

Appropriate Macroeconomic Policy for Complex Economies

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The Great Recession and the Current Policy Debate

● **Banking crises:**

- huge bail-out costs
- credit crunch and the financial accelerator reduce aggregate demand and output
- higher public deficits and possible sovereign debt crises

● **Fiscal discipline and austerity rules:**

- very fashion in almost in every country (e.g. fiscal compact)
- the myth of expansionary austerity (Alesina and Ardagna, 2009)
- excel-driven thresholds in debt/GDP ratio (Reinhard and Rogoff, 2010)
- empirical estimation of fiscal multipliers (e.g. Blanchard and Leigh, IMF 2013)
- serious fallacy of composition (family vs. state)

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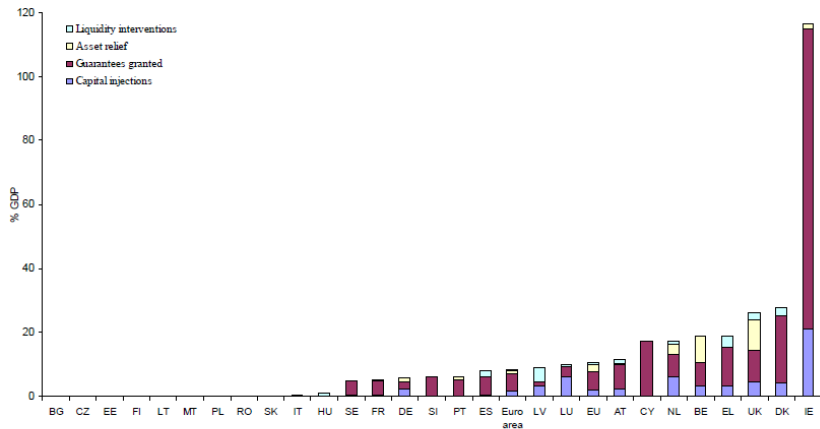
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Banking Crises and Bail-Out Costs

Graph IV.2.1: EU public interventions in the banking sector as of 31/10/2010 (in % of GDP)



Source: the EFC questionnaire (based on data from 31/12/2009), and updates up to 31/10/2010.

Fiscal Effects of Banking Crises

Figure : Evolution of fiscal aggregates, change in variables as % of GDP, Baldacci et al. (2009)

	Before Crisis ($t-2$; $t-1$)	During Crisis (t)	After Crisis ($t+1$; $t+2$)
Debt	-9.2	27.1	-7.2
Budget balance	-0.1	-5.9	1.5
Primary budget balance	0.3	-4.9	2.8
Total revenues	0.8	-3.7	4.9
Total expenditures	0.9	2.3	2.6

Source: Author's calculations based on data from WEO and GFS.

Fiscal Rules

Figure : Fiscal rules with escape clauses, Schaechter et al. (2012)

Country and Date	Natural disaster	Economic recession	Banking system bailout, guarantee schemes	Change in Government	Change in budget coverage	Other events outside govt. control	Voting mechanism defined	Transition path defined
Brazil (since 2000)	X	X	-	-	-	-	X	-
Colombia (since 2011)	-	X	-	-	-	X	-	-
Germany (since 2010)	X	X	-	-	-	X	X	X
Jamaica (since 2010)	X	X	-	-	-	X	-	-
Mauritius (since 2008)	X	X	-	-	-	X	-	-
Mexico (since 2006)	-	X	-	-	-	-	-	-
Panama (since 2008)	X	X	-	-	-	X	-	X
Peru (since 2000)	X	X	-	-	-	X	-	X
Romania (since 2010)	-	X	-	X	X	X	-	X
Slovakia (since 2012)	X	X	X	-	-	X	-	-
Spain (since 2002)	X	X	-	-	-	X	X	X
Switzerland (since 2003)	X	X	-	-	-	X	X	X
EU member states/ euro area (since 2005)	-	X	-	-	-	-	-	X
WAEMU (since 2000)	-	X	-	-	-	-	-	-

Source: National authorities; and IMF staff assessment.

What Do We Do Here?

Extend the Keynes+Schumpeter (K+S) Model (Dosi et al., 2010, 2013, JEDC) introducing **heterogeneous banks**:

- role of credit in generating business cycles and crises, and in affecting long-run growth trajectories
- endogenously and costly banking crises
- interactions between fiscal and macro-prudential policies
- constraining Government's ability to create deficits

Our Contribution to the Current Policy Debate

- **Credit and fiscal policy effectiveness:**

- both depend on the income distribution i.e. firms' dependence on external finance vs. aggregate demand
- banks' behavior to avoid failure can lead to credit crunch episodes

- **Self-defeating effects of austerity rules:**

- fiscal rules harm GDP growth, increase volatility and unemployment and may lead to debt crises
- the effect is even stronger when combined with high levels of inequality

Related Literature

● Empirical literature

- wide differences in direct fiscal costs of bank crises and recovery rates (Laeven and Valencia 2008, 2010; Reinhart and Rogoff 2009; IMF 2009)
- impact of supply-side financial shocks on firms' investment (Amiti and Weinstein 2013)
- non-linear relation between fiscal policy and credit regimes (Ferraresi, Roventini and Fagiolo, 2013)

● Standard DSGE macro models

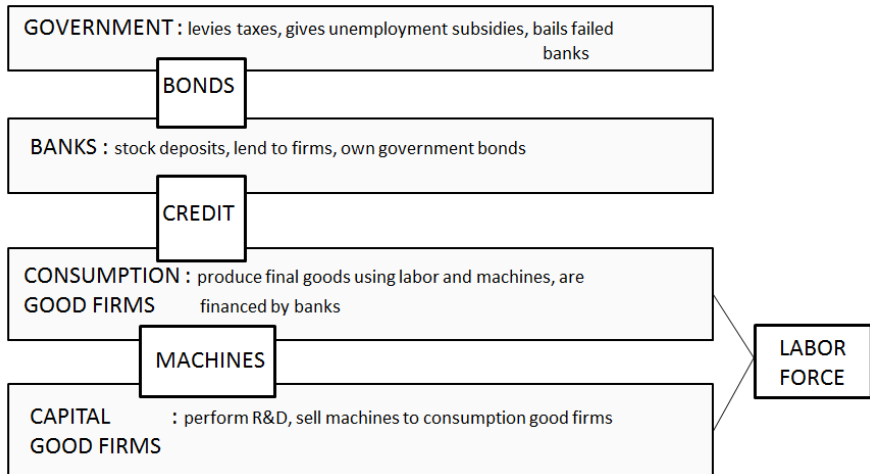
- difficulty to account for bank bailouts and economic crises (Gertler and Kiyotaki 2010)

● Agent-based computational economics

- propagation of bank failures in a network (Cincotti et al. (EURACE); Delli Gatti, Gallegati and co-authors; Ashraf, Gershman and Howitt 2011, Lengnick et al 2012)

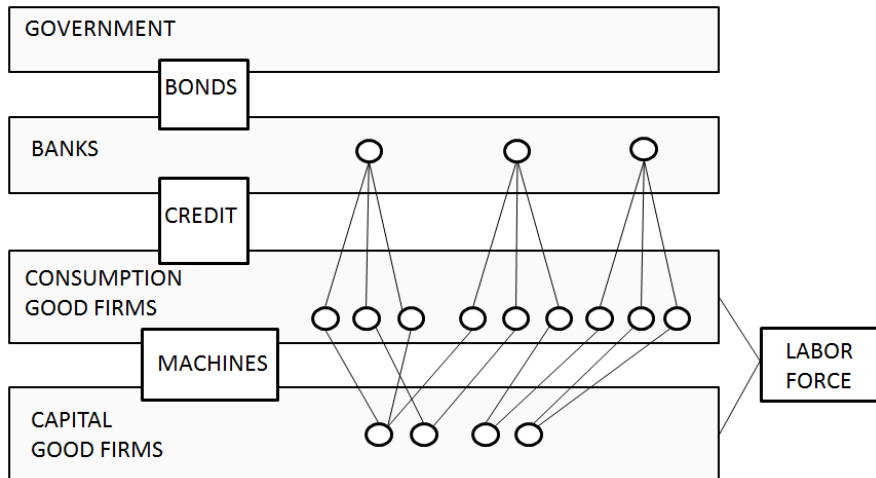
Model Structure I

Close antecedents: Dosi et al. (2010, 2013), JEDC



Model Structure II

Close antecedents: Dosi et al. (2010, 2013), JEDC



The Sequence of Microeconomic Decisions

- 1 Banks fix the maximum credit supply
- 2 Capital-good firms perform R&D
- 3 Consumption-good firms decide how much to produce and invest
- 4 Firms ask for credit if needed, machines are paid
- 5 Production begins, firms hire workers
- 6 The consumption-good market opens
- 7 Firms repay their debt, bank profits and equity are computed accordingly
- 8 Entry and exit
- 9 Machines are delivered to consumption-good firms

The Banking Sector - Credit Links

- Fixed number of banks
- Banks are heterogeneous in their number of clients (random draw of an integer from a Pareto distribution)
- Each consumption-good firm has only one bank
- Credit links are set at the initialization step and kept fixed over the simulation

The Banking Sector - Credit Demand

- **Source of firms' credit demand**
 - desired production and investment in new capacity depending on adaptive demand expectations (animal spirits)
 - replacement investment depending on technical change and pay-back period routines
- **Maximum credit demand is constrained by loan-to-value ratio**

The Banking Sector - Deposits and Credit Supply

- Bank gathers deposits (stock of liquid assets of firms) and provides credit to consumption-good firms
- **Basel capital adequacy (τ_b)**: maximum credit supply of banks ($TC_{k,t}$) is a multiple of their equity ($NW_{k,t-1}^b$)
- **Endogenous capital buffer**: credit supply is reduced if the bank is fragile

$$TC_{k,t} = \frac{NW_{k,t-1}^b}{\tau_b * (1 + \beta BDratio_{k,t-1})}$$

- Bank net worth is:

$$NW_{k,t}^b = Loans_{k,t} + Cash_{k,t} + GovBonds_{k,t} - Deposits_{k,t}$$

The Banking Sector - Credit Allocation

- Credit is allocated to firms on a pecking-order base
- Pecking order depends on the ratio between firm net worth and sales

$$NW_{j,t-1}/S_{j,t-1}$$

- Credit rationing may arise
- Heterogeneous risk premium (credit classes)

$$r_{deb,j}(t) = r_{deb,t} (1 + (q - 1) * k_{const})$$

r_{deb} base loan rate; q credit class of firm j , k_{const} scaling parameter.

Firm Failure and Entry Rules

● Firm exit

- firms fail if their market share fall to zero or if their stock of liquid assets becomes negative
- in that case, firms exit and default on their loans.

● Firm entry

- in both sectors, entrants replace the exiting firms
- entrants are smaller than incumbents: net worth is a fraction of the average value in the sector

Bank Failures

● Bank failure:

- firm default has a negative effect on banks' profit:

$$\pi_{k,t}^b = \sum_{cl=1}^{Cl_k} r_{deb,cl,t} L_{cl,t} + r_{res,t} Cash_{k,t} + r_{B,t} Bonds_{k,t} - r_D Dep_{k,t} - BD_{k,t}$$

L: Loans; *Cash*: Reserves; *Dep*: Deposits; *BD*: Bad debt

- banks fail whenever their net worth becomes negative
- ## ● Full bail-out rule
- the Government always steps in and save the failing bank
 - bank bail-out has a negative impact on public budget

Public Deficit and Fiscal Rules

- The public deficit in each period is:

$$Def_t = BankBailout_t - Tax_t + G_t + r_{B,t}Debt_t$$

- Public deficit is financed by bonds bought by banks

- **Fiscal Rules:**

- 1) constant tax and unemployment-subsidy rate (baseline)
- 2) fiscal rule (e.g. balance-budget) w. or w.o. escape clause

$$Def_t \leq def_{rule} * GDP_{t-1}$$

- 3) counter-cyclical (Keynesian) fiscal policy (φ subsidy rate)

$$\varphi_t = \varphi_{low}, \text{ if } U_t \leq U_{threshold};$$

$$\varphi_t = \varphi_{high}, \text{ if } U_t > U_{threshold};$$

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Labor Market and Central Bank

● Wage equation

- the wage is updated according to the inflation target, the inflation gap, changes in productivity and unemployment

$$\frac{\Delta w(t)}{w(t-1)} = \pi_{target} + \psi_1 * (\pi_t - \pi_{target}) + \psi_2 * \frac{\Delta \overline{AB}(t)}{\overline{AB}(t-1)} - \psi_3 * \frac{\Delta U(t)}{U(t-1)}$$

● Central bank

- Taylor rule on the inflation gap:

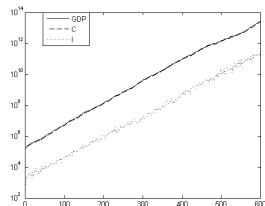
$$r_t = r_{target} + \gamma_\pi * (\pi_t - \pi_{target}), \quad \gamma_\pi > 1$$

- all the other interest rates are defined in each period based on r_t

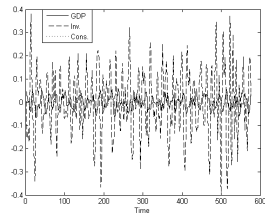
Macroeconomic Stylized Facts

- (1) Self-sustained growth with endogenous business cycles
- (2) Distribution of economic crises duration follows an exponential (Ausloos et al, 2004)
- (3) Investment more volatile than GDP; consumption less volatile than GDP
- (4) BP-filtered cross-correlation with output:
 - *Procyclical*: consumption, net investment, productivity, inflation;
 - *Countercyclical*: prices and mark-ups, unemployment

Log series of GDP, C and I



Bandpassed filtered GDP

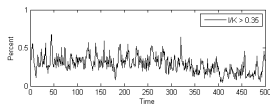
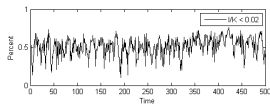


Microeconomic Stylized Facts

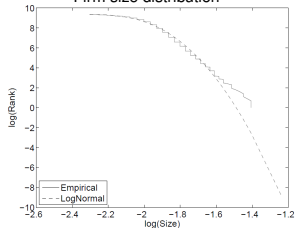
Dosi, 2007

- (1) Productivity dispersion among firms is large
- (2) Persistency in productivity differential among firms
- (3) Firm size distributions are right-skewed
- (4) Fat-tailed firm growth-rate distributions
- (5) Investment rates are lumpy (Gourio & Kayshap, 2007)

Investment spikes



Firm size distribution

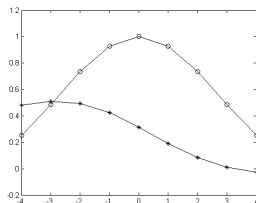


Bank-related Stylized Facts

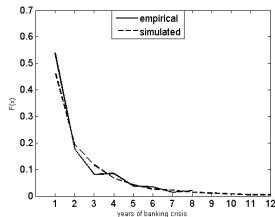
Bikker and Metzmakers, 2005

- (1) Firm debt, credit supply, bank profits and bank equity are procyclical
- (2) Credit characterized by a boom-bust cycle (Shlaeck et al 2009; Mendoza and Terrones, 2012)
- (3) Distribution of fiscal costs of banking crises is fat-tailed (Laeven and Valencia, 2008)
- (4) Distribution of duration of banking crises is fat-tailed (Reinhart and Rogoff, 2009)

Debt dynamics



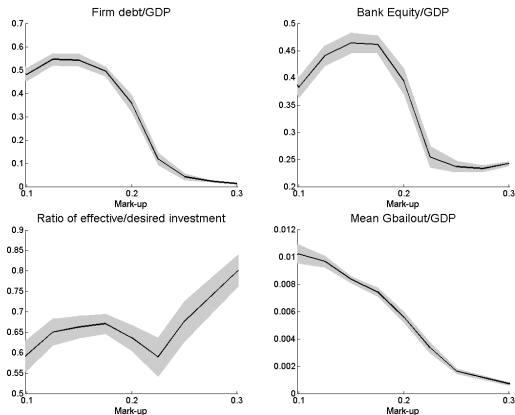
Duration of banking crises



Policy Experiments

- 1 **Experiment on (functional) income distribution**
⇒ impacts on firms' ability to self-finance and the size of banking sector
- 2 **Fiscal policy:** interaction between mark-up and fiscal policies
⇒ fiscal austerity vs. counter-cyclical rules
- 3 **Quantitative easing**
- 4 **Credit policy:** interaction between capital adequacy parameter and bank behavior
⇒ lending channel of monetary policy

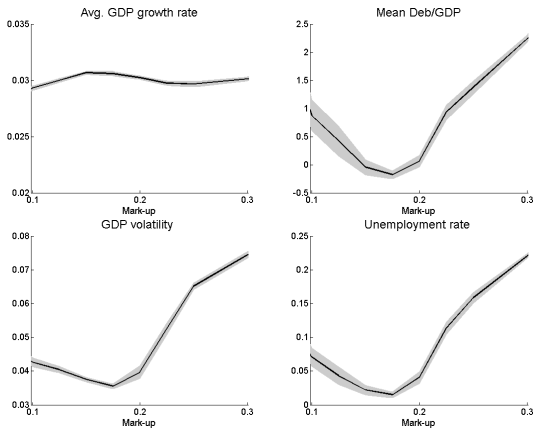
1. Income Distribution and the Banking Sector



The lower the mark-up rate:

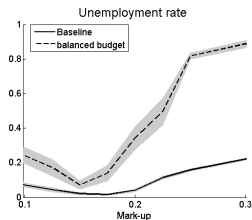
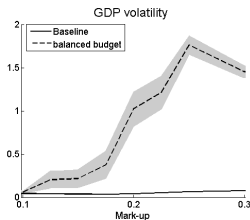
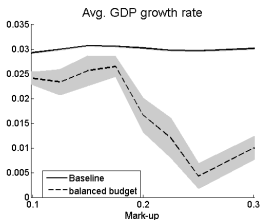
- the more credit constrains firms' real decisions
- the larger the banks and the higher bank bail-out costs

1. Income Distribution and the Real Sector



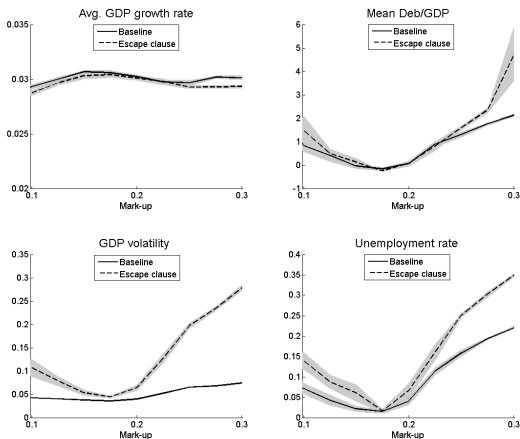
higher mark-ups lead to higher economic instability, unemployment and worsen the state of public finance (via aggregate demand)

2a. Balance-Budget Fiscal Rule



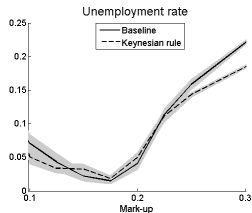
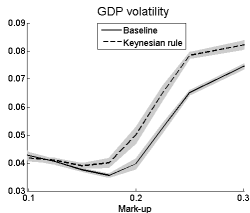
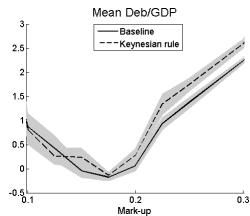
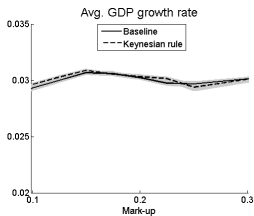
- under balance-budget-rules, long-run growth is lower and business cycle fluctuations are wilder, unemployment is higher
- interactions between inequality and fiscal rules: the higher the level of income inequality, the stronger the negative effects of the balance-budget rule
- **austerity policies are self-defeating**

2b. Balance-Budget Fiscal Rule with Escape Clause



- with escape clause, long-run growth is not affected but output volatility and unemployment are still higher
- expansionary fiscal policy still needed to tackle economic downturns

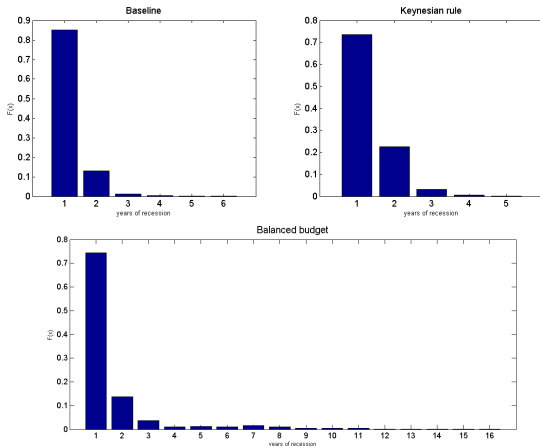
2c. Counter-Cyclical (Keynesian) Fiscal Rule



when income distribution is more skewed toward profits, slightly higher volatility and debt/GDP ratio, but lower unemployment rate

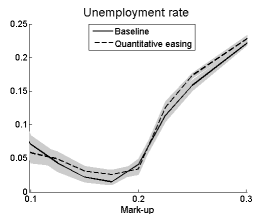
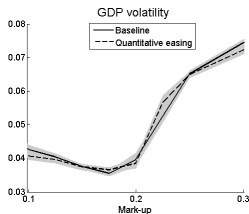
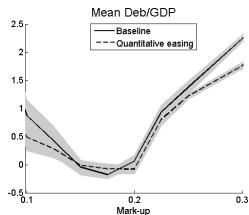
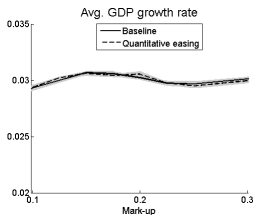
Fiscal policy and duration of recessions

mark-up=20%



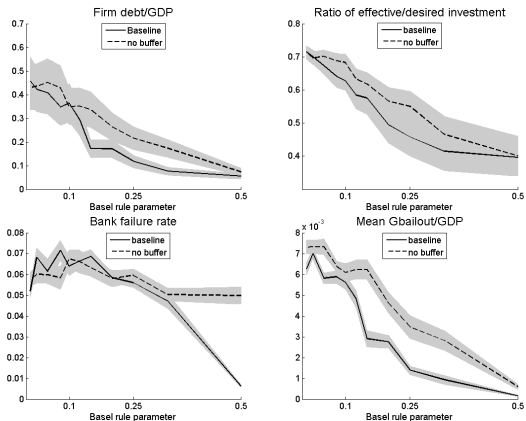
balance-budget rule considerable increase the length of recessions

4. Quantitative Easing ($r_B = 0.01$)



quantitative easing improves debt/GDP ratio but doesn't affect the performance of the economy

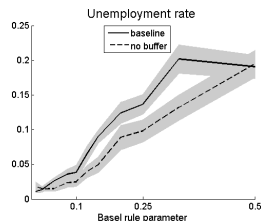
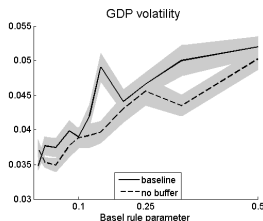
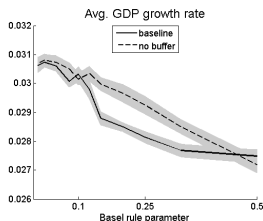
5. Credit Policy and the Banking Sector



When banks follow a capital-buffer adjustment rule:

- firms are more credit rationed (higher probability of credit crunch)
- banks are smaller → lower bank failures and smaller bank bail-out costs

5. Credit Policy and the Real Sector



Banks' behavior may endogenously lead to credit crunch episodes which binds the economy

- lower economic growth, higher volatility and unemployment
- higher public debt

Summing up...

- **We extend the K+s model introducing heterogenous banks**
- **We test the effect of fiscal and monetary policies under different inequality and credit-supply scenarios**
- **Main results:**
 - inequality affects the performance of the economy and the effects of fiscal policy
 - austerity policies by worsening the performance of the economy are self-defeating
 - quantitative easing does not affect the the performance of the economy
 - banks' behaviour can increase the likelihood of credit crunch episodes

Future Works

- 1 Testing further types of fiscal rules
- 2 Studying the possible interactions between different monetary and fiscal policies
- 3 Further exploration of firms and banks interactions
- 4 Deeper study on the impact of the banking sector structure on bail-out costs and more generally on macroeconomic performance