# Making the European Banking Union Macro-Economically Resilient: Cost of Non-Europe Report

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# Outline

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# Introduction

What are the macroeconomic costs for the euro area of a shock to the financial sector?

Does the european banking union resolution pillar help?

Are there other options?

Regulatory environment:

- Banking Union: 8% bail-in before Single Resolution Fund (EUR 55 bn) & ESM (EUR 60 bn) can step in
- Basel III: 4.5% final stage capital requirement

# Result overview

1. Banking Union framework with a EUR 55 bn Single Resolution Fund can not prevent a two year recession in the euro area.
2. Size of the SRF has limited impact on macroeconomy. Recession could still not be averted
3. Higher capital requirements (~9%) can buffer most of the recessionary effects. The economy is more resilient to financial shocks.
4. Higher capital requirements come at a modest cost to the real economy.

# Outline

# Model foundations

Important prior works:

- Richard M. Goodwin (1967). A growth cycle. *Socialism, capitalism and economic growth*, 5458.
- Steve Keen (1995). Finance and Economic Breakdown: Modeling Minsky's "Financial Instability Hypothesis". *Journal of Post Keynesian Economics*, M.E. Sharpe, Inc., vol. 17(4), pages 607-635, July.
- Wynne Godley and Marc Lavoie (2007). *Monetary Economics*. Palgrave MacMillan

# Model assumptions

Model is based on

- holistic representation (aggregate agents or classes)
- macro-behavioural assumptions
- disequilibrium
- frictions

Model is NOT based on

- representative agents (micro foundations)
- rational expectations
- maximization of profit/utility/objective
- Nash equilibrium
- perfect market clearing
- agent-based representation

# Stock-Flow Consistency

A general fundamental requirement is SFC:

- based on National Accounting standards (Copeland's flow of fund analysis)
- guarantees integration of all flows and stocks in an economy (real and nominal)
- presented in Tobin's Nobel lecture (1981) for the several advantages:
  - modelling short-run changes
  - tracking exchanges of assets
  - multiple assets (returns)
  - modelling monetary policies and operation (credit money)
- sufficiently general to include various techniques of modelling (DSGE included)

# The Goodwin (1967) model

Production is at constant utilization rate:

$$Y_t = \min\left\{\frac{K_t}{\nu}, a_t L_t\right\} = \frac{K_t}{\nu} = a_t L_t$$

Wages are consumed, Profits reinvested

$$\dot{K} = I_t - \delta K_t = (Y_t - w_t L_t) - \delta K_t$$

Wages are negotiated according to employment rate

$$\frac{\dot{w}}{w} = \Phi(\lambda)$$

Productivity and population grow exponentially

$$\frac{\dot{a}}{a} = \alpha \quad , \quad \frac{\dot{N}}{N} = \beta$$

# Reduced form (Goodwin, 1967)

The wage share:

$$\omega_t = \frac{w_t L_t}{Y_t} = \frac{W_t}{Y_t}$$

The employment rate:

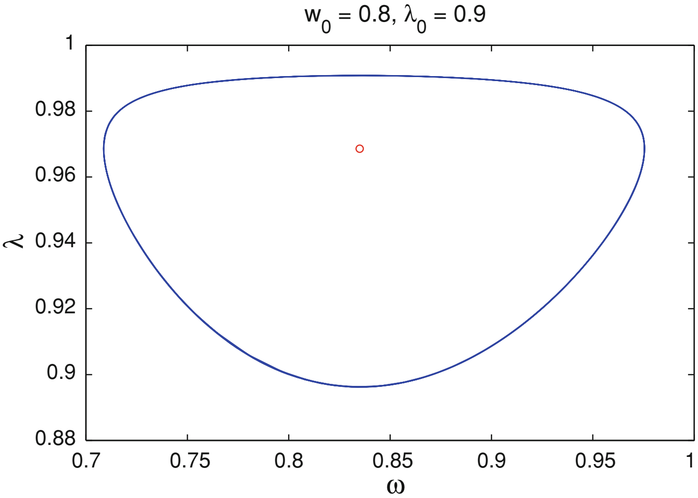
$$\lambda_t = \frac{L_t}{N_t}$$

We have an autonomous ordinary differential system

$$\frac{\dot{\omega}}{\omega} = \Phi(\lambda) - \alpha$$
$$\frac{\dot{\lambda}}{\lambda} = \frac{1-\omega}{\nu} - \alpha - \beta - \delta$$

This is a Lotka-Volterra (predator-prey) system: employment preys on profits.

# Lotka-Volterra dynamics (Goodwin, 1967)



# Stock-flow matrix (Goodwin, 1967)

| | Households | Firms | | Sum |
|---|---|---|---|---|
| **Balance Sheet** | | | | |
| Capital stock | $S_h(=0)$ | $+K$ | | $+K$ |
| **Transactions** | | current | capital | |
| Consumption | $-C$ | $+C$ | | 0 |
| Investment | | $+I$ | $-I$ | 0 |
| Accounting memo [GDP] | | $[Y]$ | | |
| Wages | $+W$ | $-W$ | | 0 |
| Financial Balances | $S$ | $\Pi$ | $-I$ | 0 |
| **Flow of Funds** | | | | |
| Change in Capital Stock | | $+I$ | | $+I$ |
| Column sum | $S_h(=0)$ | $\Pi$ | | $I$ |
| Change in net worth | $\dot{S}_h = 0$ | $\dot{K}(+\delta K) = \Pi$ | | $\dot{X}$ |

# Addition of credit (Keen, 1995)

Keen (1995) adds the possibility for relaxed investment:

$$I_t = \kappa(\pi_t)Y_t \neq \Pi_t \quad , \quad \text{with } \pi_t = \Pi_t / Y_t$$

financed by extra credit:

$$\dot{D} = I_t - \Pi_t$$

on which interest, $r$, is paid:

$$\Pi_t = Y_t - w_t L_t - rD_t$$

# Reduced system (Keen, 1995)

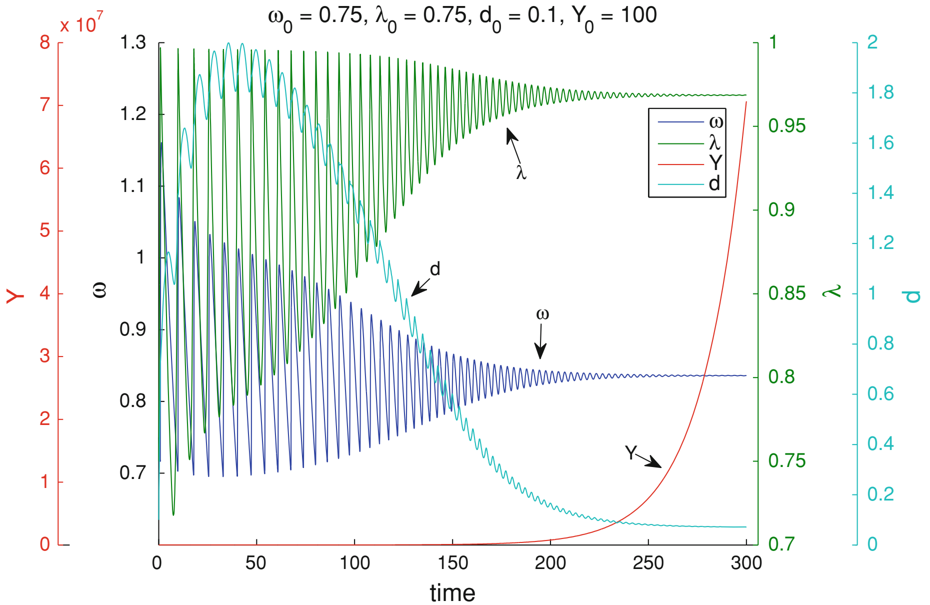
We denote $d = D/Y$ and obtain the ODS:

$$\dot{\omega} = \omega\left(\Phi(\lambda) - \alpha\right)$$
$$\dot{\lambda} = \lambda\left(\frac{\kappa(1-\omega-rd)}{\nu} - \delta - \alpha - \beta\right)$$
$$\dot{d} = \kappa(1-\omega-rd) - (1-\omega-rd) - d\left(\frac{\kappa(1-\omega-rd)}{\nu} - \delta\right)$$

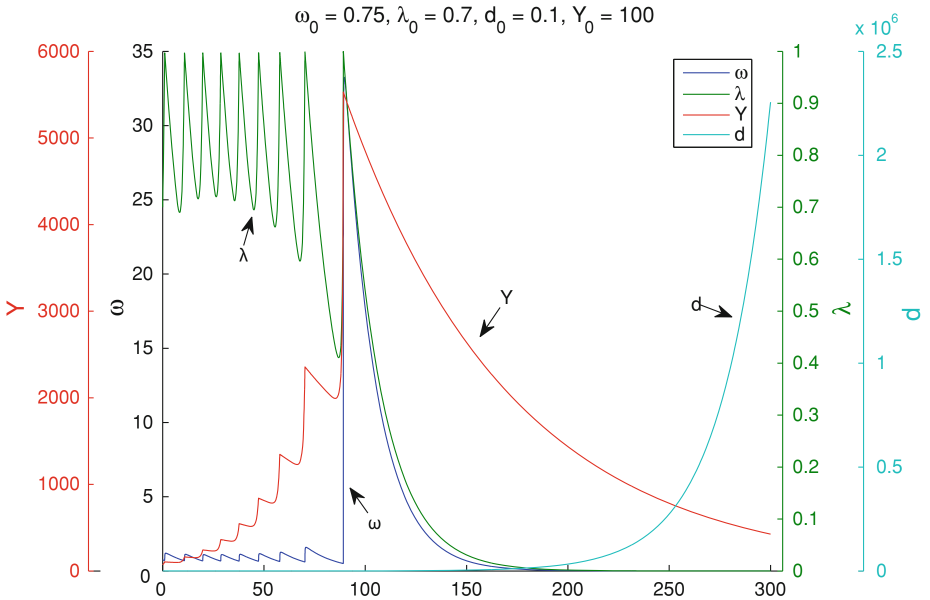
Credit allows for countercyclical dampening of cycles, euphoria to optimism (bubble), credit charges to crisis:

- a locally stable equilibrium with natural growth rate $\alpha + \beta$
- a locally stable singular state $(0, 0, +\infty)$ preceded by high growth

# Good equilibrium with finite debt (Keen, 1995)



# Bad equilibrium with infinite debt (Keen, 1995)



# Criticism of Goodwin (1967), Keen (1995)

- unrealistic long term variations/values of variables (e.g. wage share greater than one)
- no standard calibration method
- chaotic behavior
- simple and stylized

# Model Extensions used for our model

Inventories, sales expectations and variable capacity utilisation (Grasselli and Nguyen-Huu, 2014)

Endogenous, non-neutral money (Keen, 2013)

# Our Model Extensions

Non-linear and non-Gaussian estimation of investment, consumption and wage functions (Voudouris et al., 2012)

Our contributions:

- private debt for firms *and* households and government
- interest rate dynamics for all borrowers
- credit crunch and fiscal consolidation regime
- *estimated* on Euro Area data
- policy analysis

# Model extensions

Inventories as in Grasselli and Nguyen-Huu (2014)

$$\dot{V} = Y - Y_d = u\frac{K}{\nu} - (C + I_k + (X - IM)) \quad , \quad u = \frac{Y}{Y_{max}}$$

Modified price and wage dynamics from Goodwin (1967), Keen (1995)

Employment rate:

$$\frac{\dot{\lambda}}{\lambda} = \gamma\frac{\dot{Y}}{Y} - \alpha - \beta$$

Inflation:

$$\frac{\dot{p}}{p} = -\beta_1\left[1 - m\frac{c}{p}\right] - \beta_2\frac{\dot{Y}}{Y}$$

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supply: $Y$, capital stock: $K$, capital-to-output ratio: $\nu$, capacity utilisation: $u$, maximum production: $Y_{max}$, depreciation: $\delta$, real capital investment: $I_k$, change in inventories: $\dot{V}$, demand $Y_d$, trade balance: $X - IM$, price level: $p$, unit cost: $c$, productivity growth: $\alpha$, population growth: $\beta$, employment: $\lambda$, parameters: $\gamma, m, \beta_1, \beta_2$

# Characteristic functions: non-linear, non-Gaussian estimation

Investment:

$$\frac{\dot{I}_k}{I_k} = \kappa(\pi_{ef}) \text{ with } \pi_{ef} = \frac{p(Y - W + G_f - T_f) + r_B \tau_f B - r D_f}{pY}$$

Consumption:

$$\frac{\dot{C}}{C} = \varphi\left(\frac{W}{Y}\right)$$

Real wage per person:

$$\frac{\dot{w}_r}{w_r} = \Phi(\lambda)$$

Estimated as polynomials up to 4th degree, with non-gaussian error distributions, using GAMLSS (Voudouris et al., 2012).

expected firm profit share: $\pi_{ef}$, employment: $\lambda$, wages: $W$, taxes: $T_f$, subsidies: $G_f$, gov. bond interest income: $r_B \tau_f B$, firm debt interest payment: $r D_f$

# Banking Sector is connected to all agents in economy

Bank constraints and freedoms:

- set the interest rate, $r$, to the economy
- face reserve requirements, $\zeta = \frac{1}{f+v(1-f)} \simeq 12.6$
- and Basel III capital requirements, $\frac{E_b}{E_b+M+L_b} > 4.5\%$

Bank Balance Sheet:

$$E_b + M_h + M_f + L_b = X_b + L_h + L_f + \tau_b B$$

Equity evolves according to:

$$\dot{E_b} = p(\Pi_b - \text{Div}_b),$$

and bank debt:

$$\dot{L_b} = \frac{\dot{L_h} + \dot{L_f} + \dot{B}}{\zeta} + \dot{B} - p(X - IM).$$

bank net worth: $X_b$, household loans: $L_h$, firm loans: $L_f$, fraction of money converted into fiduciary money: $f$ ($\sim 7\%$), and the reserve requirement : $v$ (1% in the Euro zone since January, 18, 2012)

# Setting the interest rate

Cash flows (excl. government payments):

$$r(D_h + D_f) + \tau_b r_B B = E_b \times ROE + r_b L_b$$

Taylor rule with inflation target, $inft \leq 2\%$

$$\dot{r_b} = \frac{3}{2}\frac{\dot{p}}{p} - inft \text{ and } r_b \geq 0.05\% \text{ lower bound}$$

Government interest rate is increasing function of debt to $GDP_n$ ratio, $b = \frac{B}{GDP_n}$ (Dell'Erba et al., 2013):

$$\dot{r_B} = \dot{b}/40 + \dot{r_b}^1$$

Bank dividends:

$$\text{Div}_b = E_b \times ROE$$

[1] A 1% point increase in the debt to $GDP_n$ ratio leads to a 0.025% point yield increase.

# Interest rate $r$ decreases with higher bank capitalisation

Banks set $r$ based on effective return on equity, $ROE^e$, which increases with the equity shortfall versus the target level defined by $e_{target}$:

$$ROE^e = \frac{e_{target}}{\frac{E_b}{E_b+L_b+M}} ROE,$$

and the effective equity, being at least the required level of equity:

$$E_b^e = \max\left\{E_b, e_{target}(E_b + L_b + M)\right\}.$$

banks set the interest rate, $r$, according to debt levels, central bank rates, government debt yields and their own balance sheet:

$$r(D_h + D_f) + \tau_b r_B B = \frac{e_{target}}{\frac{E_b}{E_b+L_b+M}} ROE \times \max\left\{E_b, e_{target}(E_b + L_b + M)\right\} + r_b L_b$$

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# Scenarios for the shock and policy options

1. No Shock:
   baseline scenario calibrated to fit the European Commission (EC) forecast
2. Shock:
   shock to banking sector & EUR 55 bn Single Resolution Fund (SRF) already in place (anticipating the 2023 Banking Union)
3. Shock and no SRF
4. Shock and larger SRF (165 bn)
5. Shock and higher $e_{target}$ and lower dividends ($ROE$)
6. No shock and higher $e_{target}$ and lower dividends ($ROE$)

# Shock and fiscal consolidation

Shock to bank assets: $l = \frac{-\dot{A}}{E_b + M + L_b} \Rightarrow$ immediate bailout by SRF and governments $\Rightarrow \nearrow \frac{B}{Y_n} \Rightarrow$ possible fiscal consolidation

Debt financed bailout adds to debt on balance sheet of banks and governments.

# Shock and fiscal consolidation

Taxes:

$$T = \begin{cases} T_h = \Theta_1 W, & \text{Households} \\ T_f = \Theta_2 (Y - W), & \text{Firms} \\ T_b = \Theta_3 Y, & \text{Banks} \\ \frac{\dot{T}}{T} = a_{aust}, & \text{Fiscal consolidation, while } \frac{B}{Y_n} > \text{pre-shock level} \end{cases}$$

Subsidies:

$$G = \begin{cases} G_h = \Gamma_1 W, & \text{Households} \\ G_f = \Gamma_2 Y, & \text{Firms} \\ G_b = \Gamma_3 Y, & \text{Banks} \\ \frac{\dot{G}}{G} = -a_{aust}, & \text{Fiscal consolidation, while } \frac{B}{Y_n} > \text{pre-shock level} \end{cases}$$

# Credit Crunch | no debt financed consumption or investment

Fostel and Geanakoplos (2013), Geanakoplos (2010): sudden increase in leverage ratios ⇒ banks reduce lending

$\frac{D_h}{E_b}$ and $\frac{D_f}{E_b}$ > pre-crisis level ⇒ credit crunch:

$$I_k = \min\left\{ I_k^{t=0} e^{\int_0^t \kappa(\pi_{ef}(s))ds} \quad , \quad (1-\mu)\Pi_{nef}/p \right\}$$
$$C = \min\left\{ C^{t=0} e^{\int_0^t \varphi(\omega(s))ds} \quad , \quad R_h \right\}$$

Shock to bank assets ⇒ equity further away from target ⇒ $\nearrow ROE^e \Rightarrow \nearrow r$

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# Data and Estimation

Eurostat and ECB data for the Euro Area

Estimation of characteristic functions (investment, consumption, wage per person) on time series up to 2012Q4 using GAMLSS procedure Voudouris et al. (2012)

Parameter grid for 20 free parameters and evaluation of fit vs European Commission and Macro-Imbalance Procedure forecast

# Outline

# Mechanisms behind the results

Shock scenario:

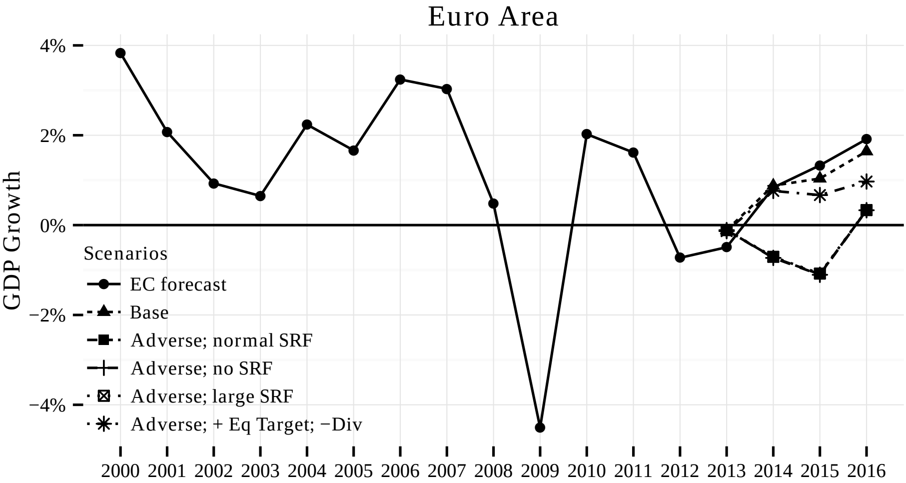
1. Shock hits financial sector
2. Consequences in the model economy:
    - Higher government debt may lead to fiscal consolidation
    - Lower bank equity ratio worsens credit conditions for the real economy
    - Higher leverage ratios may trigger credit crunch for firms and households

Severity and duration of three effects largely depend on private debt levels, degree of debt financing and financial sector capitalisation in the economy.

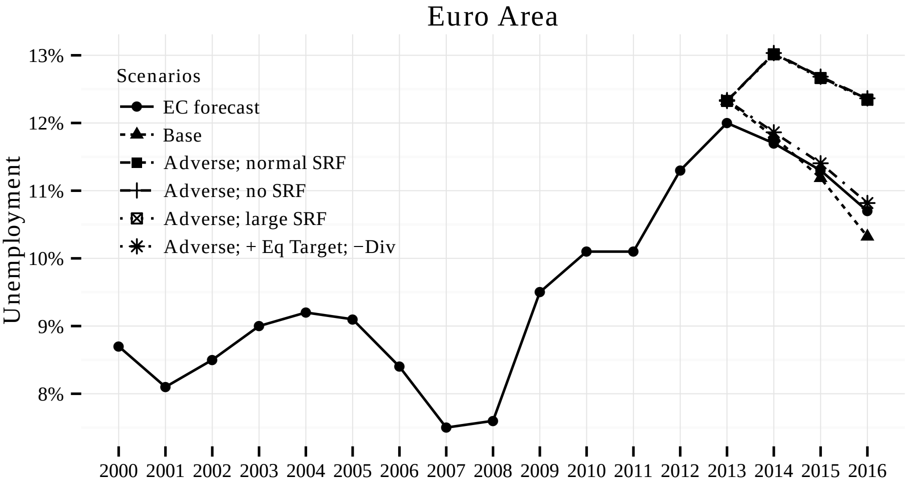
Alternative policy scenario:

1. Higher capital requirements
2. Banks charge higher interest rate, $r$, on the economy
3. Less investment and consumption

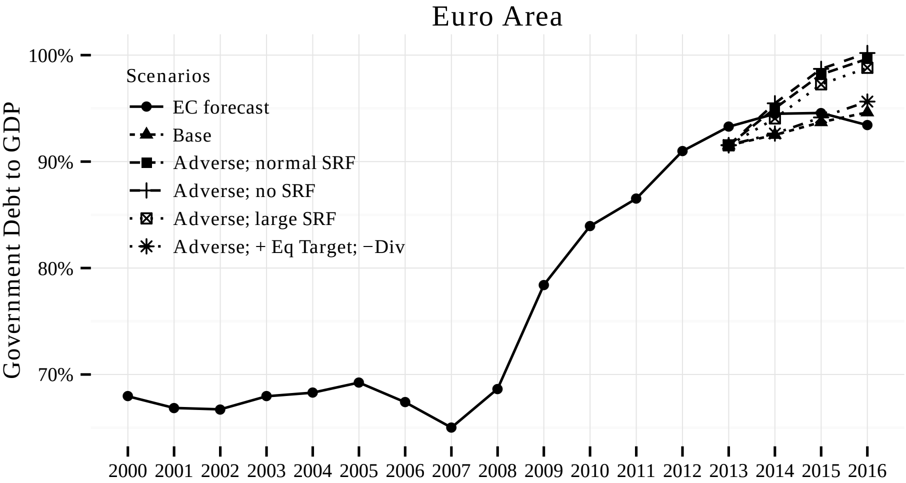
# Shock in 2013Q2 ⇒ 2-yr recession; alternative policy avoids major downturn



# Shock leads to higher unemployment and slower job recovery



# Governments avoid bailout under alternative policy; debt varies with size of SRF



# Private debt in the EMU and scenario forecasts