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Document de travail

AN ASSESSMENT OF STABILITY AND GROWTH PACT REFORM PROPOSALS IN A SMALL-SCALE MACRO FRAMEWORK

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An Assessment of Stability and Growth Pact Reform Proposals in a Small-Scale Macro Framework*

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Abstract

This paper contributes to the debate on fiscal governance for the European Monetary Union, assessing the different fiscal rules currently discussed. We simulate a small scale macroeconomic model with forward looking agents, augmented with a public finances block. We account for both the positive (output stabilization) and negative (via risk premia) effects of debt and deficit. By the appropriate choice of the exogenous fiscal variables, in the fiscal block, we replicate the working of the rules embedded in the so-called “fiscal compact”: a balanced budget rule (the “new golden rule”), and the debt reduction rule (to reach 60% of GDP in 20 years). We compare these rules with the Maastricht 3% deficit limit (status quo), and with an “investment” rule leaving room for public investment. We evaluate the performance in terms of output loss during a fiscal consolidation, as well as following demand and supply shocks in steady state. All rules guarantee long run sustainability. The investment rule emerges robustly as the one guaranteeing the lower output loss, followed by the status quo. The “fiscal compact” rules appear to be recessionary.

Keywords: Fiscal Rules, Small scale Macroeconomic Models, golden rule, fiscal consolidation, EMU economic governance, fiscal compact, Dynare

JEL-Codes: C63, E62, E63, H61

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1. Introduction

The paper addresses the macroeconomic impact of a set of different European fiscal rules that were, will, or might be implemented. The European fiscal crisis and the ensuing requirement to reduce public debt levels paved the way for a set of reforms of the European fiscal rules. Two rules are currently discussed to strengthen the Stability and Growth Pact (SGP): the existing limit of public deficit at 3% of GDP (the status quo) could be supplemented with a limit on the structural deficit at 0.5% of GDP, and a debt-reduction scheme. The limit on structural deficit goes beyond the 3% Maastricht provision in that it aims at introducing balanced budget constraints in the Constitution of each euro zone member state. It can be labeled a “new golden rule”¹. The debt-reduction scheme imposes high debt countries to reduce each year their public debt ratio by one twentieth of the difference with the 60% reference level.

It is hard not to notice a possible paradox: rules aimed at preventing governments from intervening in the economy are discussed precisely after the worldwide financial crisis triggered governments’ interventions that have helped to dampen shocks ensuing from market failures. Thus, the introduction of the above-mentioned rules raises the question of their respective incidence on the usual objectives of economic policies, namely the output gap and the inflation rate.

The contribution of this paper is to simulate the macroeconomic effects of the adoption of these rules in a reduced form small scale New-Keynesian model, in which we introduce a public finance block and a yield curve embedding risk premia. We aim at shifting the attention back from the objective of fiscal stabilization to the one of macroeconomic stabilization. As the proposed rules stand, public deficit and debt are not to be managed as means to smooth the cycle. European authorities - governments, the ECB, or the Commission - seem to consider them as objectives of policy action rather than what they should be, namely *instruments* for obtaining the final objective of stabilizing output gap and inflation. This reversal of targets and instruments is equivalent to *a priori* denying any role to macroeconomic (in particular fiscal) policy. With this exercise we intend to account for the negative impact of excessive deficit and debt, while emphasizing their role as instruments for attaining the *final objective* of aggregate welfare maximization.

We assess the macroeconomic impact of adopting the fiscal rules on four economies that we take as representative of the euro zone: a large (relatively) low-debt economy (France), a small high-debt one (Belgium), a large high-debt one (Italy) and a small-low debt one (the Netherlands). The size of nations – large or small – relates to the size of their fiscal multiplier. The four countries also differ in terms of the size and sign of their primary

¹ Throughout the paper we call the legal endorsement of budget balance “new golden rule” to distinguish it from the “old golden rule”, or investment rule. Introduced in the 1997, the UK golden rule of public finance typically excludes public investment from the budget limits over the cycle. See Buiters (2001) for a comprehensive discussion.

structural balance: France and the Netherlands have a deficit, whereas Belgium and Italy hold a surplus.

We simulate the effect of the rules on the level and variability of the output gap, the inflation rate and the structural deficit, and the impact on the level of public debt. This is done in a framework in which on one side the evolution of deficit is countercyclical, but on the other, excessive debt feeds back into the economy through increasing risk premia. We simulate the different rules over a 20-year horizon, consistently with the target of the one twentieth debt reduction rule.

The rules we simulate are (a) the balanced (at 0.5% of GDP) budget or “new golden rule”; (b) the 5% yearly debt reduction rule; (c) the 3% total deficit cap (status quo). We also evaluate the effect of (d) adopting an investment rule in the vein of the UK golden rule of public finances, that broadly speaking imposes budget balance over the cycle only for current spending, while allowing public investment to be financed through debt.

The simulations are carried out starting from a reduced-form New-Keynesian model, where the IS and Phillips curves have hybrid specifications with backward and forward expectation terms. The solution technique we use is described in Juillard (1996) and implemented in DYNARE. It ensures that (partially) forward looking agents form appropriate expectations and, in our specification of the economy, it also takes into account the nonlinearity of the risk premium and the zero lower bound. It is worth emphasizing here that the macroeconomic framework is partly biased against the use of an investment rule, because we rule out the endogeneity of potential output, which could be positively affected by public investment.

We investigate two related scenarios. First, we analyze the path followed by the four economies under the adoption of each fiscal rule, starting from 2010 public debt and deficit levels. We ask, in other words, how the rules fare in a fiscal consolidation scenario as the one Europe will likely experience in the coming years. Second, we simulate the dynamics of the economy after a demand and a supply shock, starting from a Maastricht-type steady state, with the economy at a 5% nominal growth rate (3% potential growth plus 2% inflation rate), and a 60% debt level. It is worth noticing that the original back-of-the-envelope calculation that led to the limits embedded in the Maastricht Treaty is at odds with actual potential growth in the Eurozone countries, that since 1992 has been consistently below 3%; this contributed to making the limits to public finances behaviour even more stringent than originally planned.

Results are manifold. First, the adoption of the rules produces in all cases a short-run recession, even in small countries with a low multiplier and low initial public debt like the Netherlands. Second, recessions sometimes foster deflation. Under the zero lower bound for the interest rate, deflation is very difficult to reverse with a binding fiscal constraint. Third, the investment rule performs better than the other three rules: recessions are shorter and milder; hence the average loss of output over a 20-year horizon is smaller. Fourth, this result is strongly robust to changes in the parameters’ values. Fifth, the status quo outperforms the “new golden rule” and the debt reduction rule in terms of output loss, although it is more inflationary for large countries. Sixth, when the economy is hit by demand and supply shocks at the steady state, the status quo seems appropriate to cope with them. This vindicates the

claim that the current SGP gives fiscal margins for manoeuvre (see e.g. Buti and Giudice, 2002). The simulations show nevertheless that the status quo remains costly in comparison with the investment rule.

The paper is structured as follows: Section 2 introduces and discusses the reduced form model. In section 3, we simulate the behaviour of large and small countries following different types of shocks, and give a quantitative assessment of the macroeconomic performance for the different fiscal rules. Section 4 is devoted to a robustness check of the main results, and section 5 concludes.

2. An augmented New-Keynesian model

The economy is characterized by a standard framework with the aggregate demand side described by a dynamic IS curve, and aggregate supply by a hybrid Phillips curve. By hybrid, we mean that expectations are forward and backward-looking. In order to study the different fiscal rules, we add to this core a public finances block, with sufficient details so as to allow a correct simulation of the differences between the rules. To properly take into account the effect of debt, deficit and monetary policy on private agents' behaviour, we also explicitly model the equations for long and short run interest rates.

2.1 The reduced-form model

All variables are deviations from their steady state value, except public finance variables which are expressed in percentage of GDP.

The AD bloc is described by a dynamic hybrid IS curve, detailing the determinants of the output gap $x_t = y_t - y^*$:

$$x_t = \alpha_1 \cdot x_{t-1} + (1 - \alpha_1) \cdot E_t x_{t+1} + \alpha_2 \cdot (r_t - E_t \pi_{t+1} - rr^*) + \alpha_3 \cdot (dsp_t - dsp_{t-1}) + \varepsilon_t^d, \quad (1)$$

where α_1 stands for the incidence of backward-expectations on demand behavior, r_t is the nominal long-term interest rate, π_t is the inflation rate, rr^* is the long-term real interest rate; dsp_t is structural primary balance (i.e. the deficit net of interest payments and of cyclical components), and its change over time, $(dsp_t - dsp_{t-1})$ is the fiscal impulse, or stimulus; α_2 and α_3 are parameters ($\alpha_2 < 0$, $\alpha_3 > 0$). The apparently *ad hoc* nature of the introduction of the fiscal impulse should not be overstated. In its simplest form, the expectational IS curve is a linearised Euler equation for an economy without capital and government. Backward-looking expectations were empirically introduced in the Euler equation, e.g. by Fuhrer and Rudebusch (2004). The introduction of government in the model modifies the Euler equation: the intertemporal ratio of consumption *plus* public spending replaces the intertemporal ratio of consumption, and the new ratio is set equal to the real interest rate. We assume that public spending has a direct incidence on the goods market equilibrium and hence introduce the

fiscal impulse – the difference between structural balances at time t and time $t-1$ – in the expectational IS curve.

The aggregate supply block is represented by a standard hybrid Phillips curve, where λ_1 stands for the incidence of backward-expectations on supply behavior and λ_2 is the elasticity of inflation to the output gap and is a positive parameter:

$$\pi_t = \lambda_1 \cdot \pi_{t-1} + (1 - \lambda_1) \cdot E_t \pi_{t+1} + \lambda_2 \cdot x_t + \varepsilon_t^s \quad (2)$$

The third equation describes the very simple behavior of nominal (2-year) long-term interest rates r_t along the yield curve, where i stands for (1-year) short-term interest rate, and γ represents the risk premium associated with debt variations above the target b^* :

$$(1 + r_t)^2 = (1 + i_t) \cdot (1 + E_t i_{t+1}) \cdot [1 + (\gamma \cdot \max(0, b_t - b^*))] + \varepsilon_t^f \quad (3)$$

Monetary policy is described through a usual Taylor rule. The central banker sets the nominal short-term interest rate in response to expected future inflation and current output gap, with a close-to-zero bound on the nominal rate (here at 0.25%):

$$i_t = \max(0.25, rr^* + E_t \pi_{t+1} + \Phi_1 \cdot (E_t \pi_{t+1} - \pi^*) + \Phi_2 \cdot x_t + \varepsilon_t^m) \quad (4)$$

In equations (1) to (4) the error terms ε stand for exogenous shocks. Hence ε^d and ε^s represent a demand and a supply shock respectively.

The public finance block is made explicit to facilitate the introduction of different fiscal rules in the model. Total government deficit can be decomposed into a cyclical component and a structural component:

$$dt_t \equiv dc_t + ds_t \quad (5)$$

The cyclical component, or cyclical deficit, depends linearly on the output gap, because of the working of automatic stabilizers (see e.g. Girouard and Andre, 2005):

$$dc_t = \psi_1 \cdot x_t \quad (6)$$

The structural deficit is the sum of interest payments and structural primary deficit:

$$ds_t = ip_t + dsp_t \quad (7)$$

where, denoting with b the stock of public debt, interest payments are denoted by $ip_t = r_t \cdot b_{t-1}$. The latter part of the structural deficit is close to the discretionary part of fiscal policy. The annual difference in the structural primary deficit stands for the annual fiscal impulse.

Public debt follows the usual law of motion:

$$b_t = b_{t-1} \cdot \left(1 - \frac{\pi_t + x_t + y_t^*}{100}\right) + dt_t \quad (8)$$

The model has a steady state with a potential growth rate y^* of the economy exogenously set at 3%, in accordance with the underlying hypothesis of the European Union Treaty. The real natural interest rate rr^* also equals 3%, the debt target b^* is 60% and the inflation target π^* is 2%. The steady-state public deficit is thus equal to interest payments (3%), and primary balance is achieved.

2.2 Calibration

The output gap and inflation rate in the expectational IS and Phillips curve equations are introduced with half-backward and half-forward-looking components ($\alpha_I = \lambda_I = 0.5$). For the IS-augmented curve, this seems to be a reasonable hypothesis considering the average results by Fuhrer and Rudebusch (2004) over a wide range of estimations. Estimations by Goodhart and Hofmann (2005) however point to a relatively lower incidence of forward-looking expectations for the US and Euro area economies, which would put α_I in the range of [0.2, 0.4]. The parameters of the expectations-augmented-Phillips curve are more controversial (and estimations are more numerous). Gali et al. (2005) and Goodhart and Hofmann (2005) find that the coefficient on past inflation is rather modest (both around 0.2-0.3). Rudd and Whelan (2006), on the contrary, conclude that the forward-looking component is insignificant, and recent evaluation drawing on survey-based expectations concludes that the hybrid Phillips curve (with a significant backward term) outperforms the New-Keynesian Phillips curve (having no inflation persistence), and found that the forward-looking coefficient was close to $\lambda_I = 0.5$ (see Paloviita, 2008). We decided to follow this road, which is agnostic with respect to a debate that is yet unsettled. At any rate, we included λ_I (and α_I) among the parameters for which we made robustness checks.

Table 1 reports the parameters in the simulations. The coefficient value of the incidence of the output gap in the hybrid Phillips curve is close to Paloviita's (2008) estimate. The parameters in the monetary rule are taken from Taylor (1993). The targets are consistent with the Maastricht Treaty and the Stability and Growth Pact's requirements. Two different values for the coefficient of the fiscal impulse in the expectational IS equation are introduced, in order to take into account the higher external leakage of a domestic fiscal policy in a small (and open) economy. The robustness of the simulations to a range of parameters' values was performed and is reported in section 4.

2.3 Fiscal rules

The medium-to-long term performance of European economies crucially depends on the macroeconomic governance tools put in place by the EU. Three main options are before

policy makers: (a) a *status quo* where the ratio of public deficit to GDP must be maintained below the 3% limit. (b) The “new golden rule of public finances”, with the objective of balanced structural deficit, i.e. a balanced total deficit over the cycle. (c) A constant reduction of the debt ratio that would bring it to 60% of GDP in twenty years (i.e., 5% per year of the initial difference). Proposals (b) and (c) were both mentioned in the December 2011 Council conclusions; and in January 2012, all EU countries, except the UK and the Czech Republic, accepted the “fiscal compact” embedding the “new golden rule” in their legislation at a constitutional level. We add an alternative reform proposal namely (d) the “investment rule” that allows to finance an increase in public net assets by public debt issuance. These four rules differ on the criteria and on the type of constraints imposed to countries. We show below that in assessing their impact, both the size and the initial debt level play a crucial role.

Table 1: Calibration Parameter Values

α_1	0.5
α_2	- 0.2
α_3	0.8 (large country / 0.2 (small country)
λ_1	0.5
λ_2	0.2
γ	0.01
Φ_1	0.5
Φ_2	0.5
ψ_1	- 0.5
y^*	3%
b^*	60%
π^*	2%
<i>discount rate</i>	0.95 [=1/1.05]

In the fiscal block, what variables are endogenous and what are exogenous depends on the fiscal rule that is followed. Thus, we for the status quo, we impose that total deficit is exogenously given at 3%:

$$dt = 3$$

Because the limit is not always fulfilled in practice, we evaluate the path of convergence towards the status quo, from the initial, larger, public deficits of the countries under study.

The European Council’s conclusion, on December 9, 2011, states that “*General government budgets shall be balanced or in surplus; this principle shall be deemed respected if, as a rule, the annual structural deficit does not exceed 0.5% of nominal GDP.*” Therefore, when simulating the balanced budget rule or “new golden rule”, structural deficit is exogenous and constrained at:

$$ds = 0.5$$

The “investment rule” allows increasing public investment up to a threshold equal to the inflation depreciation of current debt. Thus, everything else equal, the “investment rule” keeps the real level of public debt constant. Public investment increases public debt only insofar as it goes beyond this threshold. The possible incidence of higher investment on debt may produce higher net interest charges: they are assumed to be compensated with a lower cyclically-adjusted primary deficit, e.g. with lower current expenditures $dcur$. The “investment rule” is described as follows:

$$\begin{aligned} dsp &= inv^g + dcur \\ inv^g &= (\pi/100). b^* \\ dcur &= -(1/10).ip + (9/10).dcur_{t-1}, \end{aligned}$$

where the last equation assumes that the current surplus needed to finance interest rate payments is spread over a ten-year period. Notice that this is a “mild” version of the rule because, first investment is accepted only up to the limit that keeps the debt ratio on a stationary path.; second, because we make the assumption that public investment has not impact on potential growth (that we assume constant), so that it is analytically equivalent to current spending. This puts us in a “worst case scenario”, in which we artificially shut off the main advantages of the investment rule.

As regards the one twentieth (5% debt reduction) rule advocated by the European Commission, the exogenous variable is the yearly change in debt. Furthermore, the “fiscal compact” implicitly assumes that once the 60% debt threshold is attained the “new golden rule” becomes binding. Hence, the one twentieth rule runs as follows:

$$\begin{aligned} \text{delta} &= \begin{cases} 1 & \text{if } b > b^* \\ 0 & \text{if } b \leq b^* \end{cases} \\ dt &= \delta.(-0.05.(b^{init}-b^*)) + (1-\delta).(\psi_1.x + 0.5) \end{aligned}$$

Initial Values

Initial debts and deficits for the four countries under study are 2010 OECD figures. They are reported in Table 2 below. By assumption, France and Italy are considered as larger countries than Belgium and the Netherlands; hence the fiscal multiplier of the former is equal to 0.8 rather than 0.2 for the latter.

Table 2: Initial Debt and Deficit Values, 2010

	Initial Debt	Initial Structural Primary Deficit	Fiscal multiplier*
France	94	2.63	0.8
Italy	127	- 1.84	0.8
Belgium	101	- 0.63	0.2
Netherlands	71	2.62	0.2

Source: OECD

*: assumption

3. Assessing the impact of the different amendment proposals of the Stability and Growth Pact

To our knowledge, there are very few examples of papers attempting at the evaluation of different fiscal rules in the EU context. Most recent papers dealing with this issue focus on one type of rule, like an expenditure rule (e.g. Hauptmeier et al., 2011), whereas those which study different rules use the classification by Kopits and Symansky (1998) (e.g. Creel and Saraceno, 2009, 2010; and Schuknecht et al., 2011). In contrast, Creel et al. (2011) performed a comparison between various fiscal rules within a simple simulation exercise in the vein of Eichengreen and Wyplosz (1998) and Monperrus-Veroni and Saraceno (2005). These exercises start from a simple reduced form VAR system that has its theoretical basis in a new Keynesian aggregate demand/Phillips curve model: the dependent variables are the output gap and inflation, while domestic public deficits are among the explanatory variables. The estimation results are the basis for a counterfactual assessment of the effect of alternative budgetary rules. Such an exercise has many shortcomings, the main being that it represents a typical Lucas' Critique victim: had the rules been applied in the past, agents would have embedded their consequences in their behaviors which would have been different. Actual data hence have a limited explaining power when trying to quantify the effects of alternative policies. The paper by Eichengreen and Wyplosz nevertheless retained a remarkable interest because it gave a measure of the magnitude of costs and benefits of the Pact; furthermore, in the extension of Creel et al. (2011), that included debt among the explanatory variables, it had the advantage of allowing a meaningful and consistent comparison of different institutional arrangements.

Creel et al. (2011) show that both for single and coordinated consolidations non-Keynesian crowding-in effects (if any) are more than compensated by the standard textbook contractionary effect of fiscal consolidations, even if the reduction of debt tends to soften this effect. As a consequence, the *status quo* and the “new golden rule” fare considerably worse than the debt and the investment rules. This has to be ascribed to the fact that in the two latter cases the debt ratio decreases over time, and that this has positive effects on the long run performance of the economy. It is also interesting to notice that the reduction of debt is considerably more beneficial in the two large economies, France and Italy, than in Belgium.

Our analysis in this paper completes these results, because instead of relying on data it builds on a theoretical model, and the differences across countries are given by parameters (notably the weight of government spending in the output gap equation), and by initial conditions of public finance variables.

We first discuss the application of the different fiscal rules to a consolidation occurring in the 4 countries starting from current conditions, and then we examine the case of supply and demand shocks hitting an economy at the Maastricht-type steady state. We will then perform a robustness test over the parameter space.

3.1 Fiscal Consolidation and Alternative Rules

Figures 1 to 4 show output gap and inflation, together with interest rates and the public finance variables, for France. The figures for the other countries are qualitatively similar and are presented in the Appendix. The economy starts from current levels of deficit and debt, and is tracked for the next 20 years. We decided to focus on fiscal consolidation abstracting from the *initial* size of the output gap and inflation which as a consequence in the simulations are set at their steady state values (0 for the output gap and the 2% central bank target for inflation)².

Before discussing the details of each rule, it is worth pointing out two things. First, all the rules yield long run convergence of output gap and inflation towards their steady state levels. Likewise, after an initial worsening, the debt ratio steadily decreases albeit at different rates. The convergence of the output gap towards zero implies that deficit also stabilizes, at the level necessary for interest rate payments. The second feature that is common to all the rules is the deep recession induced by consolidation in the short run which may even be deflationary and results in a sharp drop of interest rates. This initial drop in activity explains the initial increase of the debt ratio, thus supporting the argument in favour of more gradual consolidation, even in what concerns public debt sustainability.

Looking at the rules in detail, the 5% yearly debt reduction yields the larger initial drop of output, requiring more than a decade of total budget surplus. Furthermore, monetary policy loses traction, because it quickly hits the zero lower bound. On the other hand, the long run reduction of debt is more substantial than for the other rules. Looking at figures 1 and 3 we remark that the status quo (3% total deficit limit) and the structural balance rule (the “new golden rule”: a 0.5% structural deficit limit) yield very similar output gap patterns, but the constraints to deficit in the case of structural deficits is more deflationary (inflation is negative for 10 periods). Short term rates drop almost to zero, and as a consequence interest payments are lower than in the status quo. This in turn yields faster debt reduction in the medium to long run.

Finally the investment rule – figure 4 – yields much larger deficit levels in the short run, and hence a small increase of debt over the first 8 years. On the other hand, the rule turns out to be the least recessionary in the short run, with an output gap that even at the peak remains below a negative 1%.

To compare the different rules, we computed for each country (i.e. initial public finances values) the average of the discounted variables of interest (assuming a discount rate of 5%). They are reported in Table 3 . The table shows that for the four countries the average loss of output is considerably lower in the case of the investment rule than in the others, which in addition is associated with lower variability. As can be guessed from the figures above, this

² If we began with the current values of the (negative) output gap and inflation, the initial drop of output would be larger, and the interest rate would hit faster the zero lower bound.

can most probably be attributed to the lesser recessionary impact in the early phase of the consolidation process.

Table 3: Discounted Average Values of the Rules for 20 years

<i>France</i>					<i>Italy</i>				
	Status Quo	Inv. Rule	New Golden Rule	5% Debt Red.		Status Quo	Inv. Rule	New Golden Rule	5% Debt Red.
mean(x)	-0.14	-0.11	-0.20	-0.36	mean(x)	-0.05	-0.04	-0.11	-0.24
s.d.(x)	0.44	0.25	0.49	1.42	s.d.(x)	0.16	0.18	0.26	1.18
mean(π)	0.49	0.09	0.12	0.29	mean(π)	1.03	0.69	0.74	0.80
s.d.(π)	0.36	0.58	0.58	1.01	s.d.(π)	0.25	0.39	0.32	1.03
mean(ds)	2.00	1.62	0.5	-0.45	mean(ds)	1.91	1.14	0.5	-1.30
s.d.(ds)	1.23	1.46	0	2.11	s.d.(ds)	0.71	0.98	0	2.03
$b(t = 20)$	87.3	83.9	61.2	40.6	$b(t = 20)$	89.6	77.8	64.0	34.3

<i>Belgium</i>					<i>Netherlands</i>				
	Status Quo	Inv. Rule	New Golden Rule	5% Debt Red.		Status Quo	Inv. Rule	New Golden Rule	5% Debt Red.
mean(x)	-0.02	-0.02	-0.05	-0.09	mean(x)	-0.05	-0.02	-0.08	-0.09
s.d.(x)	0.07	0.05	0.15	0.29	s.d.(x)	0.14	0.05	0.23	0.33
mean(π)	1.10	0.97	1.10	1.18	mean(π)	1.07	0.89	1.05	1.13
s.d.(π)	0.31	0.34	0.22	0.33	s.d.(π)	0.27	0.36	0.23	0.24
mean(ds)	1.92	1.61	0.5	-0.31	mean(ds)	2.00	2.34	0.5	0.38
s.d.(ds)	0.71	1.21	0	1.45	s.d.(ds)	1.01	1.62	0	1.36
$b(t = 20)$	78.1	67.8	46.3	35.6	$b(t = 20)$	66.3	69.3	35.1	32.5

Average discounted values over 20 years. In bold, the best performance (larger average output gap, smaller structural deficit and inflation rate) according to the mean or standard deviation.

As regards inflation, the investment rule yields lower inflation on average, even if in this case the status quo exhibits lower variability for all countries except the Netherlands. However, the results for inflation are more difficult to interpret; as figures 1 to 4 show, during the consolidation the economy may go (in all the cases except the status quo) through a period of deflation. Thus, a low average inflation may not denote stable prices, but a prolonged period of price deflation.

Setting aside the investment rule, which is not a policy option in the current debate, we can observe that the status quo performs considerably better than the balanced budget or the 5% debt reduction rules, even if for large countries it is more inflationary.

As would be expected, on the other hand, the debt rule and the “new golden rule” yield substantially lower debt levels at $t=20$. In fact, both rules would yield, as a new steady state value, a null debt ratio (see, e.g. Creel and Saraceno, 2009).

To conclude, for all possible initial situations (large and small countries; high and low initial debt), the model yields the unequivocal result that implementing the investment rule would minimise the average loss of output, and also prove less inflationary than the different alternatives currently discussed in the European Union. Among these, the status quo is largely to be preferred if we use the output gap as a metrics, while structural balance and debt reduction are both less inflationary and yield faster debt reduction.

3.2 Supply and Demand Shocks in Steady State

The previous section dealt with the performance of the different rules during a consolidation process, starting from high debt ratios. Here we ask how the same rules would affect the dynamics of the economy if it were hit by a demand shock (in the output gap equation) or by a supply shock (in the Phillips curve equation) while in steady state. The results are summarized in Table 4, where we distinguish between “small” countries (with a low fiscal multiplier) and “large” ones (with a large fiscal multiplier)

We did not test the debt reduction rule, because that is typically a rule that applies when away from steady state. Table 4 shows first of all that the differences between the different rules are not substantial, though they exist, a result that were to be expected given that we are studying adjustments close to the steady state. Second, also not surprising, the best performance in terms of cumulated output gap is generally the status quo. In fact, the two other rules are more “structural”, as they yield ever decreasing reductions in the debt ratio, and not a convergence to its reference 60% value. It follows then that for reasonable shocks they impose an excessive restriction. The status quo rule allows cyclical deficits and hence the reabsorption of the shock at a minimum cost.

Though not surprising, this conclusion is important for two reasons. First, it shows that the main drawback with the current SGP rule – the status quo – is the difficulty to reach the steady state, because once it is there, the rule leaves enough space for output stabilization. The lack of enforcement of the rule by EU governments has certainly had to do with the costly convergence path (for many countries) that we described in the previous section. Second, the good performance of the status quo in comparison with the investment rule and the “new golden rule” is obtained with relatively high average levels of public structural deficit and debt. Public structural deficits are close to 2% of GDP for the 4 countries under study, whereas public debts are slightly above 60% of GDP 20 years after the shocks. Once more, the simulations show that persisting structural deficits are not necessarily inconsistent with output stabilization and public finances sustainability, and that, because of depressed growth, debt ratios can actually increase during fiscal consolidation.

Table 4 - Response to Demand and Supply Shocks Starting from Steady State

Small countries - Fiscal Multiplier = 0.2							
<i>Negative Demand Shock</i>				<i>Positive Supply Shock</i>			
	Status Quo	Inv. Rule	New Golden Rule		Status Quo	Inv. Rule	New Golden Rule
mean(x)	-0.07	-0.08	-0.10	mean(x)	0.05	0.05	0.02
s.d.(x)	0.22	0.23	0.31	s.d.(x)	0.09	0.07	0.04
mean(π)	1.01	0.96	0.96	mean(π)	0.99	0.98	0.96
s.d.(π)	0.24	0.25	0.26	s.d.(π)	0.28	0.29	0.33
mean(ds)	1.83	1.35	0.5	mean(ds)	1.89	1.37	0.5
s.d.(ds)	0.48	0.62	0	s.d.(ds)	0.57	0.67	0
$b(t = 20)$	62.5	49.9	31.6	$b(t = 20)$	61.6	48.1	30.1

Large countries - Fiscal Multiplier = 0.8							
<i>Negative Demand Shock</i>				<i>Positive Supply Shock</i>			
	Status Quo	Investment Rule	New Golden Rule		Status Quo	Investment Rule	New Golden Rule
mean(x)	-0.05	-0.09	-0.14	mean(x)	0.08	0.04	-0.02
s.d.(x)	0.17	0.23	0.36	s.d.(x)	0.23	0.09	0.09
mean(π)	1.02	0.75	0.67	mean(π)	0.93	0.81	0.67
s.d.(π)	0.28	0.31	0.38	s.d.(π)	0.26	0.28	0.44
mean(ds)	1.84	1.13	0.5	mean(ds)	1.91	1.19	0.5
s.d.(ds)	0.50	0.53	0	s.d.(ds)	0.60	0.61	0
$b(t = 20)$	62.8	48.9	34.7	$b(t = 20)$	62.8	47.1	33.0

Average discounted values over 20 years. In bold the best performance (larger average output gap, smaller structural deficit and inflation rate).

Finally, our results highlight the fact that it is almost impossible to reach a “one-size-fits-all” most preferred fiscal rule for all EU countries. Drawing on 4 different countries like Belgium, France, Italy and the Netherlands, it appears that rules perform differently according to the nature of the shock and the objective. For instance, the investment rule performs slightly better than other rules after a demand shock in a small country as far as the mean of inflation is the policy objective, whereas the “new golden rule” performs better after a demand shock in a large country or after a supply shock in a small country.

4. Robustness

The results of our simulations show rather univocally that the “old” golden (investment) rule, fares better than the others in most situations. We checked for the

robustness of these results, performing a Monte Carlo experiment over the space of the most relevant parameters. The objective was to make sure that the comparison between time series analyzed above were not dependent of the particular set of parameter chosen in Table 1.

We investigated the more representative parameters, i.e. the ones denoting the degree of backward looking expectations in the IS and Phillips curves (α_I and λ_I respectively); the impact of real interest rates (α_2) and of the fiscal impulse (α_3) on the output gap (IS curve); the impact of the output gap on inflation in the Phillips curve (λ_2); and finally, the risk premium in the long term interest rates equation (γ).

The simulation was conducted as follows:

- a) We made random draws of the parameters, within a certain range chosen, when possible, to be consistent with the existing literature.
- b) For each draw we solved the model with DYNARE using the 4 rules. We used French debt and deficit levels as the starting values.
- c) We selected the run only if DYNARE yielded convergence of the solution algorithm under the 4 rules.
- d) We recorded the average of discounted output gap values and inflation for each rule, and each parameter draw, over 20 periods.

The range of the 6 parameters random draws is reported in Table 5. It is worth noting that for α_I , the IS “forward looking” parameter, convergence was obtained in a rather significantly smaller interval than the one we had initially chosen. Looking at the details of the simulation, it appears that excessive values of the parameter (below 0.3 or above 0.55) yield no convergence of the solution algorithm for the debt reduction rule. For the other parameters, the range chosen ex ante turned out to be fine in terms of convergence. A possible explanation of why the debt reduction rule often fails to converge might be that with expectations in the IS equation excessively backward-looking (α_I between 0.5 and 0.8) the strong reduction of debt widens negatively the output gap which in turns increase the cyclical deficit and makes the budget adjustment even more severe. In the mean time, the debt/GDP ratio does not decrease and interest payments continue to negatively influence the budget and so the output gap. In a more forward-looking setup, the reduction of the output gap is compensated by the expected future positive output gap once the debt has been reduced and the budget balanced.

We ran around 4000 simulations, and for about 8% of them (333) the solution algorithm converged for the 4 rules. Once again, non-convergence was most of the time due to the debt reduction rule.

Table 5: Parameter Ranges for the Monte Carlo

<i>Parameter</i>	<i>Range</i>
α_1	[0.2 0.8] ([0.3 0.55]) ^a
α_2	[-0.9 -0.1]
α_3	[0.2 0.8]
λ_1	[0.2 0.8]
λ_2	[0.1 0.5]
γ	[0 0.03]

^a Range with convergence for the 4 rules

The 333 converging iterations formed our dataset. In Table 6 we report the descriptive statistics of the 333 simulations for the sum of discounted output gap and inflation over the twenty years following the adoption of each of the four rules.

It may first be noticed that the results are remarkably stable. Except for the one twentieth rule, the distribution is strongly centred on the mean and the median. The standard deviation of the average of the discounted sum output gap and inflation is significant for the one twentieth rule, but virtually null for the 3 other rules. This confirms that the debt reduction rule, even when converging, is more sensitive than the others to parameter variations.

Table 6: Monte Carlo Simulation. Average Output Gap and Inflation

	Output Gap				Inflation			
	<i>Status Quo</i>	<i>New Golden Rule</i>	<i>Inv. Rule</i>	<i>5% Debt Red.</i>	<i>Status Quo</i>	<i>New Golden Rule</i>	<i>Inv. Rule</i>	<i>5% Debt Red.</i>
<i>min</i>	-0.145	-0.198	-0.114	-0.898	0.468	0.101	0.090	-1.681
<i>max</i>	-0.144	-0.195	-0.102	-0.355	0.626	0.231	0.126	0.664
<i>mean</i>	-0.145	-0.196	-0.104	-0.394	0.487	0.118	0.093	0.152
<i>median</i>	-0.145	-0.195	-0.104	-0.357	0.485	0.116	0.092	0.285
<i>s.d.</i>	0.000	0.000	0.002	0.135	0.016	0.014	0.003	0.493

Average over the 333 simulations of the discounted sum of x_t and π_t . Best Performance in bold.

Turning at the analysis of the results, we notice that the investment rule fares significantly better than the others in terms of output gap. If the “old” golden rule were to be applied during the consolidation process, the cost in terms of output gap would be of approximately one third lower than for the status quo rule. The two rules of the “fiscal compact” would yield an average discounted output gap sum, over the parameter range, of twice (balanced budget) or 4 times as much (debt reduction) than the investment rule. The Monte Carlo experiment, therefore, confirms that the results of the time series are robust to parameter changes. As we highlighted for figures 1 to 4, the results concerning inflation are

more difficult to interpret, as a lower level is not necessarily better in potentially deflationary situations.

To conclude, the sensitivity analysis conducted on the parameter space showed that the results commented in section 3 are robust, i.e. that for a large range of parameter values the investment rule outperforms the others in term of output loss.

5. Conclusion

This paper evaluates the macroeconomic impact of a set of different European fiscal rules that were, will, or might be implemented. We simulate a small-scale New Keynesian model with both forward- and backward expectations. The calibration draws on the results of the literature and on the 2010 values of public finance data of 4 euro zone countries which we take as representative of all types of euro zone member states. The four fiscal rules are: the status quo 3% limit on public deficit, a balanced-budget rule, a debt reduction scheme and an investment rule in the vein of the UK golden rule of public finances.

We focused on two different scenarios. The first involves fiscal consolidation from current debt and deficit levels, towards the Maastricht reference values. The second assesses the impact of demand and supply shocks affecting the economy when at steady state.

Three types of simulations are performed. The macroeconomic impact of four fiscal rules are assessed after, respectively, a demand and a supply shock. Beforehand, we assess the path followed by the four economies under each fiscal rule, starting from their respective 2010 public debt and deficit levels. As such, the latter simulations convey macro insights on the dynamic path towards different rules' fulfillment, including the institutional *status quo*.

The main results are first, that abiding by the rules produces in all cases a short-run recession, even in countries with a small multiplier and a low initial public debt like the Netherlands. Second, during a consolidation phase, the investment rule performs better than the other rules: the recession is milder and shorter, thus leading to a substantially lower average loss of output over a 20-year horizon. Third, if the economy is hit by a demand or supply shock at steady state, the status quo seems fit to ensure that the economy is stabilized, while the more 'structural' rules turn out to be too recessionary. Finally, the two provisions of the "fiscal compact", balanced budget and constant debt reduction, seem to generally impose large costs to the economy, while not necessarily performing better in terms of public finances' sustainability. These results are robust to parameter changes.

This leads to a general concluding remark. The "fiscal compact" discussed by European leaders in early 2010s requires a constant debt reduction, together with a "semi-balanced" (at 0.5%) structural deficit. This implies that, once the target level of 60% is reached, the debt ratio will continue to decrease, led by the structural deficit balance. Our results show that these rules are extremely costly, in terms of output loss, if compared to the investment rule or even the status quo. Nevertheless, even neglecting these results, it appears clear that in normal times, i.e. when countries are not confronted with the issue of abnormal

debt levels, these rules are unfit, and contradictory with the original treaty targets of a 60% debt ratio. If such a drastic consolidation strategy were adopted, it would be unwarranted, and unwise, to embed it into constitutional laws, thus forcing the euro zone economies to converge to a zero debt steady state.

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Figure 1 – France – Status Quo

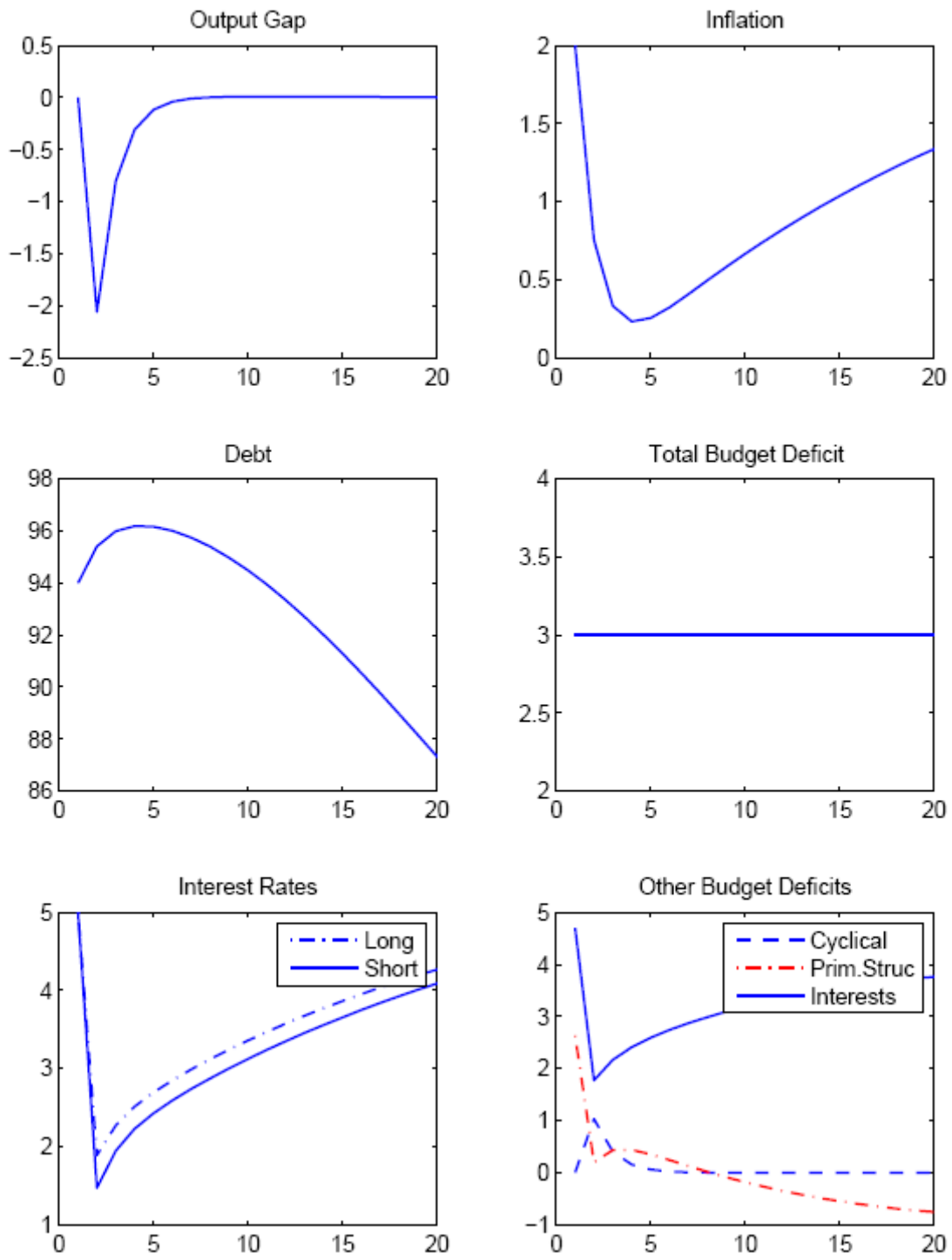


Figure 2 – France – New Golden Rule

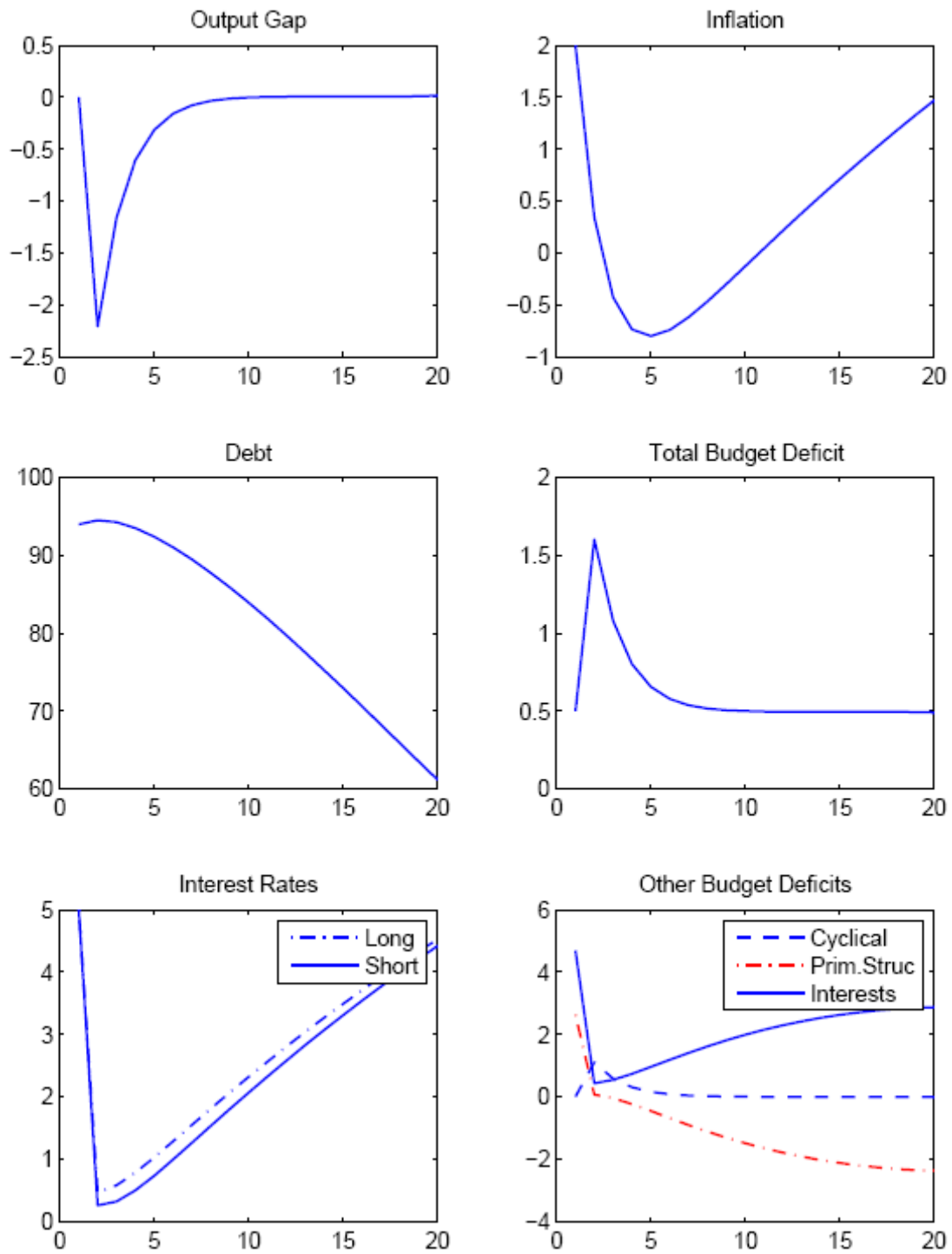


Figure 3 – France – Debt Reduction rule

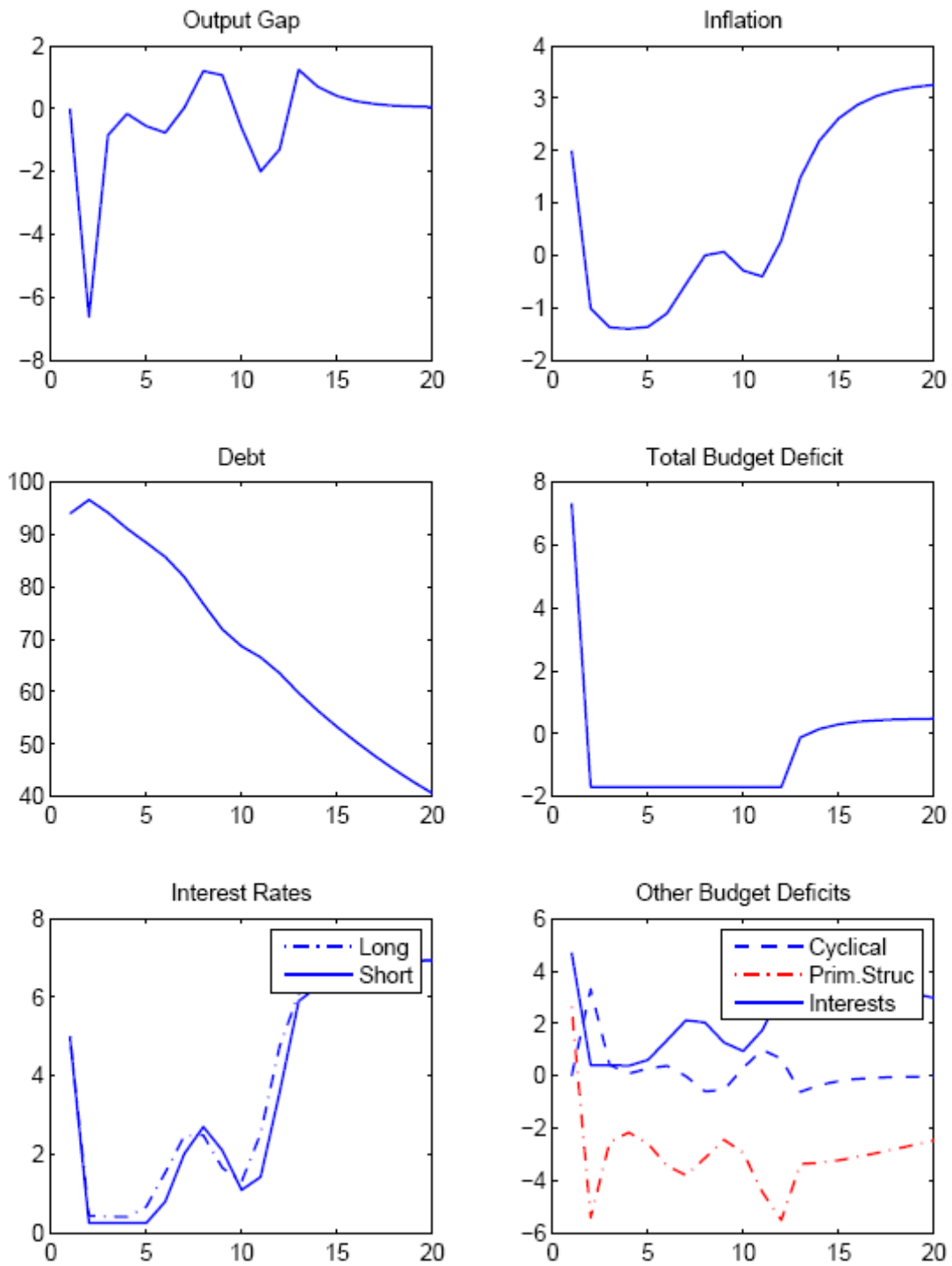
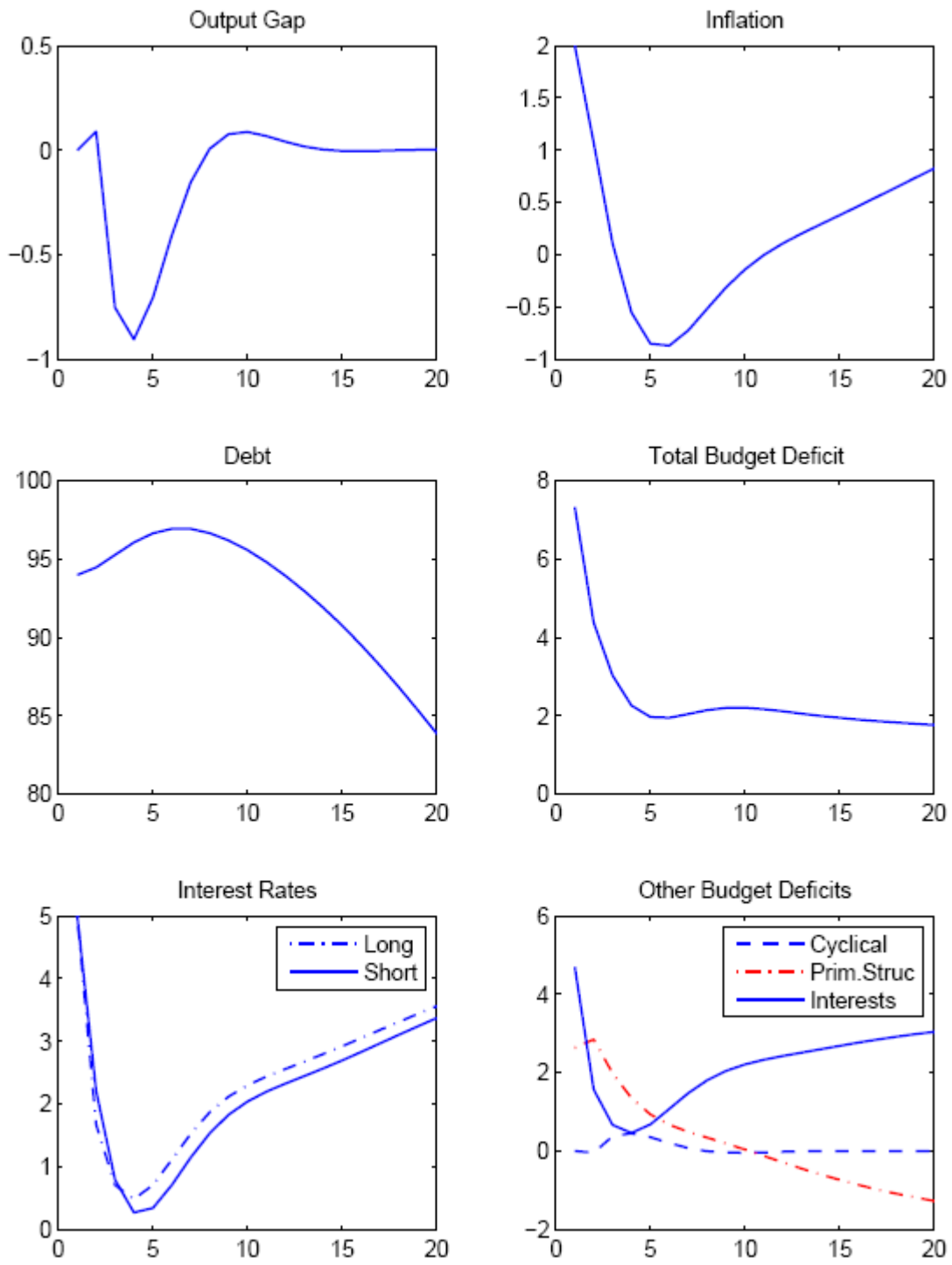


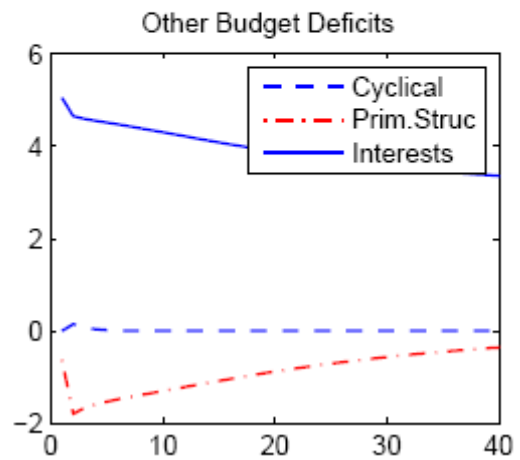
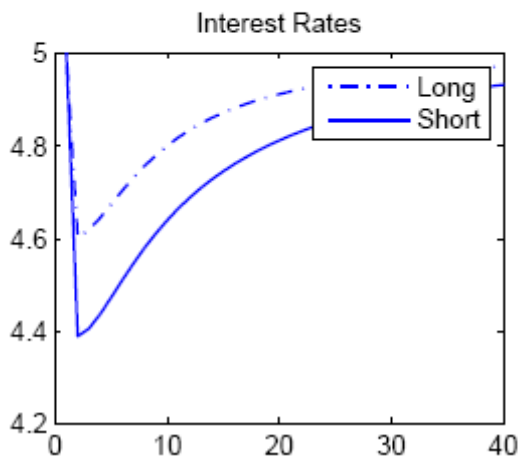
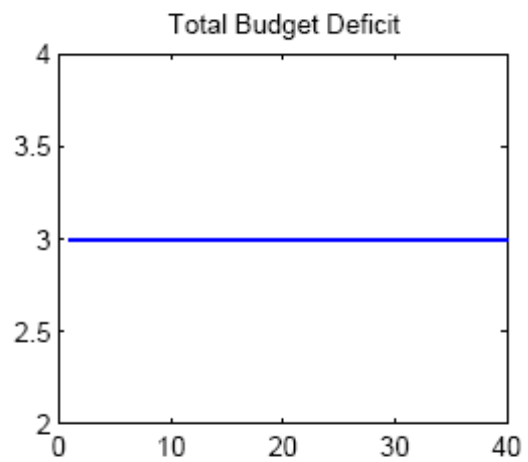
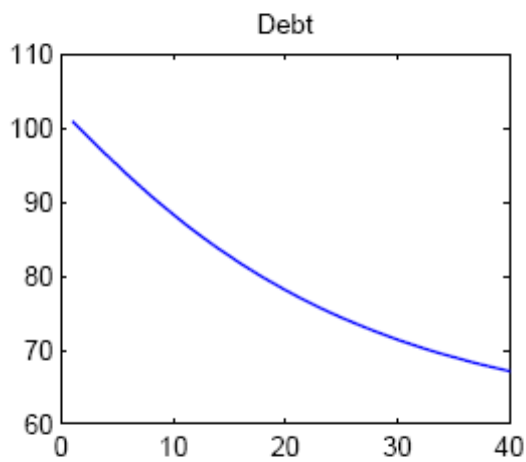
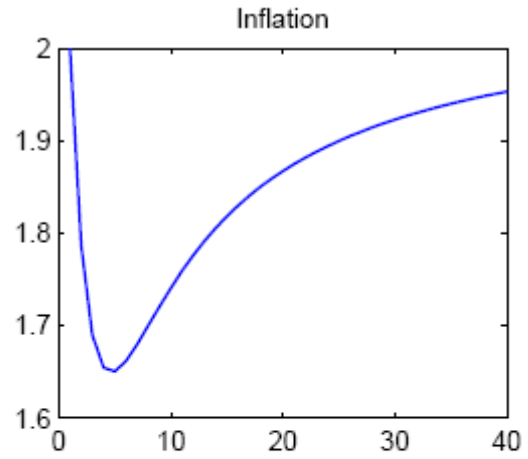
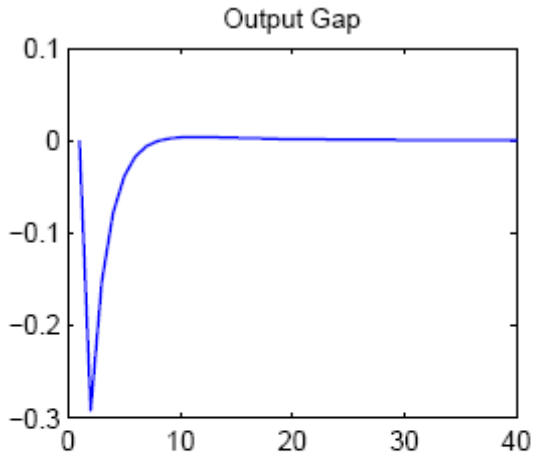
Figure 4 – France – Investment Rule



APPENDIX

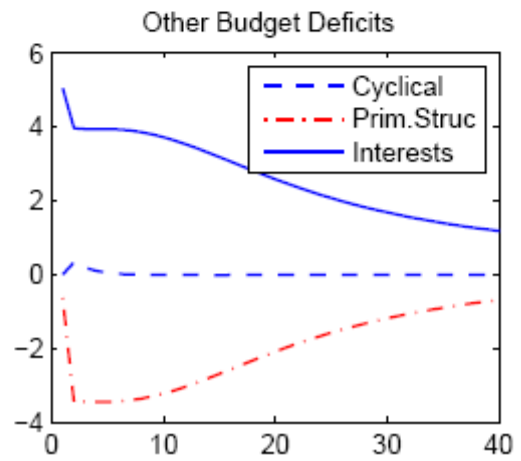
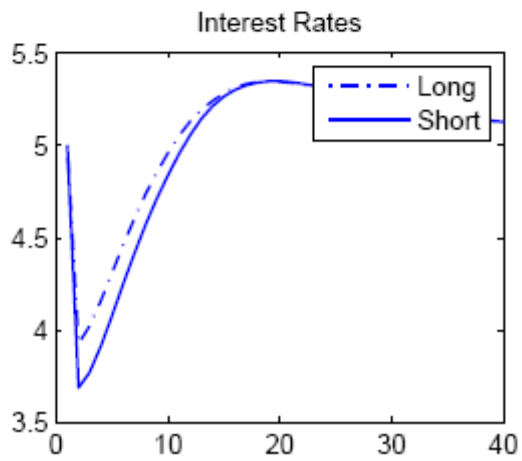
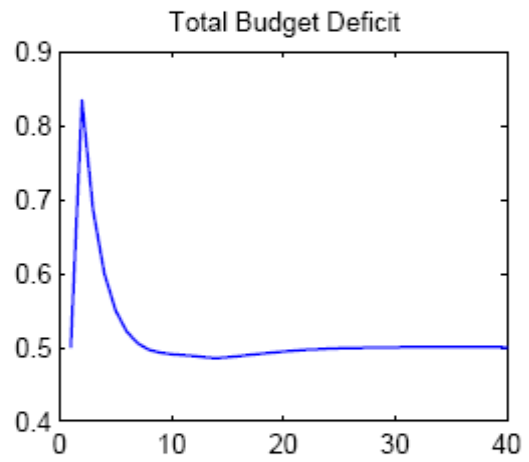
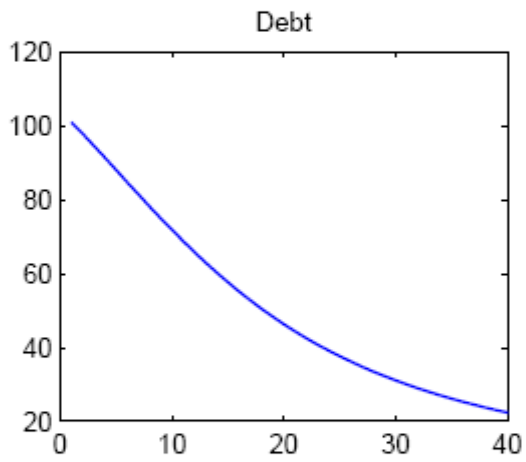
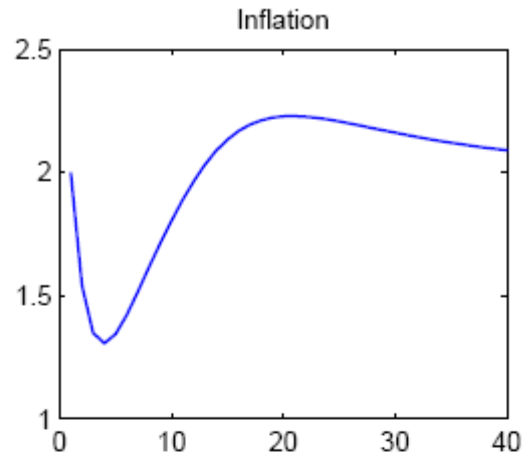
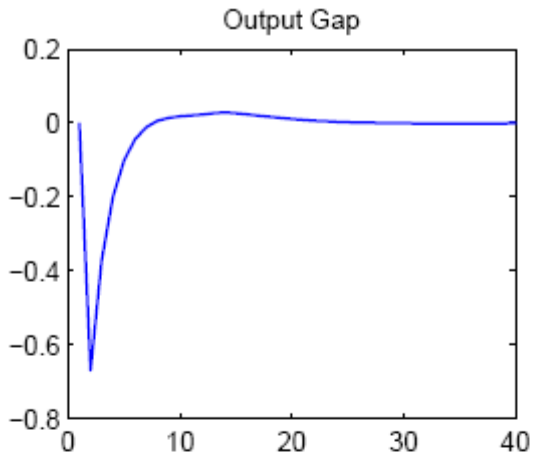
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Status Quo



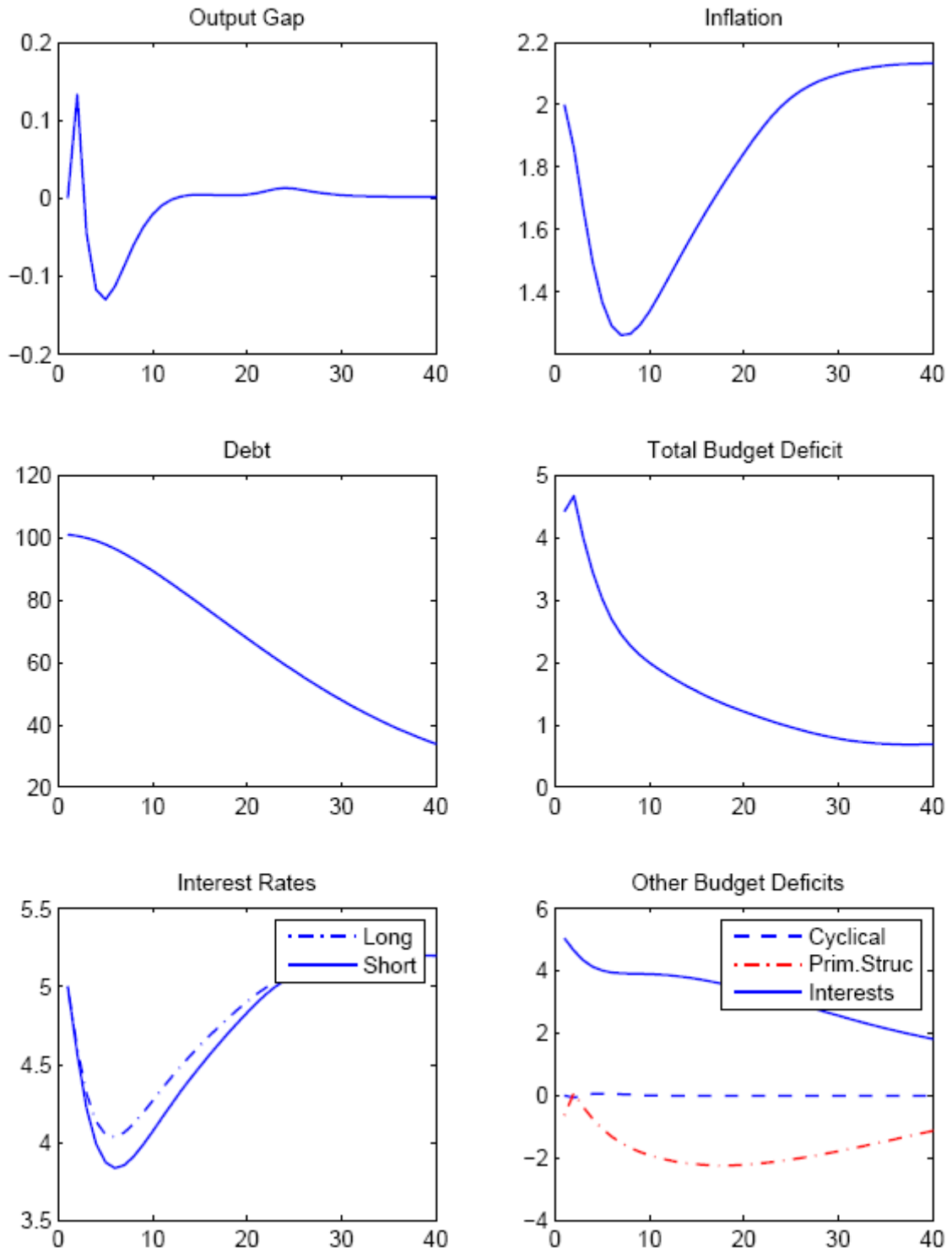
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New Golden rule



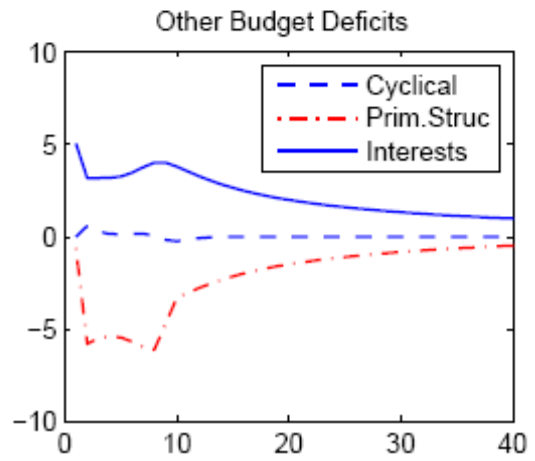
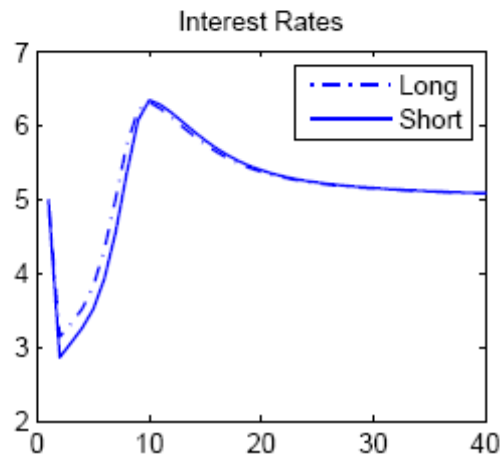
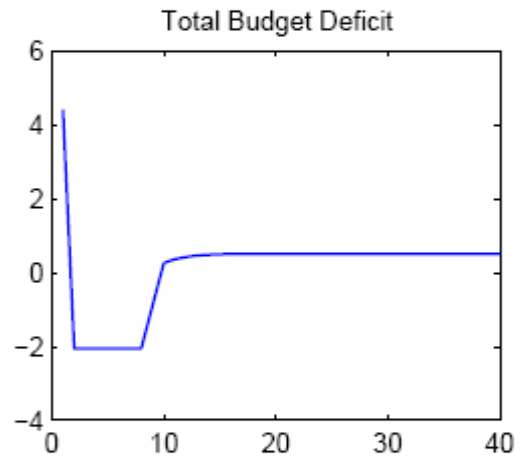
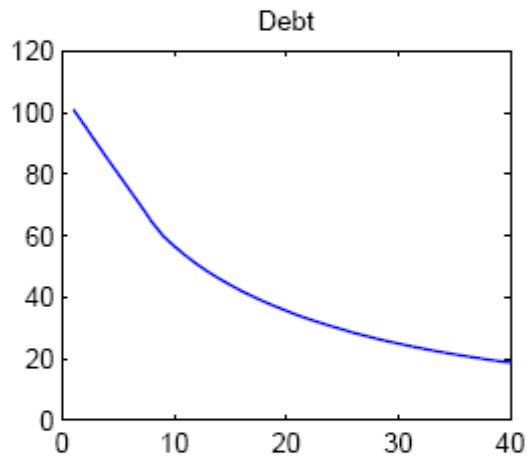
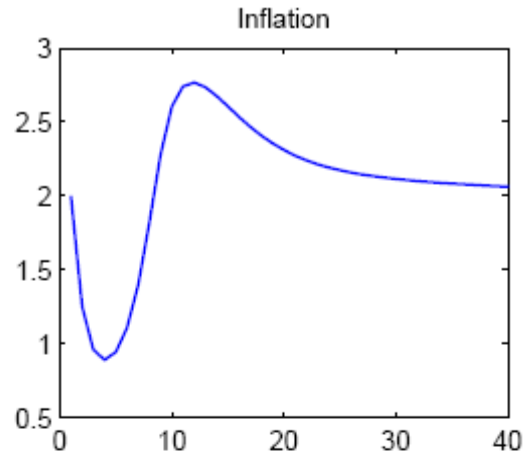
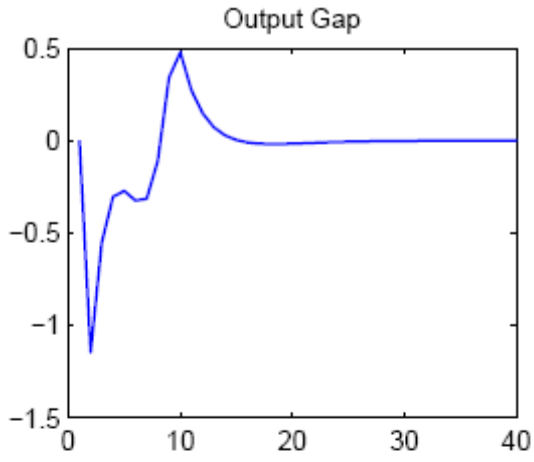
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Investment rule



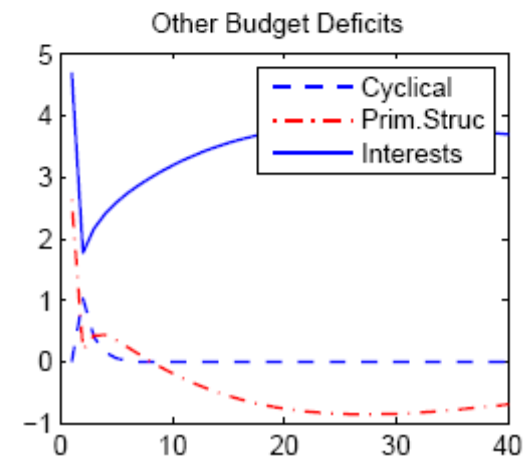
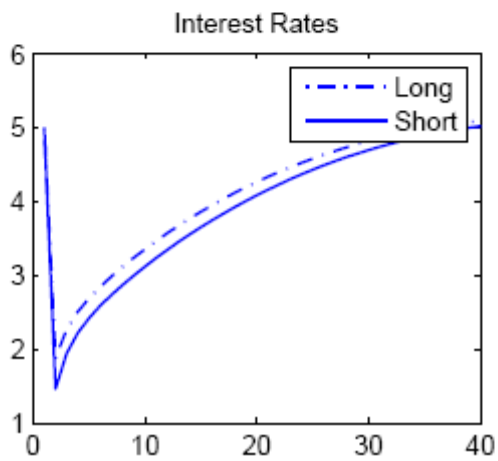
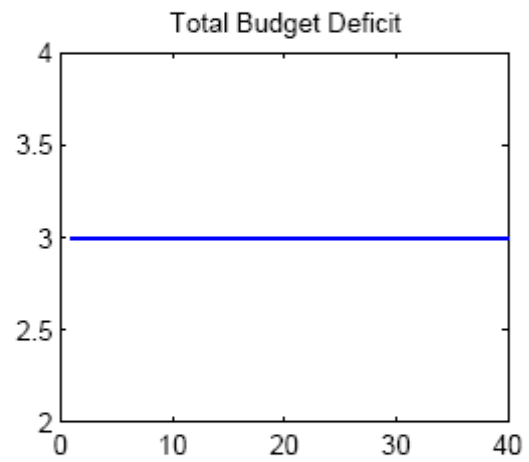
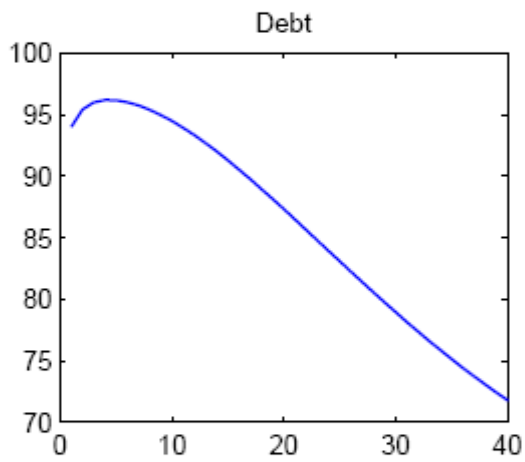
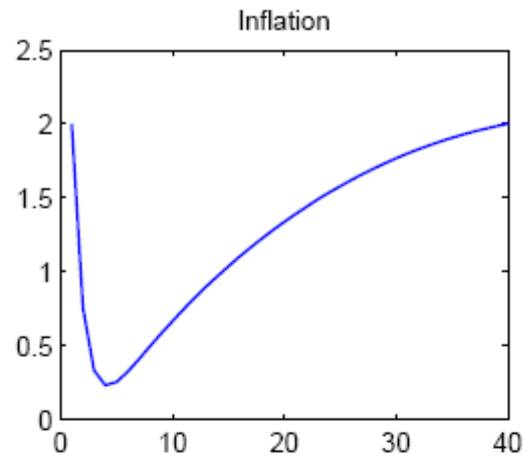
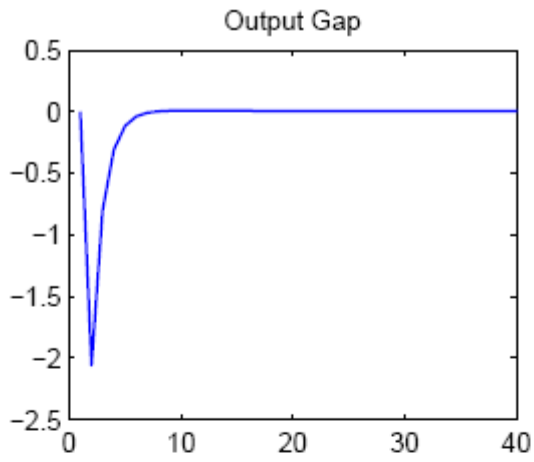
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1/20th rule



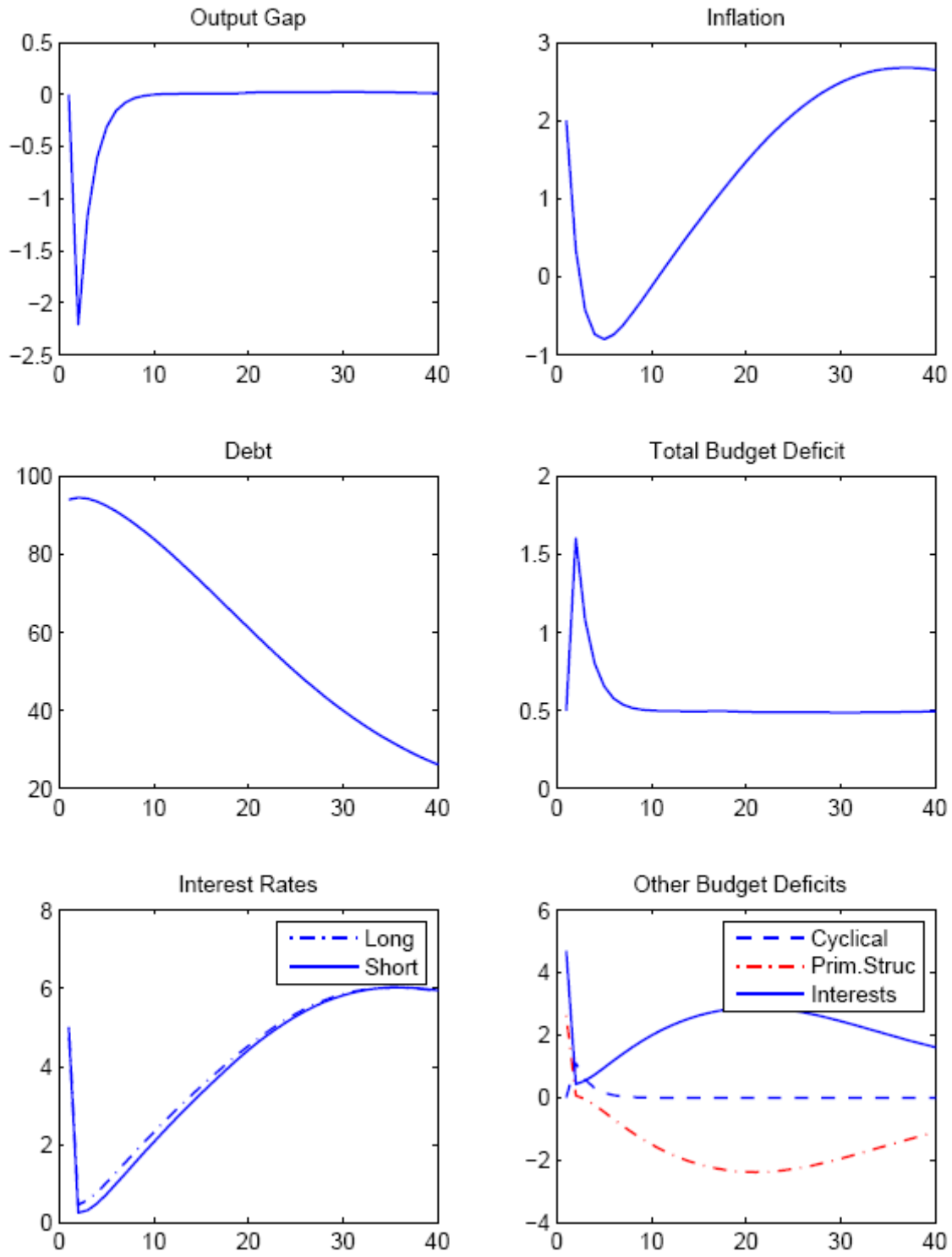
FRANCE

Status Quo



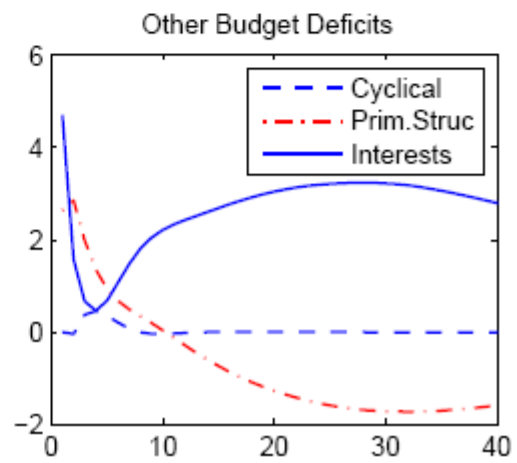
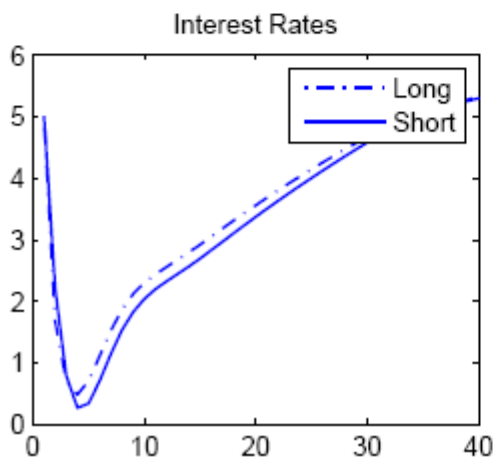
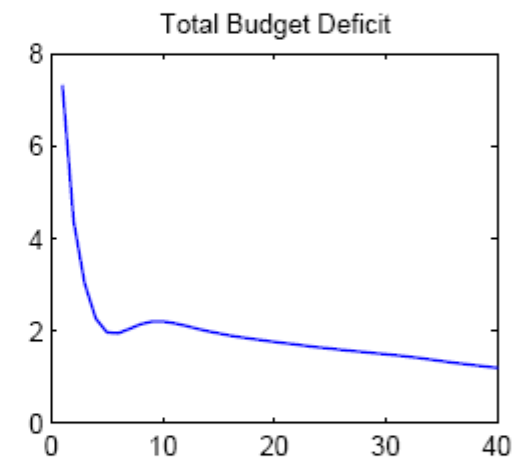
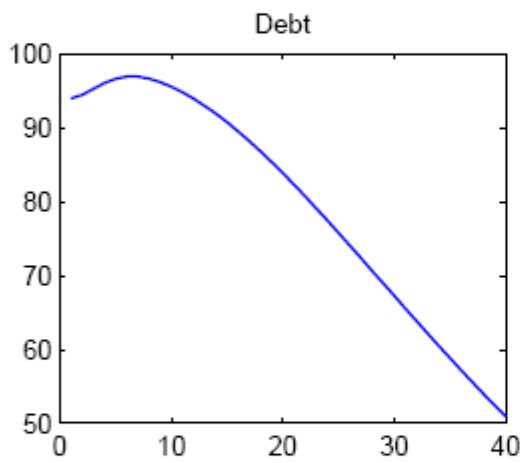
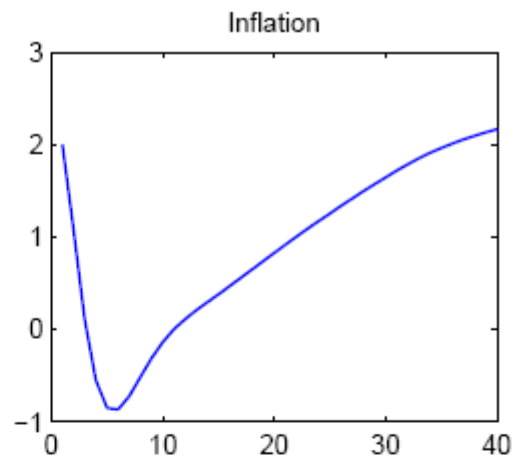
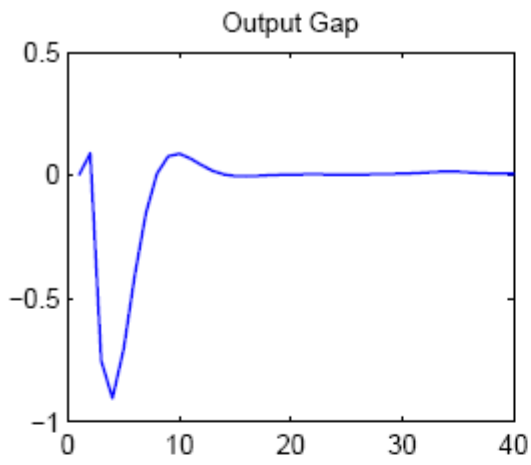
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New Golden rule



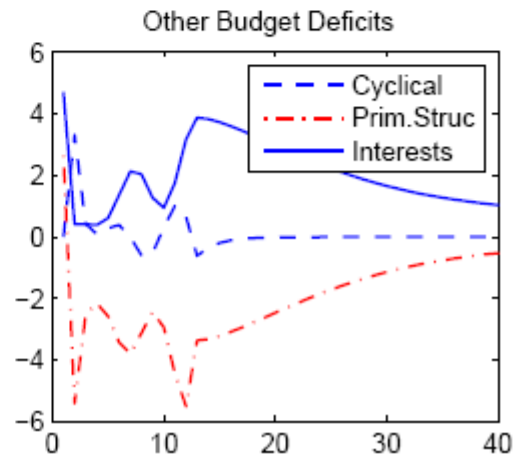
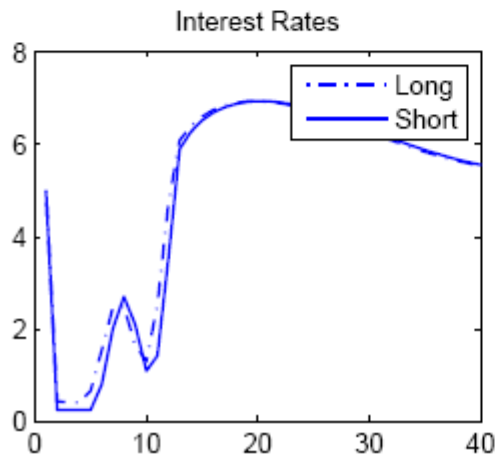
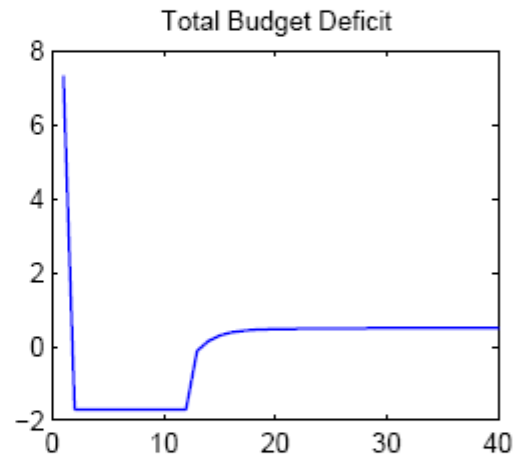
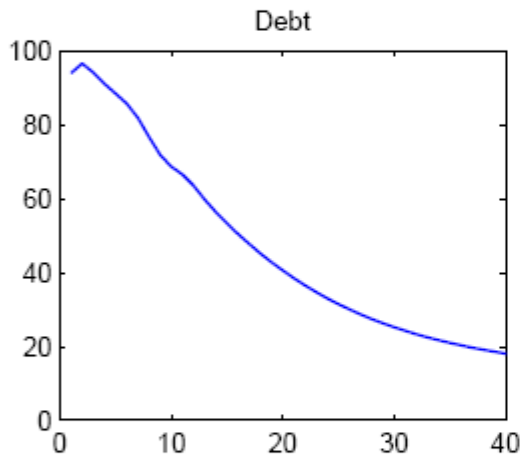
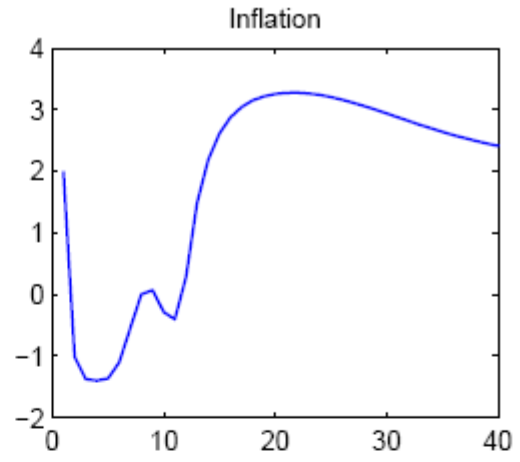
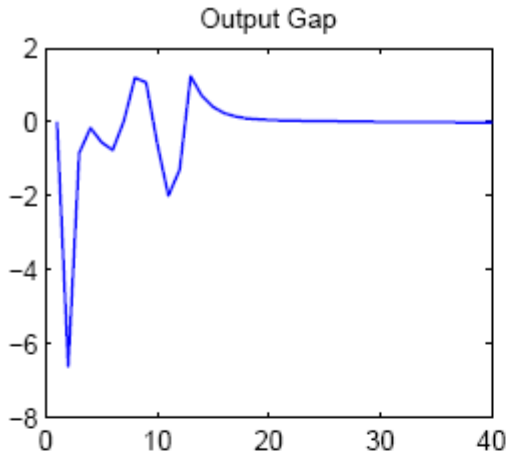
FRANCE

Investment rule



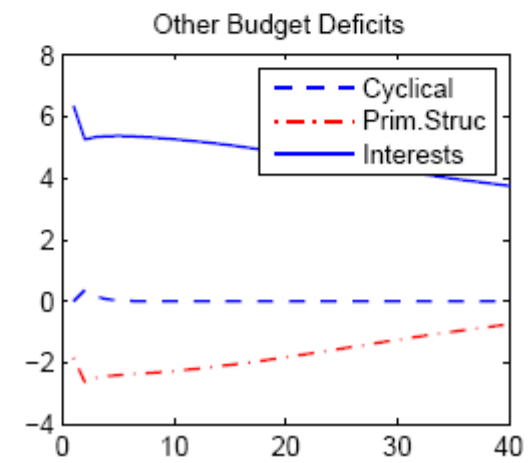
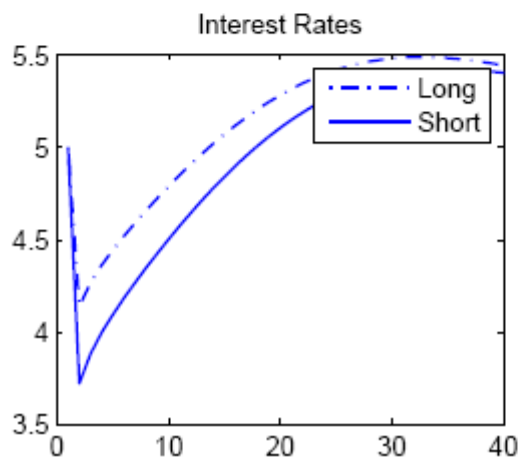
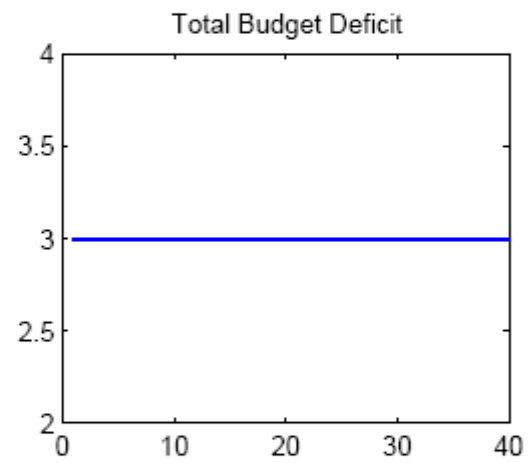
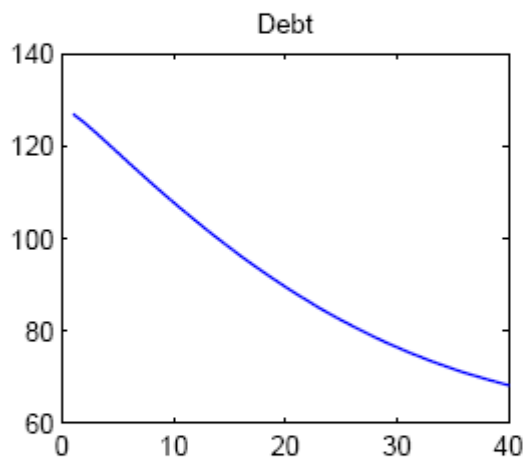
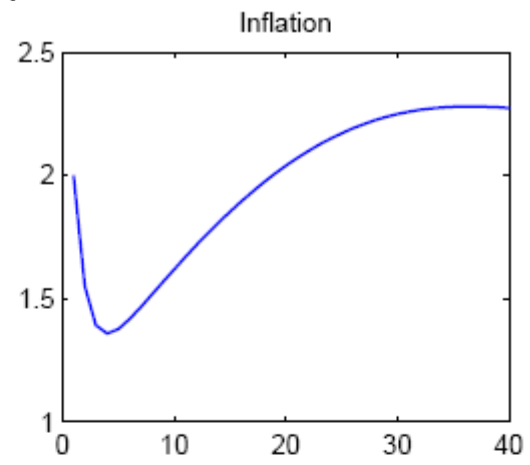
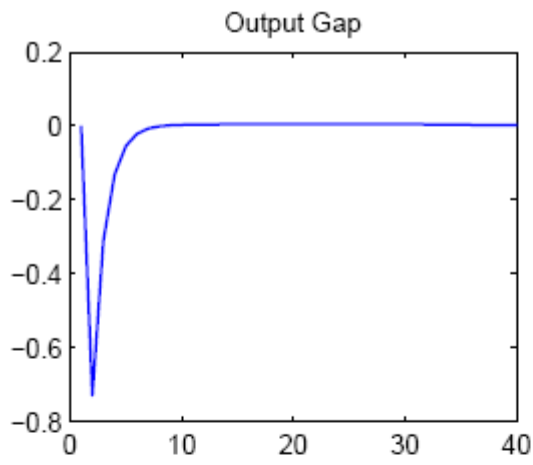
FRANCE

1/20th rule



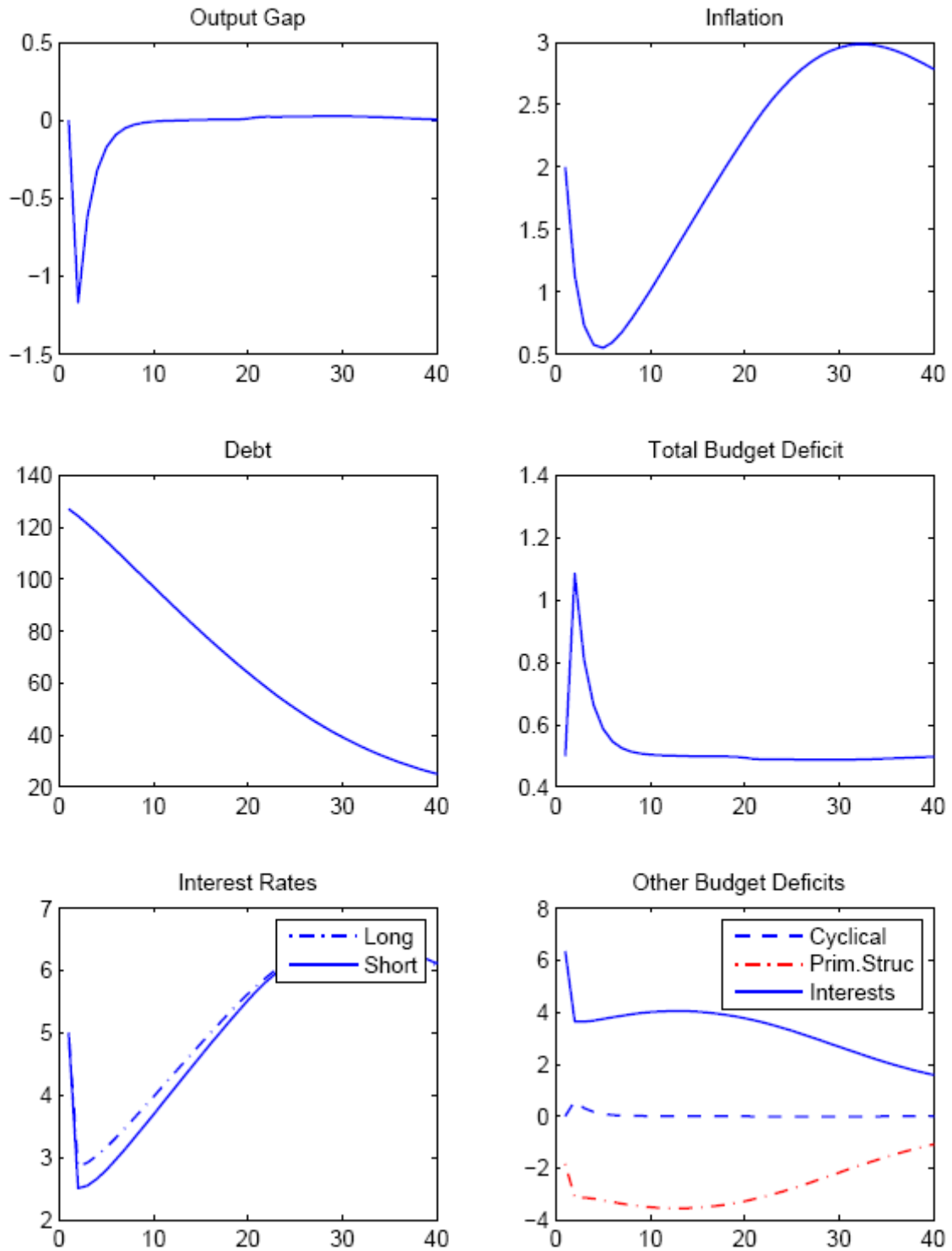
ITALY

Status Quo



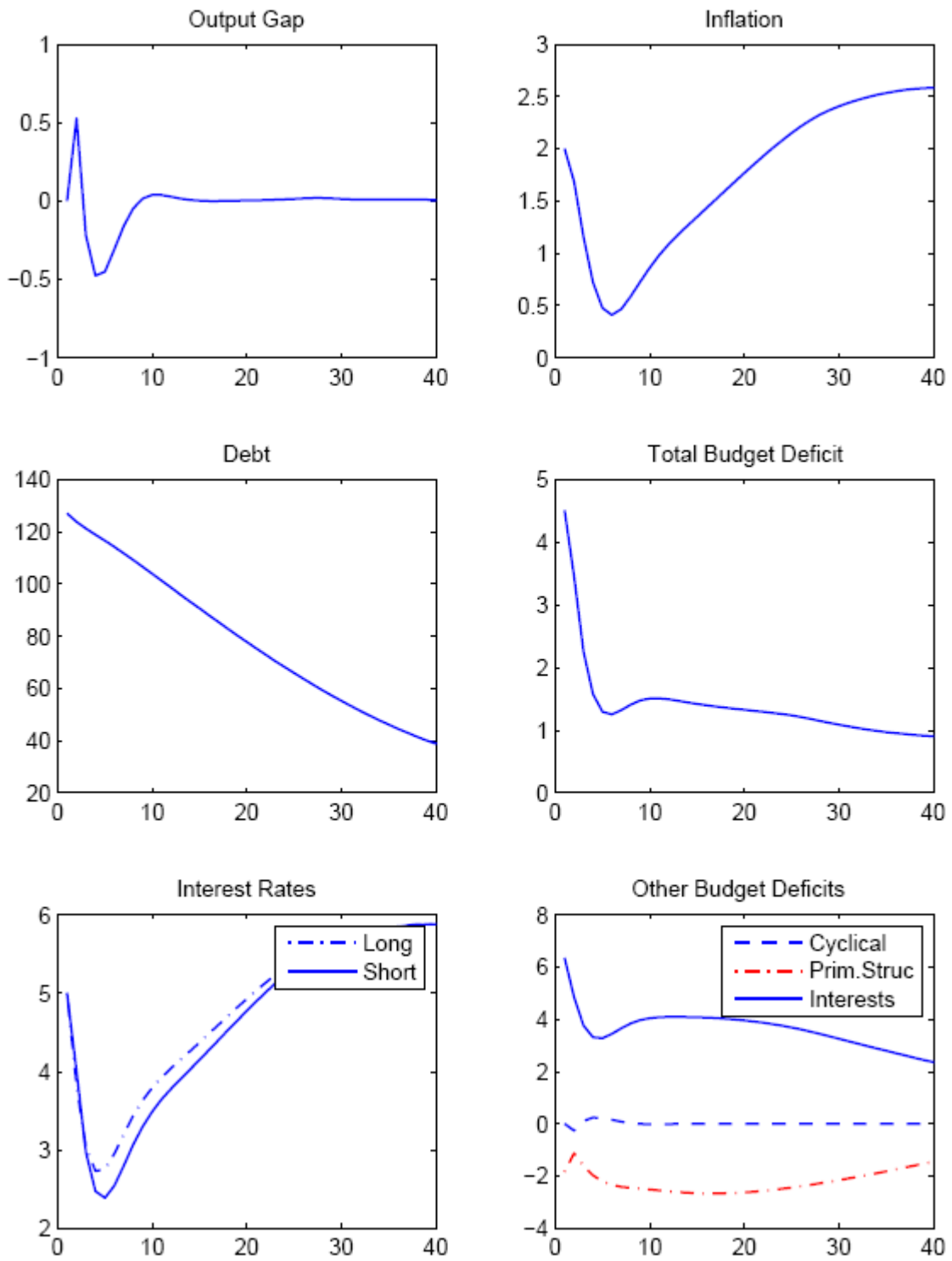
ITALY

New Golden rule



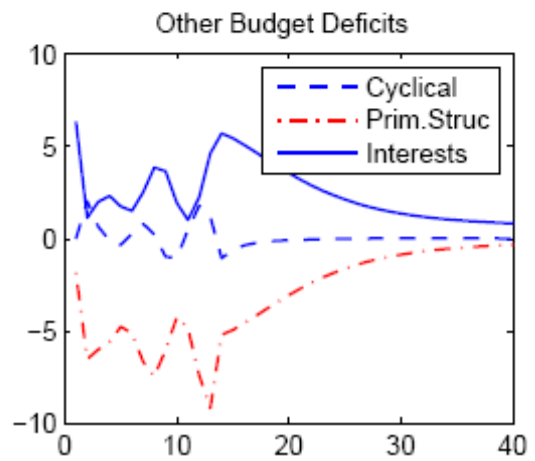
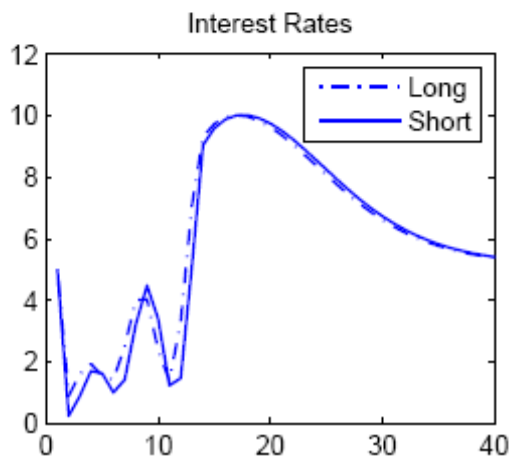
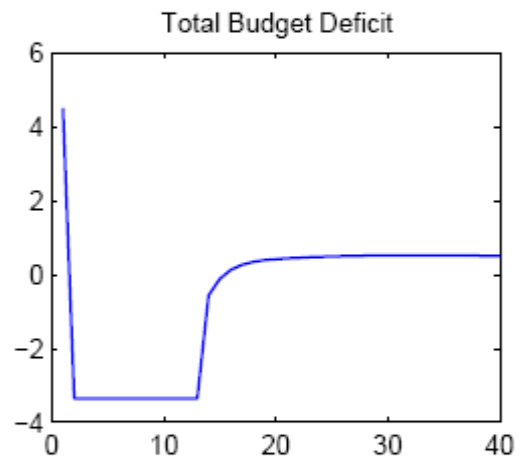
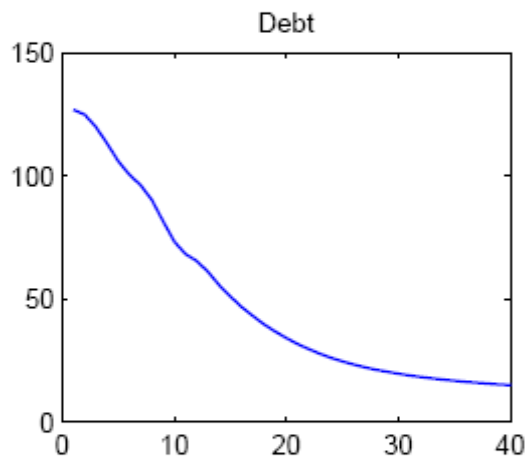
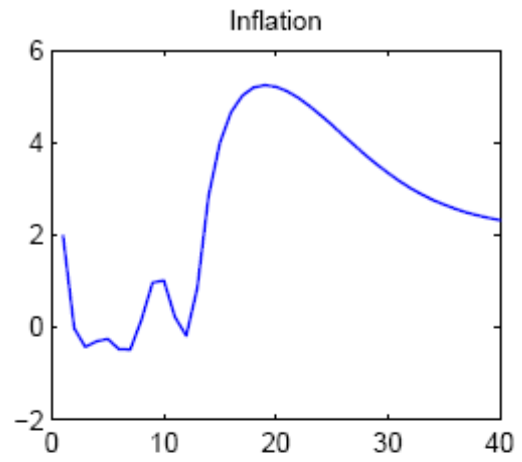
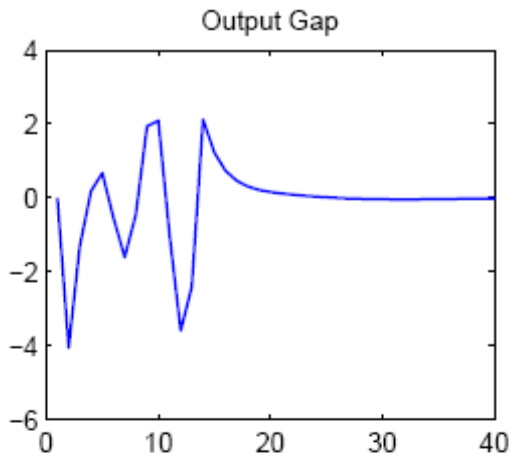
ITALY

Investment rule



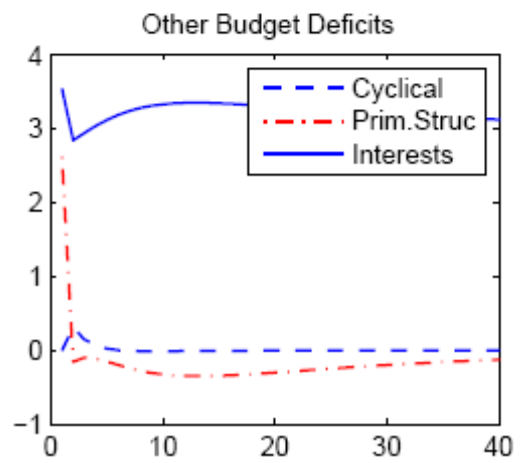
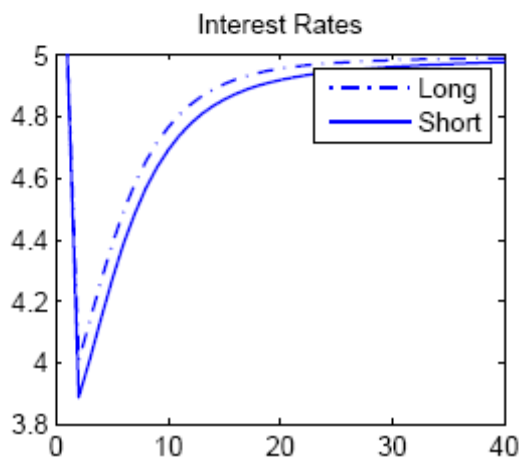
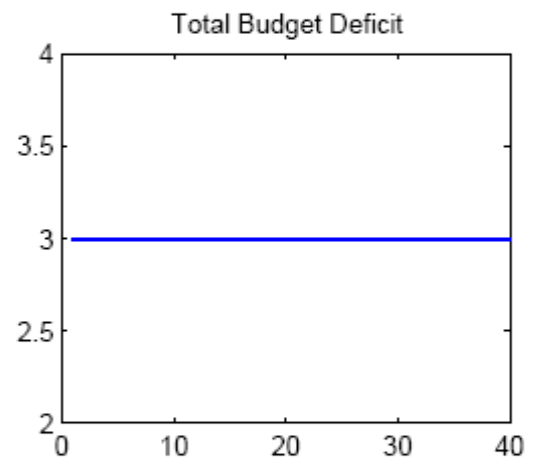
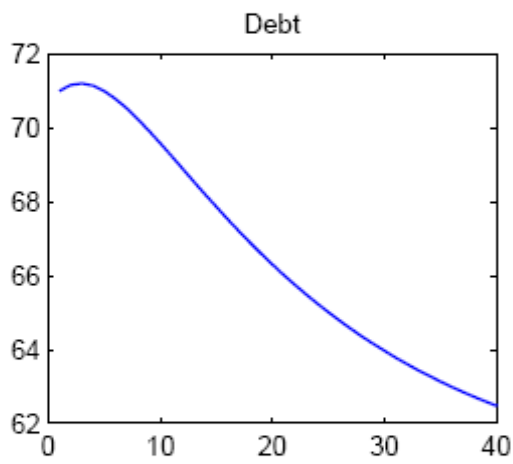
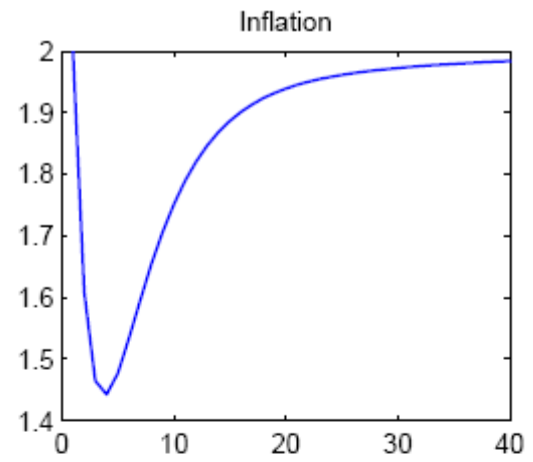
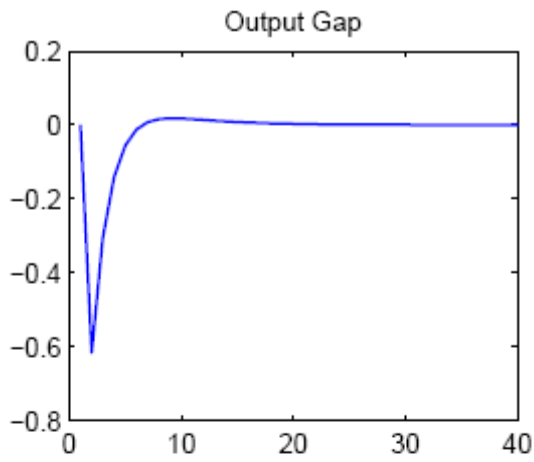
ITALY

1/20th rule



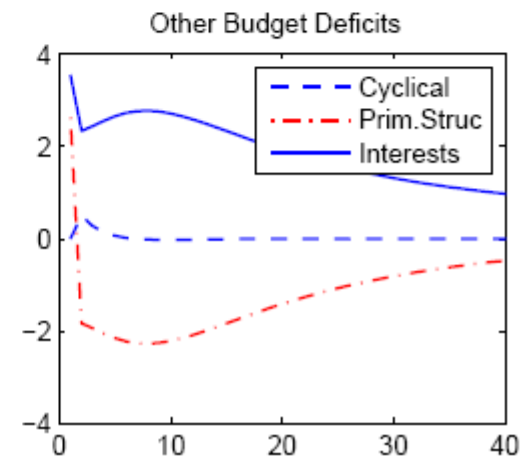
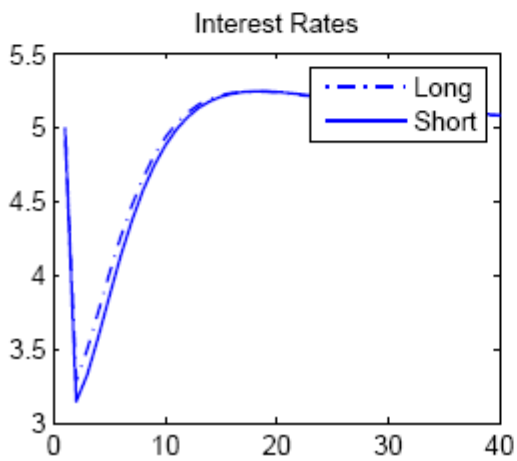
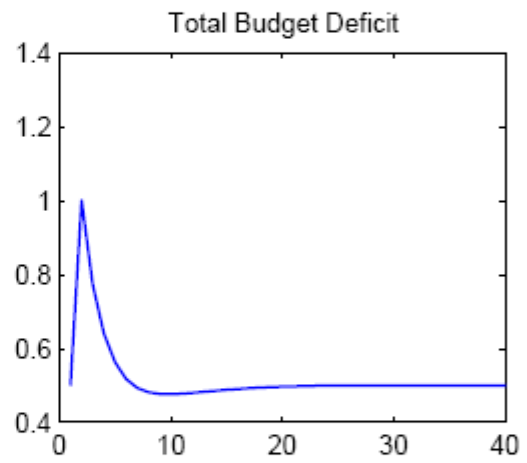
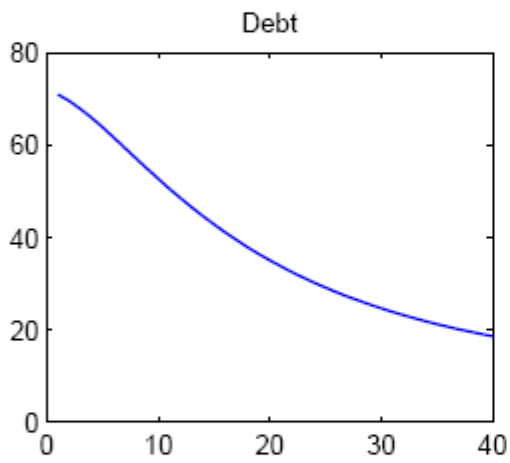
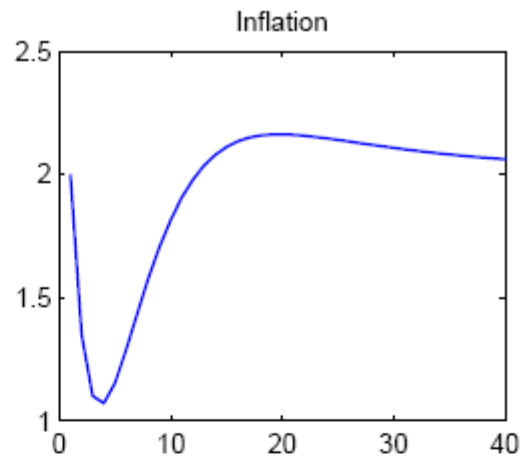
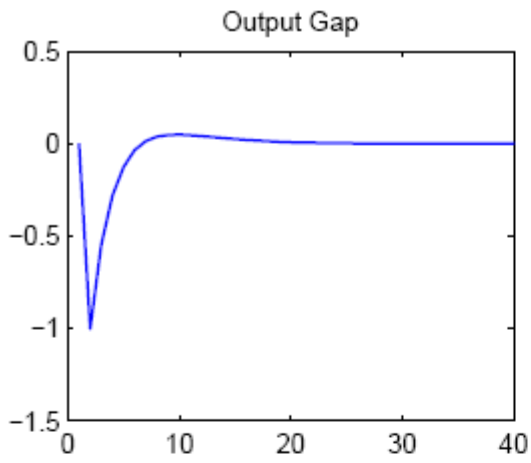
NETHERLANDS

Status Quo



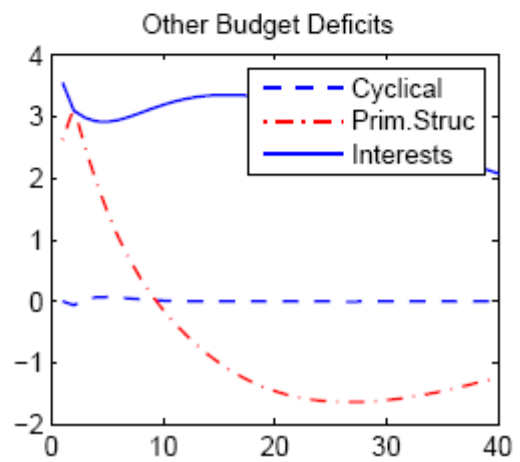
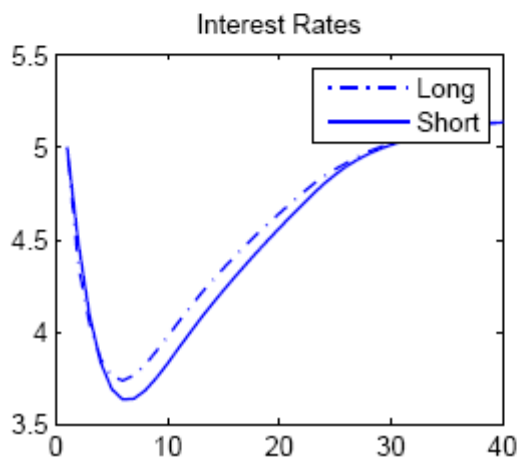
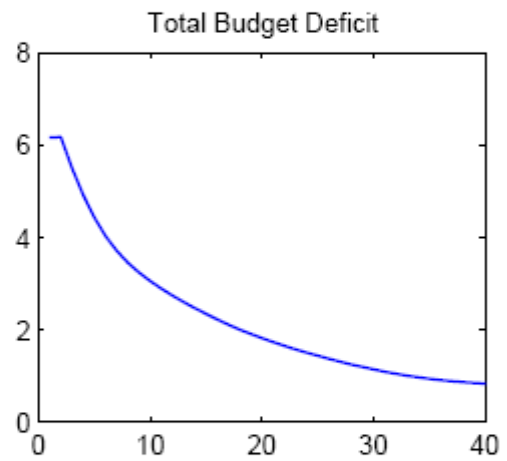
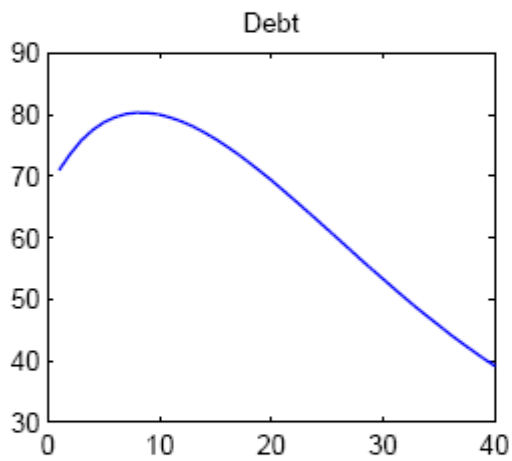
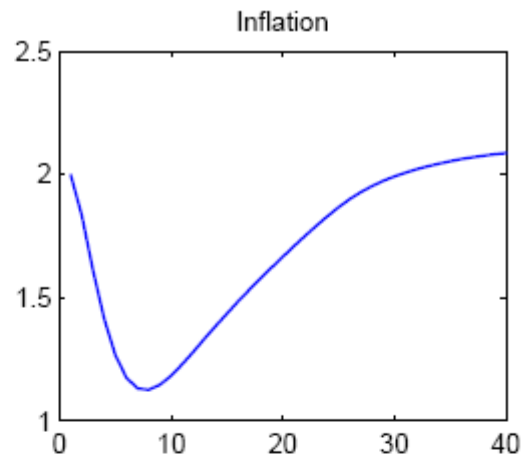
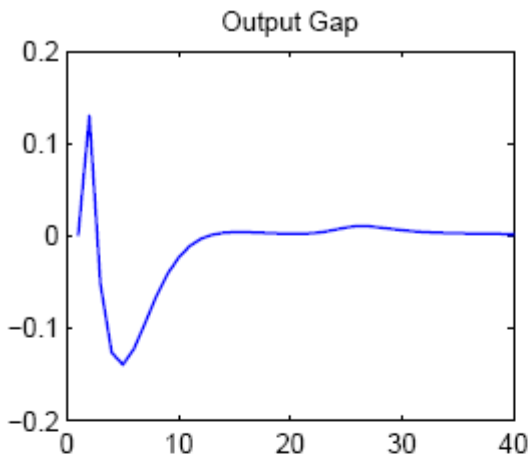
NETHERLANDS

New Golden rule



NETHERLANDS

Investment rule



NETHERLANDS

1/20th rule

