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BY BARBARA ANNICCHIARICO

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Contents

Abstract

This paper investigates the inflationary effects of fiscal policy in an optimizing general equilibrium monetary model with capital accumulation, flexible prices and wealth effects. The model is calibrated to Euro Area quarterly data. Simulation results show that government deficits, high debt level and slow fiscal adjustment adversely affect price stability in the presence of an independent monetary authority adopting a monetary targeting regime. The mechanism through which fiscal policy affects the dynamics of the price level presents monetarist properties, since the price level is determined in the monetary market. The effects produced by fiscal expansions on price dynamics are due to the behavior of consumers, facing a positive probability of death and sharing the burden of fiscal adjustment with future generations. Fiscal variables are shown to influence the consumption plan of individuals and the demand for real money balances, thus affecting the equilibrium conditions in the money market where the price level is determined.

JEL Classification Code: E31, E62.
Keywords: Price Stability, Fiscal Policy and Government Debt.

Non-technical summary

The negative consequences of high government debt and deficits on price stability and the potential interrelations between fiscal and monetary policy are a debated issue in the Euro Area. It is argued that the fiscal restrictions, defined in the Maastricht Treaty, are necessary for the ECB to pursue the primary objective of price stability. The present paper illustrates how government debt and deficits might be linked to the price level dynamics in a small structural model of analysis with overlapping generations.

The paper develops an optimizing general equilibrium monetary model with capital accumulation, fully flexible prices and wealth effects in which the Ricardian Equivalence condition is not satisfied. The main purpose is to analyze the inflationary consequences of a fiscal expansion and to study the role of wealth effects in the transmission mechanism from fiscal policy to price level dynamics. In particular, in a simulation model, calibrated to Euro Area quarterly data, this paper evaluates the implications on price level dynamics and on other macro variables of increases in transfers to households and in the level of public expenditure. All the fiscal experiments are carried out under the assumptions that the government adopts a fiscal rule that maintains a convergent path for public debt, while the rate of money growth is set by an independent monetary authority.

The main mechanism through which fiscal policy affects the dynamics of the price level can be illustrated as follows. Since the Ricardian Equivalence condition is not satisfied, fiscal policy affects the consumption plan and the timing of taxes alters the consumers' decisions. The changes in the consumption plan, due to fiscal expansions, influence the demand for real money holdings, thus affecting the equilibrium conditions of the monetary market. Since the nominal stock of money is exogenously set by the monetary authorities, the price level adjusts to guarantee the equilibrium. In other words, fiscal policies indirectly affect the equilibrium conditions in the money market in which the price level is determined. It is shown that the effectiveness of this basic mechanism depends on:

- the nature of the fiscal expansion (transfers to households or increase in public expenditure);
- the magnitude of the wealth effects;
- the level of the public debt-GDP ratio;
- the speed of fiscal adjustment.

Specifically, the simulations show that temporary fiscal expansions negatively affect price stability. Wealth effects enlarge the response of the price level and of all the other variables to fiscal expansions. The price level path is always above its long run trend during the adjustment process. In addition, economies with high public debt-GDP ratios and slow fiscal adjustment experience larger price deviations after a fiscal expansion.

From the simulations it emerges that the effects produced by fiscal expansions on price level dynamics through wealth effects are minor. The reason why the role of wealth effects seems small is that the model underlying the simulations considers only a minimum deviation from Ricardian Equivalence. It follows that the role of wealth effects is small by construction. Nevertheless, the analysis provides insights into the linkages between fiscal variables and the dynamics of the price level and illustrates the directions in which wealth effects work.

The results of this paper provide extra reasons to promote fiscal convergence in the Euro Area and to enforce the respect of both fiscal requirements, the deficit criterion and the debt criterion. In the light of this analysis, it is argued that future research should evaluate the degree to which the Euro Area deviates from Ricardian Equivalence. If Ricardian Equivalence does not hold, then the lack of fiscal discipline will make the pursuit of price stability more difficult and there will be additional reasons to enforce the Stability and Growth Pact.

1 Introduction

The negative consequences of large government debt and deficits on inflation and the possible interrelations between fiscal and monetary policy are a central issue in the current macroeconomic policy debate. The Maastricht Treaty and the Stability and Growth Pact impose limitations on the size of public debt and deficits for each country in the Euro Area. It is argued that fiscal discipline is a necessary condition for the ECB to pursue the objective of price stability and there is also consensus on the need to take into account both of the fiscal criteria defined in the Maastricht Treaty, the deficit criterion and the debt criterion[1]. From the present debate it emerges that the independence of the central monetary authority would be a necessary but not sufficient condition to ensure price stability[2].

The main aim of the present paper is to evaluate the inflationary consequences of a fiscal expansion and to provide a quantitative assessment of wealth effects in a simulation analysis. In particular, this paper represents a first attempt to quantify the effects of fiscal expansions on price level dynamics and on other relevant variables via the wealth effects in a simulation model, calibrated for the Euro Area, through the Yaari (1965)-Blanchard (1985) framework of analysis. The basic model of analysis is a non-stochastic discrete time monetary model of perpetual youth with capital accumulation and fully flexible prices, where the Ricardian Equivalence condition is not satisfied. The government is assumed to choose a sequence of taxes according to a fiscal rule that maintains a convergent path for public debt, given the monetary policy rule set by an independent authority. Both the implications of increases in transfers to households and in the level of public expenditure are considered.

The simulations carried out in this paper clearly show how fiscal policy affects the dynamics of the price level and of other relevant variables. It emerges that wealth effects enlarge the response of the price level and of all the other variables to fiscal expansions. In particular, it is shown that the price level path is always above its long run trend during the adjustment process. Moreover, the results suggest that economies with high public debt-GDP ratios and slow adjustment are likely to experience larger price deviations after a fiscal expansion.

[1] A protocol to the Treaty sets the budget deficit threshold at 3% of the GDP and the public debt at 60% of the GDP.

[2] The public debt requirement has received renewed attention and there is wide political consensus on the importance of reducing the public debt-GDP ratio at a suitable pace towards the 60% reference value. See European Commission (2003a) and European Central Bank (2003).

The mechanism of transmission from fiscal policy to prices is not straightforward. In a few words, the main mechanism at work behind the observed results, can be synthesized as follows. Since the Ricardian Equivalence condition is not satisfied, the consumption plan of individuals depends on the timing of taxes. It follows that fiscal expansions are shown to always alter the consumption plan of individuals. This change in the consumption plan alters the demand for real money balances. Since the nominal supply of money is exogenously set by the monetary authorities, the price level must change to restore the equilibrium in the money market. In this sense the mechanism through which fiscal policy affects the dynamics of the price level displays entirely monetarist properties.

The effects produced by fiscal expansions on price level dynamics through wealth effects, however, seem to be minor. The magnitude of the simulations results is driven by the departure of the economy from Ricardian Equivalence which, in the present model, is assumed to be small. Nonetheless, the paper shows the directions in which the wealth effects work in transmitting the effects of a fiscal expansion from the changes in the consumption plan to the monetary market and stresses the importance for future research of investigating the role of wealth effects and the departure from the Ricardian Equivalence condition in the Euro Area. The Yaari-Blanchard framework, in fact, is shown to provide an additional perspective to discuss the Stability and Growth Pact and offers extra reasons to promote fiscal convergence in the Euro Area.

The paper is organized as follows. Section 2 relates the present paper to the economic literature. Section 3 presents the basic monetary model with overlapping generations and capital accumulation; Section 4 describes calibration; Section 5 illustrates simulation results for different fiscal experiments. Section 6 concludes and summarizes the main findings of the paper.

2 Related Literature

A well known result since Sargent and Wallace (1981) is that fiscal policy matters for price stability, since large deficits and increasing government debt may eventually force the central bank to issue money to ensure solvency. In a seminal paper Aiyagari and Gertler (1985) study the inflationary effects of high current public deficits in an optimizing general equilibrium model when they are expected to be financed by future money creation. In a stochastic monetary model Leeper (1991) shows under which circumstances the effects of monetary policy on prices depend on the fiscal rule adopted by the government. Recently, following the contributions by Woodford (1994, 1995) and Sims (1994), the 'fiscal theory of the price level' (FTPL) has become increasingly popular in providing a theoretical framework able to identify the conditions under which fiscal policy alone determines inflation dynamics. Specifically, the FTPL distinguishes between Ricardian and non-Ricardian fiscal regimes, in the terminology of Woodford (1995): in the first case the nominal anchor is provided by monetary policy and the price level is determined in the monetary market, while in the second case fiscal policy serves as the nominal anchor and determines the price level. In other words, in the Ricardian regime fiscal policy is irrelevant for the determination of the price level and the intertemporal budget constraint of the government necessarily holds regardless of the time path of the price level. Conversely, in a non-Ricardian regime prices and not deficits adjust to satisfy the intertemporal budget constraint of the government. From this point of view the FTPL shows under which circumstances the time path of the price level is determined by the needs of fiscal solvency and provides a theoretical rationale supporting the idea that the respect of the fiscal criteria, defined in the Maastricht Treaty, is necessary for price stability. This theory, appealing as it might be, has been seriously questioned by Buiter (2002) and McCallum (2001). In particular, both authors criticize the 'fiscalist' proposition in the case of a non-Ricardian regime. McCallum claims that in this case the solution for the price level outlined by the FTPL is not unique and shows the existence of an alternative monetarist solution, based on fundamentals, as suggested by the minimal-state-variable approach. Buiter argues that the FTPL is misspecified, since it denies that the intertemporal government budget constraint must hold as an identity and assumes that it needs to be satisfied only in equilibrium. Buiter shows that this feature of the FTPL is a source of internal contradictions and anomalies.

The role of fiscal deficits in determining inflation dynamics has also been investigated in optimizing general equilibrium models with wealth effects. The Yaari (1965)-Blanchard (1985) model has been used in several contributions[3] and has become increasingly popular as a basic framework of analysis to study the interrelations between monetary and fiscal policies. See for example Marini and Van der Ploeg (1987), Leith and Wren-Lewis (2000) and the modified version *à la* Weil proposed by Detken (1999) who uses the Blanchard-Weil OLG model to address the question of intergenerational fairness and interprets the Stability and Growth Pact "as an intergenerational contract safeguarding the interests of future generations". The implications

[3]See Heijdra and Van der Ploeg (2002) for an exhaustive survey.

of the FTPL for price level dynamics are analyzed by Leith and Wren-Lewis (2002) in a continuous time version of the Yaari-Blanchard model with endogenous labor supply and sticky prices. In fully flexible price models Annicchiarico and Marini (2003a, 2003b) provide an alternative perspective and show that high public debt and deficits are inflationary by affecting money market equilibrium through the wealth effects, even when the intertemporal budget constraint of the government is satisfied for any sequence of prices and there is no money financing of public deficit[4].

This paper presents an extension of the Yaari-Blanchard model to provide a link between fiscal policy and the dynamics of the price level. In this sense the model presented could be included in the class of models proposed by the FTPL. Nonetheless, the mechanisms at work in our framework are monetarist, since the price level is always determined in the monetary market and the intertemporal budget constraint of the government is always satisfied for any sequence of prices. From this point of view the model presented is standard and is solved along the lines of the monetarist approach. All policy experiments, in fact, are carried out under the assumption that fiscal authorities adopt a tax rule which guarantees solvency, without any recourse to any of the revaluation mechanisms characterizing the FTPL, which have been the object of the main critiques, as explained above[5].

3 The Basic Model

Consider the following optimizing general equilibrium monetary model in discrete time with production and overlapping generations[6]. The economy is populated by four types of agents: consumers, firms, the monetary authority and the government. The demand side of the economy is an extended version of the Yaari-Blanchard model of perpetual youth. Money yields transaction services and enters the consumers' utility function along the lines of Sidrauski (1965) and Brock (1975)[7]. The dynamic behavior of

[4]Their approach to the problem provides a monetarist perspective that could be defined as a 'money market fiscal theory of the price level'.

[5]In this sense we assume a fiscal regime which, in the terminology of Woodford (1995), is *Ricardian.* However, in our framework this terminology can be a source of confusion, since in the present model the Ricardian Equivalence condition is not satisfied.

[6]Smets and Wouters (2002) use a discrete time version of the Yaari-Blanchard framework in an open economy, calibrated to Euro Area data, to study the implications for the optimal monetary policy of an imperfect pass-through.

[7]Real money balances entering as an argument of the utility function are a common feature of several contributions extending the Blanchard-Yaari framework to monetary models. See for example Marini and Van der Ploeg (1988), Leith and Wren-Lewis (2000,

the economy in response to fiscal expansions is also shaped by the physical capital accumulation process, which results from the saving decisions of the finite lived consumers and from the expenditure decisions of an infinite lived public sector. Prices are assumed to be fully flexible and lifetime is uncertain. For a given monetary policy rule the government finances its purchases by levying taxes and by issuing bonds, so as to always satisfy the intertemporal budget constraint.

3.1 Consumers

The demand side of the economy is composed of cohorts of different ages and population is assumed to be constant over time. All agents face the same probability of survival between two consecutive periods, $\gamma > 0$, and have the same preferences. For simplicity, the size of total population is normalized to one; hence the proportion of population dying and being born at the end of each period is $1 - \gamma$. Since lifetime is uncertain and there is no bequest motive, agents sell their contingent claims on their non-human wealth to life insurance companies. In each period agents receive a fair insurance premium, while in the case of death all their wealth goes to insurance companies. Competition among insurance companies implies that the net return on the insurance contract is $\frac{1-\gamma}{\gamma}$. All agents face the same sequences of taxes and labor income and decide on consumption, real money holdings and wealth accumulation. Total non-human wealth is composed of real money balances, physical capital and government bonds. Labor income and taxes are assumed to be independent of age. Finally, newly born agents are assumed not to hold any assets.

The representative agent of the generation born at time s faces a lifetime utility function of the form

$$U = \sum_{t=0}^{\infty} (\beta\gamma)^t \log[(c_{s,t})^{\xi}(m_{s,t})^{1-\xi}] \tag{1}$$

where $0 < \xi < 1$, $0 < \beta < 1$ is the subjective discount factor, $c_{s,t}$ and $m_{s,t}$ denote consumption and real money balances at time t. The budget constraint of the representative agent of generation s is

$$c_{s,t} + a_{s,t} + m_{s,t} = w_{s,t} - \tau_{s,t} + \frac{1}{\gamma}\left[\frac{m_{s,t-1}}{1+\pi_t} + (1+r_{t-1})a_{s,t-1}\right] \tag{2}$$

2002). See also Cushing (1999) who presents a discrete time version of the Blanchard-Yaari monetary model.

where $w_{s,t}$ and $\tau_{s,t}$ denote real wage income and lump-sum taxation in period t, respectively; $a_{s,t}$ is the individual's real non-monetary wealth, $a_{s,t} = k_{s,t} + b_{s,t}$, where $k_{t,s}$ and $b_{s,t}$ stand for physical capital and real government bonds at the end of period t[8]; r_{t-1} is the real interest rate between period $t-1$ and t and π_t is the inflation rate defined as $\pi_t = \frac{P_t}{P_{t-1}} - 1$[9]. Market efficiency and absence of uncertainty ensure that the rates of returns on capital and government bonds are equalized. The representative consumer of generation s chooses a sequence $\{c_{s,t}, m_{s,t}, a_{,s,t}\}_{t=0}^{\infty}$ in order to maximize (1) subject to (2). The solution to the dynamic optimization problem yields the following conditions

$$c_{s,t+1} = \beta \frac{R_{t-1}}{R_t} c_{s,t} \tag{3}$$

$$\eta c_{s,t} = \frac{i_t}{1+i_t} m_{s,t} \tag{4}$$

together with the solvency constraint

$$\lim_{t \to \infty} \gamma^t R_t (a_{s,t} + m_{s,t}) = 0 \tag{5}$$

where $\eta \equiv \frac{1-\xi}{\xi}$, (3) is the optimal path for individual consumption, (4) is the portfolio equilibrium condition, i_t is the nominal interest rate and R_t is the interest factor, which is composed of one-period real interest rates compounded from period 0 to period t

$$R_t = \frac{1}{(1+r_0)(1+r_1)(1+r_2)...(1+r_t)} \tag{6}$$

where by definition $\frac{R_{t-1}}{R_t} = 1 + r_t$. The nominal interest rate represents the opportunity cost of real money holdings and the Fisher equation holds at all times

$$(1+i_t) = (1+\pi_{t+1})(1+r_t) \tag{7}$$

The closed form solution for the optimal choice of individual consumption is

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[8]This timing convention is common in monetary economics and implies that money acquired in period t by the representative agent born at time s is $m_{s,t}$. Real money balances are assumed to yield transaction services within the period. On this issue see Obstfeld and Rogoff (1996), chapter 8.

[9]It should be noted that the budget constraint (2) incorporates the premium paid by insurance companies to the consumer which amounts to $\frac{1-\gamma}{\gamma}\left[\frac{m_{s,t-1}}{1+\pi_t} + (1+r_{t-1})a_{s,t-1}\right]$.

$$c_{s,t} = \frac{1-\beta\gamma}{1+\eta}\left[\frac{1}{\gamma}\left(\frac{m_{s,t-1}}{1+\pi_t} + \frac{R_{t-1}}{R_t}a_{s,t-1}\right) + h_{t,s}\right] \tag{8}$$

where $h_{t,s}$ is the human wealth, defined as the present discounted value of future labor incomes net of taxes

$$h_{t,s} = \sum_{v=0}^{\infty}\gamma^v \frac{R_{t+v}}{R_t}(w_{s,t+v} - \tau_{s,t+v}) \tag{9}$$

Since the size of the cohort born at time s at time t is $(1-\gamma)\gamma^{t-s}$, the aggregate value for a generic economic variable, say $x_{s,t}$, can be obtained as

$$X_t = \sum_{s=-\infty}^{t} x_{s,t}(1-\gamma)\gamma^{t-s} \tag{10}$$

where upper case letters denote aggregate values.

Aggregation of all generations gives the following expressions for aggregate consumption and the portfolio balance condition[10]

$$C_t = \frac{1-\beta\gamma}{1+\eta}\left[\frac{M_{t-1}}{1+\pi_t} + (1+r_{t-1})A_{t-1} + H_t\right] \tag{11}$$

$$\eta C_t = \frac{i_t}{1+i_t}M_t \tag{12}$$

where aggregate human wealth is defined as

$$H_t = \sum_{v=0}^{\infty}\gamma^v \frac{R_{t+v}}{R_t}(W_{t+v} - T_{t+v}) \tag{13}$$

The aggregate budget constraint is

$$C_t + A_t + M_t = W_t - T_t + \frac{M_{t-1}}{1+\pi_t} + (1+r_{t-1})A_{t-1} \tag{14}$$

The difference equation describing the time path of aggregate consumption is[11]

$$C_t = \beta(1+r_{t-1})C_{t-1} - \frac{1-\gamma}{\gamma}\frac{(1-\beta\gamma)}{(1+\eta)}\left[\frac{M_{t-1}}{1+\pi_t} + (1+r_{t-1})A_{t-1}\right] \tag{15}$$

[10]The portfolio balance condition characterizes the demand for real money holdings, which is increasing in consumption and decreasing in the nominal interest rate (i.e. the opportunity cost of real money balances).

[11]A specific feature of the Yaari-Blanchard framework is that the time path of aggregate consumption depends on total wealth. See Blanchard (1985). Setting $\gamma = 1$, consumption evolves according to the standard Euler equation.

3.2 Firms

The supply side of the economy is described by a standard neoclassical constant return production function in labor and physical capital. Output at each time period t, Y_t, is given by

$$Y_t = AF(K_{t-1}, L_t) \tag{16}$$

where L_t is the labor force employed by the firms and A is a measure of total factor productivity assumed to be constant and normalized to one for simplicity. For all $K, L > 0$, $F(\cdot)$ is such that

$$F(0, L) = 0, \quad F_k(K, L) > 0, \quad F_{KK}(K, L) < 0$$

and

$$\begin{aligned} \underset{K\to 0}{lim} F_K(K,1) &= \infty \\ \underset{K\to\infty}{lim} F_K(K,1) &= 0 \end{aligned}$$

Since the marginal product of labor is always positive and leisure is not an argument of the utility function, all population is employed at the optimum and $L_t = 1$ for each t. Physical capital depreciates at a constant rate $\delta \in (0,1)$. Competitive profit-maximizing firms equate the marginal product of capital to the user cost of capital, $(r_t + \delta)$

$$AF_K(K_t, 1) = r_t + \delta \tag{17}$$

and output is equal to factor payments

$$Y_t = AF(K_{t-1}, 1) = (r_{t-1} + \delta)K_{t-1} + W_t \tag{18}$$

3.3 The Monetary Authority

The monetary authority is assumed to choose its policy rule independently. We assume that a strict monetary targeting rule is adopted, that is that the nominal money stock evolves according to an exogenously given rate of growth μ_t. Real money balances are then described by

$$M_t = \frac{1+\mu_t}{1+\pi_t} M_{t-1} \tag{19}$$

In this monetary regime the long run level of the inflation rate is given by the rate of money growth, while short run inflation is endogenously determined and responds to changes in exogenous variables.

3.4 Government

The government, for a given monetary policy, is assumed to choose the sequence of taxes and public expenditure in order to always satisfy the intertemporal budget constraint. The flow budget constraint of the government is given by

$$B_t = (1 + r_{t-1})B_{t-1} + G_t - T_t - M_t + \frac{M_{t-1}}{(1 + \pi_t)} \tag{20}$$

where G_t is public expenditure[12]. Equation (20) says that public expenditures and interest payments can be financed by taxes, issuance of new bonds and seigniorage. The solvency constraint precluding Ponzi's game requires that

$$\lim_{t \to \infty} R_t B_t = 0 \tag{21}$$

Conditions (20) and (21) imply that the government satisfies its intertemporal budget constraint for a given monetary policy. The current value of the government's liabilities is equal to the present discounted value of current and future budget surpluses for any sequence of the price level, nominal interest rate and money stock. The fiscal authority can be defined as *Ricardian*, in the sense of Woodford (1995).

The sequence of public expenditure $\{G_t\}_{t=0}^{\infty}$ is exogenously given, while the sequence of lump-sum taxes $\{T_t\}_{t=0}^{\infty}$ is an increasing function of public debt

$$T_t = \theta B_t - Z_t \tag{22}$$

where $\theta > 0$ and $\{Z_t\}_{t=0}^{\infty}$ is an exogenous sequence of positive transfers[13]. The parameter θ is chosen in order to ensure a convergent path of the government debt and can be interpreted as the speed of fiscal adjustment of taxes to real public debt changes. In fact, the larger θ, the greater the effects on taxation of an increase in the public debt.

[12] It should be noted that the government is assumed to issue fully indexed bonds. In the FTPL class of models the government is assumed to issue also or exclusively nominal debt.

[13] The feedback rule (22) is a form of wealth tax and was introduced by Blanchard (1985) in his original contribution. Ganelli (2002) shows under which circumstances the wealth tax is not sufficient to ensure saddle-path stability.

3.5 Equilibrium Conditions and Steady State

Equilibrium is given by the market clearing conditions and by the efficiency conditions for consumers and firms, under the above defined monetary and fiscal rules. The dynamic competitive equilibrium is described by the following system of difference equations

$$C_t = \beta(1 + r_{t-1})C_{t-1} - \frac{1-\gamma}{\gamma}\frac{(1-\beta\gamma)}{(1+\eta)}\left[\frac{M_{t-1}}{1+\pi_t} + (1 + r_{t-1})(B_{t-1} + K_{t-1})\right] \tag{23}$$

$$K_t = AF(K_{t-1}, 1) + K_{t-1}(1 - \delta) - C_t - G_t \tag{24}$$

$$B_t = (1 + r_{t-1})B_{t-1} + G_t - \theta B_t + Z_t - M_t + \frac{M_{t-1}}{(1 + \pi_t)} \tag{25}$$

$$M_t = (1 + \mu_t)(1 + r_{t-1})(M_{t-1} - \eta C_{t-1}) \tag{26}$$

where (23) is the difference equation describing the time path of consumption; equation (24), obtained by combining (14), (18) and (20) describes the accumulation of physical capital; (25) is the budget constraint of the government incorporating the fiscal rule; equation (26), obtained from the Fisher equation combining the portfolio condition (12) with the monetary rule (20), describes the equilibrium condition in the money market. The price level adjusts in order to clear the money market.

In the absence of changes in the level of transfers and of public expenditure the economy converges to a steady state denoted by C, K, B and M. In steady state the inflation rate is equal to the rate of growth of the nominal stock of money, $\pi = \mu$.

3.6 Model Solution

In this Section the non-linear system (23)-(26) is approximated by a first order Taylor expansion around the steady state and technology is assumed to be given by

$$Y_t = AF(K_{t-1}, 1) = AK_{t-1}^{\alpha} \tag{27}$$

with $\alpha \in (0, 1)$. In particular, the model is log-linearized so as to obtain a linear system of difference equations where variables are expressed in terms of percentage deviations from the steady state.

Defining $\widehat{S}_t = [\widehat{K}_t \mid \widehat{B}_t \mid \widehat{M}_t \mid \widehat{C}_t]'$ and $\widehat{\varepsilon}_t = [\widehat{G}_t \mid \widehat{Z}_t]'$ the system can be written as

$$\Omega_S \widehat{S}_{t+1} = \Omega_S^L \widehat{S}_t + \Omega_\varepsilon \widehat{\varepsilon}_{t+1} \quad (28)$$

$$\widehat{\varepsilon}_{t+1} = \Sigma \widehat{\varepsilon}_t \quad (29)$$

where each element of vectors $\widehat{S}_t$ and $\widehat{\varepsilon}_t$, say X_t, is expressed as $\widehat{X}_t = \ln(\frac{X_t}{X}) \simeq \frac{X_t - X}{X}$. The relevant matrices of the system are defined as

$$\Omega_S = \begin{pmatrix} \frac{K}{Y} & 0 & 0 & \frac{C}{Y} \\ 0 & 1 & \frac{\mu}{1+\mu}\frac{M}{B} & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & \frac{1-\gamma}{\gamma}\frac{1-\gamma\beta}{1+\eta}\frac{1}{1+\mu}\frac{M}{C} & 1 \end{pmatrix}$$

$$\Omega_S^L = \begin{pmatrix} \alpha + (1-\delta)\frac{K}{Y} & 0 & 0 & 0 \\ -(1-\alpha)(r+\delta) & 1+r-\theta & 0 & 0 \\ \omega_{31} & 0 & (1+\mu)(1+r) & \omega_{34} \\ \omega_{41} & \omega_{42} & 0 & \beta(1+r) \end{pmatrix}$$

with
$\omega_{31} \equiv (1+\mu)(1-\alpha)(r+\delta)(\eta\frac{C}{M} - 1)$
$\omega_{34} \equiv -(1+\mu)(1+r)\eta\frac{C}{M}$
$\omega_{41} \equiv -\frac{1-\gamma}{\gamma}\frac{1-\gamma\beta}{1+\eta}(1+r)\frac{K}{C} + \frac{1-\gamma}{\gamma}\frac{1-\gamma\beta}{1+\eta}(1-\alpha)(r+\delta)(\frac{B}{C}+\frac{K}{C}) - \beta(1-\alpha)(r+\delta)$
$\omega_{42} \equiv -\frac{(1-\gamma)(1-\beta\gamma)}{(1+\eta)\gamma}(1+r)\frac{B}{C}$

$$\Omega_\varepsilon = \begin{pmatrix} -\frac{G}{Y} & 0 \\ \frac{G}{B} & \frac{Z}{B} \\ 0 & 0 \\ 0 & 0 \end{pmatrix}$$

$$\Sigma = \begin{pmatrix} \rho_G & 0 \\ 0 & \rho_Z \end{pmatrix}$$

Matrix Σ presents the autoregressive coefficients of the shocks and indicates how exogenous fiscal variables evolve over time.

The log-linearized model (28)-(29) can be solved by applying the Blanchard-Kahn (1980) algorithm. In particular $\widehat{K}_t$ and $\widehat{B}_t$ are predetermined variables and $\widehat{M}_t$ and $\widehat{C}_t$ are forward looking variables. The solution, describing the fluctuations of the economic variables of the system around their steady state values in response to changes in public expenditure and transfers, takes the following form

$$\widehat{S}_{1,t+1} = \Theta\widehat{S}_{1,t} + \Phi\widehat{\varepsilon}_t \quad (30)$$

$$\widehat{S}_{2,t} = \Upsilon\widehat{S}_{1,t} + \Psi\widehat{\varepsilon}_t \quad (31)$$

where $\widehat{S}_1$ and $\widehat{S}_2$ are the subvectors of endogenous states and of forward looking variables, respectively. The elements of the matrices Θ, Φ, Υ and Ψ depend on the underlying parameters and on the critical ratios of the model[14].

In order to better understand the dynamic properties of the model in response to changes in $\widehat{\varepsilon}_t$, we characterize the dynamics of three other forward looking variables (the inflation rate, the price level and the nominal interest rate) and of another predetermined variable (the real interest rate).

The path for the inflation rate and for the price level as percentage deviations from their trend are

$$\widetilde{\pi}_{t+1} = \widehat{\pi}_{t+1}\mu = -(1+\mu)\widehat{M}_{t+1} + (1+\mu)\widehat{M}_t \quad (32)$$

$$\widehat{P}_t = -\widehat{M}_t \quad (33)$$

where $\widetilde{\pi}_{t+1} = \pi_{t+1} - \pi$. Finally, the time path for the real and the nominal interest rate as deviations from their steady state levels are

$$\widetilde{r}_t = r_t - r = (r+\delta)(\alpha-1)\widehat{K}_t \quad (34)$$

$$\widetilde{i}_t = i_t - i = (1+r)\widetilde{r}_t + (1+\pi)\widetilde{\pi}_{t+1} \quad (35)$$

The time path of the nominal interest rate turns out to be crucial in the determination of the equilibrium conditions in the money market and in the characterization of the effects produced by fiscal expansions in the simulations.

Computations are performed under the assumption that the rate of money growth is constant over time, that is $\mu_t = \mu$ for each t.

4 Calibration

In order to analyze the response to changes in the level of transfers and public expenditure, we calibrate the parameters of the model using Euro

[14] The numerical solution of the model is reported in the Appendix.

Area quarterly data and assume that each period corresponds to a quarter of a year[15].

Private consumption share $C/Y = 0.57$ is the average ratio of final consumption of households to GDP for the period 1991-2001. Public expenditure share, set equal to $G/Y = 0.20$, and transfers share, $Z/Y = 0.26$, are defined as the average ratios of final consumption of general government to GDP and of current transfer to GDP, respectively. The average annual ratio of GDP and of the monetary aggregate M1, Y/M, for the period 1997-2001 is 3.32.

We set the rate of growth of the nominal stock of money to 2% per annum[16]. For the Euro area the average labor share is approximately 0.69 and is the average of the compensation per employee as a percentage of GDP for the period 1991-2001[17]. The implied value for the parameter α is then 0.31. The real interest rate is set equal to 3% per annum. Finally, we calibrate the probability of survival between two consecutive quarters to be 0.985[18].

In the benchmark economy the annual public debt to GDP ratio is set equal to 0.6 and the parameter of the fiscal rule θ is chosen in order to ensure public solvency[19]. The model is also solved for an economy characterized by a larger annual government debt-GDP ratio, 1.06[20]. It should be noted that the high debt economy differs from the low debt one in three important aspects: first, the level of the steady state human wealth is lower, the amount of taxes necessary to sustain a high public debt being larger as a percentage of GDP[21]; second, the parameter of the fiscal rule, θ, is smaller, implying that the speed of adjustment of taxes with respect to public debt is lower; third, the time path of aggregate consumption, described by equation (23), is substantially altered by the high public debt.

[15]The Euro Area Data Source is the ECB Statistical DataBank. Tables 2.04, 5.01 and 7.01 of the Euro Area Statistics have been used.

[16]In this simplified model the rate of money growth determines the steady state level of the inflation rate. Considering a 2% target for the inflation rate, the rate of money growth is set accordingly.

[17]See European Commission (2003b), Table 32.

[18]The choice of this parameter is crucial for the results. The positive probability of death is the only source of heterogeneity in this model.

[19]The steady state quarterly public debt-GDP ratio is then equal to 2.4.

[20]Italy and Belgium present the largest government debt as percentage of the GDP among the Euro Area countries. In 2002 Italy and Belgium's annual government debt-GDP ratios were 106.7 and 105.4, respectively.

[21]In steady state the sustainability of a high level of debt requires a larger amount of total taxation to be levied on households. It follows that human wealth, as defined in (13), is lower for consumers in the high public debt country, the flow of future labor income they face being the same.

Finally, we will analyze the behavior of the benchmark economy in the absence of wealth effects, that is setting the probability of survival between two consecutive periods, γ, equal to one. In this case Ricardian Equivalence prevails and aggregate consumption evolves according to the standard Euler equation.

Table 1 summarizes the underlying parameter values, long run properties of the economy in the three cases and the implied values for the rate of time preference β, the rate of depreciation δ and the parameters η and θ[22].

5 The Response of the Economy to Fiscal Expansions

This Section reports the responses of the economy to fiscal expansions. Specifically, increases in transfers to households and in public expenditure are considered in turn. The fiscal changes analyzed are assumed to bring on impact the fiscal deficit as a percentage of the GDP to 3% and 6%. All the experiments are carried out under the assumptions that the economy is initially in steady state and that fiscal expansions are financed entirely by issuance of new bonds and future taxes.

5.1 Increase in Lump-Sum Transfer

Figures 1 and 2 plot the responses of the economy to an increase in transfer payments to households which decays with an autoregressive coefficient of 0.95.

In the first place, consider the reactions of the relevant economic variables in the benchmark economy, described by the continuous lines. A positive change in transfers leads to an increase in consumption on impact, while real money balances negatively deviate from their steady state level. During the later phases of the adjustment consumption is below its long run level. Physical capital reduces gradually and then starts to increase again, but is always below its steady state level during the adjustment process. For a constant rate of nominal money growth, all deviations of real money balances from the steady state, observed during the adjustment process, are due to movements in the price level. In other words, after the expansion, the price level deviates from its trend. In particular, the price level jumps on impact by 0.022% and then follows a bell shaped path, as shown in Figure 1. The

[22] Full derivation of the implied parameter values is reported in the Appendix.

maximum deviation from its trend is 0.029%. In Figure 2, the impact effect is 0.049% and the maximum deviation is 0.066%.

These results can be explained as follows. When Ricardian Equivalence is not satisfied, an increase in the level of transfers to households augments the human wealth of current generations, which fully benefit from the fiscal expansion and share the burden of taxation with as yet unborn cohorts. For this reason total consumption jumps upwards on impact and then starts to decrease. After the fiscal expansion the nominal interest rate jumps upwards and is always above its steady state level along the adjustment path. The nominal interest rate is, in fact, a forward looking variable whose level depends on a weighted average of future real interest rates. At the same time the real interest rate is anchored to the level of capital, whose accumulation process is governed by consumption. In this sense all the observed dynamics are triggered by changes in the consumption plan. Consider now the effects on the money market. The initial increase in consumption boosts the demand for real money balances on impact, while the increase in the opportunity cost of real money holdings depresses the demand for money. The negative effect prevails, hence we observe a downward jump in the demand for real money balances. Afterwards both effects are negative and therefore real money balances are always below their steady state level. Since the nominal money supply growth rate is kept constant, during the adjustment process the price level path must be above its long run level to ensure the equilibrium in the money market. In this sense a temporary increase in transfers alters the equilibrium conditions in the monetary market and the time path of the price level.

The dotted lines indicate the responses of the economy to an increase in transfers when simulations are carried out neglecting wealth effects (i.e. setting the probability of survival between two consecutive periods to 1). In the absence of wealth effects Ricardian Equivalence prevails and the timing of taxes does not affect the time profile of consumption. An increase in transfers only affects the time path of public debt during the adjustment process[23]. In this case the real and the nominal interest rates are constant over time and the equilibrium in the monetary market is unaffected by the fiscal expansion. The paths of public debt with and without wealth effects are virtually identical, as shown in Figures 1 and 2.

The dashed lines illustrate the responses of economic variables to the fiscal expansion under the assumption that the steady state annual government

[23]An increase in transfer payments, financed by new bond issue and future taxes, is considered a pure 'Ricardian experiment'.

bond-GDP ratio is 1.06. The effects of an increase in lump sum transfers are larger than those observed in the low debt economy. The price level jumps on impact by 0.041 % in Figure 1 and by 0.092% in Figure 2. Results show that fiscal expansions tend to be more inflationary in economies with higher debt to GDP ratios.

The intuition behind this finding can be explained as follows. The policy experiment is conducted in such a way that two economies share the same characteristics and differ only in the public debt-GDP ratio and in the implied value of the fiscal parameter of adjustment, θ, which is lower in the high debt economy. In this case consumers pay a large amount of taxes and the level of their steady state human wealth is lower than that of individuals in a low debt economy. However, the same increase in transfers determines a larger increase in human wealth in the high debt economy. Since the low fiscal adjustment spreads the burden of future taxation across a larger number of cohorts, individuals initially benefit from the transfer increase in a large measure and boost their consumption more. On the other hand, the nominal interest rate increases more than in the low debt economy. This major change in the consumption plan of individuals, in fact, determines larger deviations of all the other economic variables from their steady state levels in response to the fiscal expansion. The same mechanism explained above is at work, but the effects produced by the fiscal expansion on the demand for real money balances are now larger, hence a greater change in the time path of the price level is required to restore the equilibrium.

5.2 Increase in Public Expenditure

Consider now the effects of an increase in public expenditures. Figures 3 and 4 plot the responses of selected variables to a temporary increase in public expenditure which brings on impact the budget deficit-GDP ratio to 3% and 6%, respectively. The autoregressive coefficient is again assumed to be 0.95. As before, we consider first the responses of the benchmark economy, with low debt and wealth effects, described by the continuous lines.

In Figure 3 the expansion generates a decrease in consumption of 1.52%; the nominal interest rate increases on impact and the price level jumps upwards by 1.70%. The demand for real money balances reduces on impact as consequence of the decline in the level of consumption and of the increase in the opportunity cost of real money holdings. Since the rate of nominal money growth is kept constant, the equilibrium in the monetary market is restored by an upward jump of the price level path. Physical capital is crowded out by public debt and is below its steady state level during the adjustment process. It follows that the real interest rate is above its steady state value. All the effects are larger in Figure 4, where a higher change in public expenditure is considered.

The dotted lines indicate the percentage deviations of the relevant economic variables with no wealth effects. Initially wealth effects amplify the responses of the nominal interest rate, of the price level and of capital to increases in public expenditure, while they dampen the effects on consumption. An increase in the level of public expenditure still crowds out private consumption in the representative agent framework, but consumption is less reduced on impact when current generations expect to share the burden of taxation with future generations (human wealth of current generations decreases less in the economy with wealth effects). At a later stage however, the situation is reverted. The 'excessive' consumption, due to the presence of wealth effects, determines a larger negative effect on capital accumulation, and therefore less resources are available for consumption at later stages. The nominal interest rate of the economy with wealth effects deviates in a larger measure from the long run level than that of the economy in which Ricardian Equivalence condition holds. The larger opportunity cost for real money holdings explains why we observe a larger deviation of the price level path in the economy with heterogeneity.

The dashed lines illustrate the responses of a high debt economy to a temporary increase in the level of public expenditure of the same amount. The downward jump in consumption is smaller than in the low debt case, because current consumers suffer a smaller reduction in their human wealth. Since the fiscal adjustment is slower, taxes are more smoothed across generations and individuals initially reduce their consumption level less. As explained above, a larger consumption level during the earlier stages determines larger negative effects on capital and reduces the resources available for consumption during the later stages. The nominal interest rate is larger than in the low debt economy, as expected. Again the demand for real money balances is lower and the deviation of the price level from the steady state path is larger.

***

This model introduces wealth effects among agents and the time path of consumption depends on wealth and on the time path of taxes. An increase in transfers alters the time profile of taxes and, via wealth effects, influences consumption. An increase in public expenditure crowds out private consumption and the magnitude of the effect is shown to depend on heterogeneity. Changes in consumption plans and in the nominal interest rate alter the demand for real money balances. Under the assumption of a constant rate of money growth, the price level deviates from its trend to clear the money market. In other words, the effects produced by fiscal variables on the price level are due to the consumers behavior facing a positive probability of death. Consumers alter their consumption plan in response to fiscal changes and their choices are shown to depend on the speed of fiscal adjustment and on the level of the public debt. These effects are rather important quantitatively in the second experiment, where public expenditure crowds out consumption in any case (even when $\gamma = 1$) and triggers a pervasive process of adjustment in the whole economy. Wealth effects explain the difference in the magnitude of these responses in the three economies considered in the simulations. On the other hand, the magnitude of the effects produced by the fiscal expansion on the price level path and on the other economic variables is minor in the first experiment. The reason is that simulations are based on a model in which the only source of heterogeneity is a positive, but low, probability of death. This paper, in fact, expressly considers the minimum deviation from Ricardian Equivalence, theoretically achievable in a microfounded optimizing general equilibrium model. The wealth effects described by the simulations must then be small by construction[24].

The departure from Ricardian Equivalence considered in the model, albeit small, is sufficient to show the directions in which wealth effects work in providing a link between fiscal variables and the dynamics of the price level. It would be interesting to investigate the magnitude of the wealth effects and the relative consequences for economic policies in the Euro Area, without any presumption ex ante on the nature of these effects.

6 Conclusions

The Stability and Growth Pact imposes limitations on the size of public debt and of budget deficit in each country of the EMU. Constraints on fiscal policy are considered by policy makers to be necessary to safeguard the ECB credibility and to ensure price stability. In the absence of fiscal limitations, in fact, political pressures might arise to finance budget deficits with seignorage and to monetize public debt. The Yaari-Blanchard model offers an additional perspective to discuss the Stability and Growth Pact. From

[24] For a survey on the empirical literature on the observed deviations from Ricardian Equivalence see Mankiw and Elmendorf (1999).

a theoretical point of view wealth effects provide supplementary reasons to enforce fiscal convergence in the Euro Area and the respect of both fiscal requirements: the deficit criterion and the debt criterion.

We have presented a small structural model showing the role of wealth effects in affecting the dynamic response of the economy to fiscal expansions entirely financed by future lump-sum taxation. In particular, this paper shows how temporary fiscal expansions affect the equilibrium conditions in the money market and negatively affect price stability. Overall the results suggest that wealth effects enlarge the response of the price level to fiscal variables. The price level path is always above its long run trend during the adjustment process. Budgetary policies need not be intertemporally unbalanced to explain the correlation between fiscal variables and price level dynamics. All the results are obtained under the assumption of flexible prices, so that the good's market is always in equilibrium and the price level has to change in response to a fiscal expansion to equilibrate the money market. In other words, the excess of real money supply requires an increase in the price level to clear the money market during the adjustment. Moreover, the model indicates that wealth effects amplify the crowding out of physical capital due to excessive public debt along the adjustment path, but the quantitative results of the simulations are obviously driven by unrealistic assumptions and the role of wealth effects is minor by construction. It also emerges that public debt-GDP ratio and the degree of fiscal adjustment influence the responses of the economy to a fiscal expansion. Economies with higher public debt ratios and slow fiscal adjustment experience larger deviations of the price level from its trend after a fiscal expansion.

This result of the analysis is in line with the renewed attention paid by policy makers to the respect of the debt criterion in the Euro Area and with the insistent recommendations to national governments to run down public debt towards the 60% of GDP reference value at an adequate pace.

This paper clearly shows the directions in which wealth effects work and the characteristics of the distortionary effects of fiscal policy and of high public debt. However, simulation analyses are based on a theoretical model which considers only a small departure from Ricardian Equivalence and wealth effects do not seem to significantly affect prices. Given these results, the natural question to address is the following: does Ricardian Equivalence hold in the Euro Area? If not, then there is an additional concern for the monetary authorities and there are extra reasons to enforce the Stability and Growth Pact. Loose fiscal policies and the lack of fiscal convergence would make it more difficult the pursuit of price stability. Equilibrium in the money market would in fact be substantially altered by fiscal expansions and a whole new game between fiscal and monetary authorities would open up.

Finally, the model presented, based on several simplifying hypotheses, can be used as benchmark for future investigations. Extensions should incorporate additional sources of heterogeneity other than a small probability of death, which is the only departure from the representative agent framework considered in the present paper. In addition, different fiscal adjustment rules could also be taken into account to analyze the responses of the economy to a fiscal expansion. Some form of price stickiness could be introduced into the model, in order to better analyze the short run implications of fiscal policy. Finally, the model could consider different monetary regimes, such as inflation targeting or interest rate rules.

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Table 1	
Average Ratios	$C/Y = 0.57$
	$G/Y = 0.20$
	$Z/Y = 0.26$
	$4Y/M = 3.32$
Baseline parameter values	$\gamma = 0.985$
	$\gamma_{NW} = 1$
	$\alpha = 0.310$
	$r = 0.007$
	$\mu = 0.005$
Implied parameter values	$\beta_{60\%} = 0.999$
	$\beta_{106\%} = 0.999$
	$\beta_{NW} = 0.993$
	$\delta = 0.020$
	$\eta = 0.026$
	$\theta_{60\%} = 0.198$
	$\theta_{106\%} = 0.115$
Other ratios	$K/Y = 11.32$
	$B/Y_{60\%} = 0.60 \times 4$
	$B/Y_{106\%} = 106 \times 4$

Appendix

Steady state conditions and implied parameter values

In steady state equations (18) and (24) can be re-written as

$$\delta\frac{K}{Y} = 1 - \frac{C}{Y} - \frac{G}{Y} \tag{1A}$$

$$1 = (r+\delta)\frac{K}{Y} + (1-\alpha) \tag{2A}$$

The rate of depreciation δ and the capital/income ratio must satisfy both conditions. It follows that

$$\frac{K}{Y} = \frac{\alpha}{r} - (1 - \frac{C}{Y} - \frac{G}{Y}) \tag{3A}$$

$$\delta = \frac{(1 - \frac{C}{Y} - \frac{G}{Y})}{\frac{\alpha}{r} - (1 - \frac{C}{Y} - \frac{G}{Y})} \tag{4A}$$

The subjective discount factor β is given by equation (23) in steady state

$$\beta = \frac{\frac{C}{Y}(1+\eta) + \frac{1-\gamma}{\gamma}[\frac{1}{1+\pi}\frac{M}{Y} + (1+r)\frac{A}{Y}]}{(1+r)(1+\eta)\frac{C}{Y} + (1-\gamma)[\frac{1}{1+\pi}\frac{M}{Y} + (1+r)\frac{A}{Y}]} \tag{5A}$$

The coefficient η is derived from equation (26)

$$\eta = \frac{M}{C}\frac{r+\mu(1+r)}{(1+\mu)(1+r)} \tag{6A}$$

Finally, the critical parameter of the wealth tax must be chosen so as to keep the budget constraint of the government (25) on balance

$$\theta = r + \frac{G}{B} + \frac{Z}{B} - \frac{M}{B}(1 - \frac{1}{1+\pi}) \tag{7A}$$

Model solution

The relevant matrices that describe the model solution under the assumption of an annual government debt-GDP ratio equal to 60% are the following

$$\Theta_{60\%} = \begin{pmatrix} .9728 & -.0002 \\ -.0206 & .8091 \end{pmatrix}$$

$$\Phi_{60\%} = \begin{pmatrix} -.0107 & -.0003 \\ .0815 & .1025 \end{pmatrix}$$

$$\Upsilon_{60\%} = \begin{pmatrix} .6949 & -.0003 \\ .7093 & .0045 \end{pmatrix}$$

$$\Psi_{60\%} = \begin{pmatrix} -.1449 & -.0024 \\ -.1292 & .0050 \end{pmatrix}$$

In the absence of wealth effects the relevant matrices are

$$\Theta_{NW} = \begin{pmatrix} .9732 & 0 \\ -.0206 & .8091 \end{pmatrix}$$

$$\Phi_{NW} = \begin{pmatrix} -.0101 & 0 \\ .0815 & .1025 \end{pmatrix}$$

$$\Upsilon_{NW} = \begin{pmatrix} .6997 & 0 \\ .6997 & 0 \end{pmatrix}$$

$$\Psi_{NW} = \begin{pmatrix} -.1413 & 0 \\ -.1413 & 0 \end{pmatrix}$$

Finally, under the assumption of an annual government debt-GDP ratio equal to 106% the solution is described by the following matrices

$$\Theta_{106\%} = \begin{pmatrix} .9732 & -.0005 \\ -.0198 & .8920 \end{pmatrix}$$

$$\Phi_{106\%} = \begin{pmatrix} -.0109 & -.0004 \\ .0461 & .0580 \end{pmatrix}$$

$$\Upsilon_{106\%} = \begin{pmatrix} .7011 & -.0018 \\ .6990 & .0119 \end{pmatrix}$$

$$\Psi_{106\%} = \begin{pmatrix} -.1483 & -.0044 \\ -.1252 & .0075 \end{pmatrix}$$

The above matrices have been used to generate the responses of any variable in the vector $\widehat{S}$ to any of the changes in the vector $\widehat{\varepsilon}$ under the assumption that autoregressive coefficients are

$$\Sigma = \begin{pmatrix} .95 & 0 \\ 0 & .95 \end{pmatrix}$$

Figure 1: Response of the Economy to an Increase in Transfers. On Impact Deficit-GDP=3%

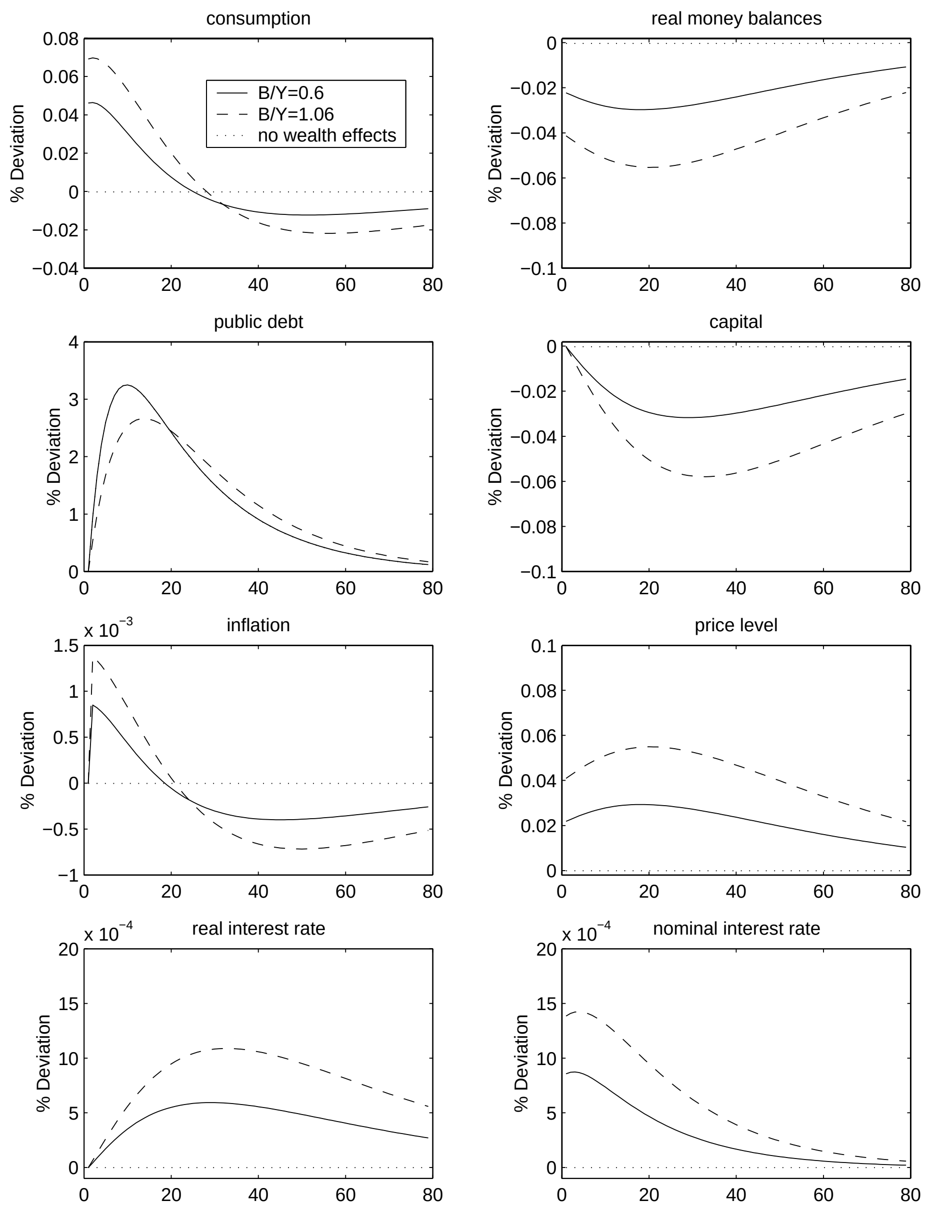


Figure 2: Response of the Economy to an Increase in Transfers. On Impact Deficit-GDP=6%

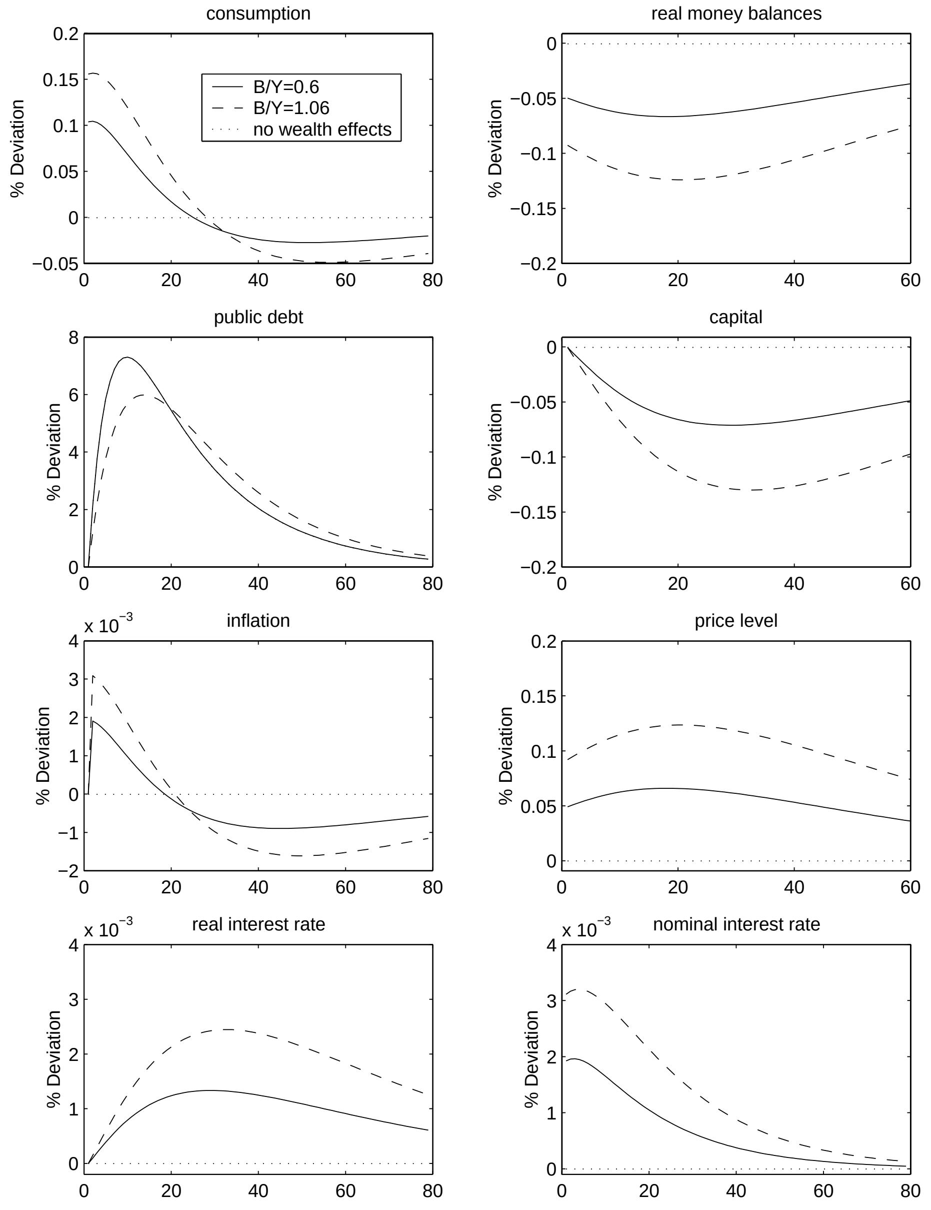


Figure 3: Response of the Economy to an Increase in Public Expenditure. On Impact Deficit-GDP=3%

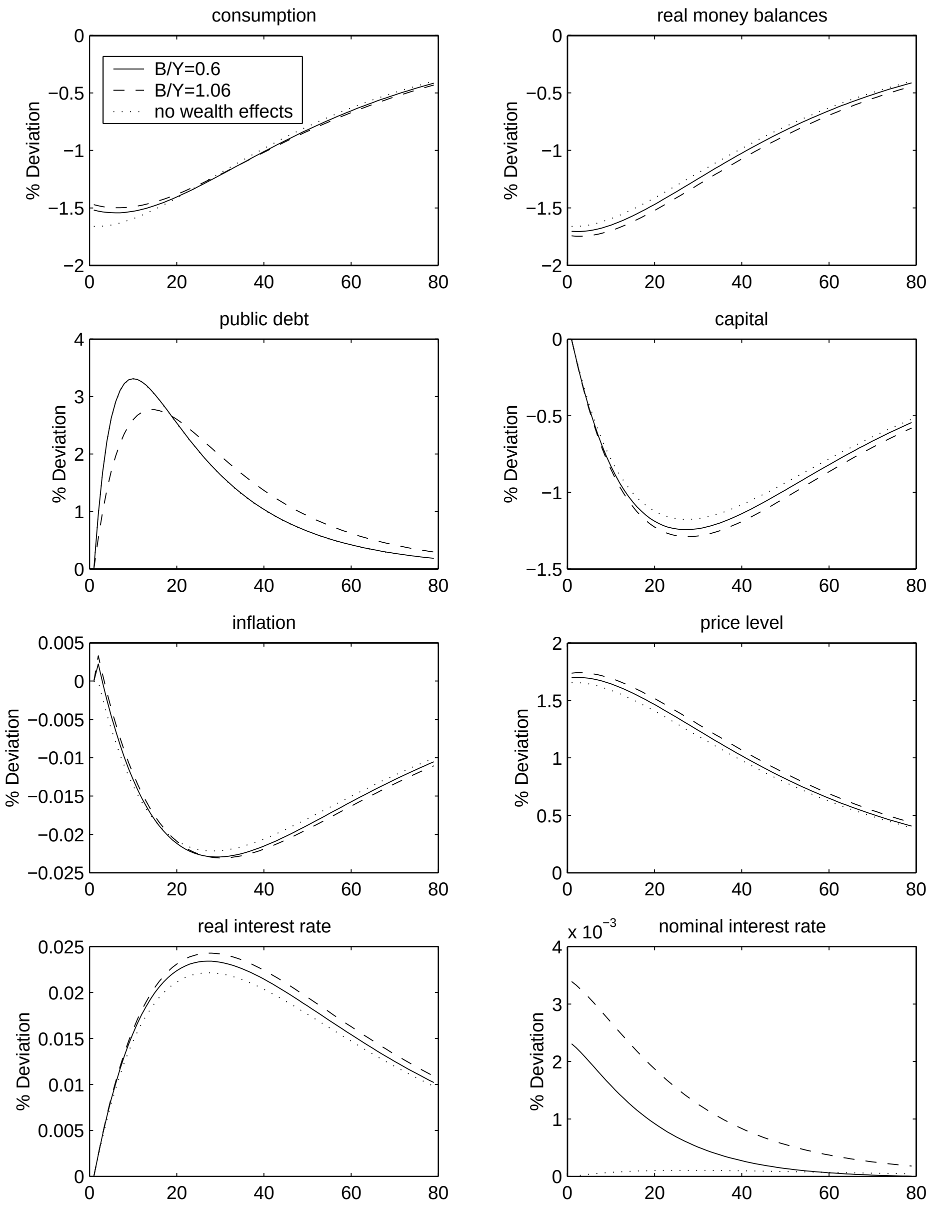
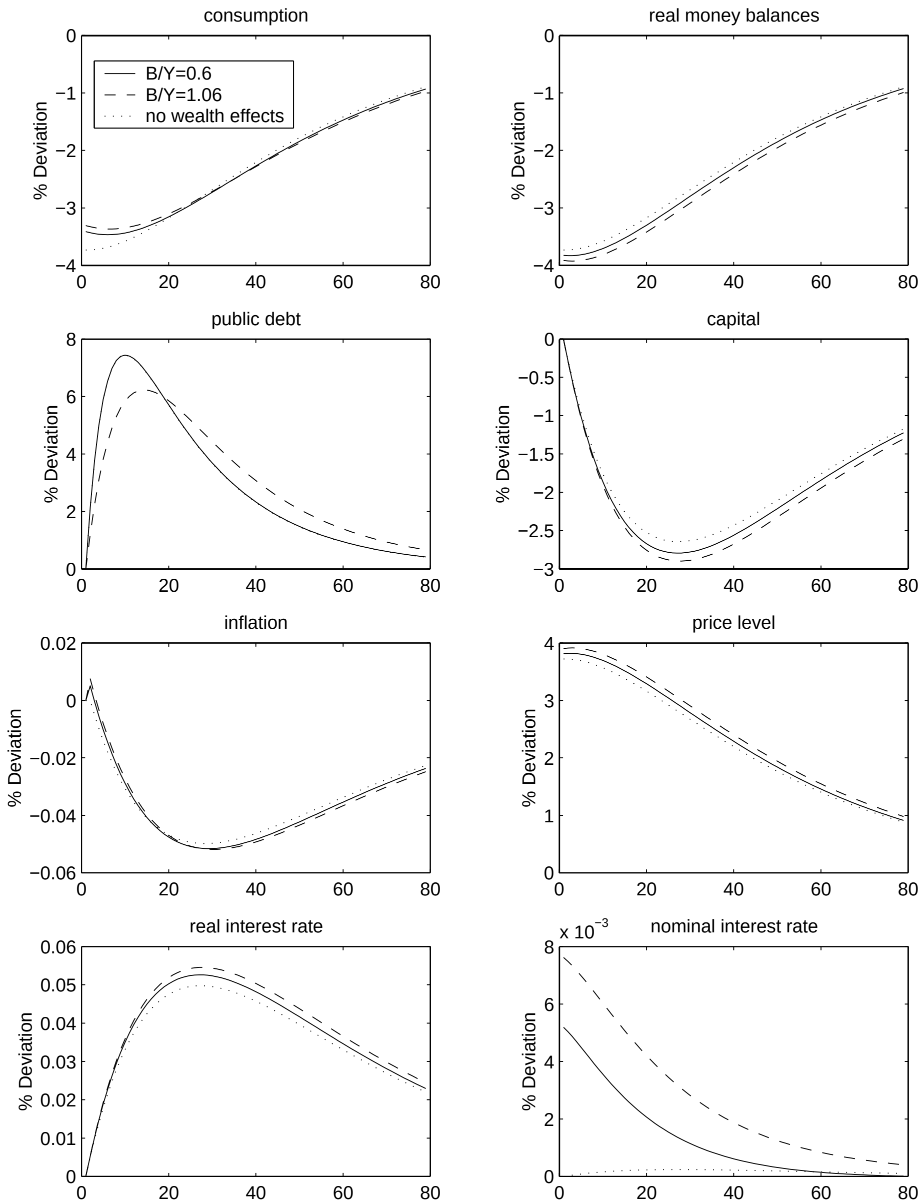


Figure 4: Response of the Economy to an Increase in Public Expenditure. On Impact Deficit-GDP=6%



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