010	0.008	0.001	-0.001	-0.004	-0.002	-0.003 *	-0.018 ***
ROA (-1)	-0.001	-0.008	-0.003	-0.012	-0.013	-0.022	-0.028	-0.057
YTM_Spread	0.017	0.014	0.031	0.025	0.036	0.047	0.064 **	0.040 *
GDP_growth					0.046 ***	0.022 **	0.008	0.003
Unemployment Rate					0.094 ***	0.036	0.014 **	0.001
GovBond_Spread					0.113 ***	0.102 ***	0.084 ***	0.060 ***
Inflation					0.062	0.112 **	0.101 ***	0.097 **
# Observations	778	778	778	778	725	725	725	725
# Cross Sectional Units	145	145	145	145	132	132	132	132
# Instruments			120	137			55	45
P_Hansen			1.0000	1.0000			0.0615	0.1359
P_AR2			0.7814	0.8029			0.8535	0.9234
Year FE	No	No	No	No	Yes	Yes	Yes	Yes
Year*Country FE	Yes	Yes	Yes	Yes	No	No	No	No
Controls for IR-Fixation	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

**SysGMM\_1: Only LendingRate(-1) instrumented, instruments collapsed**

**SysGMM\_2: All banking-group specific variables except YTM\_Spread**

**instrumented, instruments collapsed, only lags 2-5 used as instruments**

# Annex VII: Results Lending Rates (with Funding Costs) II

Dependent variable: Lending rate (loans to NFCs)

	FE_1	FE_2	Sys GMM_1	Sys GMM_2	FE_1	FE_2	Sys GMM_1	Sys GMM_2
Lending-Rate (-1)		0.340 ***	0.532 ***	0.565 ***		0.427 ***	0.529 ***	0.740 ***
<b>Net_NPL_TA (-1)</b>	<b>0.071 ***</b>	<b>0.051 ***</b>	<b>0.054 ***</b>	<b>0.099 **</b>	<b>0.062 **</b>	<b>0.042 *</b>	<b>0.034 **</b>	<b>-0.012</b>
<b>LL_Res_TA (-1)</b>	<b>-0.020</b>	<b>-0.012</b>	<b>-0.014</b>	<b>-0.075</b>	<b>-0.062</b>	<b>-0.064 *</b>	<b>-0.042 *</b>	<b>-0.037</b>
<b>Net_NPL_TA(-1)*OIS</b>	<b>-0.016</b>	<b>-0.014</b>	<b>-0.029 **</b>	<b>0.000</b>	<b>-0.043</b>	<b>-0.038 *</b>	<b>-0.046 **</b>	<b>0.004</b>
<b>LL_Res_TA(-1)*OIS</b>	<b>-0.039</b>	<b>-0.011</b>	<b>0.076 *</b>	<b>-0.004</b>	<b>0.056</b>	<b>0.028</b>	<b>0.089 **</b>	<b>-0.044</b>
Tier1_Ratio (-1)	-0.002	-0.004	-0.006	-0.008	0.005	-0.001	-0.015 **	-0.036 **
Liq_Ratio (-1)	0.009	0.008	0.002	0.000	-0.003	-0.002	-0.003	-0.014 **
ROA (-1)	-0.008	-0.012	-0.008	-0.029	-0.020	-0.028	-0.030	-0.061
YTM_Spread	0.020	0.017	0.038 *	0.028	0.035	0.046	0.069 ***	0.043 **
GDP_growth					0.046 ***	0.022 **	0.006	0.004
Unemployment Rate					0.094 ***	0.037	0.016 ***	0.004
GovBond_Spread					0.117 ***	0.106 ***	0.082 ***	0.060 ***
Inflation					0.061	0.112 **	0.099 **	0.108 ***
# Observations	778	778	778	778	725	725	725	725
# Cross Sectional Units	145	145	145	145	132	132	132	132
# Instruments			122	147			57	55
P_Hansen			1.0000	1.0000			0.0537	0.2374
P_AR2			0.7746	0.7369			0.8285	0.8725
Year FE	No	No	No	No	Yes	Yes	Yes	Yes
Year*Country FE	Yes	Yes	Yes	Yes	No	No	No	No
Controls for IR-Fixation	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

**SysGMM\_1: Only LendingRate(-1) instrumented, instruments collapsed**

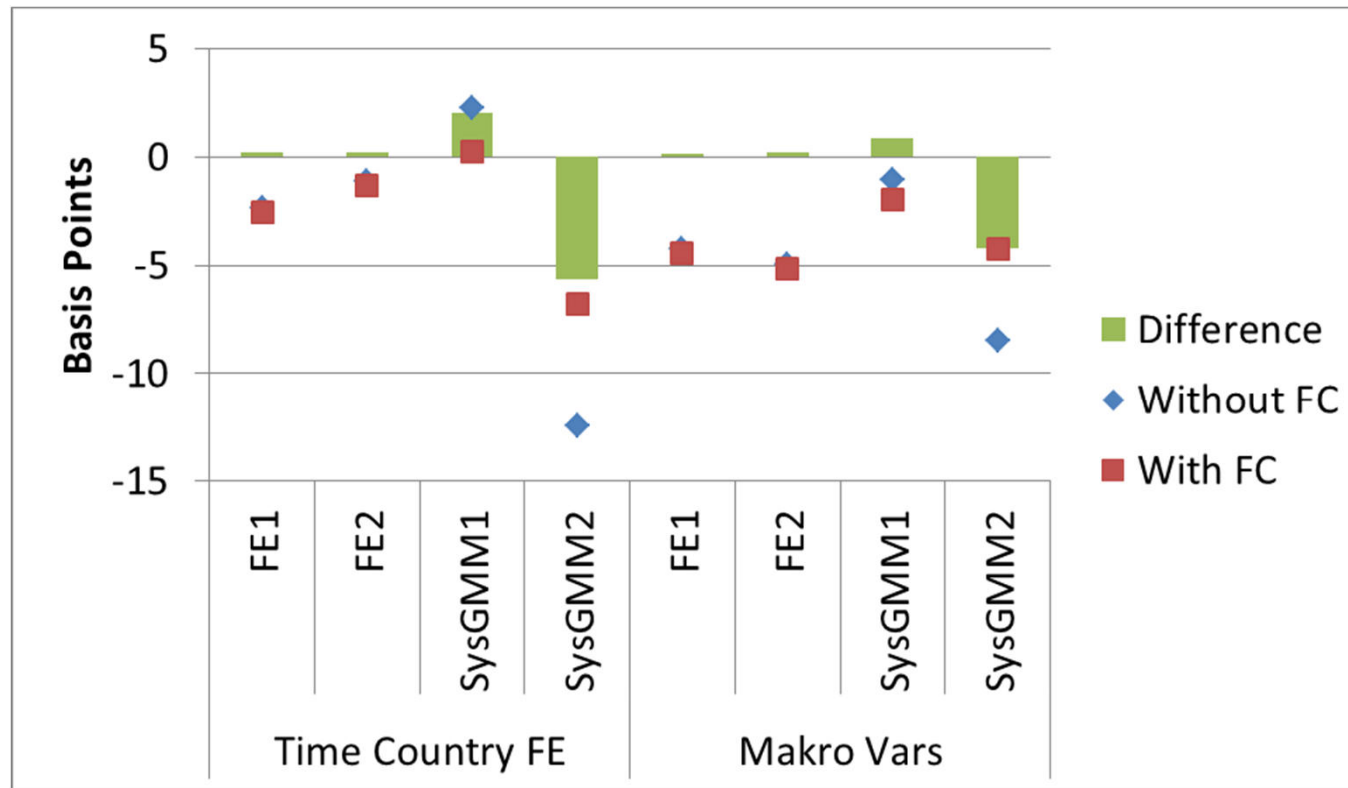
**SysGMM\_2: All banking-group specific variables except YTM\_Spread**

**instrumented, instruments collapsed, only lags 2-5 used as instruments**

MPC-WS; 01.02.2018

## Annex VIII: Model with Funding Costs vs. Model without Funding Costs

- LL Reserves (effect of mean increase between 2009 and 2015; including interaction term, OIS-rate=sample mean)



## Annex IX: Related Literature

- Recent findings based on IMIR-data suggest that NPLs affect markup of lending rates over MP-rates after controlling for capital (Albertazzi et al., 2016).
- However, NPLs do not seem to strongly affect pass-through of MP-rates or MP-shocks in the case of standard MP-measures (Albertazzi et al., 2016; Altavilla et al., 2016; Holton and Rodriguez d'Acri, 2015).
- Several papers find impact of NPLs on lending behavior, also after controlling for bank capital and borrower risk on the single country level (Jiménez et al., 2012; Burlon et al., 2016; Hernandez and Villanueva, 2014); however Accornero et al. (2017) do not find such an impact.
- Babihuga and Spaltro (2014) do not detect impact of LL-reserves on costs of unsecured wholesale funding for Euro-area banks.

## Annex X: Robustness (Model including Funding Costs)

- Net NPLs and LL reserves highly correlated, however results not overly sensitive to variations of the sample (Macro vars)

