Debt Stabilization and Business Cycle Stabilization in the EMU: Trade Off or Synergy?

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- This financial stability has to be reached through the control of the ratio Deficit/GDP in the short and in the medium term;
- Financial stability could limit the discretionary power of fiscal policy in smoothing cyclical fluctuations, so to generate a trade-off between debt stabilization and business cylce stabilization.

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  - In the presence of a monetary shock the prevoius results hold;
  - Business Cycle stabilization could be reached in the presence of ex-ante fiscal rules with the aim to stabilize the ratio Debt/GDP.

Outline of presentation

1. A brief literature review;
2. A theoretical model for Fiscal Policy in the EMU;
3. The Equilibrium Dynamics;
4. The Simulation Results;
5. Conclusions

Literature Review

The Cyclical Behavior of Fiscal Policy in the EMU

1. Evidence is not univocal, it covers a very little span (at the most ten years), it does not incorporate strong recessive scenarios;
2. Buti et al. (1997): excessive procyclicality for fiscal policy in EMU countries during and after severe recessions in the period 1961-1996;
3. Melitz (2000): strong evidence of stabilization for the ratio Debt/GDP, but not for public expenditure;
4. Wyplosz (2002): asymmetric behavior in reaction to upswings and to downswings of fiscal policy components among EMU countries;
5. Galì and Perotti (2003): fiscal policy in the EMU has become more countercyclical over time following what appears to be a trend of all the industrialized economies (EMU and non-EMU).

A Currency Union Model for Fiscal Policy in the EMU

4 Steps

1. A New-Keynesian dynamic equilibrium model with sticky prices with an explicit behavioral rule for fiscal policy variables (public expenditure and taxation);
2. Derivation and characterizion of the dynamic equilibrium conditions both for the demand side and the supply side of the economy;
3. Parameter calibration in order to match EMU countries' time series and to have a stable solution for the model;
4. Model simulation and the study of the I.R.F. in the presence of a technology shock and a monetary shock for the prototype member country.

- There are four types of agents:
  - *households*: identical, will live forever and have identical preferences defined over consumption, labor inputs and public goods;
  - *firms*: a continuum of firms, each one produces a differentiated good;
  - *government*: follows a *feedback on debt* rule for public expenditure and uses a distortionary taxation;
  - *monetary authority*: setting the nominal interest rate by following a Taylor-type interest-rate rule;
  - *markets*: complete across the Union for the financial assets and consumption goods.
- Frictions:
  - monopolistic competition in the market of goods;
  - sticky prices à la Calvo.

The Households

Preferences and budget constraint

1. The instantaneous utility function:

$$U^i\left(C_t^i, N_t^i, G_t^i\right) = (1-\lambda)\log C_t^i + \lambda \log G_t^i - \frac{N_t^{i(1+\gamma)}}{(1+\gamma)} \qquad (1)$$

2. The sequence of budget constraints:

$$\begin{aligned}
&\int_0^1 P_t^i(j)\, C_{i,t}^i(j)\, dj + \int_0^1 \int_0^1 P_t^f(j)\, C_{f,t}^i(j)\, djdf + \\
&+E_t Q_{t,t+1}\left(B_{i,t+1}^i + \int_0^1 B_{f,t+1}^i df + V_{i,t+1}^i + \int_0^1 V_{f,t+1}^i df\right) \\
\leq\ & (1-\tau_n)\, W_t^i N_t^i + B_{i,t}^i + \int_0^1 B_{f,t}^i df + V_{i,t}^i + \int_0^1 V_{f,t}^i df
\end{aligned}$$

$$\begin{aligned}
B_{i,t}^i &= 1/m^i\,(1-\vartheta)\, D_{t-1}^i\left[1 + r_{t-1}^*\,(1-\tau_k)\right] \\
V_{i,t}^i &= 1/h^i\,(1-\nu)\left[S_{t-1}^i + \Upsilon_{t-1}^i * (1-\tau_k)\right]
\end{aligned}$$

Interest rate and monetary policy

The Central bank sets the short-term nominal interest rate r_t^* for the currency union as a linear function of the the union-wide current inflation π_t^* and the union-wide output gap:

$$r_t^* = \bar{r}^* + \phi_\pi \left(\pi_t^*\right) + \phi_y \left(y_t^* - \tilde{y}_t^*\right) + \varepsilon_{r_t} \tag{2}$$

The quantity ε_{r_t} is a monetary shock, which follows an omoschedastic white-noise process and $\bar{r}^*$is the steady-state level of long-term real interest rate, that can be derived from the standard Euler equation:

$$\left[\beta \left(1 + \bar{r}^*\right)\right] = 1 \tag{3}$$

$$\bar{r}^* = 1 - \frac{1}{\beta} \tag{4}$$

The Firms

- Each country has a continuum of firms represented by the interval $j \epsilon [0,1]$. Each firm produces a differentiated good with a linear technology:

$$Y_t^i(j) = A_t^i N_t^i(j) \tag{5}$$

where A_t^i is a country-specific aggregate technology index, whose law of motion follows an AR(1) process (in logs):

$$a_t^i = \rho_a a_{t-1}^i + \varepsilon_{at}^i \tag{6}$$

where $\rho_a \{0,1\}$;

- Nominal profits in each period for the representative firm producing the variety (j) are determined by the sale revenues minus the cost of producing the goods, which is the wage bill:

$$\Upsilon_t^i(j) = \left(\frac{Y_t^i(j)}{Y_t^i} \right)^{-\frac{1}{\epsilon}} * P_t^i * Y_t^i(j) - \frac{W_t^i}{A_t^i} Y_t^i(j) \tag{7}$$

The price-setting rule

- Staggered price-setting (Calvo, 1983);
- A number $1-\theta$ of (randomly selected) firms sets new price in each period, θ is an index of stickiness:

$$\Pi_t^{i(1-\epsilon)} = \theta + (1-\theta)\left(\frac{P_t^{iR}}{P_{t-1}^i}\right)^{1-\epsilon} \tag{8}$$

- A firm reoptimizing in period t chooses a price P_t^{iR} that maximizes the current market value of the profits, by solving the following problem:

$$\max_{P_t^{iR}} \sum_{k=0}^{\infty} \theta^k E_t \left\{ Q_{t,t+k}^i \left(P_t^{iR} Y_{t+k|t} - \Psi_{t+k}^i \left(Y_{t+k|t}^i \right) \right) \right\} \tag{9}$$

subject to a sequence of demand constraints;

- Domestic inflation in a loglinear form follows this law of motion:

$$\pi_t^i = \beta E_t \left[\pi_{t+1}^i \right] + \frac{(1-\theta)(1-\beta\theta)}{\theta} \widehat{mc}_t^i \tag{10}$$

The Government

Public expenditure rule

- Government purchases are fully oriented to domestic goods;
- Public expenditures across goods are allocated in order to minimize total cost, yielding a structure of demand schedules analogous to those of private consumption:

$$G_t^i(j) = \left(\frac{P_t^i(j)}{P_t^i} \right)^{-\epsilon} G_t^i \tag{11}$$

- The aggregate level of real public consumption follows this rule:

$$G_t^i = \zeta G_{t-1}^i - \kappa D_{R,t-1}^i \tag{12}$$

where

$$D_{R,t-1}^i = \frac{D_{t-1}^i}{P_{t-1}^i}$$

indicates the real level of public debt

The Government (2)

Related literature about deficit/debt feedback rules

- Muscatelli et. al (2004) provide evidence of how fiscal variables do react to budget deficits for the U.S.A;
- Di Giorgio and Nisticò (2007) develop a stochastic two-country dynamic New Keynesian model, in which they derive the dynamic and cyclical properties of fiscal deficit feedback rules under alternative monetary regimes;
- Bohn (1998) estimates for the U.S. data a positive relationship between the U.S. primary surplus and the Debt/GDP ratio;
- Favero and Giavazzi (2007) conduct a VAR analysis of U.S. fiscal policy in which they include a debt feedback variable;
- Kirsanova and Wren-Lewis (2007) examine the impact of different degrees of fiscal feedback on debt for public expenditure with nominal rigidities where monetary policy is optimal.

The Government (3)

Tax revenues

- Tax revenues are given by the following expression:

$$T_t^i = \tau_n * W_t^i * N_t^i + \tau_k * Y_t^i + \tau_k * r_t^* * D_t^i \qquad (13)$$

- By manipulating the right side of the relationship (13), using the definition of real marginal costs, the next expression that relates tax revenues with the nominal GDP is obtained:

$$T_t^i = \left[\tau_k + (\tau_n - \tau_k) * MC_t^i\right] * P_t^i Y_t^i + \tau_k * r_t^* * D_t^i \qquad (14)$$

- The sign of the member in the square parenthesis is not univocal: it depends on the relationships between labor tax rate and capital tax rate, in the presence of strictly positive real marginal costs;
- Given the real marginal costs, if $\tau_n \geq \tau_k$ the elasticity of tax revenue with respect to nominal output is strictly positive.

The Government (4)

Public Debt

- The law of motion of nominal public debt is described by the following equation:

$$D_{t-1}^{i}\left(1+r_{t}^{*}\right)+P_{t}^{i}G_{t}^{i}-T_{t}^{i}=D_{t}^{i} \tag{15}$$

the stock of public debt in each period is equal to the present value of the past stock of public debt increased by the primary deficit, given by the difference between public expenditures and taxation $\left(P_{t}^{i}G_{t}^{i}-T_{t}^{i}\right)$;

- By solving (15) forward and assuming the no-Ponzi game condition, the following condition for the stock of public debt is obtained:

$$D_{t-1}^{i}=\sum_{j=0}^{\infty}\frac{T_{t+j}-P_{t+j}^{i}G_{t+j}}{\left(R_{t}^{*}\right)^{j+1}} \tag{16}$$

the present value of primary surplus is able to repay the current stock of public debt.

Equilibrium Dynamics

Aggregate Demand Side

- The aggregate domestic output is so defined:

$$Y_t^i = \left[\frac{P_{c,t}^i}{P_t^i} \left(C_t^i \right) + \left(\zeta G_{t-1}^i - \kappa D_{R,t-1}^i \right) \right] \tag{17}$$

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- Domestic output is positively related to domestic consumption according to the ratio $\frac{P_{c,t}^i}{P_t^i}$, that indicates the terms of trade between each country and the currency union, is positively related to the lagged real public expenditure and is decreasing in the lagged real stock of public debt;

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- The negative relationship between domestic output and the lagged real stock of public debt represents the amount of resources withdrawn from public consumption in order to reduce the lack of balance in public accounts.

Calibration

Calibration for general parameters

- The values calibrated for the labor supply elasticity $(\gamma = 3)$, for the elasticity of substitution between differentiated goods $(\epsilon = 6)$, for the degree of stickiness of prices $(\theta = 0.75)$, for the average share of public consumption $(\lambda = 0.25)$ for EMU countries, for the subjective discount factor $(\beta = 0.99)$, for the steady state value for interest rate $(\bar{r} = 0.04)$, for the persistence coefficient of total labor productivity $(\rho = 0.95)$ ensure a stable solution to the model and are in line with Galì and Monacelli's (2007) findings and with the real business cycle literature (King and Rebelo (1999));
- The index of openess with respect to EMU countries $(\alpha = 0.4)$, the share of domestic debt held by domestic households $((1 - \vartheta) = 0.44)$ and the fraction of domestic firms held by the residents $((1 - \nu) = 0.50)$ are set to a value able to match statistical data about Euro-area balance of payments (source: IMF statistical data (sample 1995-2005));

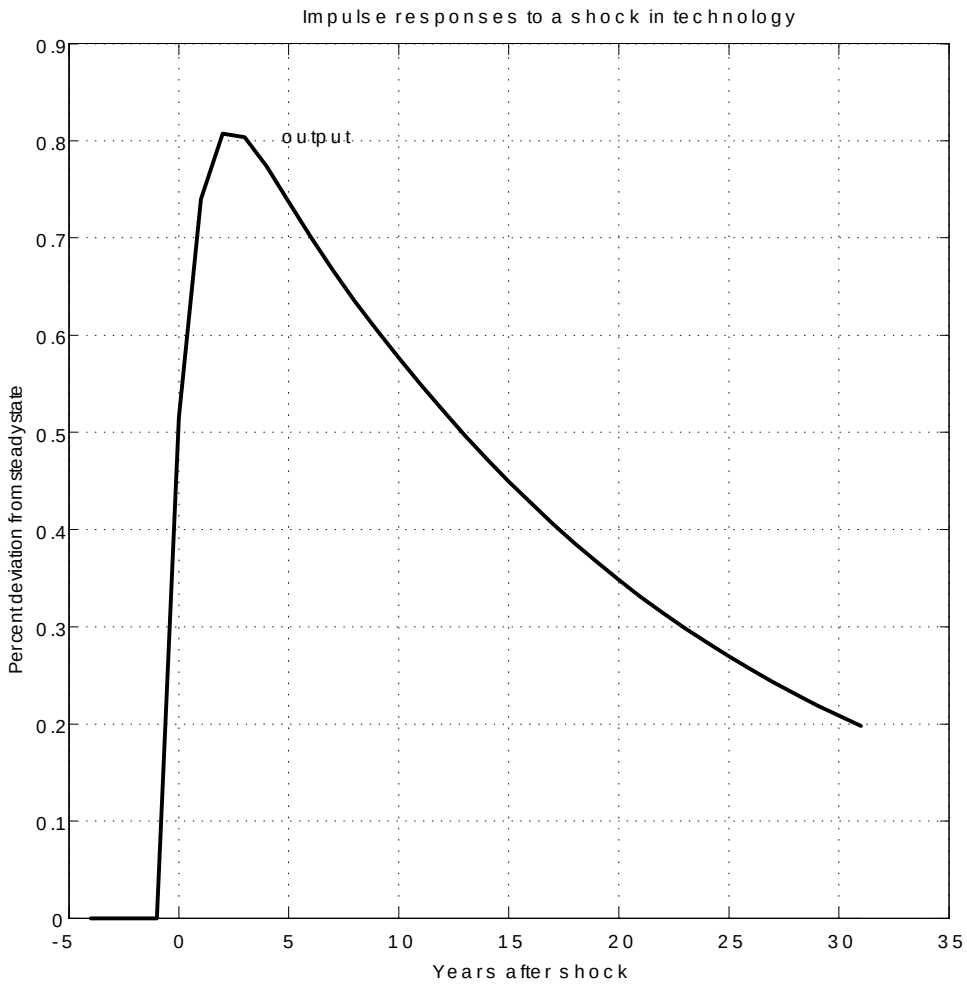
Calibration

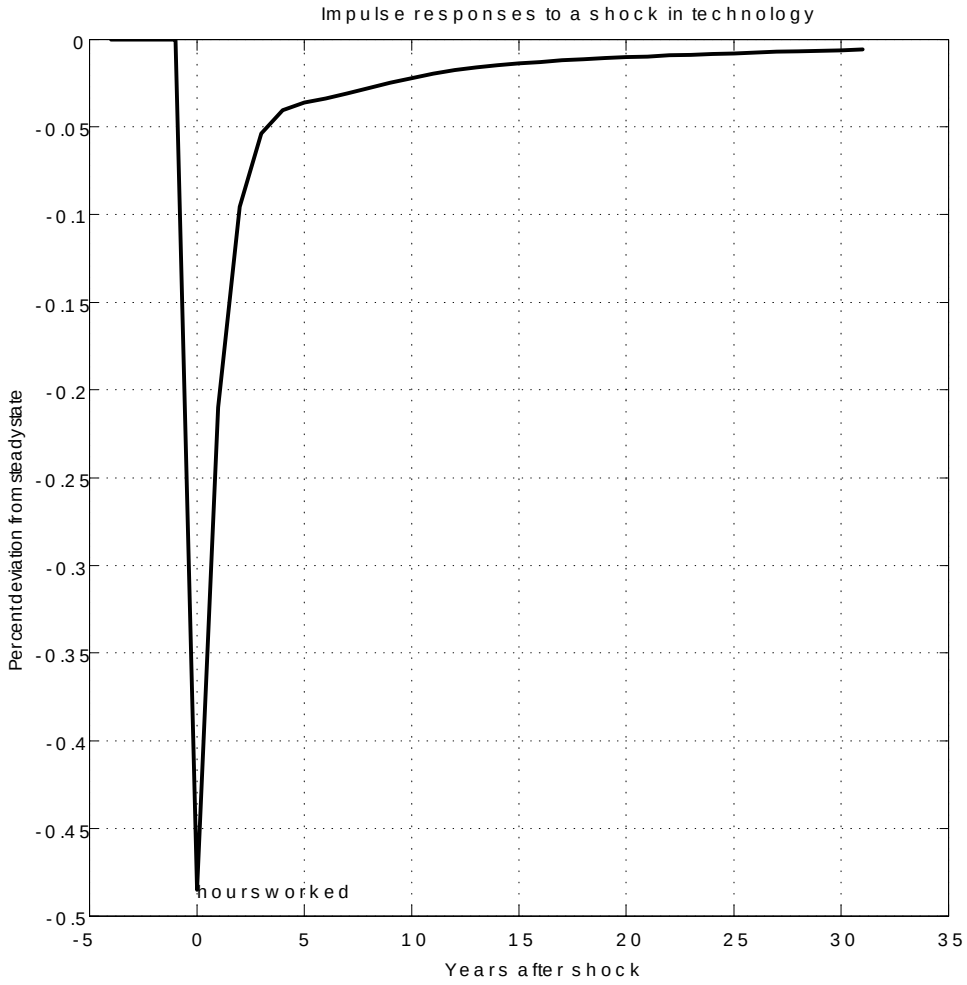
Calibration for fiscal and monetary policy parameters

- Monetary policy parameters $\left(\phi_\pi = 1.7, \phi_y = 0.125\right)$ are consistent with the empirical literature about Taylor rule in the EMU (Smets and Wouters (2003)) and are in line with the Taylor principle $(\phi_\pi > 1)$;
- Tax rate on labor $(\tau_n = 0.35)$ is set equal to the average annual implicit tax rate on labor employed for the Euro area and tax rate on profits $(\tau_k = 0.24)$ is set equal to the average implicit tax rate on capital income for the Euro area (source: Eurostat statistical data (sample 1995-2005));
- The persistence coefficient in public expenditure $(\zeta = 0.60)$ is set equal to the average persistence rate of real public expenditure for the Euro area (source: Eurostat statistical data (sample 1995-2005)), the feedback on lagged real debt parameter $(\kappa = 0.20)$ is set equal to the average ratio between the real public expenditure and the lagged real stock of public debt for the Euro area (source: Eurostat statistical data (sample 1995-2005)).

Dynamic Simulations

IRF for a technology shock: output and hours worked





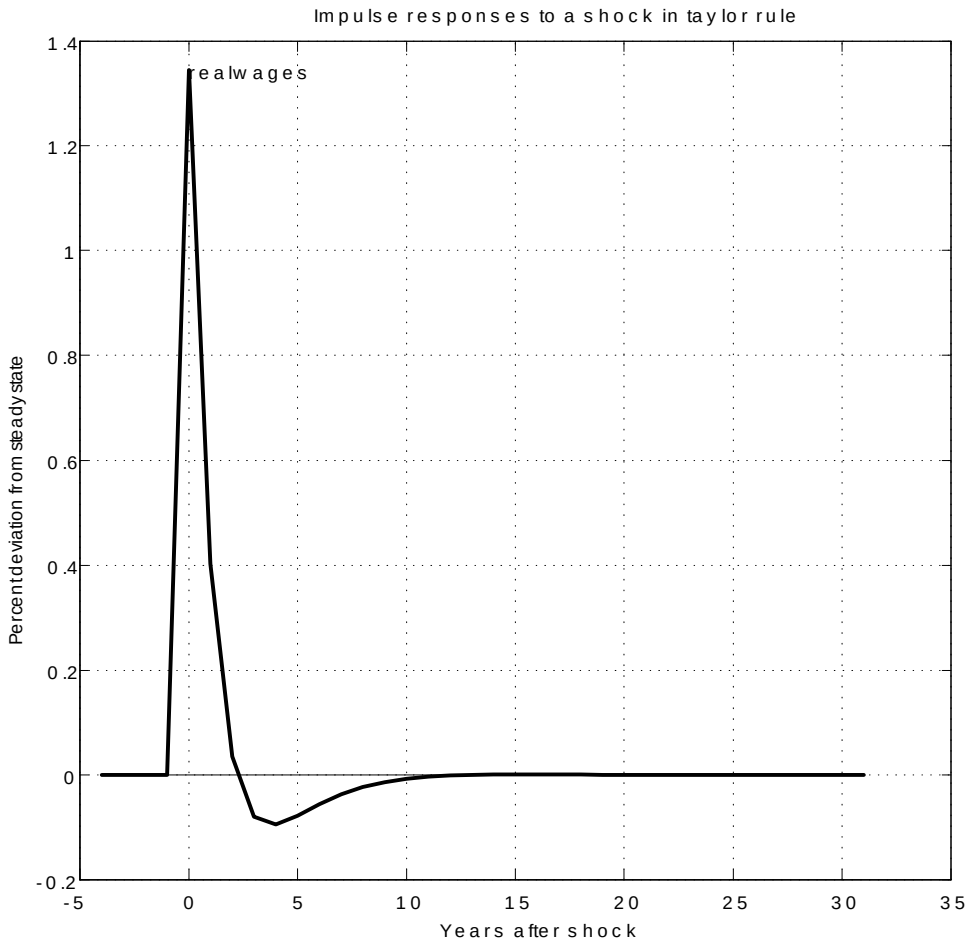
Dynamic Simulations

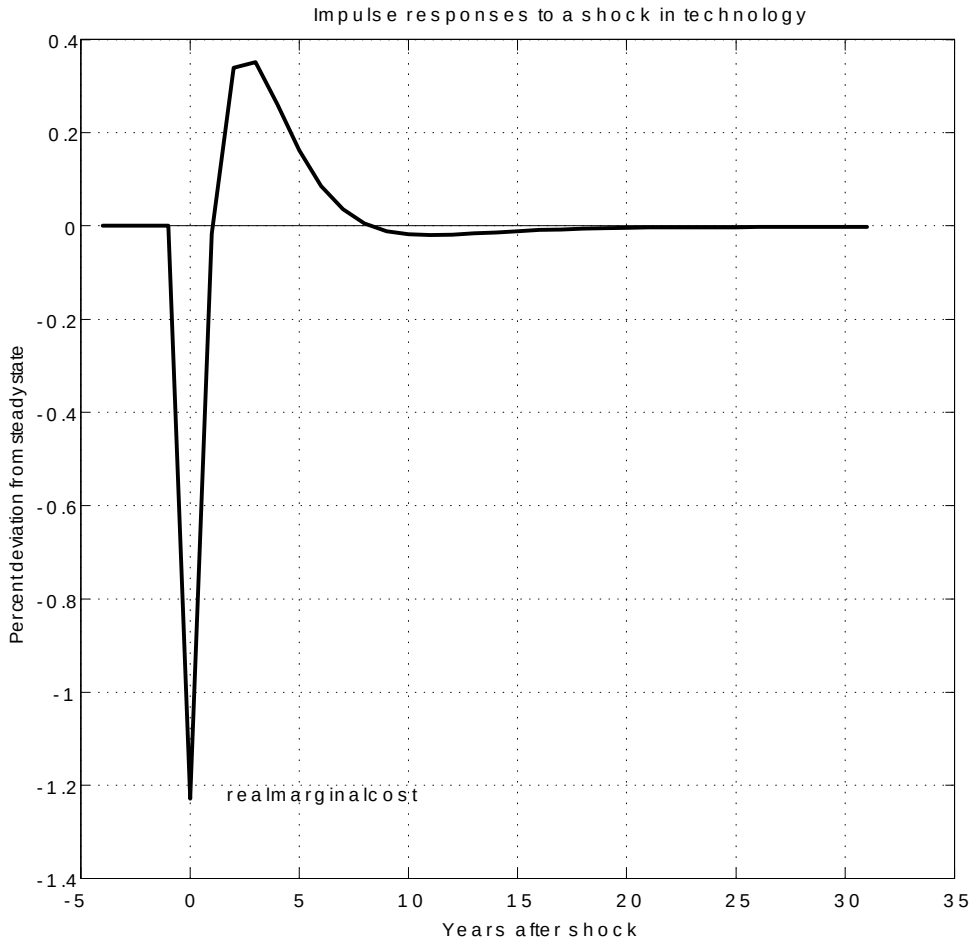
Comment: negative comovement productivity-hours worked and price stickiness

- The rigidity in aggregate demand resulting from the stickiness of the domestic price level leads technology shocks to generate a negative comovement between hours worked and productivity;
- Given the nominal rigidities, for which only a fraction $1-\theta$ of firms reset their prices, the aggregate demand does not change in the same proportion as the increasing output, in the period when the technology shock occurs;
- Each firm will meet its demand by producing a level of output lower than the one generated by the shock, that will require less labor input. As a consequence, output does not increase in the same proportion of the productivity shock (Galì (1999));
- The increase in productivity leads to an increase in real wages and to a fall in real marginal costs;
- Real profits increase due to the prevalence of the positive shift of output with respect to the increase in real wages;
- Real tax revenues are *procyclical*

Dynamic Simulations (2)

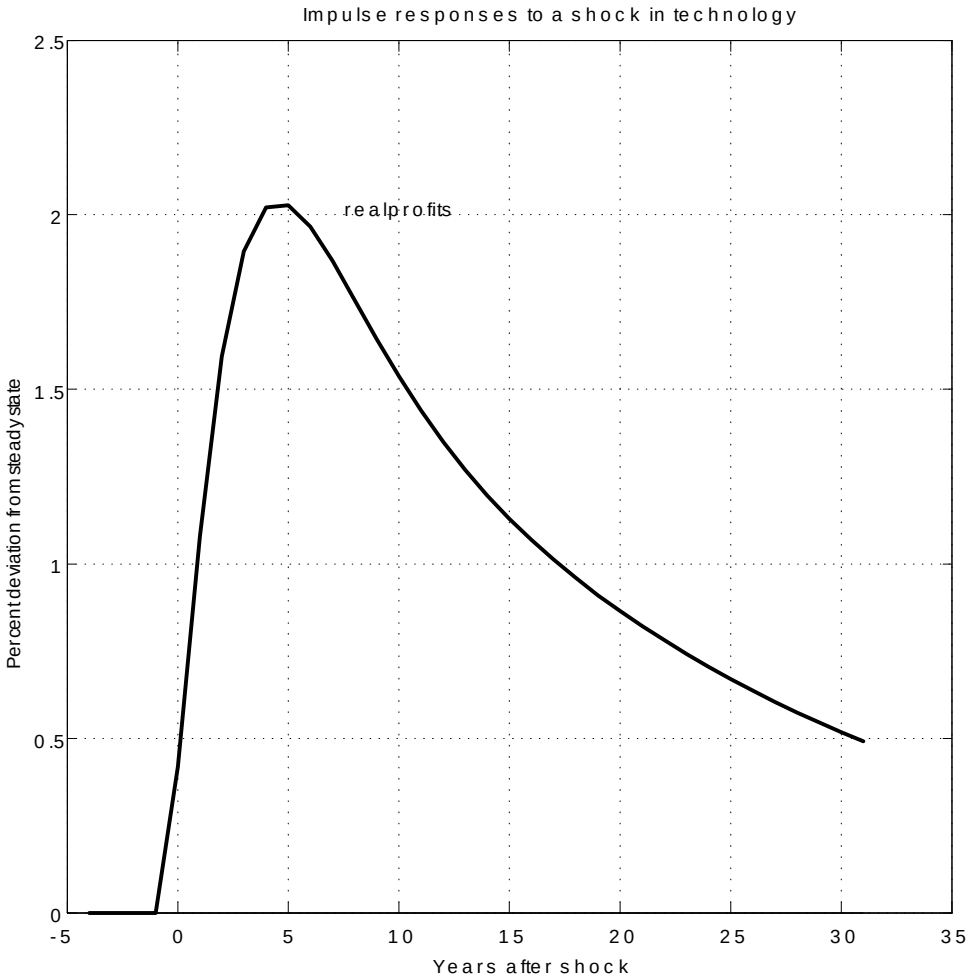
IRF for a technology shock: real wages and real marginal costs

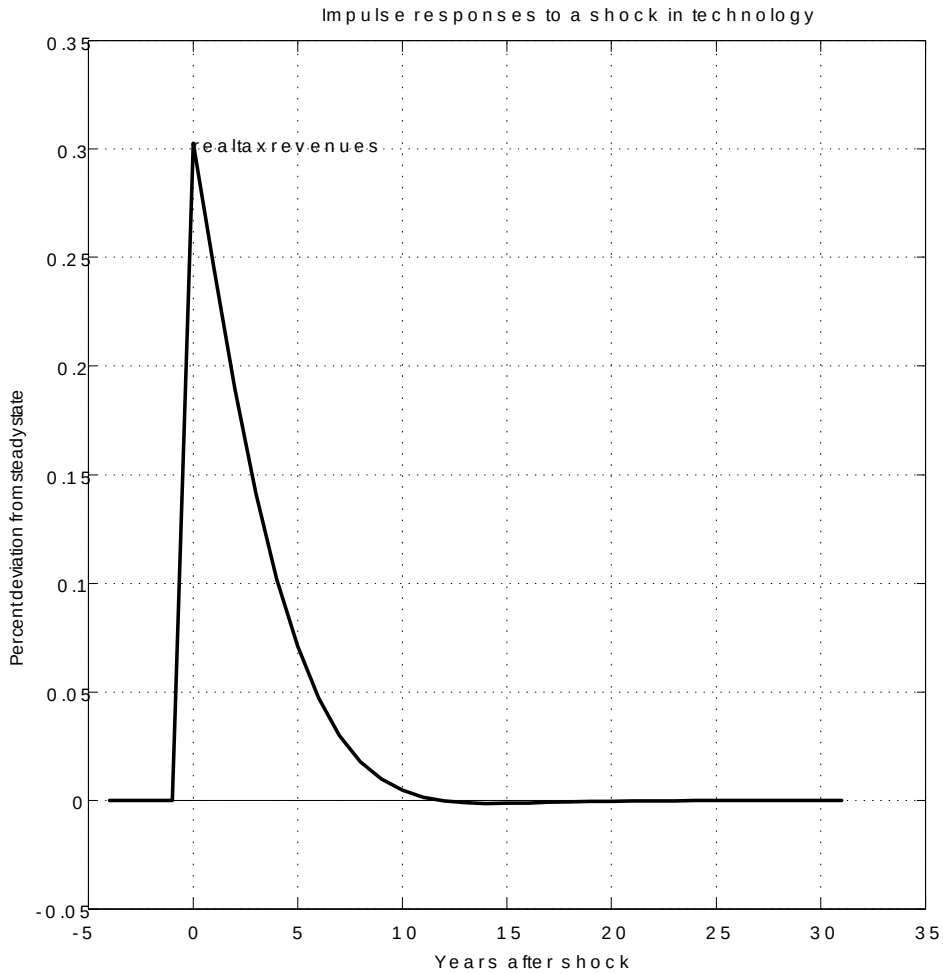




Dynamic Simulations (3)

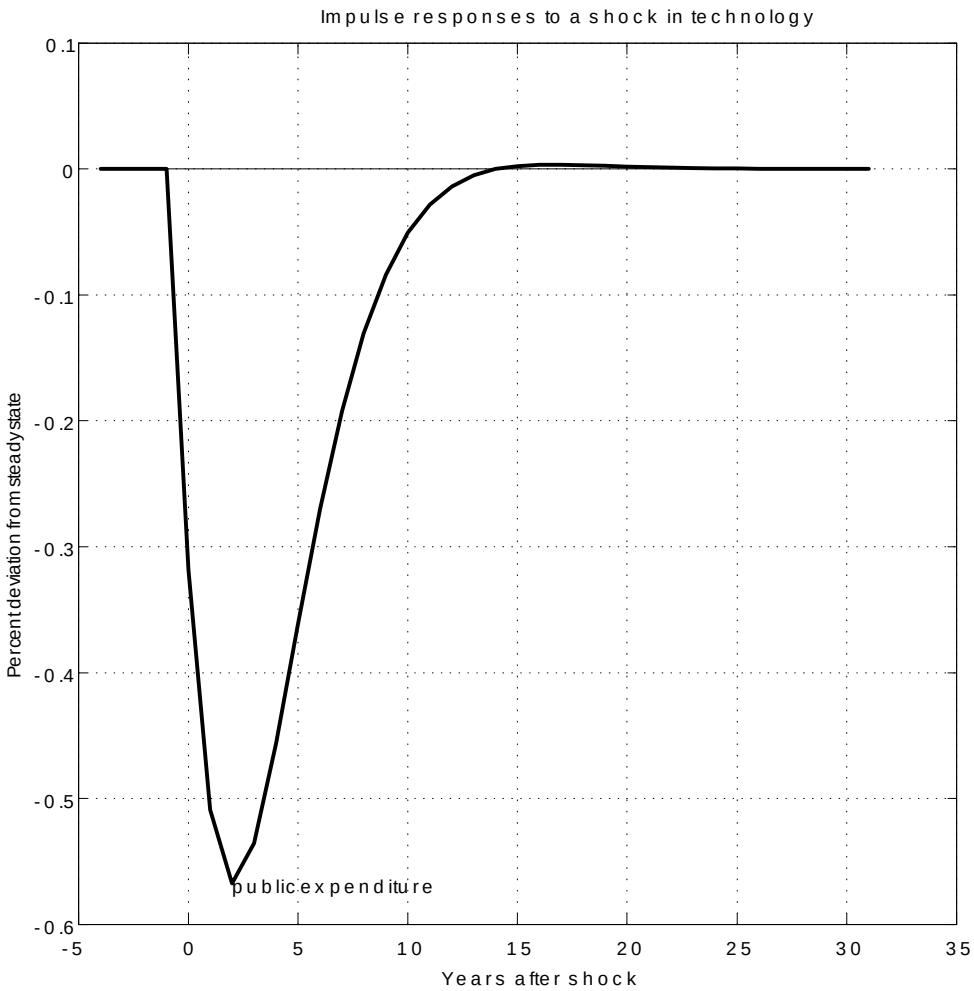
IRF for a technology shock: real profits and real tax revenues

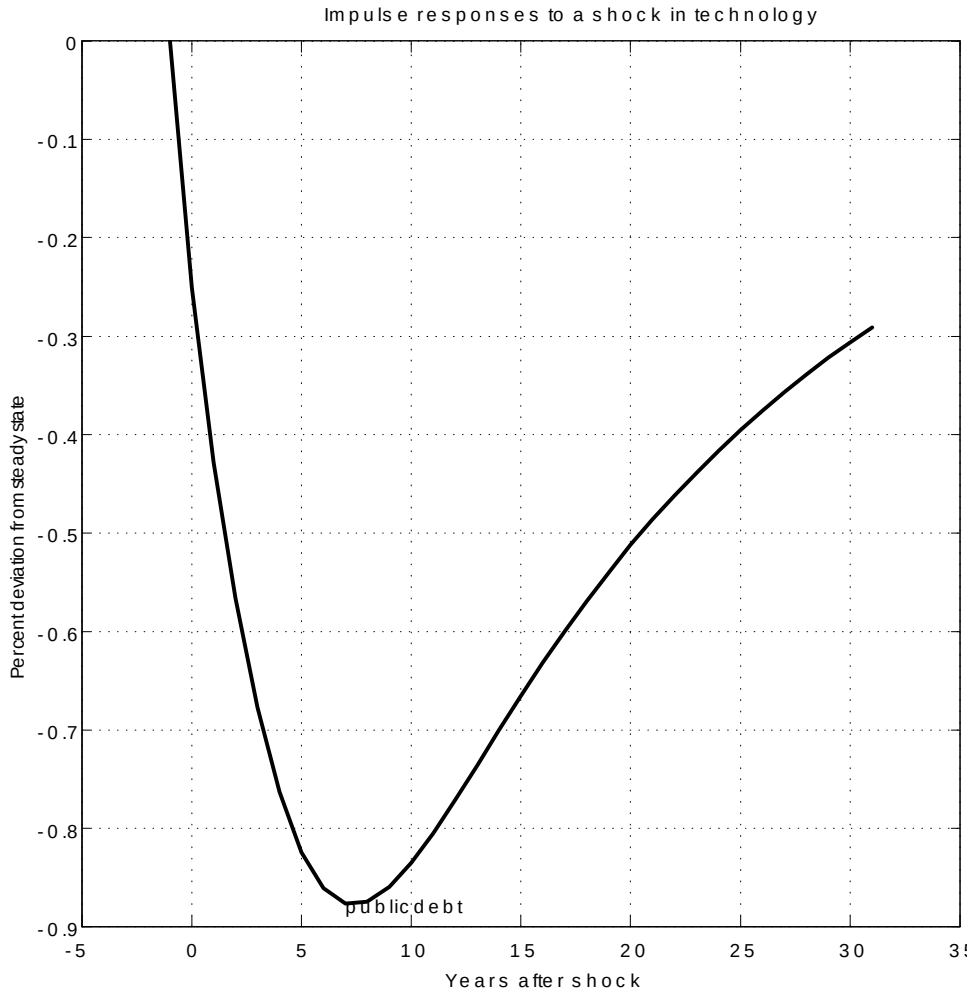




Dynamic Simulations (4)

IRF for a technology shock: real public expenditure and real debt





Dynamic Simulations

Comment: public debt

- Public debt is countercyclical;

$$D^i_{R,t-1}\left(1+r^*_{R,t}\right)+\zeta G^i_{t-1}-\kappa D^i_{R,t-1}-\frac{T^i_t}{P^i_t}=D^i_{R,t}$$

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- The ratio debt/GDP decreases for some periods, due to the contemporaneous contraction of the real stock of public debt and the increase of output, and then reverts to the original steady state value;

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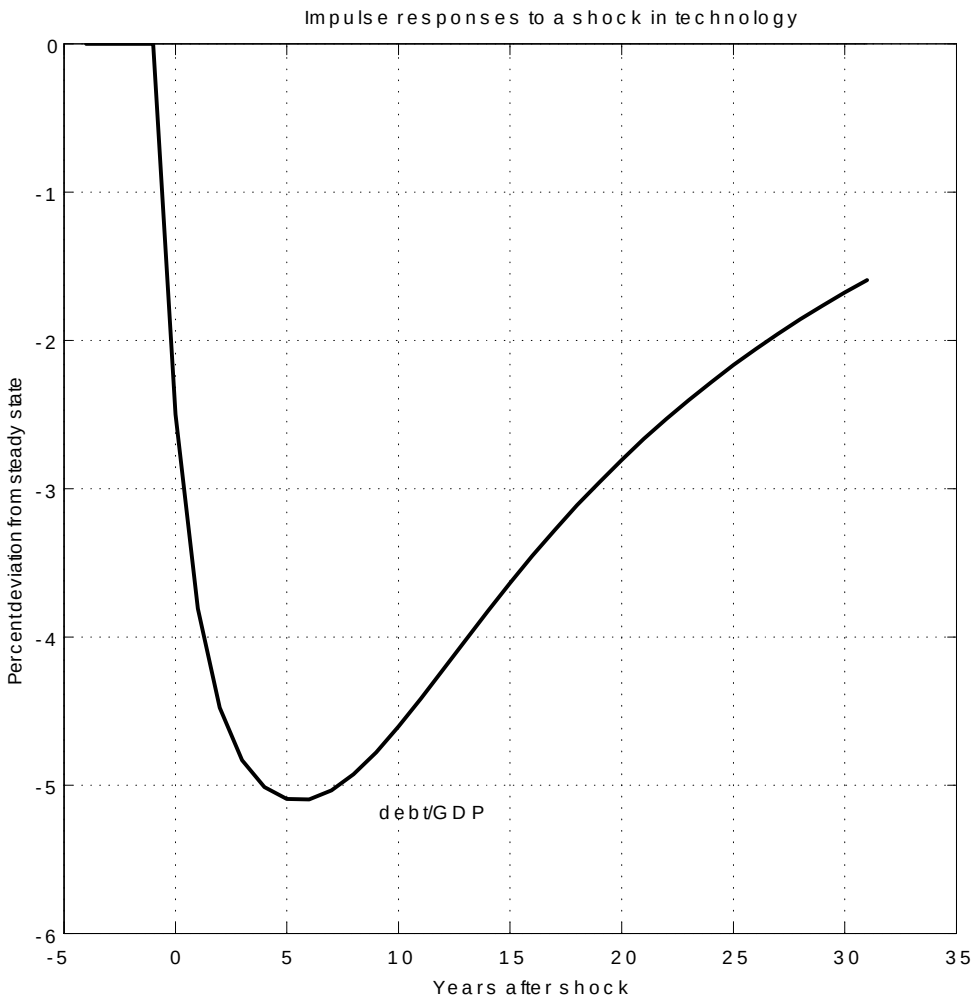
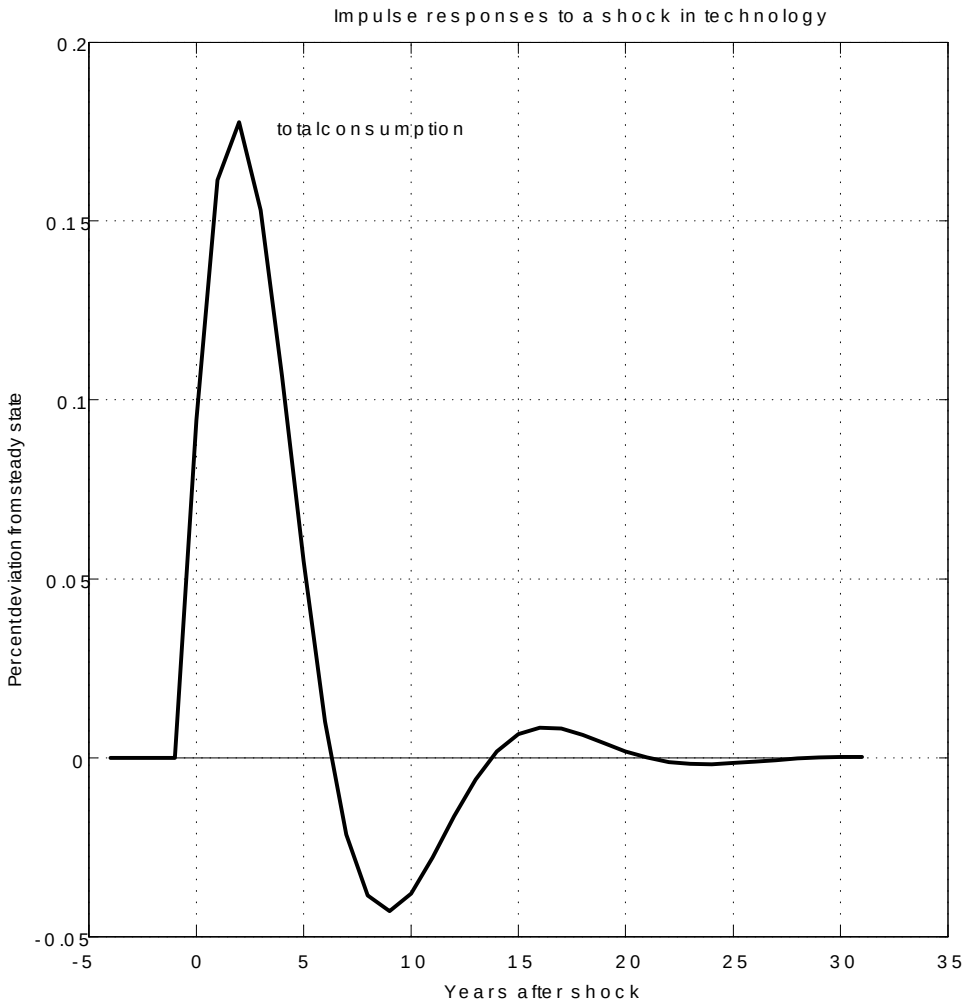
- The dynamic stability of public debt with respect to GDP is ensured.

Dynamic Simulations (5)

IRF for a technology shock: ratio Debt/GDP and total consumption





Dynamic Simulations

Comment: public expenditure

- Public expenditure is countercyclical;

$$G_t^i = \left[\zeta G_{t-1}^i - \kappa \left(\frac{\frac{T_t^i}{P_t^i}}{(R_t^*)} \right) - \kappa E_t \left(\begin{array}{c} \sum_{j=1}^{\infty} \left(\frac{\frac{T_{t+j}}{P_{t+j}^i}}{(R_t^*)^{j+1}} \right) + \\ - \sum_{j=1}^{\infty} \left(\frac{G_{t+j}}{(R_t^*)^{j+1}} \right) \end{array} \right) \right] * \left(\frac{(R_t^*)}{(R_t^*) - \kappa_i} \right)$$

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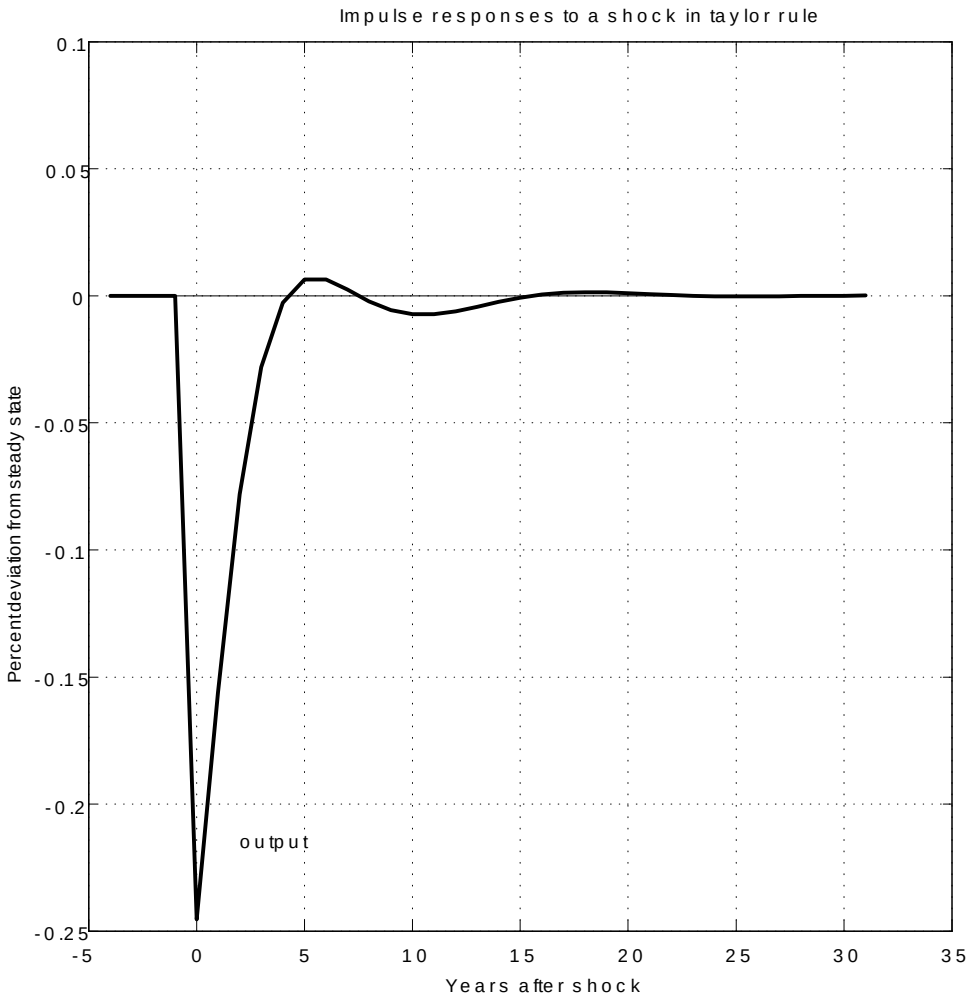
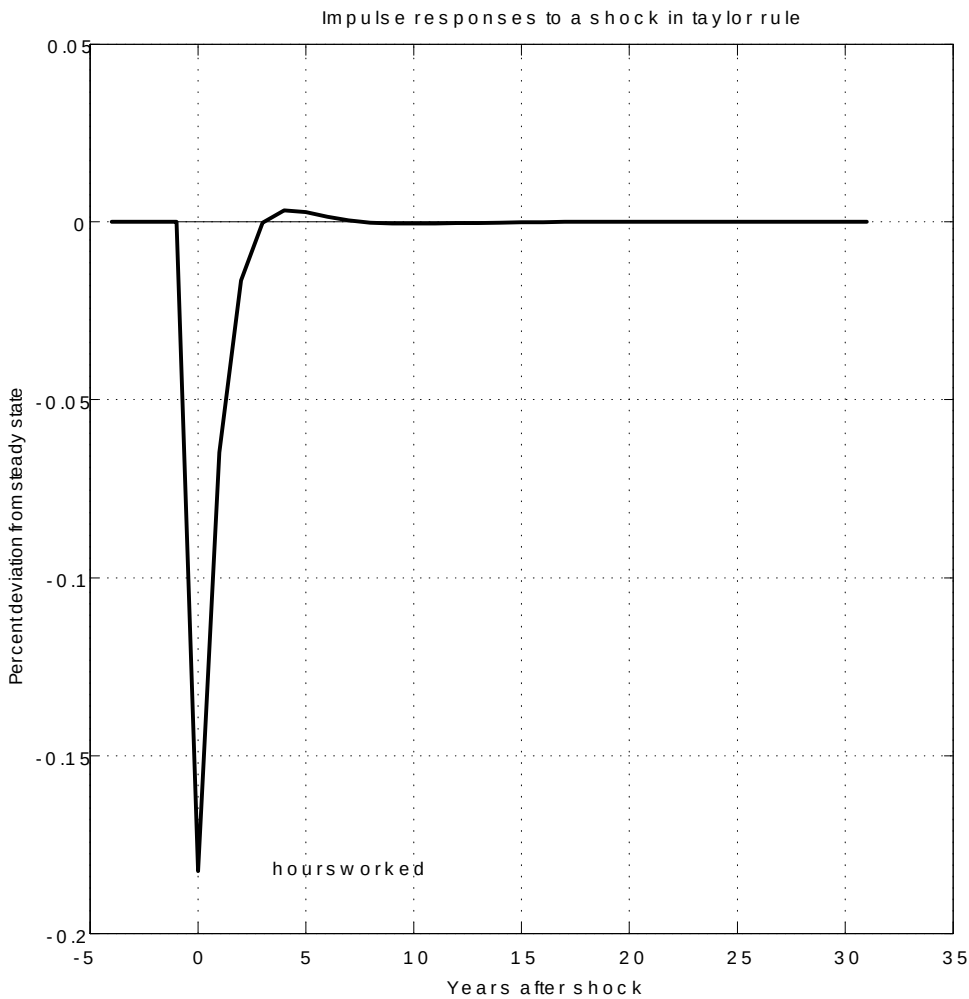
- Public expenditure is negatively related to the discounted contemporaneous value of real tax revenues and to the expected discounted sum of future primary surpluses;
- A positive technology shock pushes up tax revenues and decreases both the stock of public debt and real public expenditure;
- Public expenditure together with taxation plays the role of a "smoother" for output cyclical fluctuations.

Dynamic Simulation

IRF for a monetary shock: output and hours worked





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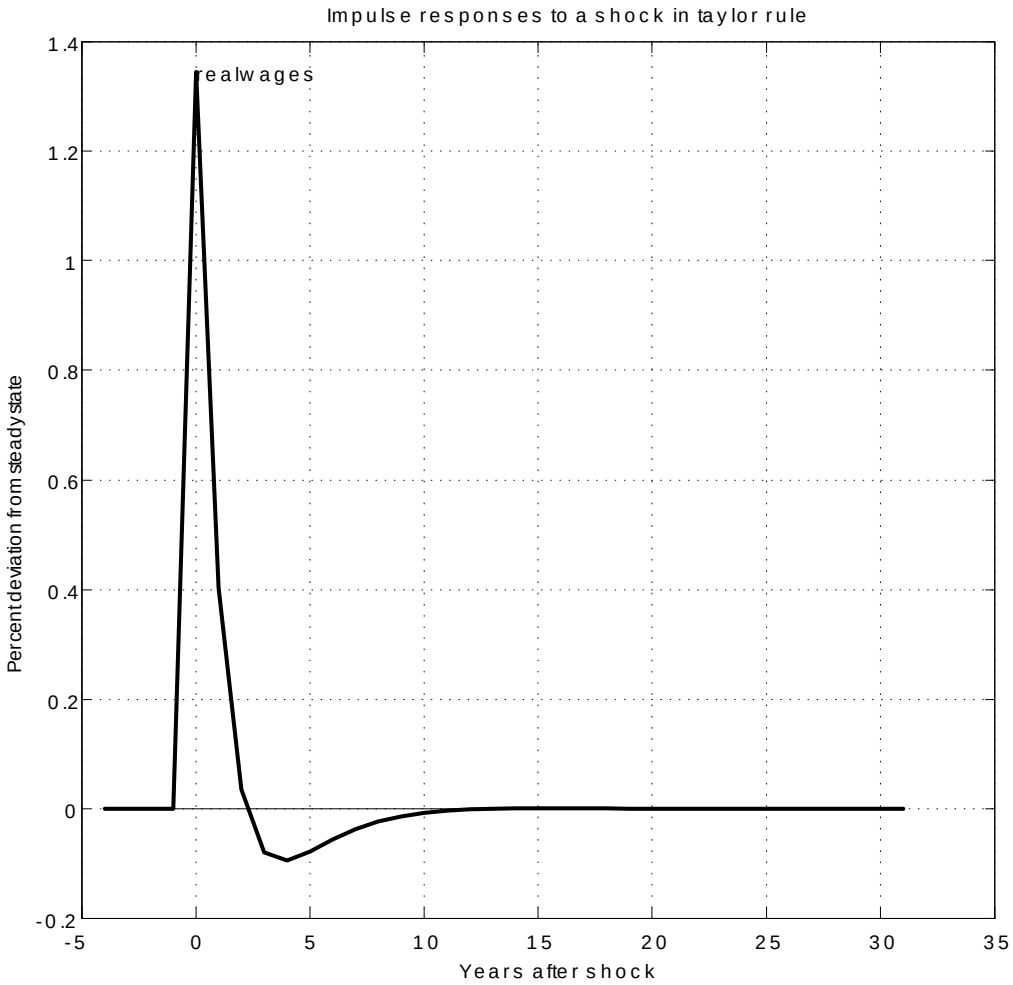
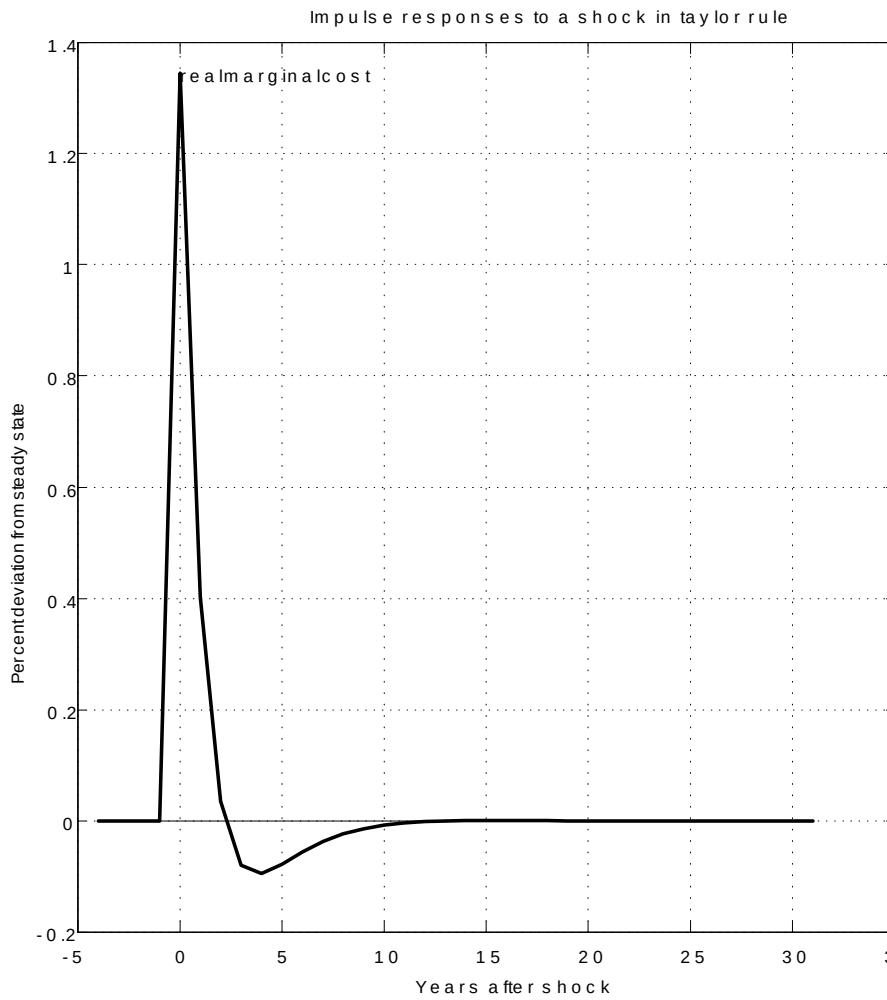
- The reduction in labor input generates, as a consequence, a fall in output and in real tax reveneus.

Dynamic Simulation (2)

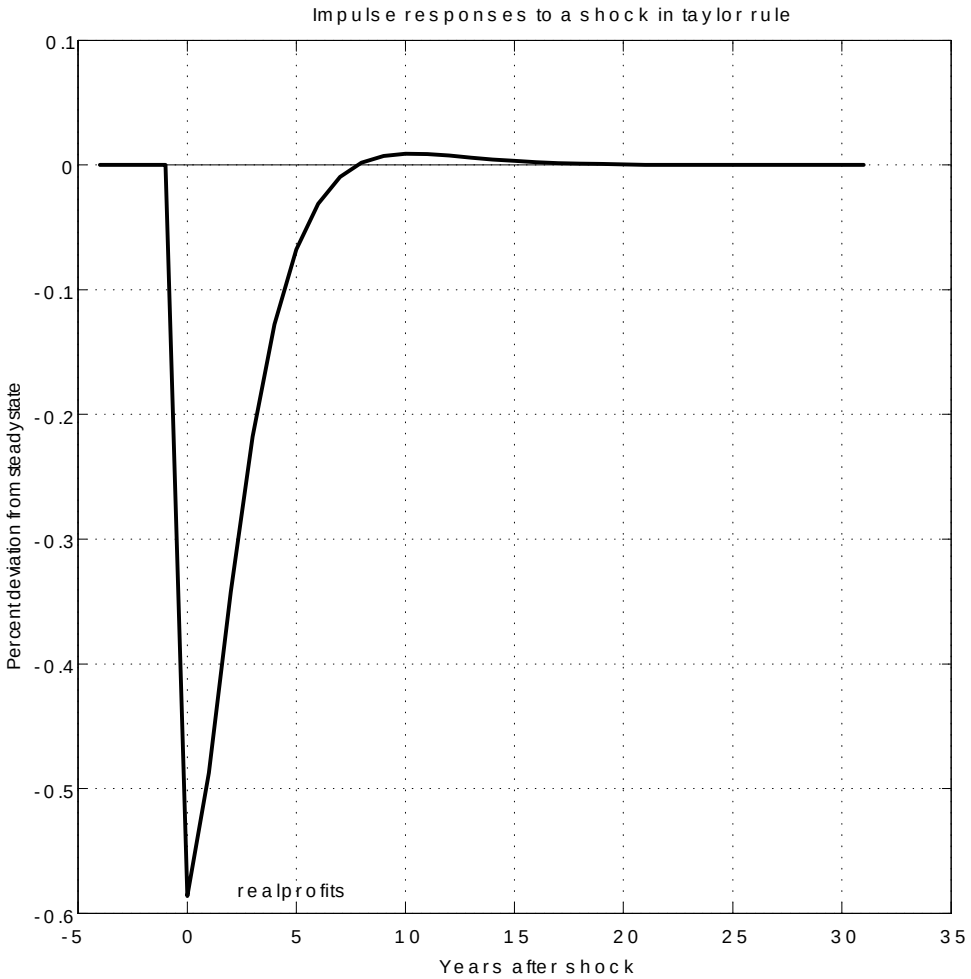
IRF for a monetary shock: real wages and real marginal costs

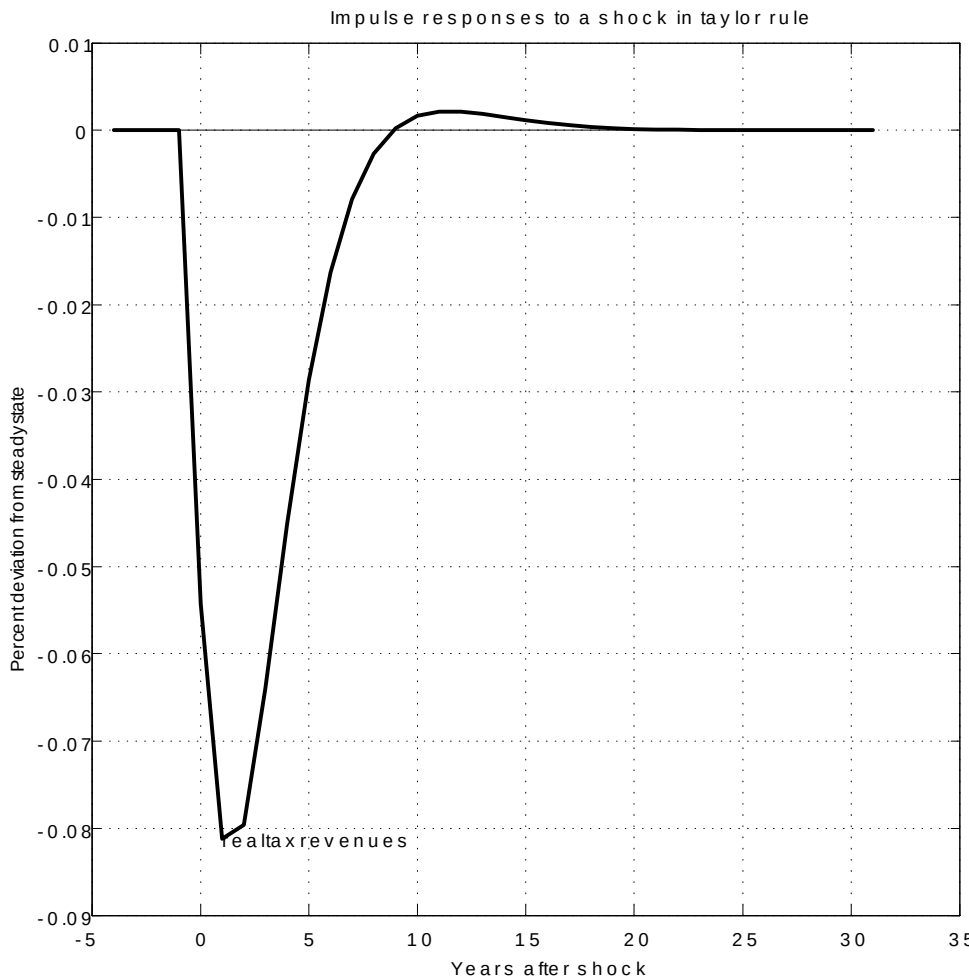




Dynamic Simulation (3)

IRF for a monetary shock: real profits and real tax revenues





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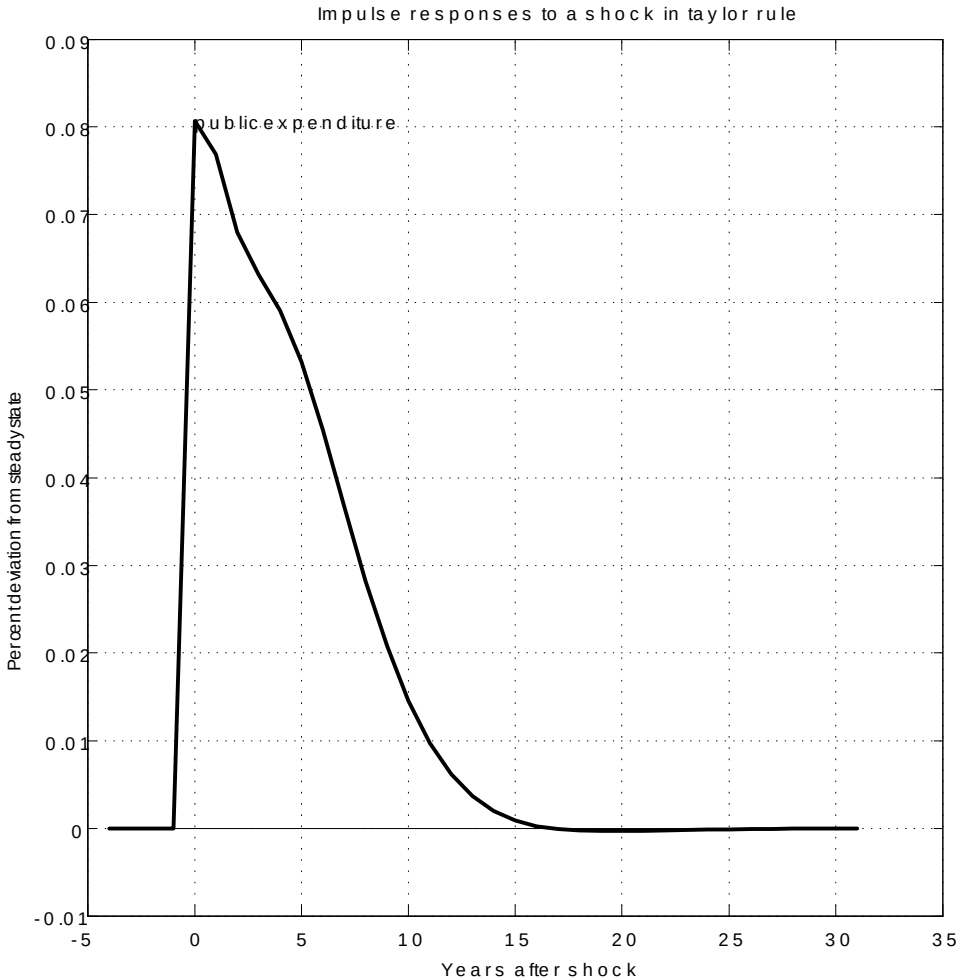
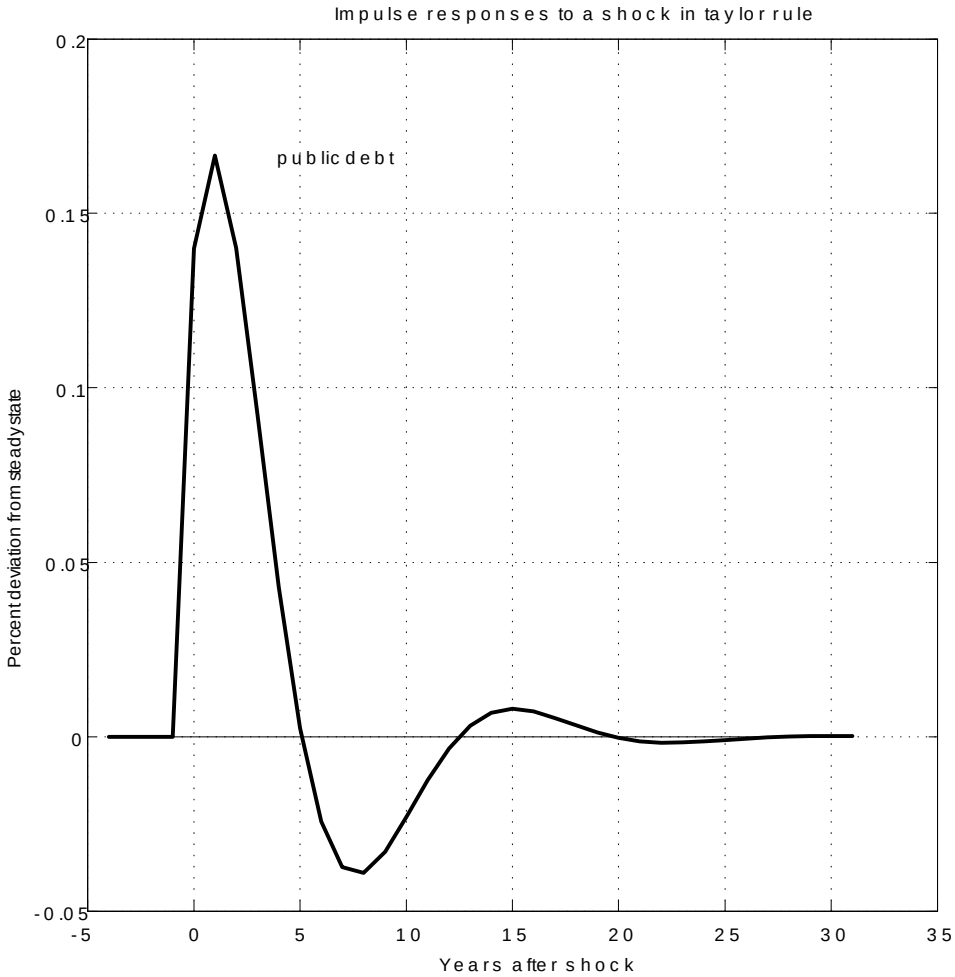
- An ex-ante feedback rule on lagged real debt for public expenditure together with a proportional taxation is able to give a stabilizing role to fiscal policy according to the Musgravian idea if the business cycle is generated by a union-wide interest rate shock.

Dynamic Simulations (4)

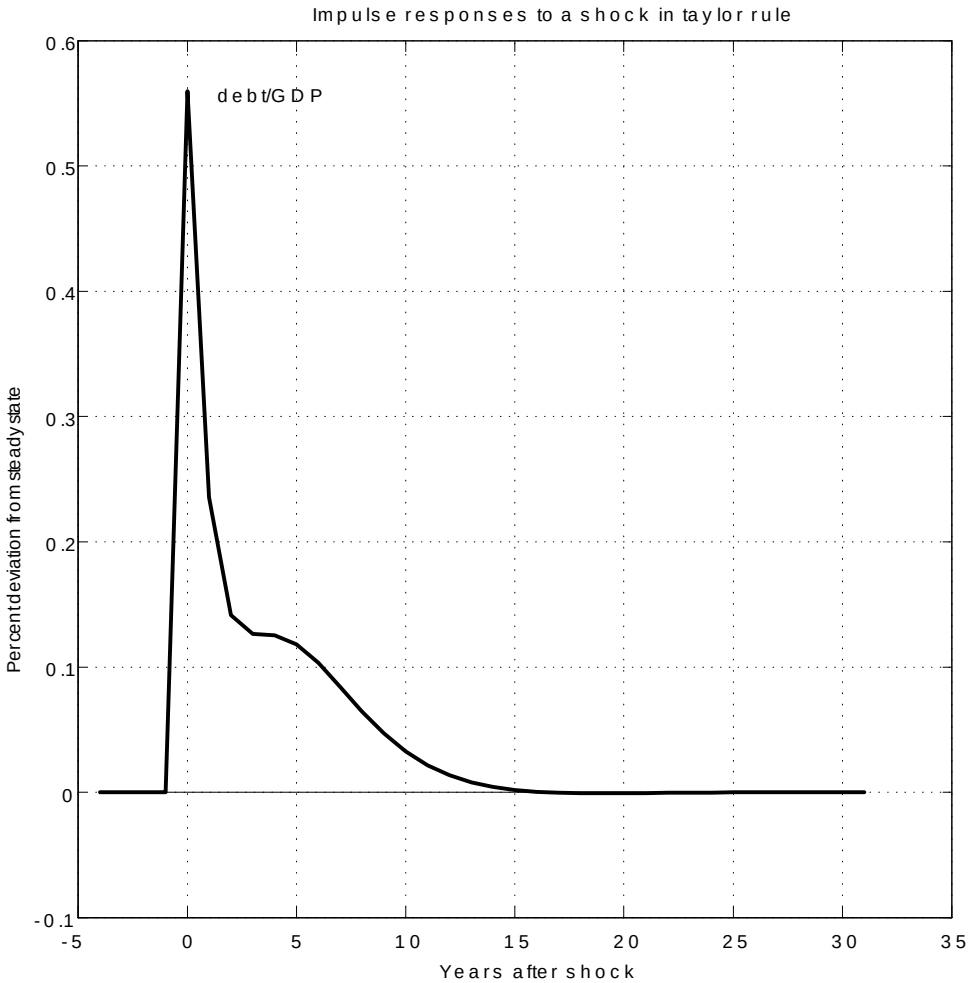
IRF for a monetary shock: real public expenditure and real debt

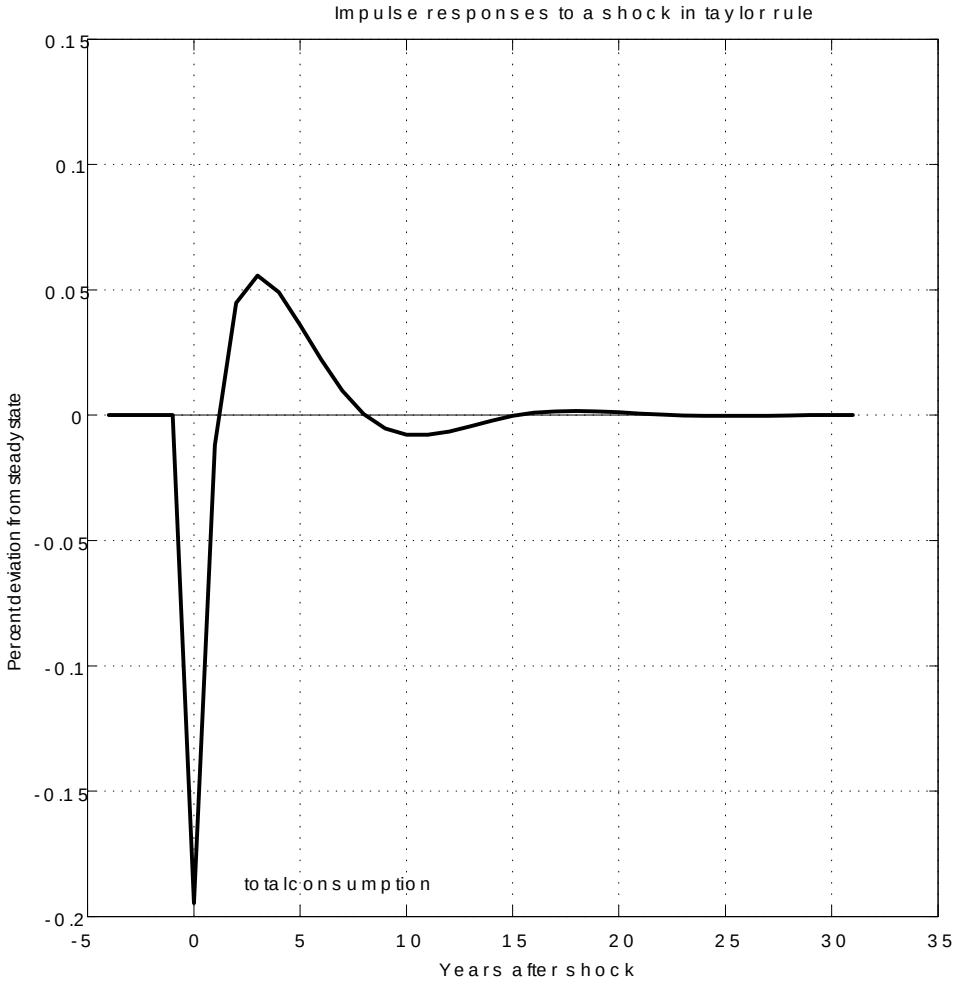




Dynamic Simulations (5)

IRF for a monetary shock: ratio Debt/GDP and total consumption





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  - to build a new microfoundation of the SGP, in the sense of focusing on the roles of the components of public balance sheets (public expenditure and taxation), that are the logical "a-priori" of public deficits and debts.

Further improvements

- The model ignores capital accumulation;
- Stickiness is confined only to prices and not to wages;
- It could be useful to make a distinction in the government expenditure rule between current public expenditure and capital public expenditure, in order to understand which of these components is actually countercyclical.

THANK YOU FOR YOUR ATTENTION!