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# Austerity versus stimulus: the polarizing effect of fiscal policy

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## Abstract

Through constructing a New-Keynesian DSGE model with heterogeneous agents, this paper investigates both the aggregate and distributional consequences of fiscal policy. Polarized preferences over the conduct of fiscal policy emerge between those agents who participate in credit markets and those who do not. Exogenous shocks impact the two types of agent differently, and, as a result, fiscal policy responses to these shocks produce minimal aggregate welfare effects as the gains of one agent are matched by the losses of another. There is, therefore, a normative justification for countercyclical fiscal policy, but on redistributive rather than stabilisation grounds.

JEL Classification: E30; E62; H30.

## 1 Introduction

The 2008 financial crisis and subsequent global economic downturn brought fiscal policy back onto the political and academic agenda. Across developed economies, governments looked to large fiscal stimuli in order to counteract the effects of recession and boost demand. Despite this return to fiscal policy, there is still much debate as to whether such measures have the desired effects, most recently seen in the ‘austerity versus stimulus’ debate. These discussions tend to focus on the aggregate impact of policy (the fiscal multiplier) in models which assume a representative agent; this paper seeks to contribute to this literature by focusing on both the positive and normative consequences of policy and, moreover, to consider these within a model which includes heterogeneous households. It does this through constructing a dynamic stochastic general equilibrium (DSGE) model which includes a proportion of agents who do not participate in capital markets.

Our results suggest that preferences over the conduct of fiscal policy are polarized and that there is a normative justification for countercyclical policy. This justification comes from redistributive concerns where there are only modest improvements in average welfare from policy. Those agents who do not participate in capital markets are the most exposed to business cycles and therefore gain from policy which promotes stability. In the absence of borrowing during downturns, these agents increase their labour supply in order to supplement their income, which suppresses wages and subsequently transfers welfare from workers to capital holders. Capital holders gain from such activity, and therefore gain from

policies which promote rather than remove volatility in the business cycle: for these agents, the actions of the credit-constrained are more insulating than any governmental activity. As workers gain from countercyclical policy, capital holders lose in a near zero sum game, which suggests that preferences are highly polarized over the conduct of fiscal measures.

The intuition behind these results is in line with the literature discussing Lucas' (2003) claim that the welfare impact of business cycles are negligible; through analysing cyclical movements in aggregate US consumption, the welfare gain of removing economic fluctuations was calculated to be the utility equivalent of less than one-tenth a percentage point increase in average consumption. Theoretical research addressing this suggests that there is heterogeneity across households in this estimate which the aggregation hides. Krusell and Smith (1999), Krusell *et al.* (2009) and Mukoyama and Şahin (2006) conclude that the poor, unskilled and unemployed are the most exposed to welfare losses from economic fluctuations: those agents who typically do not engage in capital markets. Carroll (2000) further suggests that the distribution of wealth is an important determinant in agents' experiences from macroeconomic phenomena, a point also emphasised by Mankiw (2000) when discussing the aggregate effects of fiscal policy. This heterogeneity may also support the result that when using subjective measures of welfare, the implied costs of business cycles are larger than those originally suggested by Lucas: see for example Wolfers (2003). The contribution of this paper is to discuss the effects of fiscal policy across heterogeneous agents using a New-Keynesian DSGE model, which are the main models used to analyse the theoretical aggregate impacts of policy (see for example Galí *et al.*, 2007). Through combining these two literatures, not only can the model predict aggregate dynamics under different policies, it can also predict political barriers and motives to these policies.

Our results suggest that preferences over fiscal conduct are polarized, where credit-constrained agents benefit from countercyclical fiscal policy and the unconstrained do not; moreover, the returns to those who do participate in capital markets from procyclical policy are higher the smaller their proportion is, contributing to the literature which finds fiscal policy to be frequently procyclical, especially in developing countries: see for example Woo (2009). These economies are seen to have both higher degrees of asset market non-participation (increasing the returns of procyclical policy for the unconstrained: see for example Evans and Karras, 1996) and lower rates of voter turnout (which is particularly prevalent in those with less income: see for example Nevitte *et al.*, 2009). Providing that sufficient voting power is retained by capital holders, this suggests that the prevalence of fiscal procyclicality is a political issue, rather than a financial one. The inclusion of distortionary taxes into the analysis provides further potential for polarizing preferences, as these taxes are by their nature redistributive. The results are also amplified when monetary policy is at its zero lower bound, a common feature of the recent global recession.

The paper proceeds in the following way. Section 2 builds a model which includes a proportion of agents who do not participate in capital markets. Section 3 discusses both the positive and normative consequences of fiscal policy across households through deriving algebraic properties of a benchmark model, through dynamic simulation from specific policy episodes, and through considering the cyclical properties of policy over the business cycle. Section 4 considers further extensions and sensitivity, and Section 5 concludes.

## 2 The model

The model presented below is a cashless DSGE model with sticky prices, including six types of economic agents: a continuum of households split into two heterogeneous groups; a continuum of monopolistically competitive firms producing intermediate goods and a perfectly competitive sector producing the final good; and a monetary and fiscal authority. The model is similar to Galí *et al.* (2007), the seminal paper in the rule-of-thumb DSGE literature, and differs by introducing non-policy shocks such that fiscal policy is responding to the business cycle, as opposed to causing it.

### 2.1 Households

There is a continuum  $[0, 1]$  of infinitely lived households, all of whom consume the final good and supply labour to firms. A proportion of these households  $(1 - \lambda)$  are patient, who trade in a full set of state contingent securities, own company shares, and own the capital stock of the economy. The remaining proportion  $(\lambda)$  are impatient to such a degree that they neither save nor invest in capital or company shares. The following period utility function is assumed for both types of household:

$$U_t^i = \varepsilon_t^b \left( \frac{(C_t^i)^{1-\sigma}}{1-\sigma} - \frac{(N_t^i)^{1+\varphi}}{1+\varphi} \right) \quad (1)$$

where  $C_t$  and  $N_t$  are the amount of consumption and employment consumed and supplied respectively in period  $t$ , and  $\varepsilon_t^b$  represents an exogenous shock to the discount rate which affects intertemporal substitution preferences of households. The parameter  $\sigma$  is the coefficient of relative risk aversion and  $\varphi$  is the inverse elasticity of work with respect to real wages. Superscript  $i$  differentiates these variables between patient ( $i = R$ ) and impatient ( $i = NR$ ) households who are assumed to supply labour in a perfectly competitive market with no frictions or time delays; sensitivity of the results to this labour market assumption is performed.<sup>1</sup>

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<sup>1</sup>Superscript ‘ $R$ ’ and ‘ $NR$ ’ follows Galí *et al.* (2007) and represents ‘Ricardian’ and ‘non-Ricardian’ respectively, describing the agent’s reaction to movements in lump sum taxes.

### 2.1.1 Patient households

Patient households earn income from their labour supply (at wage rate  $W_t$ ), from dividends paid on share ownership,  $D_t^R$ , from maturing one period bonds purchased in the previous period,  $B_t^R$ , and from the return on their capital stock  $K_t^R$  (at rental rate  $R_t^k$ ). They use this income to reinvest in the bond market (with return  $R_t$ ), purchase the consumption good (at price  $P_t$ ), reinvest in capital,  $I_t^R$ , and pay lump sum taxes levied by the government,  $T_t^R$ . This leaves a budget constraint for patient households given by:

$$P_t (C_t^R + I_t^R) + \frac{B_{t+1}^R}{R_t} \leq B_t^R + R_t^k K_t^R + W_t N_t^R - P_t T_t^R + D_t^R \quad (2)$$

where capital evolves according to:

$$K_{t+1}^R = \left[ (1 - \delta) K_t^R + \left( 1 - S \left( \frac{\varepsilon_t^i I_t^R}{I_{t-1}^R} \right) \right) I_t^R \right] \varepsilon_{t+1}^k \quad (3)$$

where the rate of depreciation is given by  $\delta$ , a capital adjustment cost function is imposed,  $S(\cdot)$ , which satisfies  $S(0) = 0$ ,  $S'(0) = 0$  and  $S''(\cdot) > 0$ , and  $\varepsilon_t^i$  and  $\varepsilon_{t+1}^k$  represents exogenous shocks to the investment cost function and capital quality respectively.<sup>2</sup> Patient households maximize expected lifetime utility (given by the sum of (1) from  $t = 0$  to  $t = \infty$ ) with a discount factor  $\beta^R \in (0, 1)$ , subject to the budget constraint (2) and capital flow constraint (3), with respect to consumption, employment, capital and bond purchases, where all prices are taken as given.

### 2.1.2 Impatient households

Impatient households are assumed to discount future time periods to such a degree that they do not save from current income, nor do they invest in either capital or dividends. An exogenous borrowing constraint of zero is imposed on these agents, who therefore simply consume their period disposable income generated through their labour supply:

$$P_t C_t^{NR} = W_t N_t^{NR} - P_t T_t^{NR} \quad (4)$$

Impatient households optimize by making decisions on how much labour to supply at a given wage rate: maximisation of (1) subject to the budget constraint (4).

## 2.2 Production

The final good is produced in a perfectly competitive sector using the following technology:

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<sup>2</sup>For dynamic simulation we set  $S(I_t/I_{t-1}) = \kappa/2(I_t/I_{t-1} - 1)$ , where  $\kappa$  represents a capital adjustment cost parameter.

$$Y_t = \left( \int_0^1 Y_t(j)^{\frac{\epsilon-1}{\epsilon}} dj \right)^{\frac{\epsilon}{\epsilon-1}}$$

where  $Y_t$  represents the final good sold at price  $P_t$ ,  $Y_t(j)$  represents the quantity of the intermediate good produced by firm  $j$  sold at price  $P_t(j)$ , and  $\epsilon$  represents the elasticity of substitution across intermediate goods. Profit maximisation of the final good firm, taking all prices as given, yields the following standard demand schedules:

$$Y_t(j) = \left( \frac{P_t(j)}{P_t} \right)^{-\epsilon} Y_t \quad \forall j \in [0, 1] \quad (5)$$

A continuum of firms indexed  $j \in [0, 1]$  are assumed to produce the differentiated intermediate goods,  $Y_t(j)$ , subject to Cobb-Douglas technology:

$$Y_t(j) = \varepsilon_t^a K_t(j)^\alpha N_t(j)^{1-\alpha} \quad (6)$$

where  $K_t(j)$  and  $N_t(j)$  are the level of capital and labour employed by firm  $j$  respectively, and  $\varepsilon_t^a$  represents a total factor productivity shock whose logarithm is assumed to follow an  $AR(1)$  process with stochastic volatility.<sup>3</sup> A Calvo (1983) pricing structure is assumed for intermediate goods, where firms in any period get the opportunity to reset prices with probability  $(1 - \theta)$ . This probability is fixed, exogenous, and independent of when the firm was last randomly selected to reset their price. The remaining suppliers,  $\theta$ , must maintain the same price as they had in period  $t - 1$ .

### 2.3 Monetary authority

A standard Taylor rule is applied for the conduct of monetary policy where the nominal interest rate responds to both deviations in inflation and the output gap:

$$\frac{R_t}{\bar{R}} = \left( \frac{R_{t-1}}{\bar{R}} \right)^{\rho_R} \left( \left( \frac{\Pi_t}{\bar{\Pi}} \right)^{\varphi_\pi} \tilde{Y}_t^{\varphi_y} \right)^{1-\rho_R} \eta_t^r \quad (7)$$

where  $\Pi_t = P_t/P_{t-1}$  represents inflation, variables with no time subscript represent steady state values, and where  $\eta_t^r$  and  $\rho_R$  represent, respectively, an exogenous shock to and persistence in nominal interest rates. The output gap,  $\tilde{Y}_t$ , represents deviations of output away from its potential defined as the level of output that would prevail under flexible prices.

<sup>3</sup>Specifically, it is assumed  $\log(\varepsilon_t^a) = \rho_a \log(\varepsilon_{t-1}^a) + \sigma_a^a \eta_t^a$  where  $\eta_t^a \sim N(0, 1)$  and where  $\log(\sigma_t^a) = (1 - \rho_{\sigma^a}) \log(\sigma^a) + \rho_{\sigma^a} \log(\sigma_{t-1}^a) + \eta_t^{\sigma^a}$ .

## 2.4 Fiscal authority

The fiscal authority purchases a proportion of the final goods for public consumption,  $G_t$ , raises lump sum taxation from the two households,  $T_t^R$  and  $T_t^{NR}$ , and issues nominal risk-free one-period bonds,  $B_{t+1}$ . As such, the flow constraint of the government is given by:

$$P_t G_t + B_t \leq P_t (T_t^R + T_t^{NR}) + \frac{B_{t+1}}{R_t} \quad (8)$$

The model includes a proportion of impatient households and therefore the dynamics of government expenditures, taxes and debt are relevant. Feedback rules are applied whereby the government responds to the business cycle and the level of debt:

$$\frac{G_t}{G} = \tilde{Y}_t^{\varphi_g} \left( \frac{\hat{B}_t}{\hat{B}} \right)^{\varphi_{b,g}}, \quad \frac{T_t}{T} = \tilde{Y}_t^{\varphi_T} \left( \frac{\hat{B}_t}{\hat{B}} \right)^{\varphi_{b,T}} \quad (9)$$

where  $\hat{B}_t = B_t/Y_t$  and it is assumed that  $T_t^{NR}/T^{NR} = T_t^R/T^R = T_t/T$ ; changes in lump sum taxation are equal across households and there is no redistribution between households through changes in taxation.<sup>4</sup> Setting either  $\varphi_g < 0$  or  $\varphi_T > 0$  represents countercyclical fiscal policy, and  $\varphi_{b,g} < 0, \varphi_{b,T} > 0$  ensures to preserve the solvency constraint.<sup>5</sup>

This paper reflects upon normative consequences of fiscal policy which are sensitive to the assumed presence, or not, of government spending in the utility function. We propose to bypass this issue by only focusing on those policy actions which lead to a negligible net movement in discounted government spending over the lifetime of the policy: this has the advantage that any conclusions reached are not sensitive to this empirically questionable issue. This process leaves two policy experiments upon which to focus the analysis. The first (referred to as ‘policy experiment 1’) is where short term government spending rises are repaid in the longer term through future spending cuts. Interest accrues on debt in steady state at a rate of  $(\beta^R)^{-t}$ , whereas if government spending were to enter the utility function (1) separately, individuals would discount future changes in this spending at a rate of  $(\beta^i)^t$ : this experiment therefore results in a negligible discounted government spending movement.<sup>6</sup> The second (referred to as ‘policy experiment 2’) is where short term tax cuts are repaid in the longer term through tax rises.

<sup>4</sup>In the absence of distinguishing characteristics between the two agents beyond impatience, this assumption seems reasonable: sensitivity of the results to non-lump sum taxation is performed.

<sup>5</sup>The government is also assumed to satisfy the constraint that in the long run all debts are repaid ( $\lim_{t \rightarrow \infty} B_{t+1}/R_t = 0$ ).

<sup>6</sup>Although the difference in assumed discount rates of the patient and impatient households will generate differences in net discounted government spending, these will be small over the lifetime of the fiscal experiment.

## 2.5 Market clearing

In equilibrium, aggregate consumption and employment are equal to the weighted average of the two variables across households:

$$C_t = (1 - \lambda) C_t^R + \lambda C_t^{NR}, \quad N_t = (1 - \lambda) N_t^R + \lambda N_t^{NR} \quad (10)$$

Moreover, all output must be invested or consumed by either the government or private individuals:

$$Y_t = C_t + G_t + I_t \quad (11)$$

Logarithms of shocks to preferences,  $\varepsilon_t^b$ , the investment cost function,  $\varepsilon_t^i$ , capital quality,  $\varepsilon_{t+1}^k$ , the production function,  $\varepsilon_t^a$ , and variations in the volatility of productivity,  $\sigma_t^a$ , are assumed to follow  $AR(1)$  processes with persistence given by  $\rho_i$  and standard deviations  $\sigma^i$  where  $i = \{a, b, i, k, \sigma_a\}$ .<sup>7</sup>

## 3 The impact of fiscal policy on the aggregate and disaggregate economy

This section discusses the conduct of fiscal policy and the heterogeneous impact it has across agents. It first does this through deriving algebraic conditions on a simplified version of the model in order to provide intuition on the aggregate effect of policy, independent of parameter calibration. Simulations are then performed focusing on the impact of fiscal policy during a period of a negative output gap; this is to obtain a full understanding of the transmission mechanisms involved, and to consider the recent economic environment. The section subsequently analyses the conduct of policy over the business cycle, to obtain more general results.

### 3.1 A benchmark model

If the model above abstracts from capital formation and is approximated using log-linear transformations, the resulting system can be condensed into an aggregate demand condition, a New-Keynesian Phillips curve, and monetary and fiscal rules. The benefit of this is that algebraic conditions (independent of parameter calibrations) can be derived, illustrating the impact of fiscal policy on the aggregate economy. From such a model it is possible to show that, providing  $\lambda < \lambda^*$  (for some constant  $\lambda^*$ , defined in the appendix):<sup>8</sup>

<sup>7</sup>The non-stochastic steady state of the model is solved, and the perturbation method in Dynare is used to apply a third-order approximation of the model. The stochastic simulations are also computed using Dynare.

<sup>8</sup>At high proportions of impatient households,  $\lambda$ , the dynamics and determinacy of the model are reversed as reflected upon in Bilbiie (2008): the critical value being notated in Bilbiie as  $\lambda^*$ . When  $\lambda > \lambda^*$  tax rises, interest rate rises and



$$\frac{\partial y_t}{\partial \widehat{g}_t} > 0, \frac{\partial y_t}{\partial \widehat{t}_t} < 0, \left| \frac{\partial y_t}{\partial \widehat{g}_t} \right| > \left| \frac{\partial y_t}{\partial \widehat{t}_t} \right| \quad (12)$$

$$\frac{\partial(y_t/\partial \widehat{g}_t)}{\partial \lambda} > 0, \frac{\partial^2(\partial y_t/\partial \widehat{g}_t)}{\partial \lambda^2} > 0, \frac{\partial(\partial y_t/\partial \widehat{t}_t)}{\partial \lambda} < 0, \frac{\partial^2(\partial y_t/\partial \widehat{t}_t)}{\partial \lambda^2} < 0 \quad (13)$$

where lower case variables represent log deviations from steady state values, and *hatted* variables represent deviations from steady state as a proportion of steady state output. Results presented in (12) are typical demand conditions stating that government spending rises and tax cuts lead to increases in output. The third condition in (12) illustrates that the aggregate demand impact of a unit change in government spending is greater than the aggregate demand impact of a unit change in taxes, which happens for two main reasons: first, tax movements only impact the consumption decisions of the impatient whereas patient agents adhere to Ricardian equivalence: as  $\lambda < 1$  there is a share of consumers for which a (lump sum) tax cut is not initially impacting. Second, government spending movements directly effect demand through direct production. The impact of tax movements on aggregate demand depend on the decisions of households, who can use, say, a tax cut to both purchase more consumption and more leisure, the latter of which will reduce production in the economy.<sup>9</sup> The conditions presented in (13) state that the impact that fiscal policy has on the aggregate economy is increasing in the proportion of impatient agents, and is doing so in a non-linear way. The first condition is a result from Galí *et al.* (2007), and the second is a result from Bilbiie (2008), both of which carry forward to this model.

### 3.2 Calibration

The calibration of parameters applied for dynamic simulation is standard: each period represents a quarter where  $\beta^R$  and  $\beta^{NR}$  are set at 0.99 and 0.973 respectively.<sup>10</sup> The inverse of the intertemporal elasticity of substitution,  $\sigma$ , and the inverse of the elasticity of labour with respect to real wages,  $\varphi$ , are set at 1 and 2 respectively. The capital share ( $\alpha$ ) is set at 1/3, depreciation ( $\delta$ ) at 0.025, price stickiness ( $\theta$ ) at 0.75, the capital adjustment cost parameter ( $\kappa$ ) at 5, and the elasticity of substitution across intermediate goods ( $\epsilon$ ) at 6. The resulting calibration of the steady state share of investment in output is 0.2, and the steady state shares of consumption and government spending in output are set at 0.64 and 0.16 respectively: government debt is assumed to be zero in steady state. The Taylor rule parameters are set such that  $\varphi_\pi = 1.8$ ,  $\varphi_y = 0.1$  and  $\rho_r = 0.8$ ; the persistence of the other shock processes are also

government spending cuts all lead to a rise in aggregate demand.

<sup>9</sup>The magnitude to which government spending increases dominate tax cuts can be algebraically shown to be inversely proportional to the level of asset market non-participation, and positively related to the level of private consumption in steady state and the markup charged by intermediate firms.

<sup>10</sup>Lawrance (1991) presents evidence to suggest that rates of annual time preference vary by 7% between rich and poor households.

set equal to 0.8, with their standard deviations set to  $\sigma^a = 0.007$ ,  $\sigma^b = 0.004$ ,  $\sigma^i = 0.001$ ,  $\sigma^k = 0.001$  and  $\sigma^{\sigma^a} = 0.1$ . Lump sum taxes are set such that the level of consumption for impatient agents in steady state is 0.8 of that of patient household consumption, and  $\lambda$ , the proportion of impatient households in the population, is set at 0.35.

The following two subsections discuss the conduct of fiscal policy whilst the economy has a negative output gap. The impact of fiscal policy on the aggregate and disaggregate economy, with respect to the benchmark of an acyclical fiscal response, is not sensitive to the type of shock applied and as such, for brevity, analysis will focus on a shock to total factor productivity; sensitivity of the results to other shocks will be discussed.

### 3.3 The positive consequences of fiscal policy

Figure 1 illustrates dynamic responses from a positive shock to total factor productivity to both the aggregate and disaggregate economy under three scenarios: a benchmark of acyclical fiscal policy ( $\varphi_g = \varphi_T = 0$ ); a countercyclical ‘policy experiment 1’ ( $\varphi_g < 0, \varphi_{b,g} < 0$ ); and a countercyclical ‘policy experiment 2’ ( $\varphi_T > 0, \varphi_{b,T} > 0$ ). In the presence of acyclical fiscal policy, a positive shock to total factor productivity leads to a fall in both the output gap (as adjustment costs and stickiness in the model lead to potential output rising faster than actual output), and also to an initial fall in actual output. This second result does not occur in an economy populated with only patient agents ( $\lambda = 0$ ), but does so in this calibration as a rise in productivity leads to a fall in labour demand. This subsequently reduces employment and disposable incomes of impatient households, and as such their consumption falls: this fall is sufficiently large enough to cause a decrease in aggregate consumption.<sup>11</sup>

[Insert Figure 1]

This fall in consumption of credit-constrained agents is in contrast to a rise in consumption for patient agents, who also increase their level of investment (as capital becomes more productive) and decrease their level of employment (as a result of lower labour demand). Taken together, patient households both consume more and work less in response to the shock with acyclical fiscal policy, compared to both the steady state and to impatient households, which happens for two main reasons: first, patient households’ consumption is determined by the level of real interest rates which fall as a result of the negative output gap and falling inflation; and second, with a zero-borrowing-constraint impatient consumers can only use their labour supply in order to insulate themselves from exogenous shocks. In the presence of falling disposable income, credit-constrained agents increase their labour supply in order to increase their consumption.

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<sup>11</sup>Note that throughout the lifetime of the experiments in Fig. 1, the net real interest rate is never large enough to induce impatient households to save.

The impact of fiscal policy in both experiments is to increase output in the short run, above the benchmark of acyclical policy, as there is greater demand in the economy. In policy experiment 1, where government spending increases in the short run are funded by future spending cuts, this increase in demand comes directly from the government; in policy experiment 2, the increase in demand derives from impatient agents' consumption as their disposable income increases in the presence of short term tax cuts. In both examples, the impact on the disaggregate economy is consistent: the consumption of impatient agents rises and the consumption of patient agents falls in the short run, compared to the benchmark of acyclical fiscal policy.

Through countercyclical fiscal policy, the government is insulating the economy from the shock, and, as such, is removing the costs associated with impatient households' lack of engagement with credit markets. Increased demand within the economy increases real wages and credit-constrained agents are therefore less exposed to shocks. Patient agents, on the other hand, substitute leisure for consumption as the increase in labour demand increases their employment levels: they optimise by reducing consumption. Real interest rates are higher compared to a benchmark of acyclical policy, which further suppresses patient agents' consumption and increases their employment. In policy experiment 2, impatient households use some of the tax cut to buy more leisure and optimise by reducing their levels of employment below the acyclical benchmark: in policy experiment 1, labour demand is increased and these agents respond to higher wages.

Over the short run, output in policy experiment 1 dominates that from policy experiment 2 which reconciles with (12). Over the medium run, the path of output in the acyclical policy benchmark dominates output under the two policy experiments, as fiscal actions contract the economy as debt is repaid. This has the impact of reversing the disaggregate effects discussed above, but only mildly, as debt is repaid over a long time horizon.

### 3.4 The normative consequences of fiscal policy

The normative consequences of fiscal policy are now investigated by evaluating the different agent's welfare under the policy experiments discussed above. In order to control for the difference in discount factors between the patient and impatient households, welfare ( $W^i$ ) is written in a Cobb-Douglas form evaluating instantaneous utility ( $U_t^i$ ) and future movements in welfare such that:

$$W_t^i = (1 - \beta^i) U_t^i + \beta^i E_t W_{t+1}^i \quad (14)$$

Note that under the scenarios described above, where there is one initial shock followed by different fiscal experiments, this welfare criterion reduces to the sum of discounted utility for each household normalised

by  $(1 - \beta^i)$ . This normalisation ensures that more patient households are not perceived to gain more welfare simply through discounting future utility by less; this normalisation is important in order to evaluate the relative movements in welfare across households. A constant elasticity of substitution social welfare function is also applied:

$$W_t = \left[ \lambda (W_t^{NR})^{-\gamma} + (1 - \lambda) (W_t^R)^{-\gamma} \right]^{-\frac{1}{\gamma}} \quad (15)$$

where if  $\gamma = -1$  provides a utilitarian welfare function,  $\gamma > -1$  represents inequality aversion, and as  $\gamma \rightarrow \infty$  a Rawlsian social welfare function is produced.

Figure 2 presents welfare valuations of the two policy experiments when the economy is struck by the same total factor productivity shock discussed above for varying values of the cyclical-response parameters ( $\varphi_g, \varphi_T$ : the top row), and varying values of the debt response parameters ( $\varphi_{b,g}, \varphi_{b,T}$ : the bottom row). The vertical line in the top row represents acyclical policy ( $\varphi_g = \varphi_T = 0$ ), where it is observed that the welfare of patient agents dominates that of the impatient as a result of the total factor productivity shock. The gain in welfare of patient agents is due to their rise in consumption and fall in employment, and is larger than in an economy populated fully by patient agents, due to the insulating presence of impatient households; credit-constrained agents respond to falling incomes through increasing their labour supply, which both decreases real wages and increases production in the economy. This leads to a redistribution of welfare from workers to capital holders, as lower wages lead to higher profits, which subsequently leads to contrasting welfare implications from exogenous shocks in the model.

[Insert figure 2]

From this acyclical benchmark, Fig. 2 presents four clear results on the heterogeneous impacts of fiscal policy. First, impatient households gain welfare and patient households lose welfare as a result of countercyclical policy; this reconciles with the dynamics presented above. It is observed that the more countercyclical the response, the greater the gains and losses of welfare from the benchmark of acyclical policy. Through insulating the economy, the government is also reducing the response of the impatient agents to increase their labour supply, which is the source of the redistribution from workers to capital holders. As demonstrated in the fourth column of Fig. 1, this is most pronounced over a shorter time period, where movements in utility are most affected by the policy response: as debt is repaid, the welfare impacts are dampened. This results in impatient agents deriving all their benefit from policy upfront, whereas the patient gain as the policy matures. This is significant because the polarizing nature of fiscal policy is stronger over a shorter political time horizon compared with a lifetime perspective.

Second, quicker repayment of debt resulting from countercyclical fiscal actions leads to lower movements in relative welfare as a result of policy (the second row in Fig. 2). This occurs because the initial

impact of the intervention is shortened as the repayment of the policy is accelerated in the economy.

Third, impatient agents benefit more from policy experiment 2 as the tax cuts provide them with the most freedom to optimise their utility, especially in the short term (as demonstrated in Fig. 1), which they do by both consuming more and working less.<sup>12</sup> Patient households are also seen to lose less as a result of tax cuts, compared to spending increases, due to comparatively lower labour demand requiring less work from these agents. A normative assessment would therefore favour policy experiment 2, which is in contrast to the conclusions based on output movements; policy experiment 1 provides more output stabilisation (as demonstrated in (12) and Fig. 1), which provides a different trade-off for policy makers.

Finally, average welfare movements from policy are small, which is coherent with Lucas (2003). The normative justification for fiscal policy comes from its redistributive consequences, as it reduces the divergent experiences across the two agents as a result of the shock. In policy experiment 2, mild improvements in social welfare are observed with a utilitarian function, whereas in policy experiment 1 inequality aversion is required to see an improvement in social welfare ( $\gamma \geq 3.4$ ; the third column of Fig. 2). The result that average welfare changes as a response of fiscal intervention are negligible leads to the polarization across agents in the model: as one agent gains welfare from policy, the other agent loses.

### 3.4.1 Other shock processes

The same analysis as presented in Figs. 1 and 2 can be performed for when the initial shock originates from any of the other exogenous processes. The redistribution of welfare, in the presence of the shock and acyclical fiscal policy, from impatient to patient households is observed whereby the former agents' labour market decisions (due to the lack of participation in capital markets) improves welfare for the latter agents over an economy populated only by the patient. As other shocks have limited impact on potential output, the acyclical welfare results become more polarizing with the losses of impatient agents being mirrored by the gains of the patient, as utility is transferred from workers to capital holders. From this benchmark, fiscal policy interacts with the economy in a similar way to those presented above, and the disaggregated welfare experiences of the two households also follow similar paths.

## 3.5 The conduct of fiscal policy over the business cycle

The above analysis was performed considering only shocks resulting in a negative output gap in order to focus on the recent economic environment. If we were to consider periods of a positive output gap, the intuition from above would be reversed: countercyclical fiscal policy would temper demand within the economy resulting in lower labour demand and wages, compared to an acyclical benchmark. To obtain

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<sup>12</sup>Note that when considering the dynamics of instantaneous utility (as opposed to welfare over the whole fiscal experiment) the assumption of whether government expenditure enters the utility function is no longer trivial in policy experiment 1. The plots in Fig. 1 assume that government consumption does not enter the utility function.

more general results, the conduct of fiscal policy over the business cycle is considered where the cyclical response parameters are varied and set equal to each other in absolute terms ( $-\varphi_g = \varphi_T$ ). The results are not sensitive to this policy and as such this approach is adopted for brevity. Stochastic simulations are run, using the calibration of shocks as outlined in Section 3.2, with key statistics documented in Fig. 3.

[Insert Figure 3]

A countercyclical fiscal response leads to higher average levels of utility for impatient households and lower average levels for patient households, compared to the benchmark of acyclical policy. In the absence of engagement with credit markets, impatient households are more exposed to business cycles and as such have the most to gain from policy removing these cycles.<sup>13</sup> Capital holders, on the other hand, benefit from volatility as it generates labour supply movements from the credit-constrained agents, which are more insulating for patient households than government intervention.<sup>14</sup> This occurs because whereas countercyclical fiscal policy impacts the aggregate economy in a non-discriminating way, the insulating effect of credit-constrained households is redistributing from workers to capital holders. As is demonstrated from the second pane in Fig. 3, the improvements in the variance of consumption for impatient households from countercyclical policy are large in comparison to the slight rise for patient households. From a social welfare perspective, weighted average movements as a result of policy are minimal (as presented in Fig. 3), and a high degree of inequality aversion is required in order for improvements to occur monotonically with more countercyclical policy.<sup>15</sup>

However, this is a stylised economy with stylised policy. If imperfectly competitive labour markets were included which prohibited both households supplying labour independently of one another, the returns to countercyclical policy would be greater, and more so were wages to be sticky. Moreover, if the share of impatient households were to increase, greater social gains would be seen from fiscal intervention. Policies focusing on changing lump sum taxes have a bigger impact on credit-constrained agents as they directly influence their disposable income.

Polarizing preferences over the conduct of fiscal policy are again observed and these results are of particular significance because they contribute to the literature which finds fiscal policy to be frequently procyclical, especially in developing nations, see for example Woo (2009). This can be reconciled to our

<sup>13</sup>Throughout the lifetime of the simulation, the real interest rate is never sufficient to induce impatient households to want to save, at any calibration of fiscal parameters.

<sup>14</sup>Trivially, at very high values of  $-\varphi_g$  and  $\varphi_T$  the business cycle is virtually removed as agents expect the government response to movements away from flexible output to be strong. If such a policy is credible and possible, this would be optimal for both types of agent.

<sup>15</sup>As patient households are the majority of the population, a social planner with low  $\gamma$  optimises with procyclical policy as patient agents benefit from this. At values of  $\gamma > 20$ , countercyclical policy becomes optimal for the inequality-averse planner, using the calibrations in the above experiment. Allowing more flexibility, impatient agents prefer policy focusing on tax movements as these directly contribute to disposable income; patient agents, on the other hand, prefer countercyclical policy focusing on government spending, and the social planner compromises with more of the latter.

model by observing that the results above are amplified the higher the proportion of credit-constrained agents, see (13) and Section 4.3, and therefore the returns to procyclical policy for patient households are greater in such economies. Empirical data illustrates that the proportion of credit-constrained agents is greater in developing countries, see for example Evans and Karras (1996), and that voter turnout in both parliamentary and presidential elections are lower in these countries.<sup>16</sup> Providing sufficient voting power is retained in the remaining patient households of a nation, the model would predict the empirical regularity that these developing countries are more fiscally procyclical, as they provide more insulation for the capital owners within the economy.

## 4 Further extensions and sensitivity analysis

### 4.1 Distortionary taxation

The above analysis has been performed using lump sum taxation, however, using distortionary taxes provides similar results. From the structure of the model it is possible to include taxes on wages, capital income, consumption, and employment by firms.<sup>17</sup> If these distortionary taxes are included in the model and experiments performed in line with those above, similar results prevail: countercyclical policy is to the advantage of impatient households and at the expense of patient households. Consumption and labour income taxes are more effective at redistributing welfare, compared to employer social security contributions and capital income taxes, as the latter two accrue to patient households who can smooth the impact of the policy. However, a countercyclical response of these taxes leads to an incentive to increase employment, and subsequently a stabilisation of the economy.

Simulations performed over the course of a business cycle provide similar results to those presented above: countercyclical policy focusing on any combination of distortionary taxes, but especially on consumption and income taxes, is to the benefit of impatient agents whereas patient households prefer procyclical policy. The result that those agents who are most exposed to business cycles gain from policy which stabilises these is maintained. Moreover, the concept that, in the presence of acyclical policy, credit-constrained agents insulate patient households through their labour market transactions is also

<sup>16</sup>Evans and Karras (1996) estimate the proportion of credit-constrained agents in 54 different countries, and applying World Bank classifications the mean estimate for developing countries is nearly double that of developed countries. Moreover, applying the same World Bank classifications to voter turnout data from the Institute for Democracy and Electoral Assistance, rates of 78% are found for developed economies followed by a monotonic decline with the level of development with rates of 65% for low income countries. Studies into the socio-economic factors influencing voter turnout frequently show that it is those with less education and less income who are less likely to vote (see for example Neviite *et al.*, 2009): those individuals most likely not to participate in capital markets.

<sup>17</sup>Taxes on consumption ( $\tau_t^c$ ) and wages ( $\tau_t^l$ ) enter such that the price paid on consumption and the income earned on labour are  $(1 + \tau_t^c)P_t$  and  $(1 - \tau_t^l)W_t$ , respectively. In production, employers pay social security contributions ( $\tau_t^{er}$ ) and patient households pay a tax on their capital income ( $\tau_t^k$ ) such that the total cost of labour is  $(1 + \tau_t^{er})W_t$  and the returns on capital are  $(1 - \tau_t^k)R_t^k K_t$ . All tax rates are assumed to respond to both the business cycle and the level of debt, as in (9).

maintained.

What distortionary taxation does provide is further scope for politics to interact with the economy and influence decisions, and it allows for more polarizing combinations of policies. For example, a policy which cuts consumption taxes today and raises capital taxes in the future is seen to benefit impatient households at the expense of patient households, with the opposite result from the opposite policy. As distortionary taxes are explicitly redistributive they distort the political discussion about policy. From the perspective of those agents most vulnerable to business cycles, the most important characteristic of policy is that it is countercyclical.

## 4.2 Fiscal policy at the monetary zero lower bound

A characteristic that has been prevalent in the recent recession, and which has received much academic attention, is that monetary policy has been operating at its lower bound: where nominal interest rates reach, or are close to, zero. Under such a scenario fiscal multipliers are shown to increase as the deflationary impact of higher interest rates associated with higher levels of output are removed (see for example Christiano *et al.* (2011)). If the above analysis is performed with monetary policy at its lower bound, the results are strengthened. In the presence of acyclical policy there is an amplification of the impact of the shock as the stabilising property of monetary policy is diminished: this leads to an amplification in the welfare consequences resulting from the shock. From this benchmark, fiscal policy has more scope to rebalance this larger redistribution of welfare; as above, the weighted average movements from policy are not large (although are larger), and as such any improvements for impatient households from countercyclical policy are at the expense of patient households.

## 4.3 Sensitivity

If the model were adapted to include imperfectly competitive labour markets similar to those in Galí *et al.* (2007), where a continuum of trade unions bargain to add a markup on wages by aggregating individual preferences to create a weighted average labour supply function, the results remain qualitatively unchanged as those presented above. There is a redistribution of welfare observed in the presence of an exogenous shock and this can be reduced through countercyclical fiscal measures. The quantitative results are amplified, with the losses of impatient agents being increased from shocks leading to a negative output gap, and the scope of fiscal policy is therefore extended by this additional rigidity in the market.<sup>18</sup> Although it is the labour market response of impatient households which drives the redistribution from exogenous shocks, perfect labour markets provide these agents with the most flexibility

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<sup>18</sup>Similar results can be derived if it is assumed that the two types of agent's labour are imperfect substitutes of each other.



with which to minimise their losses. With imperfectly competitive labour markets, there is still a desire to increase their labour supply in response to a fall in disposable income, and trade unions incorporate this preference in their negotiations resulting in a fall in real wages. This subsequently maintains the redistribution of welfare to capital owners.

The greater the share of impatient households,  $\lambda$ , the greater the impact of any initial shock (as the economy is more exposed to movements in labour demand) and the greater the impact fiscal policy has on aggregate demand within the economy (as demonstrated in (13)). Moreover, the greater the population of credit-contained agents, the fewer remaining patient households there are to benefit from the redistributive impact of business cycles. These relationships act to increase the above results at higher values of  $\lambda$ , however both the qualitative and quantitative results are retained at reasonable calibrations.

Price stickiness in the model also tends to increase both the impact of shocks and the scope for fiscal policy to interact within the economy, therefore, higher calibrated values of  $\theta$  amplify the above results. If stickiness in the model were removed altogether, there would be a role for countercyclical fiscal policy to aid those most exposed to business cycles due to the presence of other rigidities in the economy. However, with price flexibility, the costs associated with not having access to capital markets diminish. Moreover, the effectiveness of fiscal policy also diminishes as the removal of rigidities leads to smaller fiscal multipliers. At all reasonable calibrations of  $\theta$ , the results above are both qualitatively and quantitatively maintained.

## 5 Conclusions

The results from the paper suggest that preferences across agents over the conduct of fiscal policy are polarized, which subsequently predicts strong debates over appropriate policy measures, something frequently observed. The intuition behind these results is clear: those agents who have limited access to credit markets to smooth their consumption are the most exposed to fluctuations caused by business cycles, and therefore have the most to gain from measures which promote stability. In the presence of falling incomes, these agents insulate themselves through increasing their labour supply, which suppresses real wages, and therefore transfers income and utility from workers to capital holders. From the perspective of patient agents, these labour market transactions provide more insulation than non-discriminating government policy. Over the course of the business cycle, credit-constrained agents see welfare improvements through the adoption of countercyclical fiscal policy, whereas patient households benefit more from the volatility caused by procyclical policies. These results are amplified the higher the level of credit market non-participation, and therefore the returns from procyclical policy to patient

agents are increased within these economies. This contributes to the literature which finds fiscal policy to be procyclical, especially in developing economies, as it is these countries which have higher levels of credit market non-participation.

In effect, these fiscal decisions are played in a near zero-sum game where the gains of one household are netted off against the losses of the other, and this is the source of the polarizing preferences across agents in the model. These polarized effects are consistent with those observed in the real world, and come from a model which assumes away progressive taxes and which possesses modest multipliers. The normative justification for fiscal policy is present, therefore, despite its relatively modest impact on output.

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## Appendix: derivation of algebraic results performed on a log-linear version of the model

If the model abstracts from capital formation and log-linear conditions are taken, it is possible to condense the model into an aggregate demand condition, a New-Keynesian Phillips curve, and monetary and fiscal rules. The aggregate demand relationship can be obtained by combining the log-linear versions of the goods market clearing condition (11), the production function (6), and the Euler equation obtained through combining the optimisation of the patient and impatient households utility:<sup>19</sup>

$$\begin{aligned}
 y_t &= E_t \{y_{t+1}\} - \Phi E_t \{\Delta \hat{g}_{t+1}\} - \Phi \Theta_A (r_t - E_t \{\pi_{t+1}\} - E_t \{\Delta \varepsilon_{t+1}^b\}) \\
 &\quad + \Phi \Theta_B E_t \{\Delta \varepsilon_{t+1}^a\} + \Phi \Theta_C E_t \{\Delta \hat{t}_{t+1}^{NR}\} \\
 \Phi &= \frac{\Gamma^{-1}}{\Gamma^{-1} - \gamma_c [\varphi \lambda (1 + \varphi)]} \\
 \Theta_A &= \gamma_c (1 - \lambda) \frac{1}{\sigma} (\varphi (1 + \mu) \gamma_c + \sigma (1 - \alpha)) \Gamma \\
 \Theta_B &= \gamma_c \varphi \lambda (1 + \varphi) \Gamma \\
 \Theta_C &= \gamma_c \varphi \lambda (1 + \mu) \Gamma \\
 \Gamma &= [\varphi (1 + \mu) \gamma_c + \sigma (1 - \alpha) [1 - \lambda (1 + \varphi)]]^{-1}
 \end{aligned} \tag{16}$$

where  $\gamma_c$  is the steady state share of private consumption to output ( $C/Y$ ). From this relationship the conditions presented in (12) and (13) can be derived.

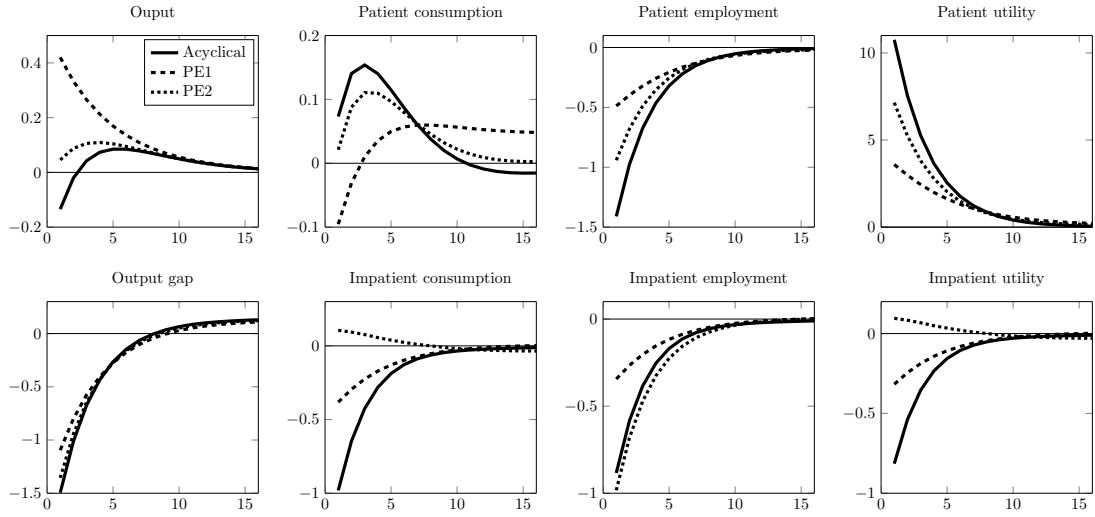
Providing  $\Phi$ ,  $\Theta_A$ ,  $\Theta_B$ ,  $\Theta_C$  and  $\Gamma$  are positive the aggregate demand condition provides the expected relationships; increases in government spending and reductions in taxes and interest rates lead to increases in aggregate demand. However, it is possible to observe from the definition of  $\Phi$  that this is not always the case. There exists a bound on the proportion of impatient households,  $\lambda$ , such that above this limit (notated as  $\lambda^*$ ), the traditional demand relationships are reversed. Bilbiie (2008) refers to this as the region of ‘inverted Keynesian logic’. From the derivation of the aggregate demand condition it is possible to show this limit in the benchmark economy is:

$$\lambda^* = \frac{\varphi \gamma_c (1 + \mu) + \sigma (1 - \alpha)}{(1 + \varphi) [\varphi \gamma_c + \sigma (1 - \alpha)]}$$

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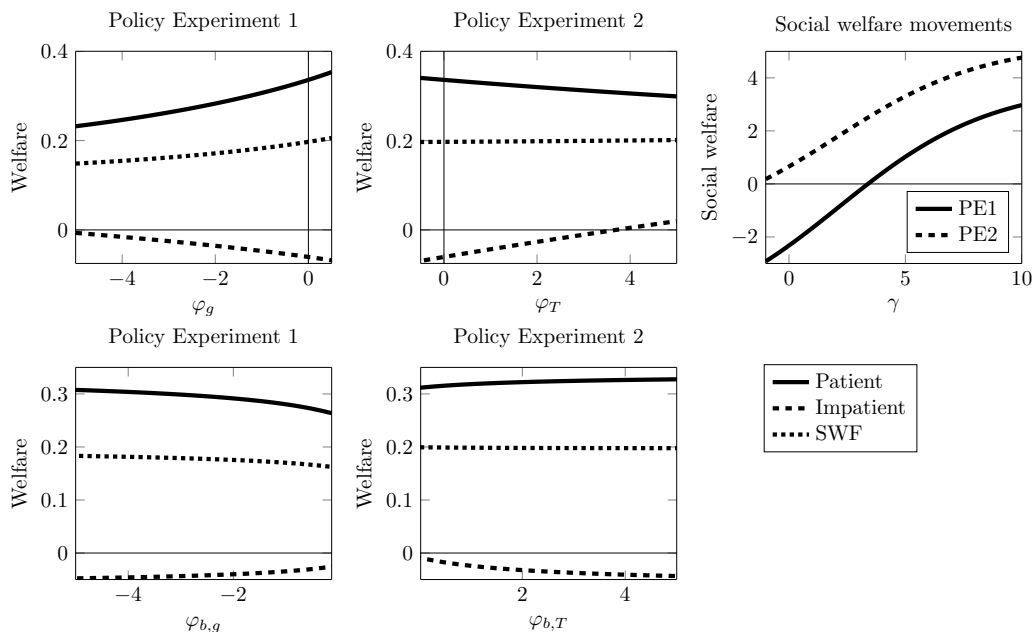
<sup>19</sup>Specifically, the log-linear consumption function of impatient households is combined with the patient household’s Euler equation to obtain dynamics of aggregate consumption. The resulting equation is a function of future consumption, employment, and wages where the latter two can be substituted using the production function and an aggregate labour supply function, respectively.

**Fig. 1** Dynamics under different fiscal experiments



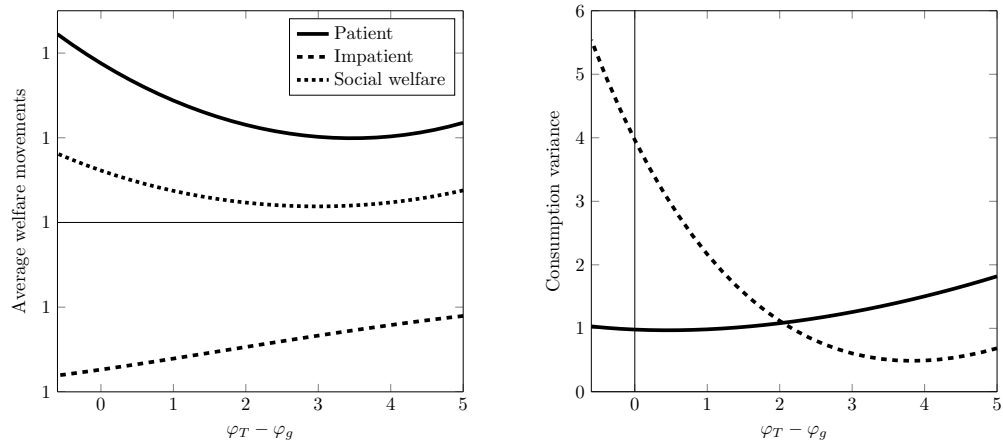
Dynamics achieved through a third-order approximation of the the model using the calibration described in Section 3.1 and with a one standard deviation shock to total factor productivity. The x-axis represents the number of quarters and the y-axis the percentage deviation of the variable from steady state levels. ‘Acyclical’ policy is when all fiscal parameters are set to zero; ‘PE1’ represents policy experiment 1 with calibration  $\varphi_g = -3$  and  $\varphi_{b,g} = -0.1$ ; ‘PE2’ represents policy experiment 2 with calibration  $\varphi_T = 3$  and  $\varphi_{b,T} = 0.1$ . These fiscal parameters are arbitrarily set for the purposes of demonstration. Note, debt aversion parameters equal to 0.1 in modulus relate to an expected halflife of debt of two years.

**Fig. 2** Welfare consequences of policy experiments



Dynamics achieved as in Fig. 1. In the top left pane  $\varphi_g$  is varied whilst  $\varphi_{b,g} = -0.1$ ; in the middle top pane  $\varphi_T$  is varied whilst  $\varphi_{b,T} = 0.1$ ; in the bottom left pane  $\varphi_{b,g}$  is varied whilst  $\varphi_g = -3$ ; and in the bottom right pane  $\varphi_{b,T}$  is varied whilst  $\varphi_T = 3$ . The legend in the bottom right of the figure represents those for the first two columns, whereas the figure in the third column has its own legend. Welfare is calculated as in (14) where social welfare ('SWF') is calculated using (15), and in the first two columns using  $\gamma = -1$ . The figure in the third column plots the social welfare function for different values of  $\gamma$ , where in policy experiment 1 ('PE1')  $\varphi_g = -3$ ,  $\varphi_{b,g} = -0.1$  and policy experiment 2 ('PE2')  $\varphi_T = 3$ ,  $\varphi_{b,T} = 0.1$ ; the figure is plotted as the percentage improvement as a result of the policy over acyclical policy. This normalisation is performed because different values of  $\gamma$  cause both a change in the slope and the intercept of the social welfare function, and the normalisation controls for the latter to isolate the former.

**Fig. 3** Fiscal policy and welfare through the business cycle



Stochastic simulation achieved through a third-order approximation of the model using the calibration described in Section 3.1. A simulation period of 1,000 quarters is used where the first 200 observations are dropped from the analysis. Debt aversion parameters are set such that  $-\varphi_{b,g} = \varphi_{b,T} = 0.05$  and where cyclical response parameters are varied but set such that  $-\varphi_g = \varphi_T$ . The left hand pane measures the average levels of welfare over the stochastic simulation period as a proportion of steady state levels, and the right hand pane compares absolute values of disaggregated consumption by normalising by the variance of total consumption.