Modeling Corporate Credit Markets with Securitization in an Agent Based Stock Flow Consistent Approach

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Motivation

- One consequence of the euro area crisis is the weakness in private investment.
- In response, the European Commission calls for a policy package, the *Capital Market Union* (CMU), which aims to facilitate firms' access to capital.
- Beside others, it should be carried out through the reactivation of the securitization market in order to
  - boost lendings by removing supply side restrictions
  - render the financial markets more stable

Motivation (cont.)

- But, survey evidence rather suggests a lack of demand (Commission 2007)
- Following Tasca & Battiston (2014), the deepening of financial interrelationships may lead to higher systemic risk.
- Acharya et al. (2013) show that securitization does not necessarily transfer the risk out of the banks' balance sheets and emphasize the accompanying systemic risk
- Gorton & Metrick (2012) point to the close correlation between the spreads on securitized loans and the solvency of the banking sector.
- To address this particular aspect of the CMU, we developed a SFC-AB model to study the macrofinancial effects of lending with varying degrees of securitization.

The Basic Model Framework

- Consider a closed economy without a government sector
- The private sector is divided by firms and households
- Output consists of investment and consumption
- The household sector is configured in a very simple manner while the corporate and banking sector are microfounded
- The banking sector incorporates a *special purpose vehicle* (SPV)
- Consider 200 firms and 40 commercial banks where the household sector is represented as one single aggregate

Macroeconomic Outcomes before Interaction

- Aggregated output is measured in terms of effective demand
- Firms' determine their planned investment by a simple neo-Kaleckian accumulation rate

$$\begin{aligned} g_t^d &\equiv i_t^d / K_{t-1} \\ &= \gamma_o + \gamma_1 u_{t-1} + \gamma_2 (1-\omega) + \gamma_3 \frac{\pi_{t-1}^T}{K_{t-1}}. \end{aligned} \tag{1}$$

- Thus the firms' demand for capital goods is

$$i_t^d = g_t^d K_{t-1}. \tag{2}$$

Firm default and credit demand at the Micro-Level

- Individual firm insolvencies will endogenously occur in the model, where the starting point is set by non-uniformly distributed capital costs of the banks as the initial distribution of equity ratios is Pareto, but above a minimum target set by the authorities.
- If the fraction of insolvent firms remains low (which implies no bank insolvency), apart from a concentration process, there will be no real economic consequences.
- The entire volume of desired investment is homogenously allocated to the solvent firms.
- Firms differ in the amount of internal financing by retained earnings because of last period's capital costs, which itselves depend on borrowers' and lenders' creditworthiness.
- Firms' credit demand is residually determined.

The Partner Selection Mechanism

- Consider N_C, N_B being the number of firms and banks, where $N_C > N_B$.
- Credit relationships evolve as in Delli Gatti et al. (2010) and Caiani et al. (2016).
- The *partner selection mechanism* (PSM) is as follows:
  - Each firm i draws a random set of M potential banks k
  - Each bank k offers an individual lending rate

$$r_t^{l,i} = \bar{r} + \rho_{lr}(LR_t^i - \overline{LR}) - \rho_{er} ER_t^k + \epsilon_t \tag{3}$$

  - The firm selects the most attractive or "best" credit supplier
- Assume further a "house-bank relationship".

Credit Market Frictions

- It might happen that some firms cannot borrow up to the desired collateral value due to credit market frictions.
- Credit rationing occurs through transaction/search costs which arise due to bankruptcies:
  - Bankrupt condition firms: $LR_t > LR^T$
  - Bankrupt condition banks: $ER_t < ER^T$
- The costs arise when a solvent firm is matched with an insolvent bank
- Transaction costs thus transmit bankruptcies to the real economy since firms cannot realize the full amount of planned investment.

Securitization

- Banks have the possibility to move loans off-balance sheets by selling them to a *special purpose vehicle* (SPV).
- The transfered pool of corporate loans is the assets of the SPV.
- It builds a capital structure on those assets using different layers $\Rightarrow$ the A- and B-tranche.
- The SPV sells the A-tranche in the capital market in terms of tradable bonds where the B-tranche stays in the owner banks' books.

Balance sheet matrix before SPV resolution

	Households	Firms	Banks	SPV	$\sum$
Tangible Capital		$+K_f$			$+K$
Deposits	$+M_h$		$-M_h$		0
SPV Bonds	$+B_A$		$+B_B$	$-B$	0
Loans		$-L_b$	$+L_b$		0
Securitized Loans		$-L_s$		$+L_s$	0
Corporate Equities	$+p_f e_f$	$-p_f e_f$			0
Bank Equities	$+p_b e_b$		$-p_b e_b$		0
Net Worth	$-NW_h$	0			$-K$
$\sum$	0	0	0	0	0

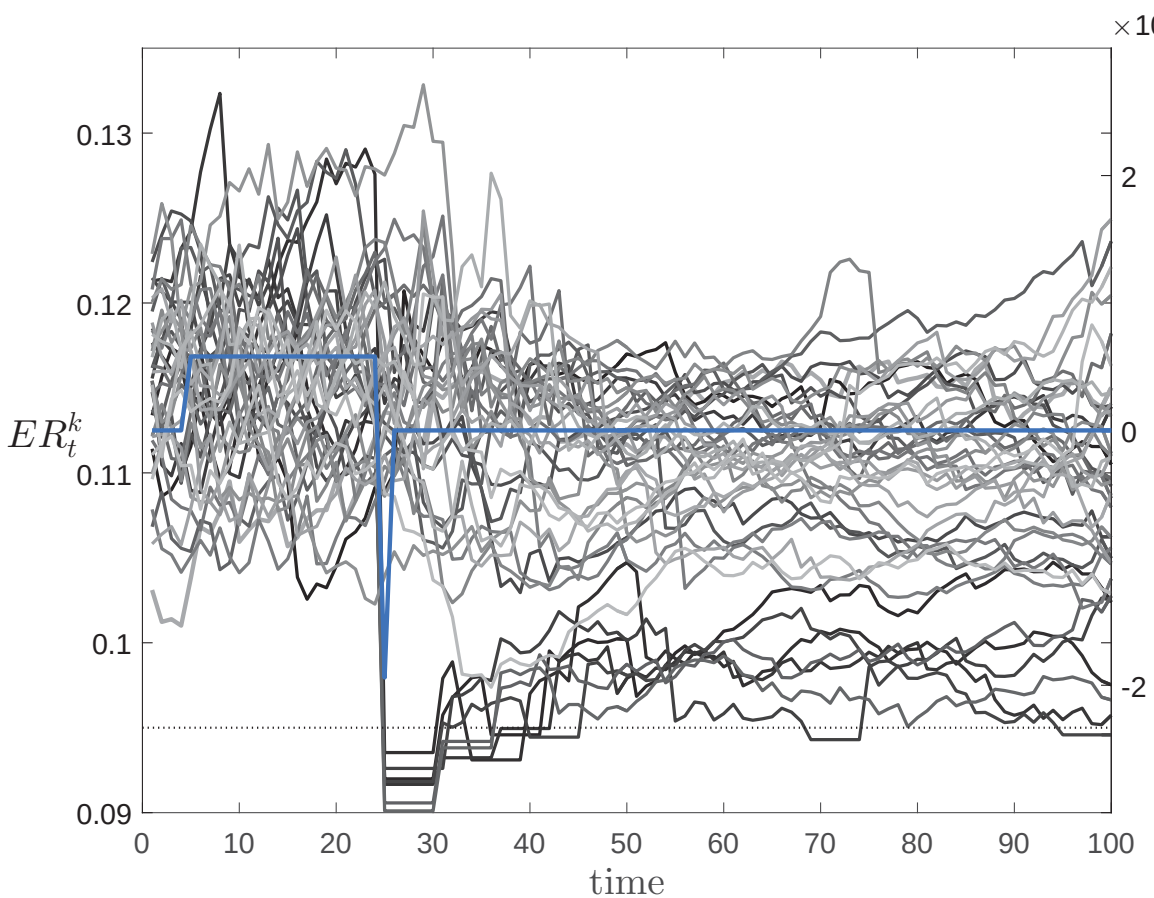
Transaction flow matrix before SPV resolution

	Households	Firms		Banks		SPV	$\sum$
		Current	Capital	Current	Capital		
Consumption	$-C$	$+C$					0
Investment		$+I$	$-I$				0
Wages	$+WB$	$-WB$					0
Firm Profits	$+FD_f$	$-F_f$	$+FU_f$				0
Bank Profits				$-F_b$	$+F_b$		0
SPV Profits					$+F_s$	$-F_s$	0
Deposit Interest	$+r_M M_h(-1)$			$-r_M M_h(-1)$			0
SPV Bond Interest	$+r_B B_A(-1)$					$-r_B B_A(-1)$	0
Loan Interest		$-r_L L(-1)$		$+r_L L_b(-1)$		$+r_L L_s(-1)$	0
Change in Deposits	$-\Delta M_h$				$+\Delta M_h$		0
Change SPV Bonds	$-\Delta B_A$				$-\Delta B_B$	$+\Delta B$	0
Change in Loans			$+\Delta L$		$-\Delta L_b$	$-\Delta L_s$	0
Change in Equities	$-\Delta p_f e_f$		$+\Delta p_f e_f$		$+\Delta p_b e_b$		0
	$-\Delta p_b e_b$						0
$\sum$	0	0	0	0	0	0	0

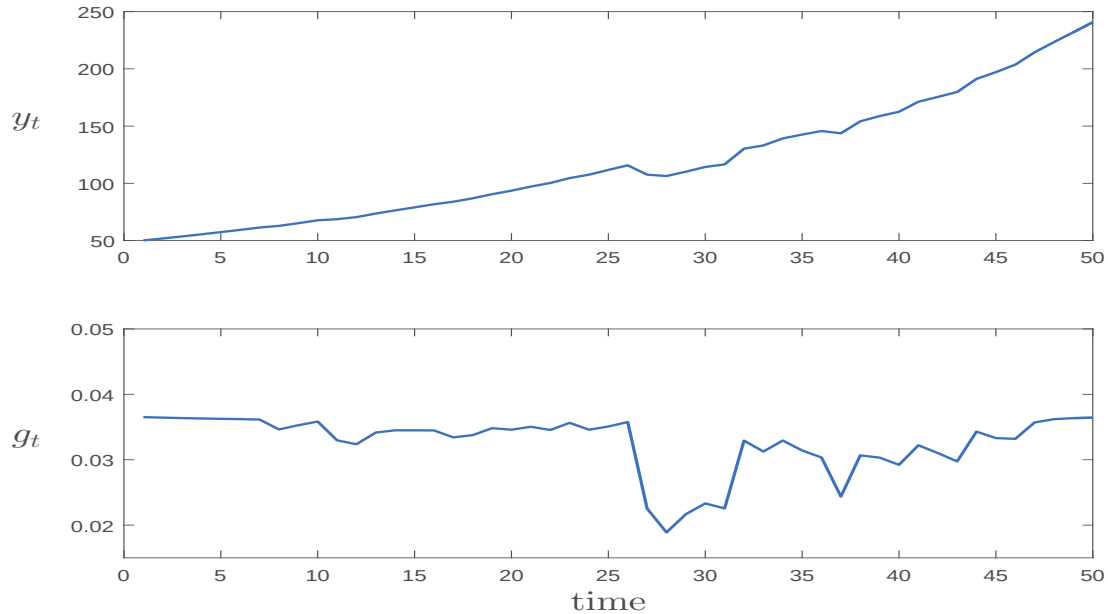
Financial stress in the securitization market and risk propagation

- If there are sufficiently enough firm defaults in the securitized credit pool, the SPV profits will turn negative.
- This represents a loss to the owner-banks and they decide to liquidate the SPV at the cost of their equity ratios. As a consequence some banks may come under pressure of fulfilling capital requirements.
- This means a bank may fail, although there was no significant default in its own (monitored) credit portfolio (systemic risk).
- How realistic is an SPV originated by several banks ? At first glance, maybe not realistic.
- But the way of modeling just stands for other interbank-linkages: i. banks have invested in other banks' securitization, ii. even the draft of the European Commission allows the SPV to enter into derivatives transactions (for hedge purpose).

Banks' Equity Ratios & SPV Profits



Economic growth



- The model incorporates a market re-entry mechanism for banks in order to return to quasi steady state solution.
- As we do not model the government sector explicitly, the banking sector has to take care of the bank resolution itself:
- The x best capitalized banks transfer some equity to the corresponding lowest capitalized ones after z periods.

Monte Carlos simulation and securitization intensity

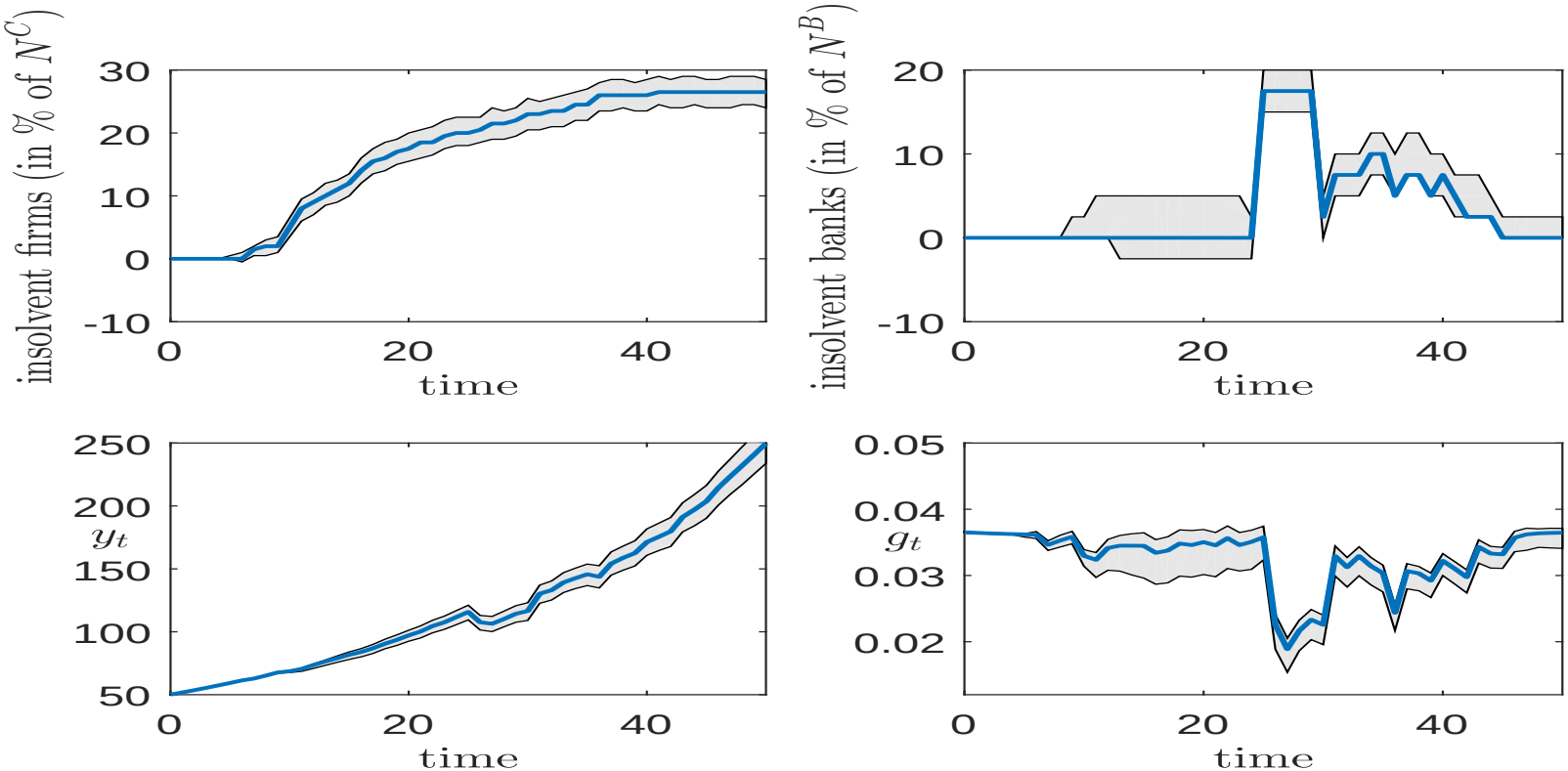


Table 1: Value at Risk Measures

	Volume of Securitized Loans (n^{spv})		
VaR Measure	1%	5%	10%
$\text{VaR}_{p=5\%}$	0.1135	0.1084	0.1046

Concluding Remarks

- Our research suggests that an increase in the securitization intensity might increase the vulnerability of the banking sector
- A deepening of financial interrelationships, implicit in securitization, can lead to higher systemic risk (bank bankruptcies).
- In the medium and longer-run, this could well turn out to be counterproductive for economic performances.

Calibration, (validation and sensitivity analysis, *to do*)

Table 1: Parameters

Par.	Description	Value
α_1^c	marginal propensity to consume out of disposable income	0.18
α_2^c	marginal propensity to consume out of wealth	0.10
γ_o	animal spirits term/intercept of the investment function	0.00
γ_1	sensitivity parameter linking investment to utilization (% of K)	0.01
γ_2	sensitivity parameter linking investment to profit share	0.02
γ_3	sensitivity parameter linking investment to profit rate	0.60
θ_b	initial bank equity ratio	0.115
θ_c	initial firm equity ratio	0.34
θ_{md}	scaling parameter linking deposit to loan growth	0.92
$\theta_r \approx \frac{r_{md}}{\theta_{SPV} r_{SPV}}$	scaling parameters linking interest rates: $\theta_r = 0.80, \theta_{SPV} = 0.95$	
μ_r	expected value of the randomly drawn interest rate mark-up	0.00
σ_r	standard deviation of the randomly drawn interest rate mark-up	0.007
ξ_c	share of distributed profits	0.25
ϕ_{spv}	securitization intensity (baseline: 0.01, scenario: 0.1)	0.01
ω	wage share	0.7
ρ_{er}	sensitivity parameter linking loan rate to corporate leverage	0.08
ρ_{lr}	sensitivity parameter linking loan rate to bank leverage	0.1
ER^T	threshold equity ratio	0.095
LR^T	threshold leverage ratio	0.95
$\overline{LR}$	benchmark leverage ratio for interest rate mark up	0.5
M	number of firms i's potential credit supplier	5
N_C	number of firms/no financial corporations	100
N_B	number of banks	40
r_{l0}	intercept in loan rate	0.036
t_{spv}	date of securitization	15
η	max. number of recapitalized banks per period	6
ζ	duration of the resolution proceedings	6
κ	size of recapitalization	0.05

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