Monetary and Macroprudential Policy Complementarities:
Evidence from European Credit Registers

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(work in progress)

Motivation on macroprudential and monetary policies

- The 2008 global financial crisis showed limitations of prevailing bank regulation in preventing build-ups of excessive financial stability risks (credit booms) and ensuring banking resilience to large adverse shocks (Freixas, Laeven and Peydró, 2015)

  ➔ Macroprudential policy focused on the stability of the financial system as a whole, notably risks over the credit cycle, e.g. credit booms

- The crisis also prompted a rethink of the role of financial stability in monetary policy, which was mostly focused on price stability, and is insufficient for financial stability (Adrian and Shin, 2010; Allen and Rogoff, 2011; Stein, 2012; Brunnermeier and Sannikov, 2013, 2020)

  – Low interest rates also limited to use conventional monetary policy tools, leading to the use of unconventional ones

- During the COVID-19 crisis, central banks softened both monetary (MP) and macroprudential (MAP) policies

Interactions of macropru & monetary policies?

- Possible interactions of MP and MAP:
  - MAP by maintaining financial stability makes achieving price stability easier. Similarly, MAP affects economic conditions with implications for MP
  - Changes in MP may affect bank risk taking that MAP may want to offset (Borio and Zhu 2008; Adrian and Shin 2009; Stein 2014; Dell'Ariccia, Laeven and Marquez 2014), or reinforce as:
  - Softer MP may try to increase credit and risk-taking, and softer MAP (eg on capital requirements) may augment its effects (Adrian et al., 2020)
  - Limits to the effectiveness of MAP in practice (Cerutti, Claessens and Laeven, 2017; Stein, 2012)

- Two views on the role of MP and financial stability:
  i. Financial stability objectives may force central banks to raise MP rates beyond the level for price stability, "leaning against the wind" in e.g. credit booms (e.g., Woodford, 2012; Borio, 2014)
  ii. To be passive and limit to "cleaning up" in crises with e.g. credit crunches (e.g., Yellen, 2009; Bernanke, 2009; Mishkin, 2009)
  - Recent theory work, modeling the tradeoffs of MP and MAP: e.g. Farhi and Werning (2016), Van der Ghote (2019) and Adrian et al. (2020)

Our paper

- How do monetary policy and macroprudential policy interact in the credit, bank lending and risk-taking channels?

- We use loan-level data from a unique dataset comprising multiple credit registers from several European countries
    – We use corporate loans, consumer credit and mortgages
    – We merge them with borrower and bank level characteristics

- We also use indicators summarizing macroprudential and monetary policy action. MAP decided in countries, while MP at the ECB

- Key to have several countries to have variation of credit conditions and also of policies, e.g. for MAP, but even MP shocks may imply difference stance for each country depending on their econ conditions
    – Key then also to have multiple credit registers for analyzing credit, not more aggregated country level data as eg bank level data

Preview of results

- Our results suggest complementarities between the two policies. Economic effects are strong, not just statistical ones

- A softening of macroprudential measures augments the increased bank lending and risk-taking induced by a more accommodative MP
    - Or stricter MAP diminishes the lending and risk-taking effects of softer MP

- Effects are stronger for less capitalized banks and for these banks lending to riskier borrowers

- Results apply to both the household and firm sectors, but with overall stronger results for household loans

- For firms, the increase in bank risk-taking activities induced by a loose policy mix is directed toward more (ex-ante) productive firms

Contribution to the literature

- Monetary policy and credit:
  - Monetary policy via credit and bank lending channels: e.g. Bernanke and Blinder, 1988, 1992; Kashyap and Stein, 2000; Jiménez et al., 2012; Drechsler, Savov and Schnabl 2017
  - Risk-taking channel of monetary policy: e.g. Adrian and Shin, 2010; Allen and Rogoff, 2011; Stein, 2012; Brunnermeier and Sannikov, 2013, 2020; Maddaloni and Peydró, 2012; Jiménez et al., 2014; Dell'Ariccia et al. 2015

- Macroprudential literature: e.g. Cerutti, Claessens and Laeven 2017; Jimenez et al., 2017; Acharya et al., 2019; Benetton, 2018; DeFusco, Johnson and Mondragon, 2019

- Interactions of macroprudential and monetary policy: e.g. Farhi and Werning, 2016; Van der Ghote, 2019; and Adrian et al., 2020

Rest of the talk

- Data and policies
  - Credit register
  - Macroprudential policies
  - Monetary policies

- Results
  - Overall complementarities
  - Household loans, corporate loans
  - Variation across banks
  - Variation across borrowers

- Conclusions

Credit register

- Our analysis uses a unique, confidential dataset collected in the context of the preparatory phase of the AnaCredit project by the European System of Central Banks

- A dataset containing more than 140 million loan-level observations for <u>households and firms</u> from <u>many countries</u> is employed in an empirical analysis

Credit register

Time and Country coverage

Sample size

- ✓ T: June 2012 – December 2017
- ✓ N: 15 Credit Registers

15 Credit Registers

- ✓ AT, BE, CZ, DE, ES, IE, IT, RO, SI, FR, LT, LV, MT, PT, SK

- ✓ Non euro area countries. We use euro area for the monetary policy shocks

- ✓ Loans to corporates and to households: mortgages and other (consumer loans)

Variables

Measures of loan exposure
Loan (bank, firm, households) identifiers
Type of exposure (loans, debt securities)
Credit commitment or drawn (value of the loan)
Credit lines (the value of credit undrawn)

Credit risk variables
Collateral type (yes, no)
Arrears (part of the loan that is past due)
Prob. of default   (between 0 and 1)
Non-performing status

Borrower attributes
Country of residence
Institutional sector
Sector of economic activity
Size
Firm z-score
Household and firm credit history and defaults

Macroprudential policy in Europe

- Within the European Union, macroprudential measures are taken at the country level. As a consequence, macroprudential policy across the euro area shows much country heterogeneity

- Policies: Capital, liquidity, LTVs, DTIs... We obtain information on the adoption and implementation of country specific macroprudential measures from the ECB's Macroprudential Database:

  – Prudential measures, including microprudential measures that can be used for macroprudential purposes

Macroprudential policy in Europe

- We create a simple index of macroprudential policy intensity based on the number of measures that are being put in place at every period

- We consider 9 categories of measures: Minimum capital requirements; Capital buffers; Risk weights; Lending standards restrictions; Levy / Tax on financial institutions and activities; Limits on large exposures and concentration; Liquidity requirements and limits on currency and maturity mismatch; Leverage ratio; Loan-loss provisioning; Limits on credit growth and volume

  - For each category, we add a value of one to the MAPI index if a measure is adopted, and subtract a value of one if a measure is removed
  - We construct this index for the period 1994 to 2017, which is the period during which data has been collected

- Contrary to monetary policy, macroprudential policy in our sample is country specific: likely endogenous to country economic/credit cycle:

$$MAP_{c,t} = \alpha + \beta_1 GDP_{c,t} + \beta_2 CR_{c,t} + \epsilon_{c,t}$$

Macropru Index

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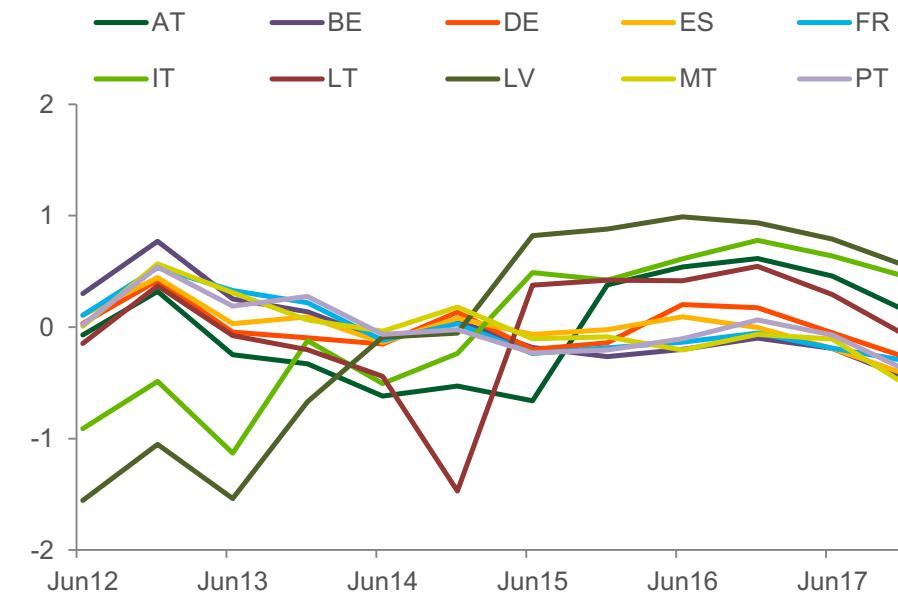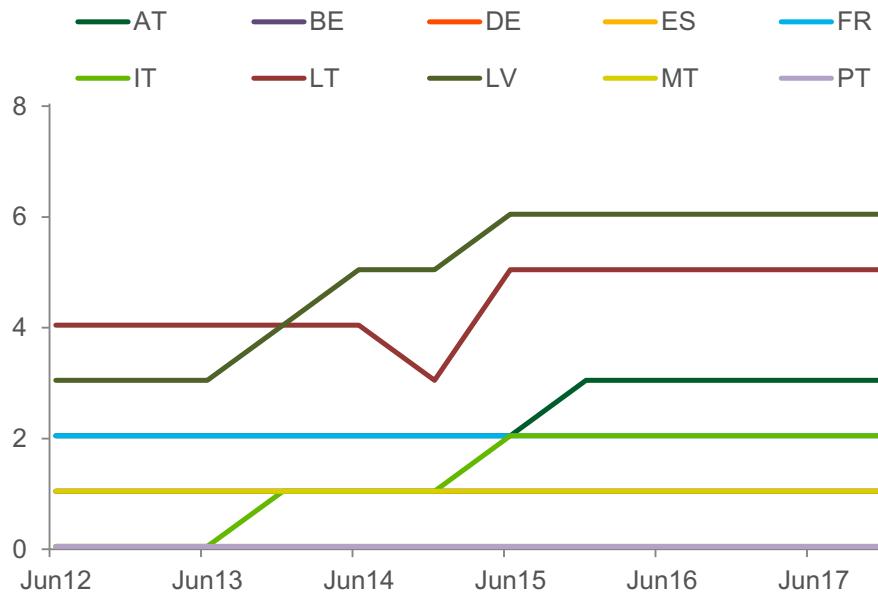
Monetary policy

- Since the onset of the financial crisis, the European Central Bank (ECB) as well as many other major central banks has complemented its operating frameworks with a broad array of non-standard policy measures: FRFA, LTROS, APP, TLTRO, NIRP, which affect the yield curve at different maturities

- To fully capture the amount of policy accommodation provided by the central bank, we use high-frequency surprises obtained by measuring the intraday changes of risk-free rates for various maturities around policy announcements (following the approach in Altavilla et al., 2019)

- We construct a variable, MP that measures the principal component of all monetary policy surprises from high-frequency intraday data on risk-free (overnight index swap, OIS) rates with different maturities, ranging from 1 month to 10 years. These surprises are calculated by measuring changes in risk free rates in a narrow time window around official monetary policy communications

- Even if in 1 time period there is 1 only MP surprise for the whole euro area, as countries differ in their business cycles, also the stance of MP for each country (Taylor, 1992; Maddaloni and Peydró, 2011)

Monetary policy in the euro area

Interest rate corridor
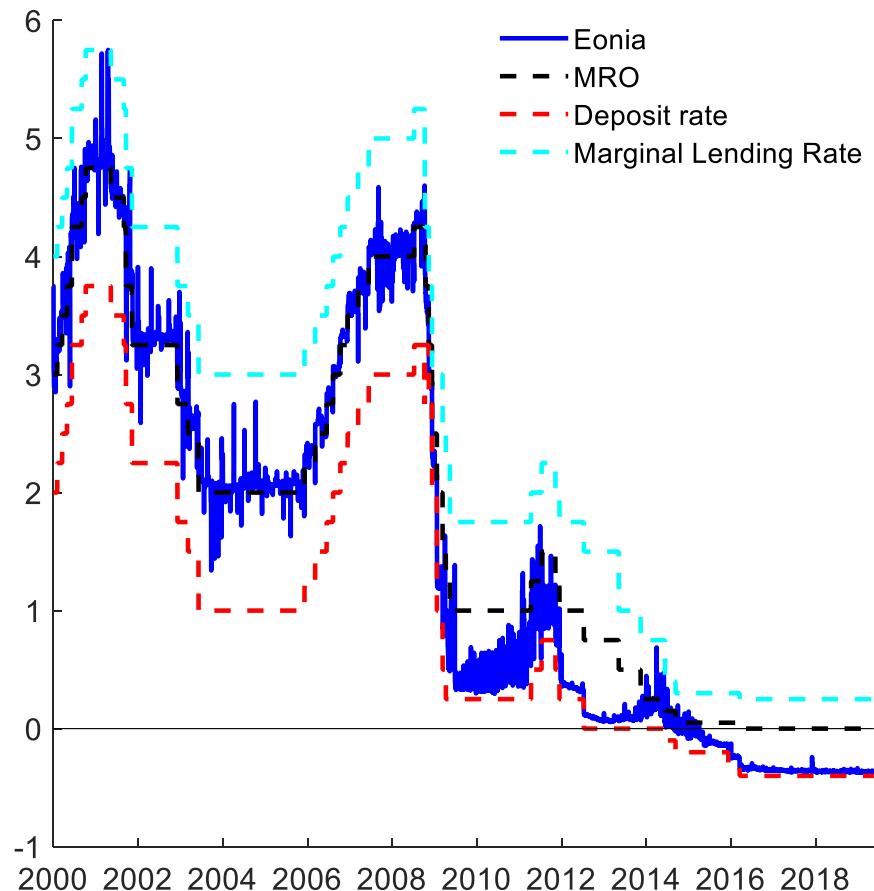
Excess Liquidity
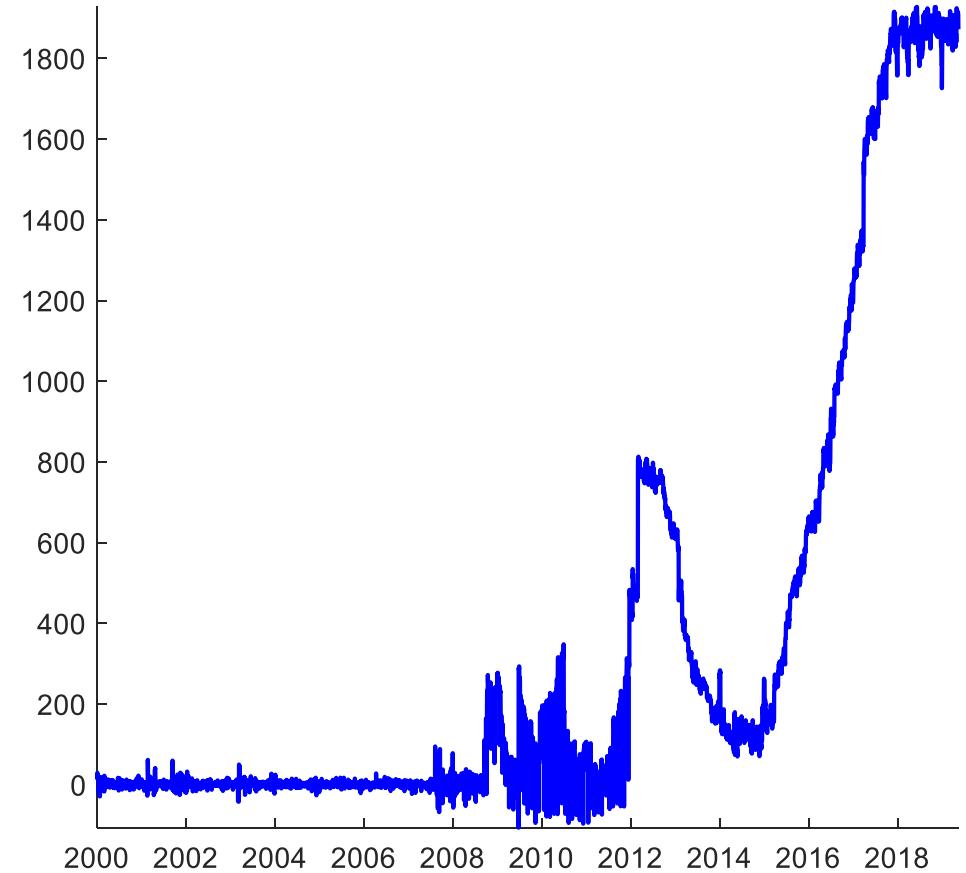
Monetary policy in the euro area: different assets
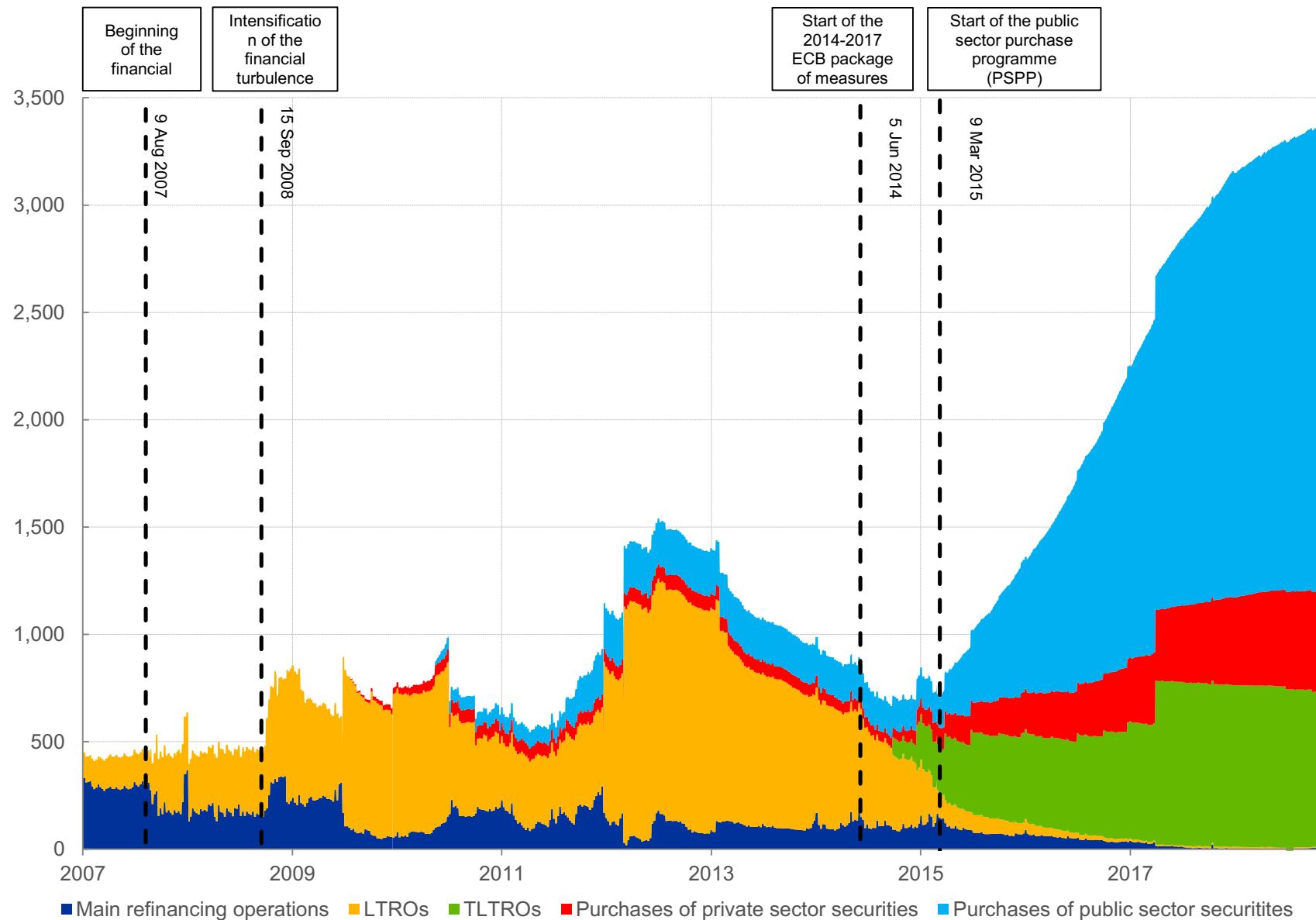
Monetary policy in the euro area: surprises

Term structure of OIS yields at different dates (percentages per annum)

Monetary policy surprises

— 01 January 2013 — 14 August 2014 --- 16 January 2017
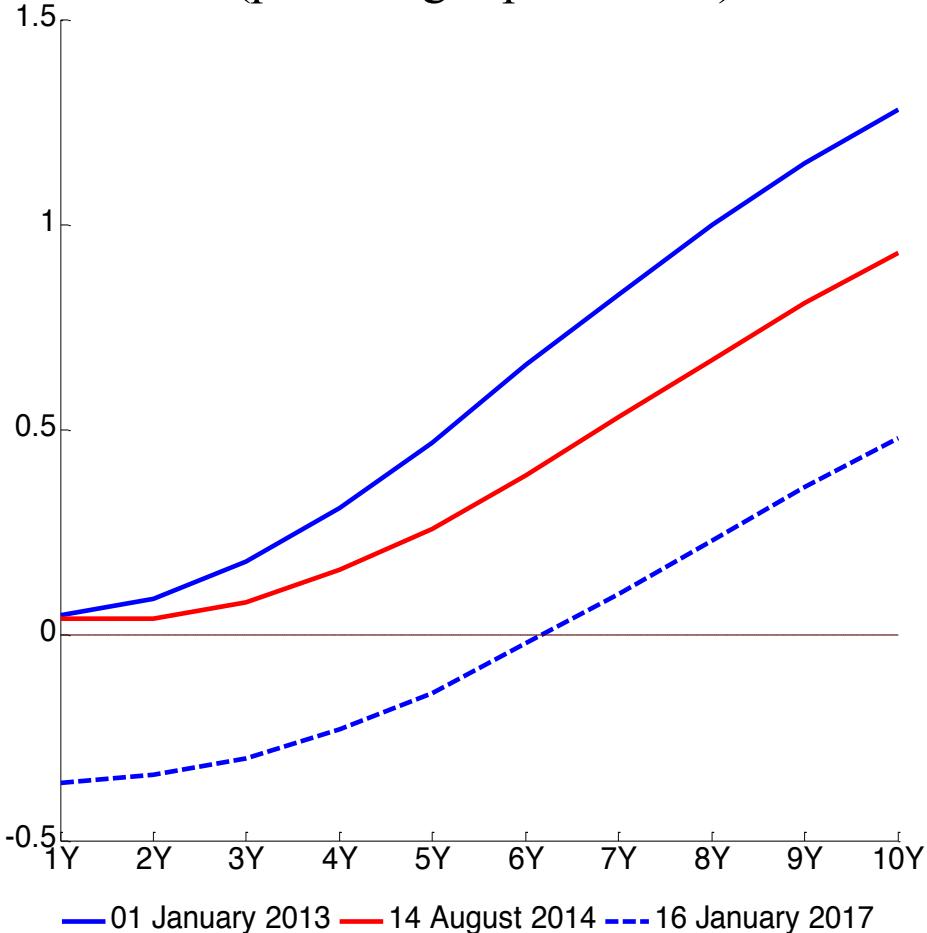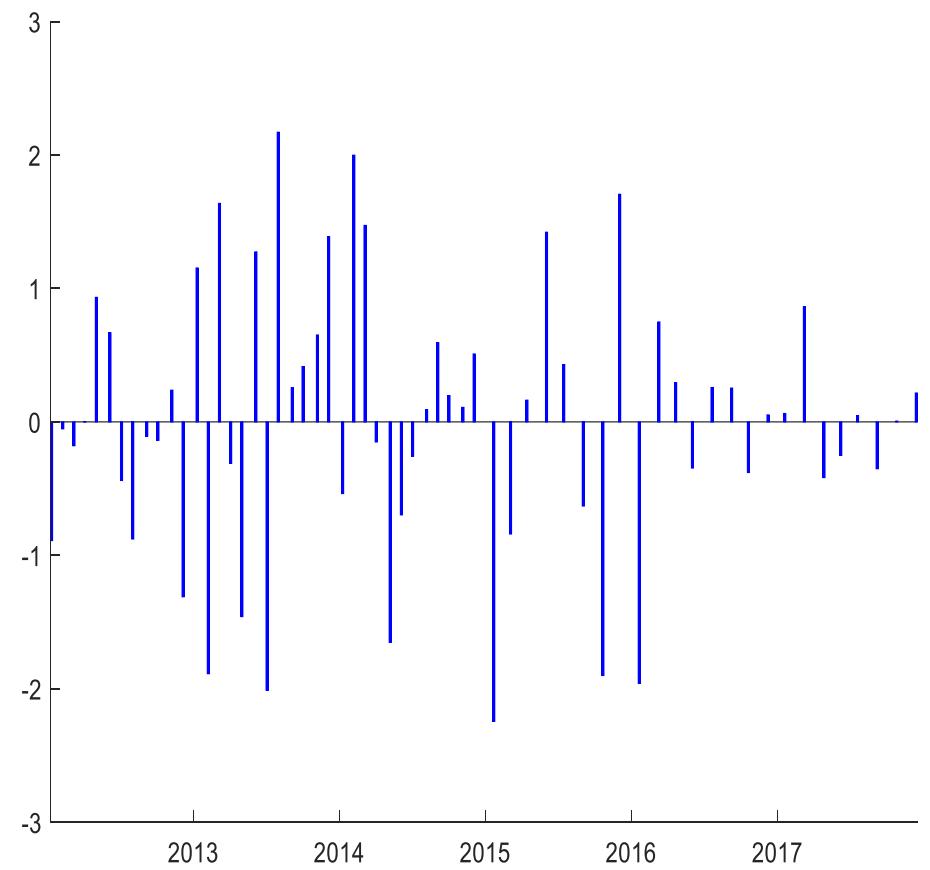
Summary statistics

Variable	Observations	Mean	Std. Dev.	p25	p50	p75
ln(Exposure to HHs)	99,475,542	3.34	1.90	2.61	3.95	4.61
ln(Exposure to HHs for House purchases)	58,631,610	4.21	0.86	3.79	4.32	4.76
ln(Exposure to HHs, other lending)	48,369,142	1.89	2.22	0.36	2.01	3.61
ln(Exposure to NFCs)	90,415,238	4.59	1.72	3.64	4.60	5.63
Non-performing exposure to NFC - NPE(NFC)	90,415,238	0.18	0.39	0.00	0.00	0.00
Non-performing exposure to HH - NPE(HH)	99,475,542	0.03	0.16	0.00	0.00	0.00
Macroprudential index - MAP	99,038,065	0.03	0.60	-0.38	0.15	0.61
Monetary policy Surprises - MP	99,475,542	0.24	4.16	-4.33	0.27	2.04
Equity (Total Equity / Total Assets)	38,734,521	0.08	0.04	0.06	0.07	0.08
Productivity (dummy)	5,322,352	0.59	0.49	0.00	1.00	1.00
ln(TFP) -firm level measure of total factor productivity	5,322,352	4.09	1.37	3.00	4.00	5.00
median(lnTFP) by country-sector-date	5,322,352	3.95	1.25	3.00	4.00	5.00
ln(z-score)	3,356,002	3.04	1.51	2.00	3.00	4.00

The average exposure of a loan to households is about 28,000 euros
while the average exposure of a loan to firms is much larger at about 100,000 euros

MAP and MP complementarities: Households

$$Loans_{b,h,t} = \alpha^{FE} + \beta_1 MP_{t-1} + \beta_2 MAP_{c,t-1} + \beta_3\left(MP_{t-1}{\times}MAP_{c,t-1}\right) + \epsilon_{b,h,t}$$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
MP	-0.00736***					-0.00530***		-0.00530***	
	(0.0000229)					(0.0000107)		(0.00163)	
MAP	-0.164***	-0.0602***	-0.0310***	-0.00935***	-0.0373***	-0.109***	-0.0170***	-0.109***	-0.0170***
	(0.000381)	(0.000721)	(0.000672)	(0.000564)	(0.000539)	(0.000183)	(0.000471)	(0.0104)	(0.00197)
MP x MAP	0.00514***	0.00248***	0.00128***	0.00233***	0.00121***	0.00429***	0.00317***	0.00429***	0.00317***
	(0.0000377)	(0.0000719)	(0.0000688)	(0.0000469)	(0.0000455)	(0.0000188)	(0.0000378)	(0.00117)	(0.000529)
N	89,567,025	89,567,025	89,566,951	88,412,340	88,412,306	85,952,062	85,952,062	85,952,062	85,952,062
r2	0.268	0.268	0.534	0.854	0.887	0.965	0.966	0.965	0.966
Fixed effects									
Country	Y	Y	Y	Y	Y	Y	Y	Y	Y
Time		Y	Y	Y	Y		Y		Y
Bank			Y		Y				
Household				Y	Y				
Bank*Household						Y	Y	Y	Y

MAP and MP complementarities: Firms

$$Loans_{b,h,t} = \alpha^{FE} + \beta_1 MP_{t-1} + \beta_2 MAP_{c,t-1} + \beta_3\left(MP_{t-1} \times MAP_{c,t-1}\right) + \epsilon_{b,h,t}$$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
MP	-0.00482***					-0.00447***		-0.00447***	
	(0.000198)					(0.0000111)		(0.000318)	
MAP	-0.00564***	-0.00240***	-0.00446***	-0.0286***	-0.0304***	-0.00346***	-0.0607***	-0.00346***	-0.0607***
	(0.000626)	(0.000676)	(0.000664)	(0.000504)	(0.000495)	(0.000393)	(0.000422)	(0.00112)	(0.00342)
MP x MAP	0.000893***	0.000579***	0.000144***	0.000994***	0.000996***	0.00376***	0.000846***	0.00376***	0.000846***
	(0.0000485)	(0.0000469)	(0.0000459)	(0.0000362)	(0.0000352)	(0.0000285)	(0.0000266)	(0.000916)	(0.000131)
N	68,611,631	68,611,631	68,611,631	68,111,293	68,111,293	67,114,059	67,114,059	67,114,059	67,114,059
r2	0.182	0.182	0.239	0.733	0.756	0.925	0.927	0.925	0.927
Fixed effects									
Country	Y	Y	Y	Y	Y	Y	Y	Y	Y
Time		Y	Y	Y	Y		Y		Y
Bank			Y		Y				
Firm				Y	Y				
Bank*Firm						Y	Y	Y	Y

MAP and MP complementarities: Summary

- For household loans, the marginal effect of a 1 st. dev. easing in both MP and MAP on lending is 1.3%. This effect is 42% larger than the average increase in lending due to softer MP alone. The additional effect from MAP is reduced to between 8% and 20% after the inclusion of a richer set of fixed effects

- For corporate loans, the marginal effect of a 1 st. dev. easing in both MP and MAP on lending is 0.22%, which is 10% larger than the increase in lending from softer MP alone, and this estimated effect remains identical with a richer set of fixed effects

- Large effects compared to the average loan growth during the period December 2012 to December 2017 of 0.63% for household loans and -0.53% for corporate loans, respectively. Effects are also similar if we weigh loans based on their particular size

Policy interactions and bank lending channel: Households

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
MP	-0.00306***							
	(0.0000640)							
MAP	-0.0588***	-0.0814***	-0.0545***	-0.0634***	-0.0541***			
	(0.000777)	(0.00130)	(0.00124)	(0.000894)	(0.000879)			
Equity	1.901***	1.993***	1.671***	1.108***	0.195***	0.298***	2.219***	0.187***
	(0.0352)	(0.0357)	(0.0295)	(0.0441)	(0.0201)	(0.0229)	(0.0370)	(0.0202)
MP x MAP	0.00789***	0.00414*	0.00498***	0.000389**	0.00378***			
	(0.00128)	(0.00242)	(0.000217)	(0.000153)	(0.000129)			
MP x Equity	-0.132***	-0.140***	-0.0487***	-0.0392***	-0.0322***	-0.0180***	-0.184***	-0.0211***
	(0.00239)	(0.00261)	(0.00236)	(0.00145)	(0.00140)	(0.00167)	(0.00321)	(0.00147)
MAP x Equity	0.612***	0.465***	0.246***	0.181***	0.378***	0.232***	0.446***	0.251***
	(0.0175)	(0.0182)	(0.0164)	(0.0121)	(0.0132)	(0.0151)	(0.0275)	(0.0131)
MP x MAP x Equity	-0.173***	-0.175***	-0.0841***	-0.0713***	-0.0627***	-0.00621***	-0.211***	-0.0107***
	(0.00324)	(0.00336)	(0.00286)	(0.00183)	(0.00173)	(0.00222)	(0.00452)	(0.00193)
N	20,837,941	20,837,941	20,837,940	19,695,844	19,695,843	19,695,843	20,837,941	19,468,157
r2	0.290	0.291	0.316	0.906	0.909	0.909	0.291	0.948
Fixed effects								
Country	Y	Y	Y	Y	Y			
Time		Y	Y	Y	Y			
Country*Time						Y	Y	Y
Bank			Y		Y	Y		
Bank*Household								Y
Bank*time								
Household				Y	Y	Y		

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Policy interactions and bank lending channel: Firms

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
MP	-0.00659***									
	(0.000383)									
MAP	-0.0123***	-0.0320***	-0.0188***	-0.0426***	-0.0469***					
	(0.000857)	(0.000960)	(0.000938)	(0.000696)	(0.000674)					
Equity	1.004***	0.677***	0.760***	1.819***	0.0204	0.507***	1.908***	0.145***	0.135***	0.461***
	(0.0377)	(0.0388)	(0.0367)	(0.0384)	(0.0265)	(0.0400)	(0.0406)	(0.0285)	(0.0239)	(0.0410)
MP x MAP	0.00173***	0.00360***	0.00149***	0.00139***	0.000907***					
	(0.000110)	(0.000107)	(0.0000717)	(0.0000639)	(0.0000513)					
MP x Equity	-0.0899***	-0.0972***	-0.0203***	-0.0123***	-0.0440***	-0.110***	-0.0179***	-0.0543***	-0.0313***	-0.0259***
	(0.00282)	(0.00286)	(0.00238)	(0.00199)	(0.00170)	(0.00318)	(0.00227)	(0.00192)	(0.00152)	(0.00270)
MAP x Equity	0.693***	1.014***	0.635***	0.753***	0.539***	0.910***	0.881***	0.721***	0.131***	0.293***
	(0.0479)	(0.0484)	(0.0411)	(0.0341)	(0.0299)	(0.0496)	(0.0350)	(0.0307)	(0.0248)	(0.0423)
MP x MAP x Equity	-0.0527***	-0.0941***	-0.0646***	-0.105***	-0.00908***	-0.0645***	-0.0886***	-0.0257***	-0.0217***	-0.0303***
	(0.00679)	(0.00688)	(0.00402)	(0.00423)	(0.00296)	(0.00721)	(0.00444)	(0.00306)	(0.00239)	(0.00421)
N	29,306,538	29,306,538	29,306,538	28,890,546	28,890,546	29,306,538	28,890,546	28,890,546	28,529,539	12,557,322
r2	0.166	0.167	0.185	0.789	0.795	0.167	0.790	0.795	0.923	0.948
Fixed effects										
Country	Y	Y	Y	Y	Y					
Time		Y	Y	Y	Y					
Country*Time						Y	Y	Y	Y	Y
Bank			Y		Y			Y		
Firm				Y	Y		Y	Y		
Bank*Firm									Y	Y
Firm*Time										Y

Policy interactions and bank lending channel: Summary

- Regarding the role of bank balance sheet characteristics, we find that the complementarity between monetary and macroprudential policies is stronger for less (ex-ante) capitalized banks

  – That is, lower bank capital enhances the positive impact on lending of a more accommodative monetary policy when the macroprudential policy stance is softer

- The effect is economically significant. For example, for corporate loans we find that the marginal effect of a 1 st. dev. lower capital ratio on bank lending following a softening of both policies is about 4% of overall effect

Policy interactions and risk-taking channel: Households

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
MP	-0.00590***									
	(0.0000243)									
MAP	-0.131***	-0.0278***	-0.0279***	-0.00995***	-0.0309***					
	(0.000415)	(0.000733)	(0.000679)	(0.000569)	(0.000542)					
NPE	-0.0113***	-0.0107***	-0.173***				-0.0130***		-0.174***	
	(0.00159)	(0.00159)	(0.00140)				(0.00158)		(0.00140)	
MP x MAP	0.00446***	0.000906***	0.000987***	0.00266***	0.00180***					
	(0.0000419)	(0.0000703)	(0.0000651)	(0.0000499)	(0.0000478)					
MP x NPE	-0.000895***	-0.000248***	-0.00333***	-0.00157***	-0.00170***	-0.00206***	-0.000963***	-0.00195***	-0.00280***	-0.00173***
	(0.0000725)	(0.0000724)	(0.0000689)	(0.0000497)	(0.0000481)	(0.0000505)	(0.0000745)	(0.0000365)	(0.0000739)	(0.0000384)
MAP x NPE	-0.0317***	-0.0443***	-0.0258***	-0.0351***	-0.0416***	-0.0379***	-0.0960***	-0.0401***	-0.00217***	-0.0316***
	(0.00106)	(0.00106)	(0.000982)	(0.000773)	(0.000728)	(0.000762)	(0.00109)	(0.000572)	(0.000707)	(0.000610)
MP x MAP x NPE	0.00726***	0.00659***	0.00628***	0.00107***	0.00117***	0.00684***	0.00564***	0.00254***	0.00766***	0.00373***
	(0.000118)	(0.000117)	(0.000109)	(0.0000752)	(0.0000717)	(0.000781)	(0.000123)	(0.000586)	(0.000126)	(0.000646)
N	76,873,421	76,873,421	76,873,346	75,748,056	75,748,019	75,748,019	76,873,421	73,840,376	76,870,649	73,837,428
r2	0.286	0.286	0.551	0.870	0.900	0.900	0.287	0.971	0.556	0.973
Fixed effects										
Country	Y	Y	Y	Y	Y					
Time		Y	Y	Y	Y					
Country*Time							Y	Y	Y	Y	Y
Bank			Y		Y	Y				
Bank*Household								Y		Y
Bank*time									Y	Y
Household				Y	Y	Y				

Policy interactions and risk-taking channel: Firms

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
MP	-0.00546***									
	(0.00209)									
MAP	-0.0169***	-0.0207***	-0.0145***	-0.0447***	-0.0472***					
	(0.000704)	(0.000741)	(0.000727)	(0.000529)	(0.000519)					
NPE	-0.211***	-0.210***	-0.212***			-0.208***		-0.212***		
	(0.00256)	(0.00257)	(0.00261)			(0.00257)		(0.00261)		
MP x MAP	0.000680***	0.000487***	0.0000280	0.000946***	0.000892***					
	(0.0000549)	(0.0000533)	(0.0000521)	(0.0000397)	(0.0000385)					
MP x NPE	-0.00257***	-0.00240***	-0.00228***	-0.00175***	-0.00178***	-0.00287***	-0.00193***	-0.00290***	-0.00202***	-0.00233***
	(0.0000599)	(0.0000599)	(0.0000582)	(0.0000466)	(0.0000451)	(0.0000637)	(0.0000361)	(0.0000631)	(0.0000366)	(0.0000476)
MAP x NPE	-0.0888***	-0.0850***	-0.0877***	-0.0628***	-0.0660***	-0.0947***	-0.0498***	-0.0935***	-0.0494***	-0.0669***
	(0.00157)	(0.00158)	(0.00152)	(0.00118)	(0.00113)	(0.00159)	(0.000962)	(0.00155)	(0.000973)	(0.00114)
MP x MAP x NPE	0.00154***	0.000860***	0.000639***	0.000385***	0.000193**	0.00201***	0.000222***	0.00134***	0.000146**	0.000431***
	(0.000120)	(0.000121)	(0.000117)	(0.0000955)	(0.0000921)	(0.000121)	(0.0000688)	(0.000119)	(0.0000692)	(0.0000929)
N	68,607,899	68,607,899	68,607,899	68,107,447	68,107,447	68,607,899	67,110,417	68,607,899	67,110,417	68,107,447
r2	0.184	0.184	0.241	0.733	0.756	0.184	0.927	0.243	0.928	0.756
Fixed effects										
Country	Y	Y	Y	Y	Y					
Time		Y	Y	Y	Y					
Country*Time						Y	Y	Y	Y	Y
Bank			Y		Y					Y
Bank*Firm							Y		Y	
Bank*Time								Y	Y	
Firm				Y	Y					Y

Policy interactions, bank leverage and risk-taking channel: Households

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
MP	-0.00740***									
	(0.0000684)									
MAP	-0.0661***	-0.0896***	-0.0689***	-0.0542***	-0.0477***					
	(0.000915)	(0.00133)	(0.00128)	(0.000920)	(0.000902)					
Equity	2.253***	2.372***	1.188***	1.160***	0.0817***	0.375***	2.581***	0.366***		
	(0.0400)	(0.0406)	(0.0346)	(0.0528)	(0.0304)	(0.0323)	(0.0416)	(0.0218)		
NPE	-0.162***	-0.165***	-0.199***				-0.169***		-0.198***	
	(0.00247)	(0.00247)	(0.00243)				(0.00247)		(0.00243)	
MP x MAP	0.0125***	0.0114***	0.00233***	0.00445***	0.00193***					
	(0.000295)	(0.000358)	(0.000306)	(0.000203)	(0.000190)					
MP x Equity	-0.115***	-0.104***	-0.00545**	-0.0212***	-0.0164***	-0.00319*	-0.160***	-0.00610***		
	(0.00251)	(0.00270)	(0.00236)	(0.00148)	(0.00143)	(0.00167)	(0.00324)	(0.00147)		
MP x NPE	-0.0112***	-0.0109***	-0.00958***	-0.00158***	-0.00122***	-0.00173***	-0.00960***	-0.00226***	-0.00663***	-0.00170***
	(0.000168)	(0.000169)	(0.000164)	(0.000104)	(0.000102)	(0.000102)	(0.000170)	(0.0000787)	(0.000166)	(0.0000785)
MAP x Equity	1.170***	1.150***	1.186***	0.0767***	0.290***	0.0716***	0.969***	0.0831***		
	(0.0209)	(0.0220)	(0.0191)	(0.0142)	(0.0121)	(0.0155)	(0.0306)	(0.0133)		
MAP x NPE	-0.0762***	-0.0777***	-0.0724***	-0.0474***	-0.0406***	-0.0467***	-0.0935***	0.0466***	-0.116***	0.0440***
	(0.00197)	(0.00197)	(0.00193)	(0.00125)	(0.00123)	(0.00125)	(0.00199)	(0.00103)	(0.00198)	(0.00104)
Equity x NPE	-2.269***	-2.278***	-2.835***	-0.196*	-0.203**	-0.182*	-2.234***	-0.473***	-2.783***	-0.568***
	(0.0664)	(0.0664)	(0.0667)	(0.101)	(0.0937)	(0.0938)	(0.0665)	(0.0446)	(0.0667)	(0.0448)
MP x MAP x Equity	-0.144***	-0.123***	-0.0121***	-0.0633***	-0.0573***	-0.00748***	-0.149***	-0.0136***		
	(0.00349)	(0.00360)	(0.00291)	(0.00186)	(0.00177)	(0.00222)	(0.00473)	(0.00192)		
MP x MAP x NPE	0.0121***	0.0116***	0.0102***	0.00589***	0.00675***	0.00488***	0.00926***	0.00384***	0.0109***	0.00366***
	(0.000362)	(0.000363)	(0.000339)	(0.000187)	(0.000181)	(0.000180)	(0.000368)	(0.000138)	(0.000347)	(0.000139)
MAP x Equity x NPE	-2.237***	-2.251***	-2.150***	-0.414***	-0.343***	-0.399***	-2.127***	-0.675***	-1.902***	-0.668***
	(0.0448)	(0.0448)	(0.0446)	(0.0294)	(0.0289)	(0.0289)	(0.0450)	(0.0238)	(0.0449)	(0.0239)
MP x Equity x NPE	0.0834***	0.0953***	0.0437***	0.0419***	0.0312***	0.0322***	0.0776***	0.0225***	0.0761***	0.0165***
	(0.00564)	(0.00562)	(0.00547)	(0.00358)	(0.00352)	(0.00354)	(0.00565)	(0.00303)	(0.00555)	(0.00302)
MP x MAP x Equity x NPE	-0.0798**	-0.118***	-0.133***	-0.184***	-0.196***	-0.101***	-0.0863**	-0.198***	-0.128***	-0.155***
	(0.0365)	(0.0366)	(0.0352)	(0.0188)	(0.0183)	(0.0159)	(0.0367)	(0.0110)	(0.0355)	(0.0110)
N	17,779,921	17,779,921	17,779,920	16,773,836	16,773,836	16,773,836	17,779,921	16,622,255	17,779,899	16,622,224
r2	0.341	0.342	0.371	0.918	0.922	0.922	0.342	0.957	0.375	0.957
Fixed effects										
Country	Y	Y	Y	Y	Y					
Time		Y	Y	Y	Y					
Country*Time						Y	Y	Y	Y	Y
Bank			Y			Y	Y			
Bank*Household								Y		Y
Bank*time									Y	Y
Household				Y	Y	Y				

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...ementarities

Policy interactions, bank leverage and risk-taking channel: mortgages

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
MP	-0.00280***									
	(0.0000589)									
MAP	-0.0313***	-0.0623***	-0.0412***	-0.0435***	-0.0429***					
	(0.000760)	(0.00173)	(0.00167)	(0.00126)	(0.00124)					
Equity	0.650***	0.713***	1.366***	0.276***	0.151***	0.281***	0.947***	0.246***		
	(0.0380)	(0.0386)	(0.0331)	(0.0374)	(0.0167)	(0.0195)	(0.0397)	(0.0172)		
NPE	-0.168***	-0.174***	-0.111***	-0.108***	-0.110***	-0.0990***	-0.187***	-0.0932***	-0.121***	-0.0867***
	(0.00958)	(0.00958)	(0.00918)	(0.00435)	(0.00423)	(0.00421)	(0.00957)	(0.00374)	(0.00905)	(0.00376)
MP x MAP	0.00164***	0.000191	0.00282***	0.000604***	0.000455***					
	(0.000115)	(0.000303)	(0.000268)	(0.000178)	(0.000162)					
MP x Equity	0.124***	0.114***	0.0249***	0.0426***	0.0377***	0.0300***	0.169***	0.0311***		
	(0.00247)	(0.00273)	(0.00234)	(0.00141)	(0.00136)	(0.00167)	(0.00347)	(0.00153)		
MP x NPE	-0.0248***	-0.0248***	-0.0164***	-0.00175***	-0.00132***	-0.00267***	-0.0246***	-0.00305***	-0.0117***	-0.00287***
	(0.00118)	(0.00118)	(0.00111)	(0.000454)	(0.000432)	(0.000430)	(0.00118)	(0.000379)	(0.00111)	(0.000382)
MAP x Equity	0.528***	0.419***	0.262***	0.566***	0.582***	0.0196**	0.426***	0.0488***		
	(0.0215)	(0.0227)	(0.0196)	(0.0105)	(0.00963)	(0.0041)	(0.0340)	(0.0124)		
MAP x NPE	-0.0474***	-0.0613***	-0.0326***	-0.0636***	-0.0632***	-0.0924***	-0.0835***	-0.0946***	-0.0628***	-0.0981***
	(0.0110)	(0.0110)	(0.0104)	(0.00445)	(0.00421)	(0.00415)	(0.0110)	(0.00356)	(0.0105)	(0.00361)
Equity x NPE	5.035***	5.026***	4.820***	0.715***	0.378***	0.427***	5.009***	0.0272	4.538***	0.0499
	(0.232)	(0.232)	(0.230)	(0.154)	(0.137)	(0.137)	(0.232)	(0.0870)	(0.227)	(0.0872)
MP x MAP x Equity	-0.146***	-0.145***	-0.0514***	-0.0568***	-0.0502***	-0.0337***	-0.417***	-0.0287***		
	(0.00340)	(0.00351)	(0.00262)	(0.00154)	(0.00141)	(0.00180)	(0.00559)	(0.00160)		
MP x MAP x NPE	0.0333***	0.0333***	0.0218***	0.00362***	0.00454***	0.00206***	0.0293***	0.00154***	0.0183***	0.000848
	(0.00225)	(0.00225)	(0.00206)	(0.000746)	(0.000700)	(0.000699)	(0.00226)	(0.000587)	(0.00207)	(0.000593)
MAP x Equity x NPE	-0.285	-0.315	-0.232	-1.021***	-0.972***	-1.111***	-0.498**	-1.115***	-0.221	-1.132***
	(0.213)	(0.213)	(0.209)	(0.0969)	(0.0913)	(0.0910)	(0.212)	(0.0746)	(0.210)	(0.0749)
MP x Equity x NPE	-0.0437	-0.0376	-0.0285	-0.0470***	-0.0484***	-0.0528***	-0.0323	-0.0404***	-0.0981***	-0.0428***
	(0.0315)	(0.0315)	(0.0307)	(0.0128)	(0.0123)	(0.0123)	(0.0314)	(0.0110)	(0.0305)	(0.0110)
MP x MAP x Equity x NPE	-0.0465	-0.0367	-0.0230	-0.00818	-0.00398	-0.0113	-0.0510	-0.00604	-0.169***	-0.0347***
	(0.0413)	(0.0413)	(0.0392)	(0.0155)	(0.0149)	(0.0148)	(0.0411)	(0.0131)	(0.0390)	(0.0132)
N	8,638,301	8,638,301	8,638,300	7,897,307	7,897,307	7,897,307	8,638,301	7,820,668	8,638,278	7820641
r2	0.215	0.215	0.249	0.913	0.915	0.915	0.216	0.939	0.256	0.940
Fixed effects										
Country	Y	Y	Y	Y	Y					
Time		Y	Y	Y	Y					
Country*Time						Y	Y	Y	Y	Y
Bank			Y		Y	Y				
Bank*Household								Y		Y
Bank*time									Y	Y
Household				Y	Y	Y				

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
MP	-0.00444***									
	(0.000228)									
MAP	-0.0779***	-0.000811	-0.0342***	-0.151***	-0.153***					
	(0.00234)	(0.00247)	(0.00228)	(0.00168)	(0.00163)					
Equity	0.826***	0.868***	1.634***	0.0876**	0.179***	0.229***	0.823***	0.176***		
	(0.0363)	(0.0368)	(0.0360)	(0.0403)	(0.0268)	(0.0306)	(0.0387)	(0.0288)		
NPE	-0.591***	-0.589***	-0.696***	-0.219***	-0.218***	-0.238***	-0.588***	-0.225***	-0.700***	-0.227***
	(0.0157)	(0.0157)	(0.0153)	(0.00948)	(0.00944)	(0.00943)	(0.0157)	(0.00848)	(0.0154)	(0.00849)
MP x MAP	0.0189***	0.0111***	0.00421***	0.00824***	0.00936***					
	(0.000389)	(0.000417)	(0.000363)	(0.000244)	(0.000233)					
MP x Equity	0.0720***	0.108***	0.0192***	0.0178***	0.0135***	0.0499***	0.132***	0.0470***		
	(0.00297)	(0.00324)	(0.00299)	(0.00190)	(0.00185)	(0.00223)	(0.00401)	(0.00206)		
MP x NPE	-0.0281***	-0.0303***	-0.0259***	-0.00717***	-0.00687***	-0.0173***	-0.0314***	-0.0162***	-0.0248***	-0.0173***
	(0.00196)	(0.00197)	(0.00193)	(0.00121)	(0.00121)	(0.00120)	(0.00199)	(0.00113)	(0.00196)	(0.00114)
MAP x Equity	1.165***	0.863***	0.373***	1.087***	1.144***	0.136***	1.045***	0.205***		
	(0.0232)	(0.0242)	(0.0212)	(0.0165)	(0.0153)	(0.0199)	(0.0354)	(0.0185)		
MAP x NPE	-0.0311*	-0.0450***	-0.106***	-0.471***	-0.463***	-0.600***	-0.0539***	-0.613***	-0.125***	-0.625***
	(0.0162)	(0.0162)	(0.0159)	(0.00978)	(0.00973)	(0.00986)	(0.0166)	(0.00927)	(0.0163)	(0.00928)
Equity x NPE	-1.976***	-1.977***	-1.572***	-0.298***	-0.294***	-0.267***	-1.964***	-0.0914	-1.519***	-0.0665
	(0.111)	(0.111)	(0.110)	(0.0727)	(0.0722)	(0.0722)	(0.111)	(0.0623)	(0.110)	(0.0625)
MP x MAP x Equity	-0.159***	-0.161***	-0.0296***	-0.0190***	-0.0111***	-0.0274***	-0.198***	-0.0264***		
	(0.00407)	(0.00424)	(0.00370)	(0.00247)	(0.00237)	(0.00304)	(0.00556)	(0.00284)		
MP x MAP x NPE	0.0368***	0.0354***	0.0409***	0.0408***	0.0413***	0.0272***	0.0367***	0.0285***	0.0429***	0.0281***
	(0.00308)	(0.00308)	(0.00299)	(0.00184)	(0.00183)	(0.00183)	(0.00312)	(0.00170)	(0.00304)	(0.00169)
MAP x Equity x NPE	-0.869***	-0.831***	-0.0584	-2.412***	-2.342***	-3.064***	-0.746***	-3.200***	-0.0441	-3.359***
	(0.124)	(0.124)	(0.122)	(0.0787)	(0.0783)	(0.0788)	(0.125)	(0.0737)	(0.124)	(0.0739)
MP x Equity x NPE	0.303***	0.314***	0.239***	0.0519***	0.0520***	0.0869***	0.303***	0.0637***	0.234***	0.0655***
	(0.0211)	(0.0211)	(0.0209)	(0.0134)	(0.0134)	(0.0134)	(0.0212)	(0.0127)	(0.0211)	(0.0127)
MP x MAP x Equity x NPE	-0.415***	-0.406***	-0.385***	-0.185***	-0.186***	-0.124***	-0.394***	-0.155***	-0.397***	-0.156***
	(0.0282)	(0.0283)	(0.0279)	(0.0181)	(0.0180)	(0.0180)	(0.0284)	(0.0170)	(0.0281)	(0.0170)
N	12,448,795	12,448,795	12,448,795	11,858,623	11,858,623	11,858,623	12,448,795	11,764,104	12,448,751	11,764,052
r2	0.265	0.265	0.291	0.882	0.883	0.883	0.265	0.914	0.293	0.914
Fixed effects										
Country	Y	Y	Y	Y	Y					
Time		Y	Y	Y	Y					
Country*Time						Y	Y	Y	Y	Y
Bank			Y		Y	Y				
Bank*Household								Y		Y
Bank*time									Y	Y
Household				Y	Y	Y				

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
MP	-0.00484*** (0.000207)												
MAP	-0.0177*** (0.00385)	-0.0133*** (0.00389)	-0.0411*** (0.00349)	-0.0109*** (0.00253)	-0.0308*** (0.00233)								
Equity	0.0197 (0.0421)	0.214*** (0.0430)	1.871*** (0.0443)	1.240*** (0.0420)	0.464*** (0.0350)	0.373*** (0.0442)	0.640*** (0.0279)	2.012*** (0.0603)			0.524*** (0.0505)		0.593*** (0.0369)
NPE	-0.251*** (0.00293)	-0.248*** (0.00294)	-0.257*** (0.00297)			-0.249*** (0.00294)			-0.256*** (0.00297)				
MP x MAP	0.0117*** (0.000544)	0.0155*** (0.000551)	0.00871*** (0.000380)	0.00487*** (0.000309)	0.00200*** (0.000254)								
MP x Equity	-0.0738*** (0.00308)	-0.0810*** (0.00311)	-0.0505*** (0.00278)	-0.0123*** (0.00211)	-0.0640*** (0.00193)	-0.0992*** (0.00351)	-0.0462*** (0.00170)	-0.0631*** (0.00557)			-0.0373*** (0.00321)		-0.0674*** (0.00218)
MP x NPE	-0.00415*** (0.000502)	-0.00333*** (0.000503)	-0.00466*** (0.000483)	-0.00550*** (0.000362)	-0.00354*** (0.000351)	-0.00304*** (0.000549)	-0.00215*** (0.000243)		-0.00640*** (0.000565)	-0.00197*** (0.000250)			-0.00121*** (0.000383)
MAP x Equity	0.269*** (0.0565)	0.554*** (0.0571)	0.0713 (0.0511)	0.720*** (0.0379)	0.459*** (0.0351)	0.340*** (0.0585)	0.299*** (0.0278)	1.346*** (0.0778)			0.602*** (0.0507)		0.671*** (0.0360)
MAP x NPE	-0.170*** (0.00746)	-0.159*** (0.00747)	-0.240*** (0.00742)	-0.0464*** (0.00526)	-0.0568*** (0.00516)	-0.200*** (0.00755)	-0.0601*** (0.00380)		-0.262*** (0.00759)	-0.0559*** (0.00384)			-0.0490*** (0.00521)
Equity x NPE	-3.304*** (0.0929)	-3.233*** (0.0930)	-3.961*** (0.0955)	-1.999*** (0.0885)	-1.583*** (0.0884)	-3.295*** (0.0934)	-2.825*** (0.0539)	-1.020*** (0.123)	-4.141*** (0.0973)	-2.989*** (0.0557)	-0.164* (0.0866)	-0.0538 (0.0889)	-1.533*** (0.0891)
MP x MAP x Equity	-0.163*** (0.00805)	-0.197*** (0.00817)	-0.124*** (0.00561)	-0.0962*** (0.00469)	-0.0192*** (0.00385)	-0.141*** (0.00851)	-0.0495*** (0.00274)	-0.205*** (0.0114)			-0.0537*** (0.00519)		-0.0385*** (0.00395)
MP x MAP x NPE	0.0182*** (0.00103)	0.0191*** (0.00103)	0.00794*** (0.00100)	0.00221*** (0.000668)	0.00277*** (0.000654)	0.0115*** (0.00105)	0.00578*** (0.000353)		0.00597*** (0.00102)	0.00526*** (0.000353)			0.00338*** (0.000656)
MAP x Equity x NPE	1.185*** (0.112)	1.092*** (0.112)	2.272*** (0.111)	0.0831 (0.0812)	0.137* (0.0791)	1.573*** (0.113)	0.432*** (0.0571)	0.393*** (0.145)	2.537*** (0.113)	0.373*** (0.0577)	0.881*** (0.0916)	0.786*** (0.0927)	0.0327 (0.0795)
MP x Equity x NPE	-0.109*** (0.00741)	-0.102*** (0.00742)	-0.125*** (0.00708)	-0.108*** (0.00529)	-0.0829*** (0.00512)	-0.0973*** (0.00793)	-0.0659*** (0.00349)	-0.0870*** (0.0113)	-0.142*** (0.00815)	-0.0614*** (0.00360)	-0.0370*** (0.00594)	-0.0273*** (0.00596)	-0.0584*** (0.00549)
MP x MAP x Equity x NPE	-0.349*** (0.0152)	-0.356*** (0.0152)	-0.187*** (0.0147)	-0.0361*** (0.0102)	-0.0443*** (0.00997)	-0.271*** (0.0153)	-0.108*** (0.00539)	-0.00859 (0.0202)	0.166*** (0.0150)	-0.101*** (0.00540)	-0.0668*** (0.00889)	-0.0458*** (0.00890)	-0.0528*** (0.00999)
N	29,304,078	29,304,078	29,304,078	28,888,058	28,888,058	29,304,078	28,527,111	13,070,495	29,304,078	28,527,111	12,557,314	12,557,314	28,888,058
r2	0.169	0.170	0.188	0.789	0.795	0.170	0.923	0.688	0.190	0.924	0.948	0.948	0.795
Fixed effects													
Country	Y	Y	Y	Y	Y								
Time		Y	Y	Y	Y								
Country*Time						Y	Y	Y	Y	Y	Y	Y	Y
Bank			Y		Y	Y							
Bank*Firm								Y			Y	Y	Y
Bank*time										Y	Y		Y
Firm				Y	Y	Y							
Firm*Time									Y			Y	Y

lementarities

Policy interactions, bank leverage and risk-taking channel: Summary

- For households, the marginal effect of a 1 st. dev. easing in MP and MAP on lending is 1.8% more for high credit risky borrowers than for low-risky borrowers. The marginal effect of a 1 st. dev. lower capital ratio on lending to risky borrowers following a softening of both policies is 1.6%

- Moreover, effects are stronger for consumer loans than for mortgages, which is consistent with consumer loans being substantially riskier than mortgages in Europe, as mortgages are not just highly collateralized but also with full recourse

- Effects are stronger overall for loans to households as compared to corporate loans if we measure ex-ante borrower risk based on borrowers' past credit history. However, results for firms are similar if we measure firm risk by the z-score, which is an ex-ante measure of firm insolvency

Policy interactions and firm productivity: Motivation

- One way to view these results is that the effect of a more accommodative monetary policy on lending to riskier borrowers is amplified by a softer macroprudential policy

- A key question is whether this higher risk-taking is only associated with pure credit risk (as captured by the credit history or z-score), or whether the higher risk-taking can also be associated with more productive (better) risk-taking

- One way to answer this question is to compare results for household loans versus corporate loans, as household loans are just for consumption or house purchases and corporate loans affect potentially more productive outcomes

- A more direct way is to use a measure of ex-ante productivity at the borrower level to distinguish between better and worse risk taking

Policy interactions and firm productivity

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
MP	-0.00170***									
	(0.000276)									
MAP	-0.0845***	-0.0693***	-0.0500***	-0.0474***	-0.0343***					
	(0.00585)	(0.00608)	(0.00577)	(0.00405)	(0.00395)					
Productivity	0.681***	0.681***	0.640***	0.00116	0.00130	0.681***	0.00233	0.637***	0.00226	0.000467
	(0.00591)	(0.00591)	(0.00564)	(0.00306)	(0.00298)	(0.00591)	(0.00247)	(0.00564)	(0.00246)	(0.00298)
MP x MAP	0.0146***	0.0121***	0.0117***	0.00452***	0.000547*					
	(0.000622)	(0.000629)	(0.000599)	(0.000327)	(0.000320)					
MP x Productivity	-0.00448***	-0.00479***	-0.00635***	-0.00660***	-0.00494***	-0.000631*	-0.000512	-0.00739**	-0.000115	-0.00563***
	(0.000368)	(0.000368)	(0.000352)	(0.00196)	(0.00191)	(0.000370)	(0.00154)	(0.00355)	(0.000153)	(0.00191)
MAP x Productivity	-0.0494***	-0.0518***	-0.0599***	-0.0367***	-0.0295***	-0.0506***	-0.00316	-0.0597***	-0.000550	-0.0295***
	(0.00775)	(0.00774)	(0.00728)	(0.00459)	(0.00441)	(0.00773)	(0.00365)	(0.00728)	(0.00365)	(0.00442)
MP x MAP x Productivity	0.0140***	0.0135***	0.0124***	0.000803*	0.000789**	0.0136***	0.00873***	0.0120***	0.00415***	0.000770*
	(0.000870)	(0.000871)	(0.000830)	(0.000414)	(0.000402)	(0.000872)	(0.000320)	(0.000835)	(0.000318)	(0.000402)
N	2,576,547	2,576,547	2,576,530	2,484,471	2,484,449	2,576,547	2,484,449	2,574,901	2,349,262	2,484,449
r2	0.0731	0.0734	0.157	0.684	0.713	0.0739	0.714	0.165	0.918	0.714
Fixed effects										
Country	Y	Y	Y	Y	Y					
Time		Y	Y	Y	Y					
Country*Time						Y	Y	Y	Y	Y
Bank			Y		Y					Y
Bank*Firm							Y		Y	
Bank*Time								Y	Y	
Firm				Y	Y					Y

Policy interactions, firm productivity and risk-taking channel

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
MP	-0.000455									
	(0.000302)									
MAP	-0.0321***	-0.0272***	-0.0109*	-0.0196***	-0.00600					
	(0.00657)	(0.00676)	(0.00635)	(0.00423)	(0.00415)					
NPE	-0.351***	-0.352***	-0.321***			-0.349***		-0.316***		
	(0.0113)	(0.0113)	(0.0109)			(0.0113)		(0.0109)		
Productivity	0.691***	0.691***	0.648***	0.00486	0.00449	0.692***	0.00281	0.644***	0.00291	0.00355
	(0.00658)	(0.00659)	(0.00625)	(0.00327)	(0.00319)	(0.00659)	(0.00269)	(0.00624)	(0.00268)	(0.00319)
MP x MAP	0.0169***	0.0140***	0.0137***	0.00103***	0.0066***					
	(0.000704)	(0.000709)	(0.000671)	(0.000348)	(0.0341)					
MP x NPE	-0.00589***	-0.00554***	-0.00483***	-0.00344***	-0.00336***	-0.00532***	-0.00257***	-0.00452***	-0.00240***	-0.00356***
	(0.000697)	(0.000696)	(0.000675)	(0.000437)	(0.000424)	(0.000696)	(0.000325)	(0.000680)	(0.000322)	(0.000425)
MP x Productivity	-0.000772*	-0.000813**	-0.000852**	0.000471**	-0.000336*	-0.00101**	-0.000108	-0.000994**	-0.000179	-0.000463**
	(0.000405)	(0.000404)	(0.000385)	(0.000208)	(0.000203)	(0.000408)	(0.000167)	(0.000390)	(0.000166)	(0.000204)
MAP x NPE	-0.244***	-0.244***	-0.229***	-0.119***	-0.122***	-0.251***	-0.0860***	-0.238***	-0.0831***	-0.124***
	(0.0134)	(0.0134)	(0.0128)	(0.00988)	(0.00937)	(0.0134)	(0.00766)	(0.0128)	(0.00766)	(0.00938)
MAP x Productivity	-0.0591***	-0.0610***	-0.0653***	-0.0347***	-0.0276***	-0.0590***	-0.00182	-0.0659***	-0.00164	-0.0273***
	(0.00886)	(0.00885)	(0.00826)	(0.00485)	(0.00469)	(0.00885)	(0.00393)	(0.00825)	(0.00393)	(0.00469)
NPE x Productivity	-0.114***	-0.114***	-0.0935***	-0.0173**	-0.0158*	-0.114***	-0.00381	-0.0909***	-0.00457	-0.0149*
	(0.0148)	(0.0148)	(0.0143)	(0.00835)	(0.00815)	(0.0148)	(0.00643)	(0.0143)	(0.00642)	(0.00814)
MP x MAP x NPE	0.00929***	0.00942***	0.00974***	0.00291***	0.00220***	0.00860***	0.00261***	0.00895***	0.00232***	0.00248***
	(0.00144)	(0.00144)	(0.00139)	(0.000879)	(0.000854)	(0.00144)	(0.000654)	(0.00140)	(0.000649)	(0.000855)
MP x MAP x Productivity	0.0148***	0.0143***	0.0131***	0.000760*	0.000825*	0.0145***	0.000265	0.0127***	0.000165	0.000811*
	(0.00100)	(0.00100)	(0.000950)	(0.000447)	(0.000435)	(0.00101)	(0.000354)	(0.000954)	(0.000352)	(0.000435)
MAP x NPE x Productivity	0.0851***	0.0872***	0.0692***	0.0230*	0.0229**	0.0859***	0.00716	0.0736***	0.00736	0.0240**
	(0.0175)	(0.0175)	(0.0167)	(0.0119)	(0.0113)	(0.0175)	(0.00921)	(0.0167)	(0.00918)	(0.0113)
MP x NPE x Productivity	0.00161*	0.00166*	0.00103	0.00101*	0.000868*	0.00187**	0.0000260	0.00121	0.0000582	0.000794
	(0.000921)	(0.000920)	(0.000893)	(0.000544)	(0.000527)	(0.000920)	(0.000405)	(0.000895)	(0.000402)	(0.000528)
MP x MAP x NPE x Productivity	-0.00593***	-0.00542***	-0.00527***	-0.00367***	-0.00775***	-0.00554***	-0.00973***	-0.00509***	-0.0103***	-0.00254**
	(0.00197)	(0.00197)	(0.00191)	(0.00110)	(0.00107)	(0.00197)	(0.000816)	(0.00191)	(0.000806)	(0.00107)
N	2,594,800	2,594,800	2,594,783	2,501,444	2,501,422	2,594,800	2,367,427	2,593,135	2,365,448	2,501,422
r2	0.0785	0.0788	0.161	0.684	0.713	0.0792	0.917	0.169	0.919	0.713
Fixed effects										
Country	Y	Y	Y	Y	Y					
Time		Y	Y	Y	Y					
Country*Time						Y	Y	Y	Y	Y
Bank			Y		Y					Y
Bank*Firm							Y		Y	
Bank*Time								Y	Y	
Firm				Y	Y					Y

Policy interactions, firm productivity, and bank leverage

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
MP	-0.00151***									
	(0.000353)									
MAP	-0.0587***	-0.0355***	-0.0419***	-0.0162***	-0.00916*					
	(0.00733)	(0.00759)	(0.00756)	(0.00489)	(0.00486)					
Equity	0.259	0.202	2.793***	2.691***	0.549***	0.355	0.607***	2.778***		0.850***
	(0.238)	(0.241)	(0.261)	(0.214)	(0.204)	(0.244)	(0.147)	(0.331)		(0.250)
Productivity	0.670***	0.670***	0.665***	0.00167	0.00111	0.670***	0.00329		0.00299	
	(0.00698)	(0.00699)	(0.00695)	(0.00380)	(0.00379)	(0.00698)	(0.00327)		(0.00327)	
MP x MAP	0.00465***	0.00463***	0.00741***	0.00183***	0.00160***					
	(0.000908)	(0.000900)	(0.000850)	(0.000450)	(0.000439)					
MP x Equity	-0.0713***	-0.0890***	-0.00502	-0.0648***	-0.00635	-0.0793***	-0.0247**	-0.103***		-0.0372*
	(0.0249)	(0.0252)	(0.0242)	(0.0164)	(0.0158)	(0.0254)	(0.0116)	(0.0381)		(0.0216)
MP x Productivity	-0.000784*	-0.000739	-0.000803*	-0.000198	-0.000110	-0.00104**	-0.0000544		-0.000103	
	(0.000471)	(0.000470)	(0.000466)	(0.000259)	(0.000257)	(0.000471)	(0.000211)		(0.000210)	
MAP x Equity	-4.849***	-4.540***	-3.654***	-0.713***	-0.535**	-4.635***	-0.453**	1.511***		-0.819**
	(0.374)	(0.375)	(0.370)	(0.251)	(0.244)	(0.378)	(0.183)	(0.529)		(0.339)
MAP x Productivity	-0.0582***	-0.0626***	-0.0642***	-0.0107*	-0.0109*	-0.0607***	-0.00231		-0.000947	
	(0.00981)	(0.00979)	(0.00975)	(0.00567)	(0.00565)	(0.00978)	(0.00494)		(0.00494)	
Equity x Productivity	0.394	0.395	0.546*	0.581**	0.828***	0.423	0.572***	0.404	0.582***	0.180
	(0.298)	(0.298)	(0.297)	(0.248)	(0.243)	(0.298)	(0.154)	(0.394)	(0.153)	(0.257)
MP x MAP x Equity	-0.0347	-0.00106	-0.0667	-0.0144	-0.0469*	-0.0352	-0.0531***	-0.0981		-0.127***
	(0.0488)	(0.0489)	(0.0462)	(0.0292)	(0.0274)	(0.0495)	(0.0197)	(0.0751)		(0.0390)
MP x MAP x Productivity	0.00363***	0.00318***	0.00393***	0.00585***	0.00366***	0.00335***	0.00318***		0.00263***	
	(0.00123)	(0.00123)	(0.00122)	(0.000603)	(0.000595)	(0.00123)	(0.000455)		(0.000455)	
MAP x Equity x Productivity	4.113***	4.154***	4.053***	0.171	0.322	4.017***	0.186	0.394	0.212	0.00683
	(0.482)	(0.482)	(0.479)	(0.320)	(0.314)	(0.482)	(0.224)	(0.627)	(0.223)	(0.392)
MP x Equity x Productivity	0.0468	0.0486	0.0565*	0.0190	0.0420**	0.0573*	0.0330**	0.0111	0.0292**	0.0178
	(0.0328)	(0.0328)	(0.0322)	(0.0213)	(0.0208)	(0.0329)	(0.0145)	(0.0464)	(0.0146)	(0.0256)
MP x MAP x Equity x Productivity	-0.164**	-0.172***	-0.252***	-0.192***	-0.285***	-0.170**	-0.231***	-0.143***	-0.283***	-0.145***
	(0.0659)	(0.0660)	(0.0648)	(0.0394)	(0.0386)	(0.0660)	(0.0256)	(0.0194)	(0.0256)	(0.0465)
N	1,413,834	1,413,834	1,413,828	1,353,988	1,353,987	1,413,834	1,304,122	803,517	1,304,056	741,400
r2	0.0723	0.0729	0.0856	0.719	0.725	0.0736	0.902	0.653	0.903	0.936
Fixed effects										
Country	Y	Y	Y	Y	Y					
Time		Y	Y	Y	Y					
Country*Time						Y	Y	Y	Y	Y
Bank			Y		Y		Y			
Bank*Household								Y		Y
Bank*time									Y	Y
Household				Y	Y		Y			

Policy interactions and firm productivity: Summary

- We find that the combination of softer both MP and MAP not only increases lending overall but also to firms with higher ex-ante productivity, especially if these firms had a good credit history. These results are moreover stronger for banks with less ex-ante capital

- We find that the marginal effect of a 1 st. dev. lower capital ratio on lending following a softening of each policy by 1 st. dev. is about 1.6% larger for high productive firms compared to low productive firms

Conclusions

- We analyze monetary policy and macroprudential policy interactions
  - Loan-level data – corporate loans, consumer credit and mortgages – from multiple credit registers from several European countries
  - Merge this information with borrower and bank level characteristics and indicators summarizing macroprudential and monetary policy action
  - Key to have several countries for variation on policies and credit conditions

- Our results suggest strong complementarities between MAP & MP:
  - A softening of macroprudential measures augments the increased bank lending and risk-taking induced by a more accommodative monetary policy stance
  - Effects are stronger for less capitalized banks and for these banks lending to riskier borrowers
  - Results apply to both the household and firm sectors, but with stronger results for household loans
  - For firms, the increase in bank risk taking activities induced by a loose policy mix is directed toward more (ex-ante) productive firms

Thank you!

Policy interactions and borrower quality proxied by firm z-score

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
MP	-0.00629***									
	(0.000418)									
MAP	-0.476***	-0.498***	-0.436***	-0.0464***	-0.0281***					
	(0.0148)	(0.0152)	(0.0145)	(0.00561)	(0.00537)					
Z-Score	0.111***	0.111***	0.104***	0.00355***	0.00313***	0.111***	0.00417***	0.103***	0.00324***	0.00315***
	(0.00248)	(0.00248)	(0.00238)	(0.00124)	(0.00119)	(0.00248)	(0.000978)	(0.00239)	(0.00116)	(0.00119)
MP x MAP	0.0217***	0.0209***	0.0213***	0.00107**	0.000538					
	(0.00109)	(0.00110)	(0.00106)	(0.000527)	(0.000509)					
MP x Z-Score	0.00177***	0.00177***	0.00173***	0.0000365	0.0000547	0.00175***	0.0000937**	0.00169***	0.000103**	0.0000539
	(0.000119)	(0.000120)	(0.000115)	(0.0000609)	(0.0000589)	(0.000121)	(0.0000450)	(0.000117)	(0.0000447)	(0.0000593)
MAP x Z-Score	0.145***	0.145***	0.134***	0.0104***	0.00879***	0.145***	0.000429	0.134***	0.00172	0.00887***
	(0.00489)	(0.00491)	(0.00469)	(0.00164)	(0.00155)	(0.00491)	(0.00125)	(0.00470)	(0.00124)	(0.00155)
MP x MAP x Z-Score	-0.00638***	-0.00637***	-0.00627***	-0.000181	-0.000106	-0.00632***	-0.000111	-0.00615***	-0.0000855	-0.000127
	(0.000342)	(0.000343)	(0.000329)	(0.000158)	(0.000152)	(0.000344)	(0.000117)	(0.000332)	(0.000116)	(0.000153)
N	2,272,541	2,272,541	2,272,527	2,221,694	2,221,684	2,272,541	2,131,108	2,271,715	2,130,186	2,221,684
r2	0.0509	0.0510	0.137	0.650	0.689	0.0512	0.932	0.142	0.934	0.689
Fixed effects										
Country	Y	Y	Y	Y	Y					
Time		Y	Y	Y	Y					
Country*Time						Y	Y	Y	Y	Y
Bank			Y		Y					Y
Bank*Firm							Y		Y	
Bank*Time								Y	Y	
Firm				Y	Y					Y

Estimation using weighted least squares

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	OLS	WLS	WLS clustered SE	OLS –Other lending	WLS Other lending	WLS Other lending clustered SE	OLS - Mortgage	WLS Mortgage	WLS Mortgage (clustered SE)
MP	-0.00416***	-0.00356***	-0.00356***	-0.00634***	-0.00625***	-0.00625***	-0.00125***	-0.00131***	-0.00131***
	(0.0000514)	(0.0000456)	(0.0000208)	-0.0000837	-0.0000797	-0.0000379	(0.0000298)	(0.0000286)	(0.0000138)
MAP	-0.127***	-0.105***	-0.105***	-0.151***	-0.147***	-0.147***	-0.0336***	-0.0337***	-0.0337***
	(0.000359)	(0.000324)	(0.000408)	-0.000564	-0.000553	-0.000688	(0.000216)	(0.000208)	(0.000251)
MP x MAP	0.0145***	0.0103***	0.0103***	0.0132***	0.00953***	0.00953***	0.00256***	0.00204***	0.00204***
	(0.0000946)	(0.0000859)	(0.0000460)	(0.000147)	(0.000144)	(0.0000746)	(0.0000581)	(0.0000558)	(0.0000276)
N	89,567,025	89,567,025	89,567,025	44,941,317	44,941,317	44,941,317	53,839,284	53,839,284	53,839,284
r2	0.00253	0.00202	0.00202	0.00253	0.00229	0.00229	0.000734	0.000754	0.000754

Monetary policy and macroprudential policy: Robustness

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Households				Firms			
MP	-0.00530***	-0.00530***	-0.00517***	-0.00507***	-0.00447***	-0.00447***	-0.00133***	-0.00102***
	(0.00163)	(0.00124)	(0.0000160)	(0.0000149)	(0.000318)	(0.000245)	(0.0000127)	(0.0000184)
MAP	-0.109***	-0.109***	-0.101***	-0.108***	-0.00346***	-0.00346***	-0.00394***	-0.0286***
	(0.0104)	(0.00197)	(0.000330)	(0.000429)	(0.00112)	(0.00342)	(0.000374)	(0.000416)
MP x MAP	0.00429***	0.00429***	0.00293***	0.00316***	0.00376***	0.00376***	0.00479***	0.00446***
	(0.00117)	(0.000529)	(0.0000298)	(0.0000350)	(0.000916)	(0.000131)	(0.0000313)	(0.0000285)
N	85,952,062	85,952,062	85,952,062	85,952,062	67,114,059	67,114,059	67,114,059	67,114,059
r2	0.965	0.966	0.954	0.952	0.925	0.927	0.924	0.926
Fixed effects								
Country	Y	Y	Y	Y	Y	Y	Y	Y
Bank*Household	Y	Y	Y	Y	Y	Y	Y	Y
Additional control			Y				Y	
Alternative MAP index				Y				Y
Cluster								
Bank		Y				Y		
Borrower	Y		Y	Y	Y		Y	Y
Country*time	Y	Y			Y	Y		