LOCAL VERSUS AGGREGATE LENDING CHANNELS: THE EFFECTS OF SECURITIZATION ON CORPORATE CREDIT SUPPLY IN SPAIN

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CAVEAT

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Outline

- **Motivation**
  - Securitization is a key financial innovation to provide liquidity
  - Spain used intensely
  - Impact on loan supply?
- **Methodology**
  - Disentangle supply and demand shocks
 - Separate bank supply effects from aggregate firm effects
- **Results**

Securitization in Spain

- **Spain just before the crisis was European second user of covered bonds, behind Germany**

- **Spain just before the crisis was European second user of ABS, behind UK**

- **Spain has been similar in some aspects to USA over the last 10 years**
  - *Lending boom and bust*
  - *House price evolution*
  - *Rapid growth in securitization*

- **ABS issuance came to a halt when crisis started**

Figure 2
ABS And Covered Bond Issuance In Spain

Banks: credit bubbles and crunches
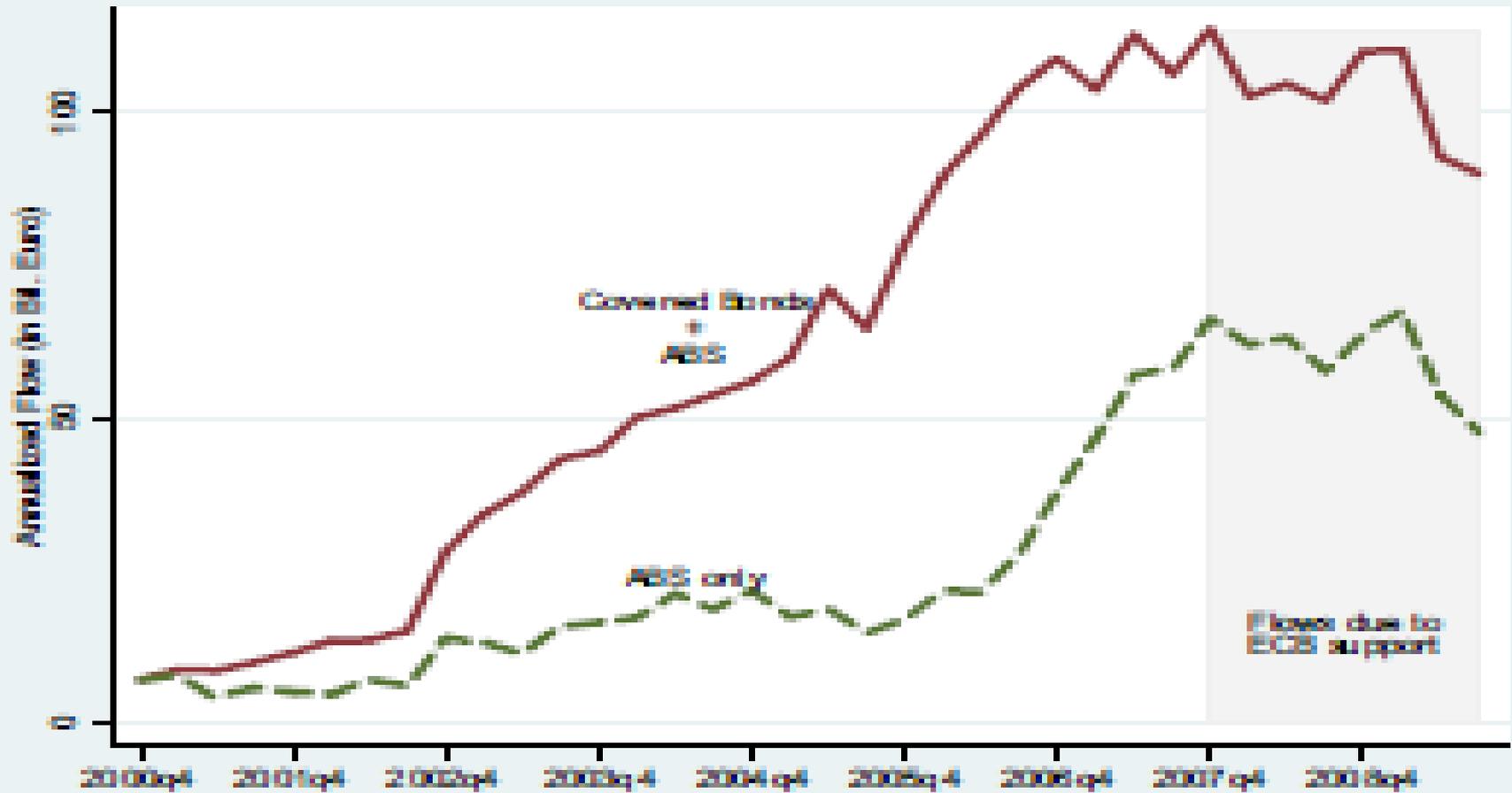
- **The banking sector is often the centre stage in economic controversies**
- **Banks are accused of:**

  - Excessive credit creation (bubbles) on the upside of the business cycle

  - Being too stingy with credit on the downside (credit crunch)

  Both with consequences for both economic activity and financial stability

The credit supply channel

- **The primary suspect of credit bubbles and crunches is the <u>credit supply channel,</u> i.e. credit growth (or lack thereof) is dictated by malfunctions in the credit supply process rather than economic fundamentals**

  - Kindleberger (1978) among others, on the other hand, regards sharp credit growth as a precursor of financial crises

  - Shocks to bank balance-sheets may have real effects through changes in credit supply (Bernanke AER 1983; Holmstrom & Tirole, QJE 1997; Allen and Gale, 2007; Gertler and Kiyotaki, 2010; Stein, Rand 1998 & 2010; Diamond and Rajan, AER 2006 & QJE 2011…

- **Many economists, however, view greater dependence on credit as a just correlate of economic growth**

Measuring the credit supply channel

- **How do we know that observed fluctuations in credit are driven by credit supply shifts, and not by demand fundamentals?**

  - Natural experiments where credit supply shocks are uncorrelated with demand (Peek & Rosengren (AER, 1997), Khwaja & Mian (AER, 2008), Paravisini (JF, 2008), Puri, et al. (JFE, 2011), Iyer & Peydró (RFS, 2011), Iyer, Lopes, Peydró & Schoar (2010))

  - Limitation: many key shocks (e.g. monetary policy, recessions/crises, capital) affect both credit supply and demand (Kashyap & Stein (AER 00), BGG (RecStat 96), Diamond & Rajan (JPE 01), Caballero et al. (AER 08…)

Measuring the credit supply channel

- **A macroprudential approach that takes into account "general equilibrium effects" is strongly needed (Hanson, Kashyap and Stein, JEP 2011; Trichet, 2009; Bernanke, 2010)**

- **Measuring credit supply side at the bank level (local credit channel) is based on a partial equilibrium analysis, and thus not sufficient from a systemic risk perspective:**

  - E.g., lower credit supply due to an adverse bank balance-sheet shock may not have any negative impact if firms can get credit from less affected banks (aggregate firm-level credit channel)

  - Some argue that such positive general equilibrium effects are very strong. On the other hand, creating new banking relationships (substitution of credit) is difficult (Diamond, RFS 1984; Rajan, JF 1992; Dell'Ariccia and Marquez, JF 2006)

What do we do?

1. **We provide a methodology for estimating the aggregate firm-level impact of the bank lending channel**

2. **We apply it to estimate the effect of securitization of real estate assets on non-real estate corporate credit supply in Spain over 2000-2010**

Methodology

- **We build on the local (partial equilibrium) analysis of Khwaja & Mian (AER, 2008): credit demand is largely unobserved (e.g. growth opportunities) → firm fixed effects for firms with multiple banking relationships (in <u>firm-bank level data</u>), where some banks are more exposed to the particular shock**

- **We then estimate the (firm-level) aggregate lending channel: we cannot put firm FE in <u>firm level data</u>, so we back out the unobserved covariance of demand and supply from OLS and FE estimators in the firm-bank level data**

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Methodology

- **H0 – credit growth is driven by supply factor δ**
  - *δ might be banks' new ability to securitize their assets*
- **H1 – credit growth is driven by demand factor η**
  - *η might be firm productivity*
- **Is H0 valid? Does it matter in "general equilibrium"?**

Credit growth from bank i to firm j at time t

Supply factor

Demand factor

$$y_{ij} = \alpha + \beta * \delta_i + \eta_j + \varepsilon_{ij}$$

Total credit growth for firm j

$$\overline{y}_j = \overline{\alpha} + \overline{\beta} * \overline{\delta}_j + \eta_j + \overline{\varepsilon}_j$$

$$\overline{\delta}_j = \sum_{i \epsilon N_j} \frac{\delta_i}{n_j},$$

Unbiased aggregate supply channel

$$\widehat{\overline{\beta}} = \widehat{\overline{\beta}}_{OLS} - \left(\widehat{\beta}_{OLS} - \widehat{\beta}_{FE} \right) * \frac{Var(\delta_i)}{Var(\overline{\delta}_j)}$$

Methodology

- **Beta is refered as the bank lending channel (local lending channel here)**

- **It can be estimated by OLS, biased if credit supply and demand shocks are significantly correlated**

- **Focusing on firms with more than one bank and absorbing η through firm fixed-effects, betaFE provides and unbiased estimate of beta**

- **BetaFE does not provide a complete picture of the net effect of bank lending channel on the economy**

- **Beta bar captures the aggregate credit supply channel. If there are adjustment at the firm level to the bank supply (e.g. a crowding out effect) beta bar should be less than beta**

- **Procedure:**

  - For any given bank shock δ, run OLS and FE on bank-firm regressions to estimate beta OLS and beta FE

  - Estimate firm-level equation using OLS to obtain beta bar OLS

  - Plug all the coefficients on last formula to obtain unbiased estimates of credit supply channel at the firm level

Methodology

$$y_{ij} = \alpha + \beta * \delta_i + \eta_j + \varepsilon_{ij} \qquad \widehat{\beta}_{OLS} = \beta + \frac{Cov(\delta_i, \eta_j)}{Var(\delta_i)}$$

- **Bank i, firm j, y is the change in (log) firm credit i from bank j, η is firm demand shock**
- **δ is bank supply shock and β is the coefficient of interest – (local) credit supply channel**
- **β=0 if credit supply does not even matter locally (e.g. MM holds for banks)**
- **Demand shock is unobserved, possibly correlated with supply shock (OLS biased)**
- **Demand channel operates at the firm level, but supply channel at the bank level**
- **Hence, firm fixed effects lead to unbiased estimate of local credit supply**
- **Can firms adjust their credit in "general equilibrium"?**

$$\overline{y}_j = \overline{\alpha} + \overline{\beta} * \overline{\delta}_j + \eta_j + \overline{\varepsilon}_j \qquad \overline{\delta}_j = \sum_{i \in N_j} \frac{\delta_i}{n_j},$$

$$\rightarrow \quad \widehat{\overline{\beta}}_{OLS} = \overline{\beta} + \frac{Cov(\delta_i, \eta_j)}{Var(\overline{\delta}_j)}$$

But, $Cov(\delta_i, \eta_j) = \left(\widehat{\beta}_{OLS} - \widehat{\beta}_{FE} \right) * Var(\delta_i)$

$$\widehat{\overline{\beta}} = \widehat{\overline{\beta}}_{OLS} - \left(\widehat{\beta}_{OLS} - \widehat{\beta}_{FE} \right) * \frac{Var(\delta_i)}{Var(\overline{\delta}_j)}$$

Financial innovation and the credit channel

- **The role of financial innovation in creating credit booms and subsequent financial crises through banks has been emphasized (e.g. Kindleberger (1978), White (1996), Allen and Gale (2007), Calorimis (2008), Bordo (2009), Reinhart and Rogoff (2009))**

- **Financial Innovation: transform illiquid into liquid assets**

  - *Securitization: Enables holders of illiquid assets (banks) to access financing by selling or pledging assets*

  - *What are the credit channel effects of financial innovation?*

    - ***Does it lead to more credit? Better loan terms? Greater risk?***

    - ***Do "general equilibrium" effects mute bank-specific credit channel effects?***

  - *We provide a detailed investigation of these hypotheses using a comprehensive loan by loan database and being able to disentangle supply and demand effects as well as local from aggregate effects*

Preview of our findings

- **We find a large local credit supply channel of securitization during the ABS global boom of 2004-07**

- **Leads also to lighter credit terms and conditions**

- **However, local credit channel for volume completely crowded out, i.e. no aggregate lending supply channel!**
  - *The effect on credit terms however survives*
  - *But no firm real effects*

- **More and riskier lending to new clients on the extensive margin**

- **The 2008 collapse in securitization leads to a reversal in the local credit channel, but firms neutralize the local credit crunch!**

Our contribution

- 4 contributions to the literature on bank transmission mechanism: (Bernanke (AER, 1983), Kashyap & Stein (AER, 2000), Peek & Rosengren (AER, 1997 & AER, 2000), Calomiris & Mason (AER, 2003), Ashcraft (AER, 2005), Khwaja & Mian (AER, 2008), Paravisini (JF, 2008), Iyer & Peydró (RFS, 2011))

1. **From a conceptual stand point, first to formally incorporate "general equilibrium" feedback effects when estimating credit supply channel**
   - *Theories are about firm (aggregate) outcomes*
   - *Dangers of analysis at the bank level, e.g. Kashyap and Stein (AER 2000)*

2. **Our methodology is thus useful and practical for macroprudential policy (Fed/ECB new responsibilities, Basel III, IMF…)**

3. **The role of financial innovation in precipitating credit booms and financial crises (Kindleberger, 1978; …)**

4. **Emerging literature on the effects of securitization on bank lending (Sufi and Mian (QJE, 2009), Keys et al (QJE, 2010), Maddaloni and Peydró (RFS, 2011))**

Credit data

- **Credit register from the Central Bank of Spain, 2000-2010**
  - *Every loan granted by banks in Spain (loan aggregated at 1 firm-bank obs. per time period)*
  - *All banks: commercial, savings (cajas), coop. and foreign*
  - *Non-financial, non-real-estate corporate credit*
  - *Quarterly data and firms with average bank credit of at least 60,000 Euros and 10% random sample (sampled at firm level) for computational ease*
  - *Loan level information on drawn amount, commitment, default, maturity, and collateral*
    - ***One can infer changes in loan price***
  - *Firm level information on sales, employees,…*

Summary stats as of 2004:Q4 (Table II)

- **Around 30,000 firms, more than 200 banks, 67,000 loans and 51,000 loans from firms with multiple borrowing (78% of total loans)**

- **2.250 bank relations on average (3.302 for multiple borrowing)**

- **Average banks' real state exposure is 44% (15.7 sd), capital is 6.68%, return to assets is 0.94% and total assets higher than 10 billion dollars**

- **Average firm size is 6.2 million euros, 1.3 million is committed bank credit and average committed loan size is 376,000**

- **Average defaults are 1.9% (raised to 8% at end of sample), collateralization is 20%, long-term loans are 23% and drawn to committed credit is 80%**

Table II
Summary Statistics

	All Firms			Multiple Relationship Firms		
	N	Mean	Std Dev	N	Mean	Std Dev
Loan Level Variables						
Banks initial exposure to real estate assets	67,838	0.466	0.156	51,397	0.460	0.158
Loan amount outstanding (2004Q4)	67,838	288.1	3191.9	51,397	295.809	1637.3
Log loan amount within firm (2004Q4)	63,941	0.000	0.852	49,787	0.000	0.966
Loan amount committed (2004Q4)	67,838	367	3608.2	51,397	376.4	2169.2
Default Rate (2004Q4)	63,941	0.019	0.134	49,787	0.017	0.129
Loan drawn to commitment ratio (2004Q4)	67,838	81.066	30.752	51,397	83.2	27.9
Collateralization rate (2004Q4)	67,838	0.198	0.371	51,397	0.148	0.230
Maturity greater than 5 years (2004Q4)	67,838	0.230	0.390	51,397	0.185	0.356
Δ log loan amount, 01Q4 to 04Q4	23,274	-0.004	1.146	26,282	0.013	1.145
Δ default rate, 01Q4 to 04Q4	23,274	0.020	0.151	26,282	0.019	0.146
Δ log loan amount, 04Q4 to 07Q4	42,609	0.057	1.223	32,647	0.059	1.217
Δ log loan amount, 04Q4 to 07Q4 (within firm)	42,609	0.000	0.754	32,647	0.000	0.861
Δ default rate, 04Q4 to 07Q4	42,609	0.019	0.140	32,647	0.021	0.147
Δ log loan amount, 07Q4 to 09Q4	31,298	-0.280	1.016	23,322	-0.262	1.034
Δ default rate, 07Q4 to 09Q4	31,298	0.061	0.241	23,322	0.074	0.263
Firm Level Variables						
Banks initial exposure to real estate assets	29,848	0.471	0.131	15,697	0.463	0.111
Number of banking relationships (2004Q4)	29,848	2.280	1.848	15,697	3.302	2.017
Loan amount outstanding (2004Q4)	29,848	662	6720.6	15,697	982.507	7101.2
Commitment amount (2004Q4)	29,848	836.5	7823.6	15,697	1249.2	8681.9
Default Rate (2004Q4)	29,848	0.021	0.135	15,697	0.017	0.119
Total Assets (2004Q4)	14,984	4547.1	52221	9,093	6238.4	66362.5
Total Sales (2004Q4)	14,984	5155.4	67860	9,093	7028	86285.2
Total Employees	12,672	28.951	278.7	7,850	37.263	351.6
Δ log loan amount, 01Q4 to 04Q4	20,908	0.146	1.193	12,627	0.384	1.019
Δ default rate, 01Q4 to 04Q4	20,908	0.017	0.142	12,627	0.015	0.125
Δ log sales, 01Q4 to 04Q4	8,606	0.213	0.627	5,837	0.23	0.587
Δ log loan amount, 04Q4 to 07Q4	25,154	0.214	1.263	14,074	0.048	1.098
Δ default rate, 04Q4 to 07Q4	25,154	0.018	0.157	14,074	0.023	0.154
Δ log sales, 04Q4 to 07Q4	11,088	0.232	0.68	7,010	0.221	0.626
Δ log loan amount, 07Q4 to 09Q4	22,120	-0.204	0.942	12,681	-0.232	0.923
Δ default rate, 07Q4 to 09Q4	22,120	0.080	0.209	12,681	0.063	0.230
Δ log sales, 07Q4 to 09Q4	11,191	0.058	0.292	6,032	0.049	0.363
Bank Level Variables						
Total Assets (2004Q4)	192	7.8E+06	2.5E+07			
Initial exposure to real estate assets	191	0.440	0.157			
Capital ratio (2004Q4)	191	6.686	3.922			
Return on assets (2004Q4)	191	0.948	0.483			

Figure 1
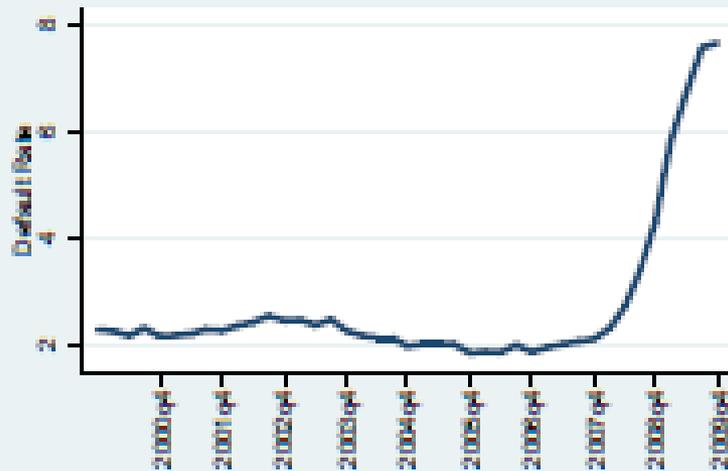Credit and Housing Market in Spain

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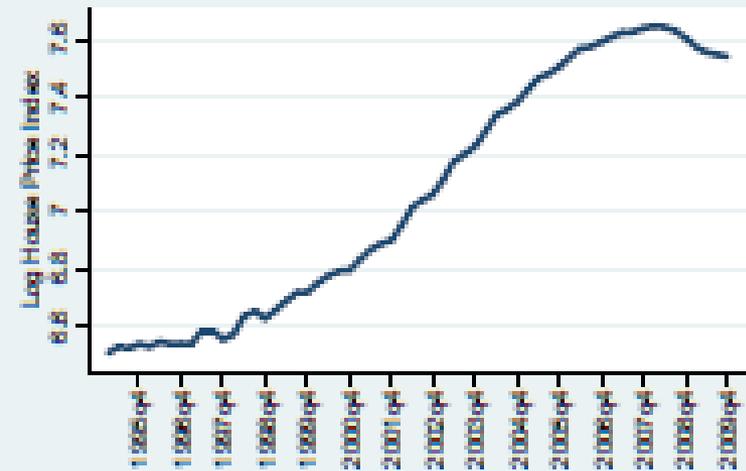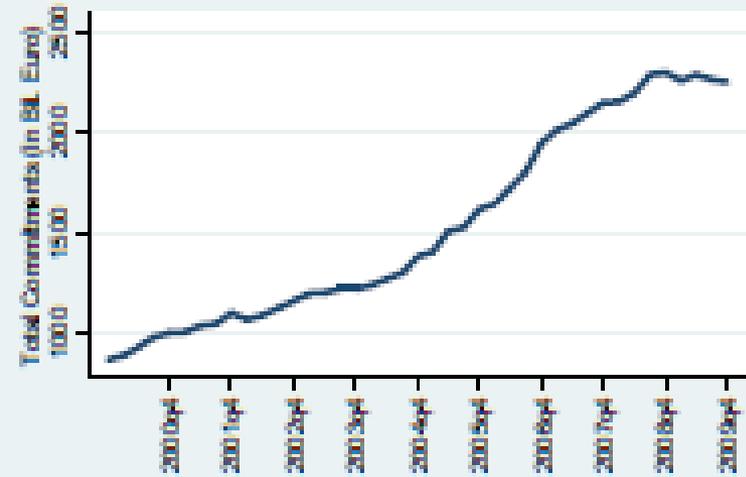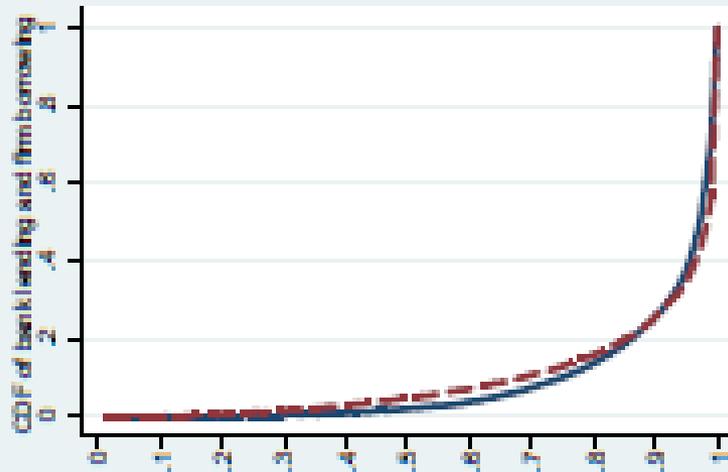
Figure 3
Securitization, Bank Credit and Banks' Exposure to Real Estate

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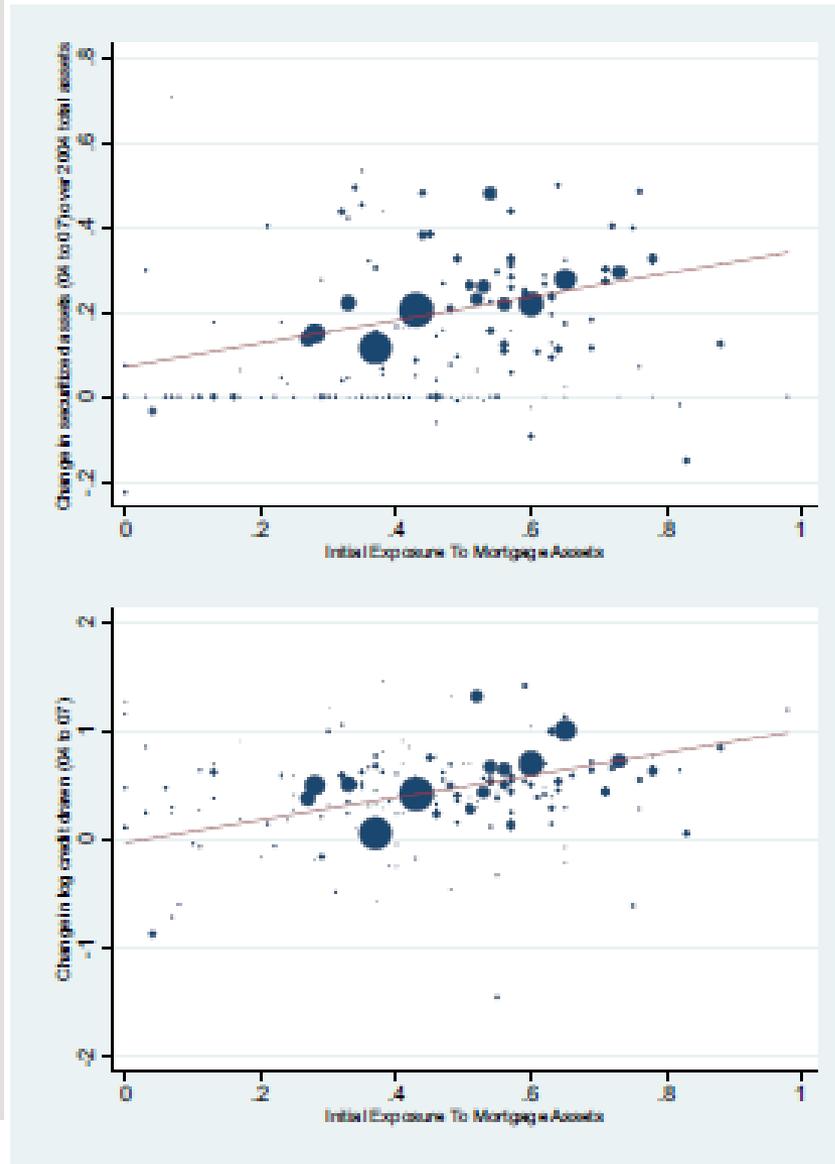
- At the bank level, higher banks' ability to securitize real-estate assets leads to higher credit extended to non-real-estate firms suggests a credit supply channel

- **Problem**: credit demand vs. supply and aggregate vs. local credit channel

Table III
Securitization and Initial Real Estate Exposure

	Δ Securitized Assets Over Total Assets ('04 to '07)		Securitized Assets Over Total Assets (2007)	Δ Log Bank Credit ('04 to '07)	
	(1)	(2)	(3)	(4)	(5)
Bank RE Exposure	0.197***	0.274***	0.349***	1.01 ***	
	(0.064)	(0.075)	(0.084)	(0.32)	
Securitized Assets Over Total Assets (2004 to 2007)					1.12 ***
					(0.415)
Constant	0.036	0.073*	0.15 ***	−0.014	0.24 **
	(0.029)	(0.039)	(0.041)	(0.18)	(0.12)
	OLS	WLS	WLS	WLS	WLS
N	179	179	179	178	178
R^2	0.063	0.14	0.14	0.18	0.12

What is correlated with bank exposure to real estate? (Table IV)

- **Bank-Level**
  - *No correlation with bank risk, profitability, and capitalization*
  - *More likely to be savings banks (cajas)*
- **Firm-Level**
  - *No correlation with firm propensity to default*
  - *Smaller firms, with more reliance on tangible assets and less dependency on short-term credit*
- **Loan-Level**
  - *No correlation with default*
  - *Conditional on lending to the same firm, no difference in loan size and maturity*
  - *More collateralized loans*

Table IV
Correlation Between Banks Exposure To Real Estate And Initial Characteristics

	Coeff	s.e.	Coeff	s.e.
Bank Level Variables (2000Q1)				
Return on assets	1.896	(1.569)		
Total Default Rate	0.0009	(0.0046)		
Capital Ratio	−0.705	(2.642)		
Cajas?	0.935***	(0.120)		
Firm Level Variables (2005Q4)				
Default rate	0.0104	(0.0114)		
Total assets	−7549.001***	(1739.05)		
Log total assets	−0.846***	(0.147)		
Total credit	−469.860**	(253.369)		
Log total credit	−0.802**	(0.379)		
Total sales	−8349.19***	(1836.714)		
Log total sales	−1.225***	(0.173)		
Number of banking relationships	−0.004	(0.343)		
Tangible assets ratio	19.109***	(2.912)		
Short term debt ratio	−27.557***	(3.213)		
Loan Level Variables (2005Q4)			*With firm fixed effects*	
Default Rate	0.013	(0.008)	0.007	(0.004)
Loan amount	−300.276***	(126.888)	−68.16	(83.267)
Log loan amount	−0.123	(0.312)	0.147	(0.285)
Collateralization rate	0.268***	(0.048)	0.150***	(0.034)
Maturity greater than 5 years	0.204***	(0.092)	0.106	(0.069)

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Local versus aggregate lending channel (Table V)

- **OLS estimate: strong correlation between business loan growth and initial exposure to real estate assets**

- **Same result with firms with multiple banking relationships**

- **When inclusing firm fixed effects we still find a positive and significant effect**

  - **One sd increase in real estate exposure generates 6.1 percentage points higher growth in credit supply**

- **Same results when controlling for degree of loan collateralization and loan maturity**

- **No impact of previous trens or result of droppping loans in the sample**

- **Despite very strong banks channel effects at the bank level, the net impact is close to zero (last column)**

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Table V
Securitization And The Credit Channel

|	ΔLog Drawn (04Q4 to 07Q4)					ΔLog Drawn (01Q4 to 04Q4)	Loan Dropped?	Tobit	ΔFirm-Level Log Drawn (04Q4 to 07Q4)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Bank RE Exposure	0.366***	0.404***	0.396***	0.382***	0.419*	−0.135	−0.245***	0.882***	0.023
	(0.099)	(0.104)	(0.113)	(0.111)	(0.225)	(0.145)	(0.070)	(0.285)	(0.100)
Firm-Bank Type fixed effects	No	No	No	No	Yes	No	No	No	-
Loan controls	No	No	No	Yes	No	No	No	No	-
Firm fixed effects	No	No	Yes	Yes	-	Yes	Yes	No	No
Data restricted to firms with multiple relationships	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	42,609	32,647	32,647	32,647	32,647	26,262	51,397	51,397	14,074
R^2	0.002	0.003	0.50	0.51	0.70	0.53	0.46		0.00

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Quarter by quarter estimates

- **Estimates of local bank channel are zero from 2001 to 2004**

- **Results are not driven by previous trends (i.e. by a boom in house prices alone)**

- **The credit channel effect is driven by the boom in securitization that kicks into force between 2004 and 2007**

- **Banks with greater exposure to real estate assets start contracting credit at a faster pace**

- **The post-2008 reversal in credit channel is larger through loan commitments that loan outstanding**

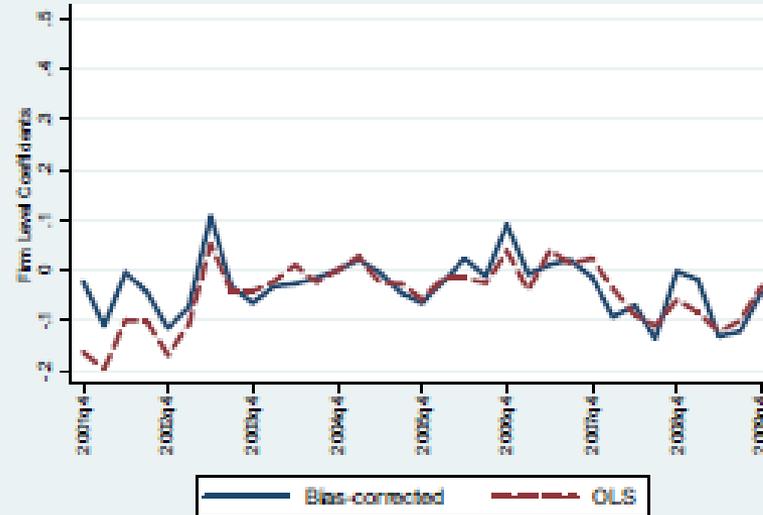- **Net impact close to zero throughout the whole sample period**

Figure 4
Loan-Level Credit Channel Coefficients By Quarter
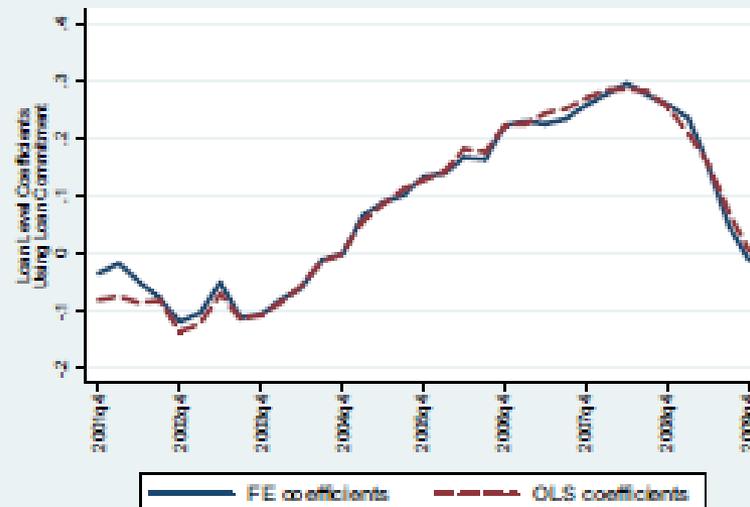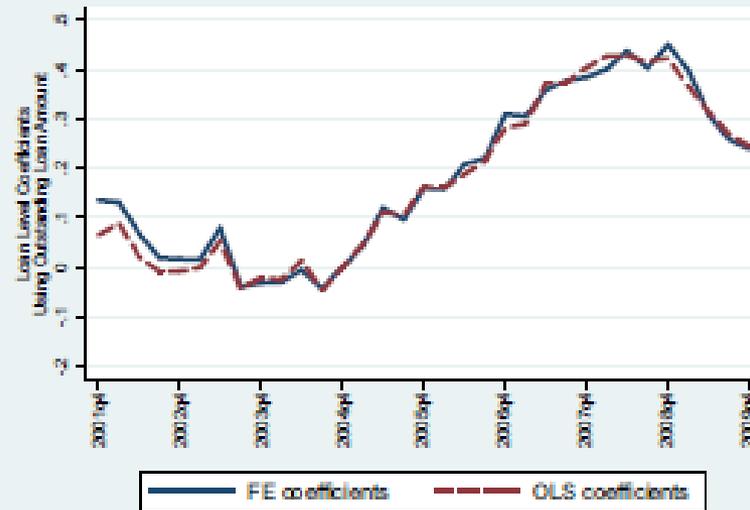
Figure 5
Firm-Level Credit Channel Coefficients By Quarter
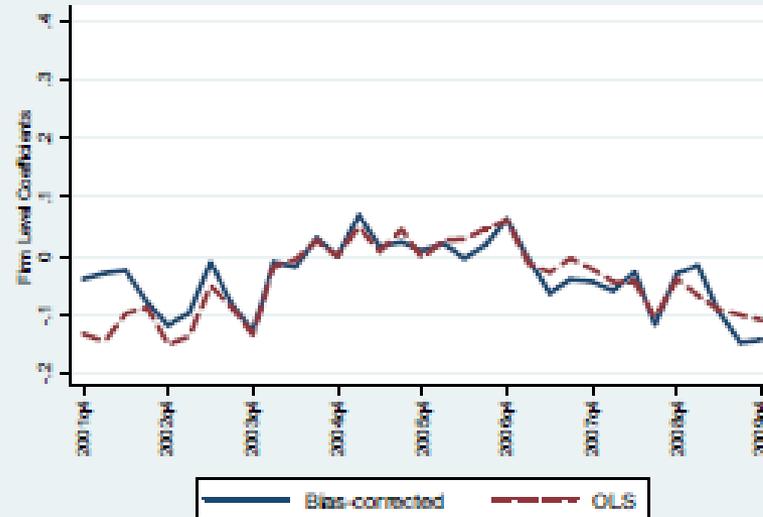
Local lending channel and credit terms (Table VI)

- **Draw-down ratio increases faster for banks with larger initial exposure to real estate**
- **Securitization leads to more favorable credit terms for borrowers**
 - **Less collateralized loans**
 - **Longer maturity loans**

Table VI
Securitization And Loan Terms

| | Change in Loan conditions from 2004Q4 to 2007Q4 | | | | | | | | |
| | Drawn to Committed Ratio | | | Collateralization Rate | | | Long-term maturity | | |
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Bank RE Exposure	8.28 +++	8.33 +++	8.51 +++	−0.016	−0.065 ++	−0.048	0.134	0.16 ++	0.13 ++
	(2.69)	(2.65)	(3.34)	(0.0114)	(0.033)	(0.03)	(0.084)	(0.067)	(0.062)
Loan Controls		Yes	Yes		Yes	Yes		Yes	Yes
Firm fixed effects			Yes			Yes			Yes
Data restricted to firms with multiple relationships	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	32,647	32,647	32,647	32,647	32,647	32,647	32,647	32,647	32,647
R^2	0.0027	0.0410	0.50	0.0001	0.25	0.62	0.0052	0.15	0.46

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Figure 6
Loan Terms Credit Channel Coefficients By Quarter

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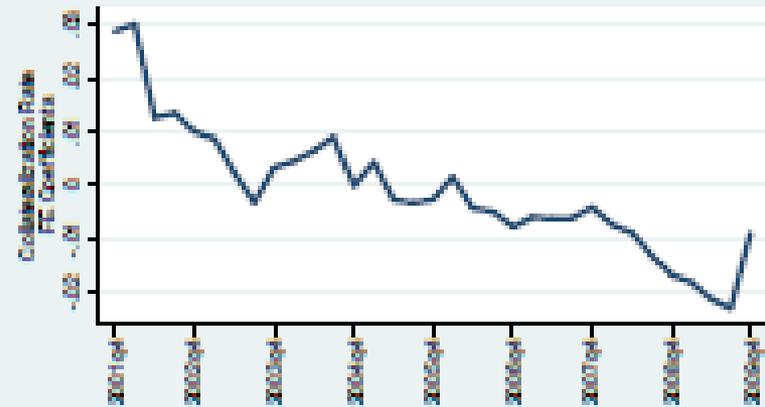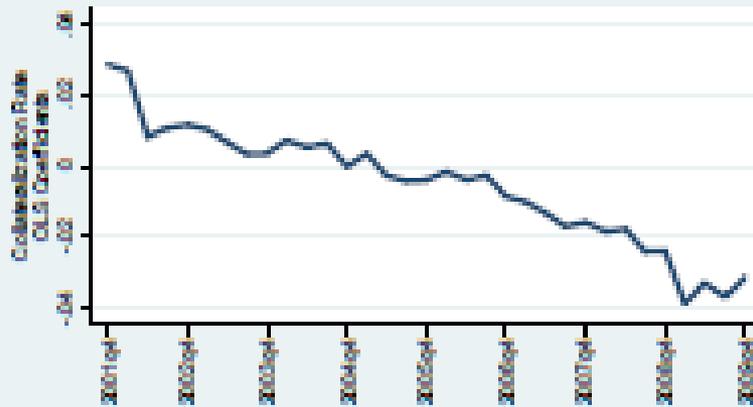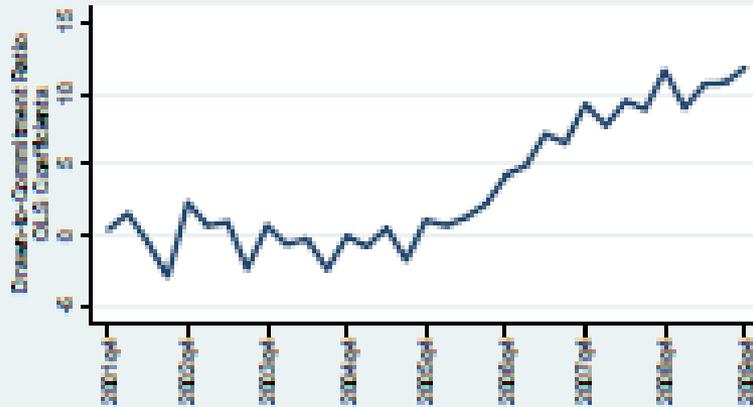
Aggregate lending channel and credit terms (Table VII)

- **Significant credit terms impact at the aggregate lvel**

- **Draw-down ratio increases faster for banks with larger initial exposure to real estate**

- **Securitization leads to more favorable credit terms for borrowers in terms of less collateralized loans and longer maturity loans**

- **Therefore, there are differences not undone at the aggregate level in credit terms while quantity impact was undone**

- **Competition across banks given more abundant liquidity results in better terms for firms**

- **Firms borrowing from banks with greater real estate exposures do not experiment different propensities to default, sales or employment**

- **Despite large effects at the bank firm level, the crowding out completely mitigates these effects for firm real outcomes**

Table VII
Firm Outcomes

	Δ(drawn to commit)	Δ(%long-term)	Δ(collateral rate)	Δ(default rate)	Δ(log sales)	Δ(employees)
	(1)	(2)	(3)	(4)	(5)	(6)
Firm Banks' RE Exposure	6.86 ***	0.054 **	−0.10 ***	0.0008	−0.0025	0.045
	(1.26)	(0.026)	(0.019)	(0.022)	(0.059)	(0.081)
Bias-Corrected Coefficient	7.38	0.066	−0.074			
Data restricted to firms with multiple relationships	Yes	Yes	Yes	Yes	Yes	Yes
N	14,277	14,277	14,277	14,277	7,019	5,984
R^2	0.0012	0.0005	0.0019	0	0	0.0001

Table VIII
Extensive Margin – Extension of Credit to New Clients

	Log Drawn	Log Commitment	Drawn Normalized	New Firms Drawn Normalized	Defaults
	(1)	(2)	(3)	(4)	(5)
Bank RE Exposure	1.97 **	1.69 **	0.665***	0.382***	0.0657**
	(0.79)	(0.73)	(0.22)	(0.153)	(0.0287)
Constant	7.99 ***	8.37 ***	0.193*	0.115*	0.0061
	(0.39)	(0.37)	(0.11)	(0.060)	(0.012)
N	175	177	179	179	163
R^2	0.025	0.019	0.064	0.08	0.068

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Figure 7
Extensive Margin Bank Credit Channel Coefficients

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Conclusions
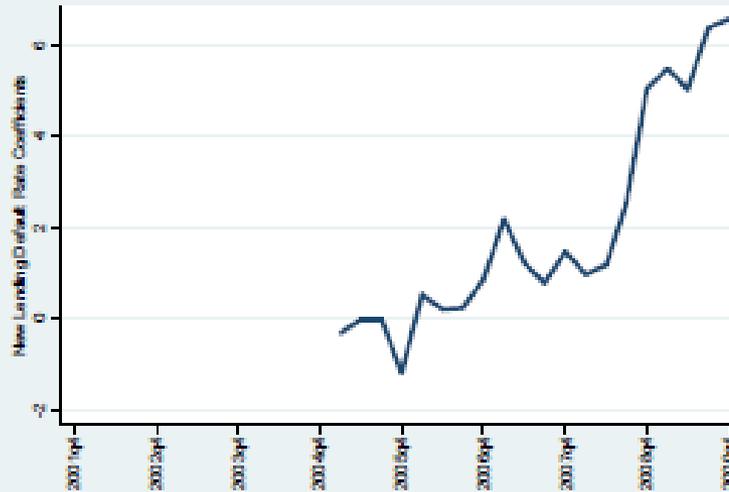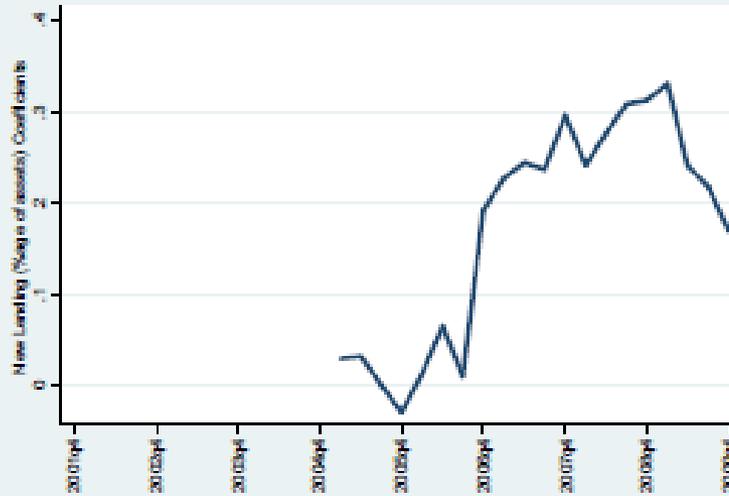
- **New methodology to provide unbiased estimates of the supply-side effect of aggregate credit channels**

  - *Necessary both for testing the theories of the credit channel and also for policy (Basel III, bailouts, liquidity assistance…)*

  - *Macro-prudential tool to analyze credit supply at monthly/quarterly frequency*

    - ***Many countries have currently credit register data (half of the world including 14 EU countries (see Djankov, McLiesha and Shleifer (JFE, 2007) and ECB (2010))***

    - ***One can check effects of bank capital, liquidity, business models, wholesale depositors, runs …***

      - *We have analyzed financial innovation in this paper*

Conclusions

- **We find a large local credit supply channel of securitization during the ABS global boom of 2004-07**

- **Leads also to lighter credit terms and conditions**
  - *Revealed preference to draw down from exposed banks (lower price) and shift towards longer term and unsecured credit*

- **However, local credit channel for volume completely crowded out, i.e. no aggregate lending supply channel**
  - *The effect on credit terms however survives*
  - *But no firm real effects*

- **More and riskier lending to new clients on the extensive margin**

- **The 2008 collapse in securitization leads to a reversal in the local credit channel, but firms neutralize the local credit crunch**

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THANK YOU FOR YOUR ATTENTION

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