Macroeconomic Effects of Banking Sector Losses across Structural Models

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Motivation

- The financial crisis has proved a catalyst for the formulation of quantitative models for policy analysis that incorporate financial frictions and an explicit role for an intermediation sector in a general equilibrium framework.
- Our work includes five models developed at the Federal Reserve Board. Each model emphasizes different aspects of the nexus between the financial sector and the rest of the economy.
- This approach can deliver "model-based confidence intervals" relative to the effects of financial shocks.
- Furthermore, in our meta-analysis, we investigate the structural factors responsible for the varied responses to a standardized financial shocks across the five models considered.

The approach

- Although all the models presented have common antecedents, each emphasizes different aspects of the interaction between the financial sector and the rest of the economy.
- Each of the self-contained model sections in our paper considers one particular form of capital shortfall, namely a lump-sum transfer of funds from the banking sector to the household sector.
- Because the transfer does not distort the actions of the household sector at the margin, it can also be thought of as a shock that writes off some assets on the balance sheet of the banking sector.
- The baseline transfer shock is a "pure" financial shock as it does not imply the depletion of real resources exogenously so that the macro repercussions can be thought of as spillover effects emanating from the financial sector.

Model Description: Iacoviello

- Agents: household savers & borrowers, bankers, entrepreneurs
- Bankers intermediate funds between savers and borrowers
- Entrepreneurs subject to borrowing/working capital constraint

$$L_{E,t} \leq m_H V_t - m_N W_{H,t} N_{H,t}$$

- Bankers are subject to capital requirement:

$$D_t \leq \gamma_E \left(L_{E,t} - \varepsilon_t \right)$$

Optimality conditions for bank implies (m is bank's SDF)

$$E_t \left(R_{E,t+1} - R_{Ht} \right) = \left(1 - \gamma_E \right) \left(1 - m_{B,t} R_{Ht} \right) / m_{B,t}$$

- Capital constraint creates wedge between cost of deposits & return on loans. Wedge is high when bank capital is low.
- Total output is
$Y_t = A_{Z,t} K_{H,t-1}^{\alpha\mu} K_{E,t-1}^{\alpha(1-\mu)} H_{E,t-1}^{\nu} N_{H,t}^{(1-\alpha-\nu)(1-\sigma)} N_{S,t}^{(1-\alpha-\nu)\sigma}$
- Model is estimated using Bayesian techniques

Model Description: Covas Driscoll

- Based on Aiyagari (1994): heterogeneous workers subject to idiosyncratic labor income risk under a borrowing constraint.
- Model encompasses (1) heterogeneous entrepreneurs who face investment risk under a borrowing constraint; (2) heterogeneous bankers subject to profitability risk and a capital requirement.
- The key frictions in the banking sector are the capital requirement and the inability of bankers to issue outside equity.
- In equilibrium, banks will choose to hold a (precautionary) buffer of equity capital above the requirement.
- The model is completed by an additional corporate sector funded directly by households. This sector is included so that the banking sector need not fund the entire economy.

Model Description: Kiley Sim

- Banks have special knowledge in selecting and managing financial projects, but face financial friction in funding their operations
- Key financial friction for banks results in

$$E_t\left(\mathcal{R}^A_{t+1} - \gamma_t R^B_{t+1}\right) = \frac{(1-\gamma_t)\left(1 - m_{B,t}R^B_{t+1}\right)}{m_{B,t}}$$

  where $m_{B,t}$ is banker's sdf, γ_t is the debt to asset ratio of the bank, R^A, R^B are bank's return on assets and borrowing rates
  Leverage chosen optimally: high when bankruptcy cost is low, dilution cost is high, volatility is low, tax shield is high
- A negative financial shock leads to higher intermediaries default; raising outside equity is costly (dilution cost); spreads rise; Y falls.

Model Description: Queralto

- The structure of the model formulated by Queralto follows closely Gertler, Kiyotaki, and Queralto (2012).
- Each bank raises funds by issuing deposits and outside equity to purchase producers' equity.
- Bankers can divert a fraction of the funds they intermediate. If they choose to do so, they are immediately discovered and are forced to cease operations.
- The incentive constraint for the bank not to steal is that funds that can be diverted should be inferior to the continuation value of the bank.
- The amount divertable is assumed to be increasing in the extent of outside equity finance x_t, and therefore the bank's constraint is tighter the larger is x_t.

Model Description: Guerrieri Jahan-Parvar

- Guerrieri and Jahan-Parvar consider the effects of sectoral and aggregate financial shocks in a two sector model.
- Firms in one sector have access to equity markets, while firms in the other sector can only finance capital purchases through credit extended by banks.
- When all firms are financed by banks, the model mirrors the framework in Gertler and Karadi (2011).
- When all firms are financed by households, the model mirrors the framework in Boldrin, Christiano, and Fisher (2001).
- Final goods are a composite of goods produced by firms that are credit-dependent and firms that are financed by households.
- A retail sector purchases the intermediate goods and repackages them for consumers in a way that supports the inclusion of nominal rigidities and monetary policy.

Comparison of Salient Characteristics across Models

	Iacov	Cov/Drisc.	Kiley/Sim	Queralto	Guerr./JP
Banks can:					
Issue new equity	no	no	yes	yes	no
Cut dividends	yes	yes	yes	no	no
Increase efficiency	no	no	no	no	no
Raise spreads	yes	yes	yes	yes	yes
Increase NII	no	no	no	no	no

- The summary mirrors the action set available to banks in reaction to changes in capital requirements, as in an report of the BIS Macro Assessment Group.
- Retaining earnings is an action that can build up the capital position of financial intermediaries in all the models presented, and in all models spreads between loans and deposits adjust in reaction to changes in capital.
- Not all models allow financial intermediaries access to outside equity.

Comparison of Salient Characteristics across Models

	Iacoviello	Covas Driscoll	Kiley Sim	Queralto	Guerrieri Jahan-Parvar
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Cut dividends	yes	yes	yes	no	no
Increase efficiency	no	no	no	no	no
Raise spreads	yes	yes	yes	yes	yes
Increase NII	no	no	no	no	no

- Not all models allow for a reduction in dividends.
- No model allows for the increases in operating efficiency and in non-interest income highlighted by the BIS MAG as possible reactions to capital shortfalls.
- Besides issuing new equity and increasing retained earnings, banks may attempt to increase risk-weighted assets by rebalancing towards less risky assets in ways not captured by the models here.

Comparison of Salient Characteristics across Models (cont.)

	Iacoviello	Covas Driscoll	Kiley Sim	Queralto	Guerrieri Jahan-Parvar
Bank role					
Liquidity provision	yes	yes	yes	yes	yes
Liquidity transf.	no	no	no	no	no

- One source of homogeneity across models is that the financial sector is engaged in liquidity provision, and not in liquidity transformation, which could contribute to understating the macroeconomic repercussions of financial shocks.

Comparison of Salient Characteristics across Models (cont.)

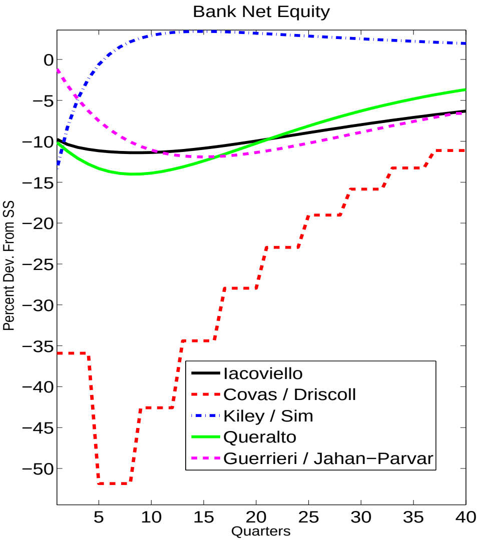
	Iacoviello	Covas Driscoll	Kiley Sim	Queralto	Guerrieri Jahan-Parvar
Other Features					
Non-bank funding	yes	yes	no	no	yes
Sticky Prices	no	no	yes	no	yes
Solution	lin.	nonlin.	lin.	lin.	piecewise lin.

- Only some of the models presented allow non-bank financing to coexist with bank financing.
- Linear solution techniques impose that all bank capital constraints bind at all times.
- Notably, the non-linear approach in the model of Covas and Driscoll allows for a disconnect between capital reductions and credit provision as the capital constraint on banks in that model is only occasionally-binding.

The Baseline Transfer Shock

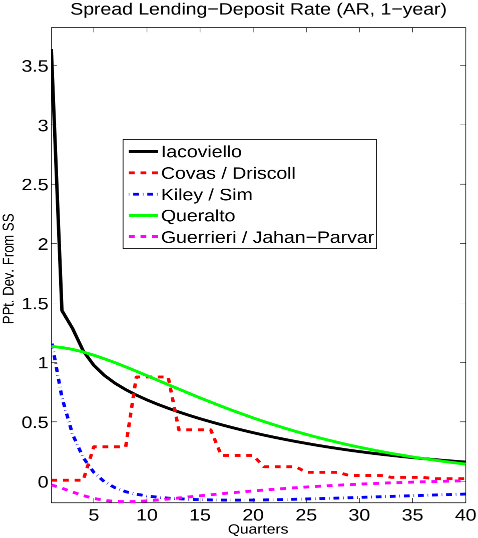
- We consider a transfer shock in line with the results from the stress tests for the U.S. banking sector mandated by the the Dodd-Frank Financial Reform Act.
- Using last year's results, under a Great Recession scenario for the U.S., total projected losses of the top 18 banks amounted to bn \$462 over 9 quarters, cumulatively (3% of 2012 GDP).
- We scale up the magnitude of the transfer to reflect that the CCAR banks account for about 60% of banking assets.
- An additional rescaling reflects that traditional banks account for 66% of the asset of the banking sector.
- Accordingly, the baseline transfer shock entails a reduction in assets equal to 7.5% of GDP (=3%/0.6/0.66) cumulatively over the first 9 quarters following the transfer.

Comparison of Results: Bank Equity



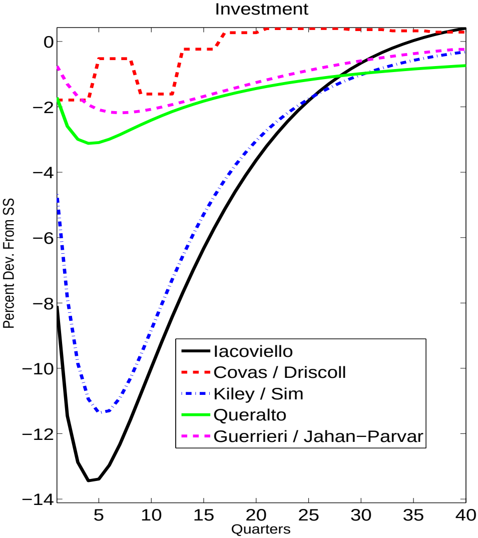
- Bank net equity does not simply reflect the size of the exogenous transfer shock because the general equilibrium nature of the models imply important movements in asset prices and the price of capital, in particular.
- Despite quantitative differences, the drop in net equity is persistent in all models.

Comparison of Results: Spread Loans-Deposit Rate



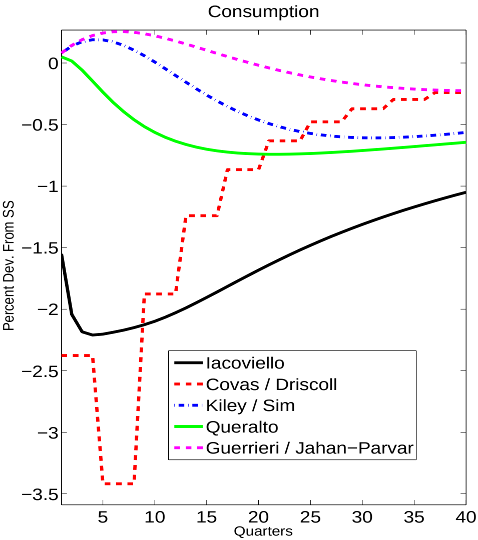
- The drop in net equity leads to a contraction in the supply of credit and an increase in the spread between interest rates on lending and on deposits across all models.
- The different responses of spreads between loans and deposits mostly reflect disparities in the behavior of bank equity account

Comparison of Results: Investment



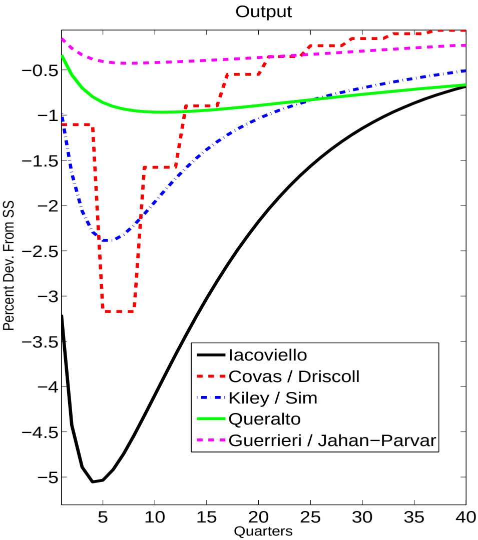
- In all the models the contraction in credit leads to a sizable contraction in investment.
- Notably, the model of Covas and Driscoll implies a looser connection between capital shortfalls and credit supply – reflected in the smallest drop in investment.

Comparison of Results: Consumption



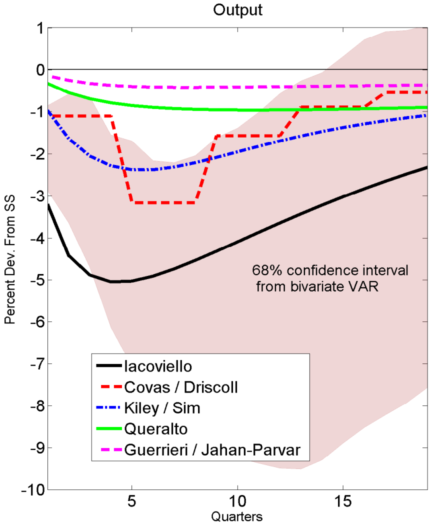
- The models that allow for banks to cut dividends show deeper contractions in consumption.
- The transfer may boost consumption temporarily.
- Eventually, the drop in investment brings down the capital stock and consumption declines across all models.

Comparison of Results: GDP



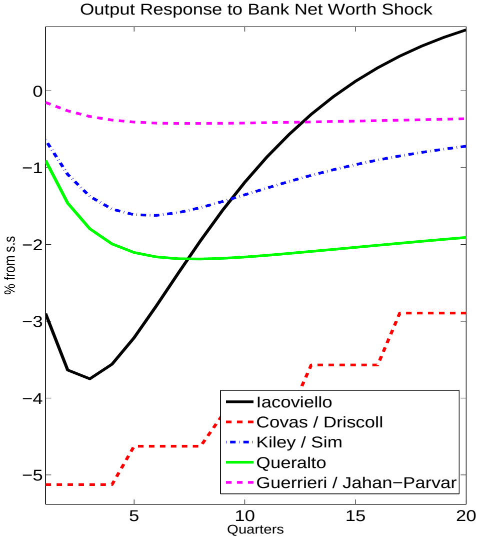
- All models predict a contraction in output, but the magnitudes differ greatly :-(.
- Apart from the interaction across sectors, sensitivity analysis to parametric assumptions brings out the importance of the interaction between financial frictions and the labor market to gauge the effects on aggregate output.

Comparison of Results: Model vs VAR



- Model predictions appear in line with those of a bivariate VAR with charge-offs and GDP (scaled appropriately).
- Uncertainty around VAR estimates also large. If anything, models underestimate VAR predictions.

Results Comparison: Response to Bank Net Worth Shock



- Subject all models to a net worth shock of banks (minus 10 percent).
- Underlying shock causing bank net worth to fall differs across models.
- Differences across models are similar to case of transfer shock.
- But ranking of responses is different.

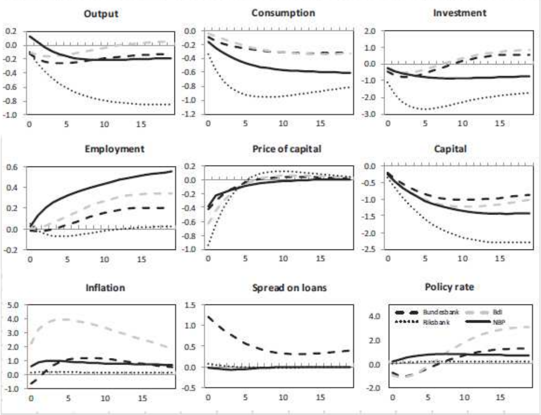
Conclusions

- The complexity of the economic environment is beyond what individual researchers can handle (Bullard).
- Pretending that one simple model can provide guideline for policy is silly.
- A horizontal comparison of models can give a better range of outcomes than robustness analysis of a single one.
- All our models show how GE channels can exert a large influence on the spillover effects of capital shortfalls through the response of asset prices.
- Alternative sectors and sources of financing can lead to large differences in results.

Related Literature

Gerke,Jonsson,Kliem,Kolasa,Lafourcade,Locarno,Makarski,McAdam.
Assessing macro-financial linkages: A model comparison exercise

Figure 5: Responses to a "Valuation Shock" in ESCB models with financial frictions



Note: This figure shows the impulse responses of selected variables to the depreciation rate of capital. All responses are reported as percentage deviations from the non-stochastic steady, except inflation and