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Richard McManus, F. Gulcin Ozkan, Dawid Trzeciakiewicz

Department of Economics and Related Studies
University of York
Heslington
York, YO10 5DD

Expansionary contractions and fiscal free lunches: too good to be true?*

Richard McManus
Canterbury Christ Church University

F. Gulcin Ozkan†
University of York

Dawid Trzeciakiewicz
University of Bradford

Abstract

This paper builds a framework to jointly examine the possibility of both 'expansionary fiscal contractions' (austerity increasing output) and 'fiscal free lunches' (expansions reducing government debt), arguments supported by the austerity and stimulus camps, respectively, in recent debates. We propose a new metric quantifying the budgetary implications of fiscal action, a key aspect of fiscal policy particularly at the monetary zero lower bound. We find that austerity needs to be highly persistent and credible to be expansionary, and stimulus temporary, responsive and well-targeted in order to lower debt. We conclude that neither are likely, especially during periods of economic distress.

Key words: fiscal austerity, expansionary contractions, fiscal free lunch, zero lower bound.
JEL Classification: E65; H2; H3.

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†Corresponding author. Department of Economics and Related Studies (DERS), University of York, Heslington, York, YO10 5DD, UK; Tel: 01904-434673; E-mail:gulcin.ozkan@york.ac.uk.

1 Introduction

The 2008 global financial crisis and subsequent economic downturn led to a deterioration in fiscal balances, resulting in widespread fiscal austerity in a large number of countries. Within this climate, some suggested that fiscal contractions can be expansionary, especially those conducted through spending cuts as agents anticipate efficiency gains and lower future taxes as a result of a smaller public sector (Alesina & Ardagna 1998). Others, however, indicated that fiscal multipliers are potentially much larger in recessions than in normal times (see for example Auerbach & Gorodnichenko 2012) and hence austerity would be even more contractionary in post-crises periods. This is argued to be particularly the case in the current climate with monetary policy being constrained at its nominal zero lower bound (ZLB: see for example Eggertsson 2011, Woodford 2011). Furthermore, it is argued, under the ZLB fiscal effectiveness is greatly amplified such that interventions become 'fiscal free lunches' (Erceg & Lindé 2014); expansionary policy stimulates output and resulting tax revenues to such an extent that there is a fall in government debt.

The innovation of this paper is to develop a formal framework that encompasses the possibility of both 'expansionary contractions' and 'fiscal free lunches'. The former is defined as fiscal contractions leading to an increase in output and the latter as expansions which reduce debt. We test for expansionary contractions by using traditional output multipliers, while we introduce a 'bond multiplier' metric which measures the response of government debt to fiscal interventions to investigate fiscal free lunches. A fiscal free lunch is observed when either spending increases or tax cuts lead to an improvement in government debt. We find that austerity needs to be permanent, credible and predominantly based on spending cuts in order to yield expansionary effects. Agents observe a potential increase in their lifetime earnings if they predict lower future taxes, but they only act on this if they perceive the spending cuts to be credibly long lasting; without this expectation and credibility expansionary contractions are not possible. In the case of fiscal expansions, we show that fiscal action improves budgetary outcomes when it is temporary, well-targeted and supported by

the accommodative monetary policy (or the zero lower bound on interest rates). We conclude that, given the political costs associated with prolonged austerity as well as those of reversing stimulus, neither extreme outcome is likely, and therefore, policy-makers are unlikely to benefit from either expansionary contractions or fiscal free lunches.

This paper builds on the literature which finds that fiscal policy, especially with respect to government spending, becomes more effective under a period of the ZLB (Eggertsson 2011, Woodford 2011, Christiano et al. 2011). Under such conditions, interest rates are not raised by the central bank who would otherwise respond to increased inflation and output when government spending increases; furthermore, higher inflation with a fixed nominal interest rate leads to a fall in the real interest rate, subsequently fuelling further increases in consumption. Indeed, fiscal policy can become so effective that spending increases lead to substantial rises in the tax base, reducing government debt (Erceg & Lindé 2014).

We extend the work of Erceg & Lindé (2014) in two important directions. First, we extend the results to many fiscal instruments; our model includes government spending on consumption goods, investment goods, transfers and public employment and distortionary taxes on consumption, labour income, capital income and employers' social security contributions. Whereas fiscal free lunches can occur for increases in spending and cuts in consumption taxes, cuts in production taxes have the opposite effect; a fall in labour, capital or employment taxes leads to lower inflation, subsequently leading to higher real interest rates in the presence of the ZLB, results also identified in Eggertsson (2011). Second, we develop a bond multiplier metric to measure the consequences of fiscal action on government borrowing. We argue that this is particularly important at the ZLB where the budgetary consequences of different fiscal action are different from those in normal times.

Our results also provide a basis for the main findings in the empirical literature on the output effects of fiscal consolidations. This literature identifies two factors as key determinants of the possibility of expansionary contractions: first, the political environment in which the fiscal consolidation is performed; and second, specific fiscal instruments used in the

fiscal adjustment. With respect to the former, it has been shown that fiscal consolidations, for example, those which are against type (parties on the political left cut spending and those on the right raise taxes) are associated with buying credibility and are more likely to succeed (see for example von Hagen & Strauch 2001). With respect to the latter, it is found that fiscal consolidations which focus more on spending cuts, especially politically sensitive spending cuts, and more likely to be successful (see for example von Hagen et al. 2002). Indeed, our analysis based on a DSGE model with a rich set of fiscal instruments reveals that expansionary fiscal contractions are possible, but require a commitment of the fiscal authority that is credibly perceived by private agents as well as a judicious choice of fiscal instruments. We, therefore, argue that these fiscal outcomes are unlikely, and potentially this is why the literature finds only rare occurrences of these events.

The paper proceeds in the following way. The next section builds a dynamic stochastic general equilibrium model with a full set of fiscal instruments. Section 3 then identifies the circumstances through which expansionary fiscal contractions and fiscal free lunches occur: by first developing a new bond multiplier metric; then conducting a range of fiscal experiments; and finally assessing specific fiscal outcomes, including a series of sensitivity checks on the robustness of the results. Section 4 concludes.

2 Model

We utilize a DSGE model featuring rigidities in prices, adjustment costs in investment and distortionary taxation on labour, capital and consumption. Our model includes five types of agent: a continuum of households who invest in capital stock and bond markets, purchase the final good, and supply labour to firms; a production sector featuring both monopolistically competitive intermediate good producers and a perfectly competitive market of final good producers; and authorities who conduct monetary and fiscal policy.

2.1 Households

The economy is populated by a continuum of households with access to capital and bond markets who supply labour (L_t) in a perfectly competitive frictionless market to firms and purchase the final consumption good (C_t). Each household, h, seeks to maximize:

$$E_0 \sum_{t=0}^{\infty} \beta^t \left(\ln \left(C_t(h) \right) - \frac{1}{1+\sigma_l} \left(L_t(h)_t \right)^{1+\sigma_l} \right) \tag{1}$$

where E_0 denotes the expectation operator, $\beta \in (0,1)$ the discount factor, and σ_l the inverse of the Frisch labour supply elasticity.

The household's total expenditure on consumption, investment in physical capital (I_t), and accumulation of a portfolio of riskless one-period contingent claims from the government, B_t, must be no greater than the household's total disposable income:

$$\begin{aligned} \left(1+\tau_t^c\right) C_t(h) + I_t(h) + B_t(h) \leq & \left(1-\tau_t^l\right) w_t\left(h\right) L_t\left(h\right) + \Pi_t(h) \\ & + \left(1-\tau_t^k\right) r_t K_{t-1}(h) + \frac{R_{t-1} B_{t-1}(h)}{\pi_t} + T_t \end{aligned} \tag{2}$$

where τ_t^c, τ_t^l and τ_t^k represent distortionary taxes on consumption, labour income and capital; w_t is the real wage; Π_t represents dividends from firms profits, and r_t the real return on capital services, and K_{t-1} the stock of physical capital; R_{t-1} the gross nominal interest rate on one-period bonds, π_t the gross inflation rate; and T_t represents a lump-sum transfer. Physical capital accumulates in accordance with:

$$K_t = (1-\delta_k) K_{t-1} + \left[1 - \frac{\phi}{2} \left(\frac{I_t}{I_{t-1}} - 1 \right)^2 \right] I_t \tag{3}$$

where $(\phi/2)\left((I_t/I_{t-1}) - 1\right)^2$ denotes the cost of investment adjustment function and $\phi_k > 0$.

2.2 Production

The final good, Y_t^P, is produced by retailers in a perfectly competitive environment by aggregating the intermediate goods, $Y_{j,t}^P$, with a constant elasticity of substitution technology. Monopolistic firms, indexed by $j \in (0,1)$ use the following production function:

$$Y_{j,t}^P = (K_{j,t-1})^{\alpha} \left(L_{j,t}^P\right)^{1-\alpha} (K_{g,t-1})^{\alpha_G} - \Phi \tag{4}$$

where K_g denotes public capital and Φ a fixed cost of production. Intermediate goods producers solve a two-stage problem. First, they minimise real costs, $(1+\tau_t^{er})w_t L_{j,t}^P + r_t K_{j,t-1}$, where τ_t^{er} denotes employers' social security contributions, subject to the production function (4). Second, they choose prices that maximise discounted real profits subject to the demand from retailers. In particular, each period a fraction $(1-\theta)$ of firms is able to reoptimise its nominal price whereas the remaining firms follow a simple rule maintaining the same price as last period; the probability θ is fixed, exogenous and independent of when the retailer was last able to change prices, which represents a Calvo (1983) pricing structure.

2.3 Monetary policy

The monetary authority sets nominal interest rates (R_t) by following a Taylor rule which responds to deviations in both output and inflation:

$$\frac{R_t}{R} = \left(\frac{R_{t-1}}{R}\right)^{\rho} \left[\left(\frac{\pi_t}{\pi}\right)^{\rho_\pi} \left(\frac{Y_t}{Y}\right)^{\rho_y}\right]^{1-\rho} \tag{5}$$

where ρ_π and ρ_y, respectively, denote the response of interest rates to inflation (π_t) and total output (Y_t) deviations from their steady-state values (represented by variables with no time subscript). The nominal interest rate has a lower bound of zero.[1] In our analysis this means that when the Taylor rule computes a negative interest rate - when either output or inflation

[1] Given the recent path of nominal interest rates, the ZLB and its impact on fiscal outcomes has been studied extensively in recent years (see for example Eggertsson 2011, Woodford 2011, Erceg & Lindé 2014).

is too low - the nominal interest rate is set to zero. The possibility and length of this ZLB is a key parameter in our analysis.

2.4 Fiscal policy

The fiscal authority has seven instruments at its disposal, three in spending (public consumption, investment and employment: G^C, I^G and L^G, respectively) and four in taxes (employers' social security contributions and taxes on consumption, capital, labour income).[2] The government budget constraint requires that spending be no greater than tax revenues received plus any cash flows from bond market transactions:

$$G_t^C + I_t^G + (1 + \tau_t^{er})\, w_t L_t^G \leq B_t - \frac{R_{t-1} B_{t-1}}{\pi_t} + \tau_t^c C_t + T_t + \left(\tau_t^l + \tau_t^{er}\right) w_t L_t + \tau_t^k r_t K_{t-1} \quad (6)$$

where all are as defined earlier. The fiscal authority also has lump sum transfers, T_t, which we use to ensure that the long run solvency condition is met by making these transfers respond to the level of debt.[3] Public capital accumulates according to:

$$K_t^G = (1 - \delta_k^G) K_{t-1}^G + I_t^G \quad (7)$$

which is equivalent to the accumulation of private capital (3), but without cost to adjustment, as is common in the literature, and where δ_k^G represents depreciation specific to public capital.

Our fiscal experiments combine two elements: first a temporary shock is applied which lasts for a predetermined length and is equally distributed over this horizon; second, after this predetermined length, the shock diminishes governed by an autoregressive persistence:

[2]Note that public employment does not enter the production function (4) as we assume this to be unproductive. The total wage cost of public employment does, however, enter the calculation of total output, as it is added to the total production of the final good. Government consumption of privately produced output is also taken to be unproductive in that it does not enter the utility function (1).

[3]With a population of fully rational forward looking agents, the exact calibration of this parameter is irrelevant for the results, as households internalise any government debt; that is, these agents adhere to Ricardian equivalence with changes in lump sum transfers.

$$x_t = x\left(1+\varepsilon_{x,t}\right); \quad \varepsilon_{x,t} = \begin{cases} \eta_x & \text{if } t = 1,...,z \\ \rho_x \varepsilon_{x,t-1} & \text{if } t > z \qquad \rho_x \in [0,1] \end{cases}$$

where $x = \{G^C, I^G, L^G, \tau^c, \tau^k, \tau^l, \tau^{er}\}$ To calculate fiscal multipliers we apply a two-year equally distributed shock to each fiscal instrument ($z = 8$). Within this framework we vary two parameters: the length of the ZLB (which we assume to be exogenous to the fiscal intervention); and the level of persistence of the shock after the eight-quarters are over (ρ_x).[4]

These experiments, therefore, incorporate a short term temporary component (potentially in response to some event) followed by a persistent element once this initial response has been exhausted. Note that when $\rho_x = 0$, the fiscal intervention is strictly temporary, and when $\rho_x = 1$ it is permanent. Further note that ρ_x represents agents' expectations of future fiscal actions, before these are realised. In this respect we use this variable to represent the credibility of the fiscal intervention. For example, when the government states that a fiscal movement is permanent, if agents do not believe this (independent of future actual intentions) in our analysis this would be represented by $\rho_x < 1$.

2.5 Market clearing

The final goods market is in equilibrium when all production is allocated between public and private consumption and public and private investment. The labour market is in equilibrium when the total labour demanded by both private firms and the fiscal authority is equal to the labour supply at the given wage rate. The capital rental market is in equilibrium when that supplied by households is equal to capital demanded by firms at a given rental rate. Finally, total output of the economy is equal to the production of the private sector, and that produced by those employed in the fiscal authority. A complete list of all model equations, including optimisation conditions can be found in the Appendix.[5]

[4]Note that similar results would prevail more broadly with 'monetary accommodation', but we focus on the ZLB given its empirical relevance.

[5]The model is solved to a second-order approximation with perturbation methods in Dynare.

3 Fiscal outcomes

3.1 Fiscal multipliers

In order to jointly examine the possibility of both expansionary contractions and fiscal free lunches, we propose employing a new metric of 'bond' multipliers, in addition to (traditional) output multipliers. Consider the following expression:

$$m_k^n = \frac{\sum_{j=0}^{n} (k_{t+n} - k_0)}{\sum_{j=0}^{n} (x_{t+n} - x_0)} \tag{8}$$

where m denotes the relevant multiplier, k is the relevant outcome/variable, n is the time horizon over which the multiplier is measured, and x is the respective fiscal instrument. When $k = Y$ equation (8) reduces to traditional output multipliers; a negative (positive) output multiplier when fiscal action is based on spending (taxes) represents spending cuts (tax increases) raising output, and hence expansionary contractions. However, these traditional output multipliers only provide partial information on the outcome of fiscal intervention because where the government may be stimulating with one instrument they may be contracting with another, dampening values of (8). Further, these multipliers do not reflect on the 'value-for-money' of the fiscal intervention, something which has received heightened importance in the recent global recession.

When $k = B$ (government borrowing) equation (8) produces 'bond multipliers', our suggested metric for calculating the budgetary consequences of each fiscal action. As such, a negative (positive) bond multiplier when fiscal action is based on spending (taxes) implies higher spending (lower taxes) reducing public debt, hence fiscal free lunches. The use of bond multipliers is particularly important at the ZLB because the path of government debt can be very different when using different fiscal instruments; this is different from normal times when fiscal shocks of similar persistence and debt refinancing lead to similar movements in government borrowing. Moreover, during severe recessions, the value-for-money of each fiscal action gains heightened importance not only on efficiency grounds but also for political

feasibility. Hence, for a true valuation of the cost of a fiscal action at the ZLB it is crucial to incorporate the resulting changes in government borrowing following each policy experiment.

3.2 Calibration

We follow a calibration procedure in line with the existing literature and described in Table 1. Steady state tax rates on consumption, capital, labour income and employer social security contributions (τ^c, τ^k, τ^l and τ^{er}) are set at 0.2, 0.29, 0.18 and 0.07 respectively and the level of government debt in steady state is set at 60 per cent of output. We select a slightly lower value of the depreciation of public capital compared to private capital with $\delta_k^G = 0.02$, and we fix the share of public employment in total employment at 0.15. The elasticity of public capital in the production function, σ_G, is set at 0.02 which is slightly higher than the value calibrated by Straub & Tchakarov (2007) for the US and the Euro area. We fix the share of public investment in GDP at 0.02, whereas the share of public consumption at 0.2. This calibration implies the ratio of private investment to GDP is 0.13 whereas private consumption to GDP is 0.65. This calibration of fiscal parameters is in line with those values in the United Kingdom, and not too dissimilar from those for other countries.

3.3 Results

Figure 1 illustrates one-year cumulative output multipliers for all seven fiscal instruments, each pane representing a different instrument. Each coordinate plots a different multiplier value for the given length of ZLB (x-axis) and the scale of fiscal persistence (ρ_x: y-axis). These coordinates create contours and the solid line in each plot represents the contour for multipliers of value zero: this divides the plots into regions of expansionary contractions and conventional Keynesian effects. As stated above, in the case of government spending (a term we use to incorporate all spending on public consumption, investment and employment) negative multipliers above the zero line represent the case of expansionary contractions as opposed to conventional positive Keynesian multipliers underneath this line, as displayed in

Table 1: Calibrated parameters and steady-state ratios

A. Parameters in the utility function		
β	discount factor	0.99
σ_l	inverse Frisch elasticity	2

B. Parameters in the production		
α	private cap. in production	0.35
α_g	public cap. in production	0.02
δ	depreciation - private cap.	0.25
δ_g	depreciation - public cap.	0.02
θ	price stickiness	0.85
$\varkappa$	markup	1.15
ϕ	adjustment cost	8

C. Parameters in monetary policy rule		
ρ	persistence	0.85
ρ_π	response to inflation	1.5
ρ_y	response to output	0.25

D. Expenditure shares		
C/Y	private cons. to GDP*	0.62
I/Y	private inv. to GDP*	0.16
G/GDP	public spending to GDP	0.20
I^G/GDP	public inv. to GDP	0.02

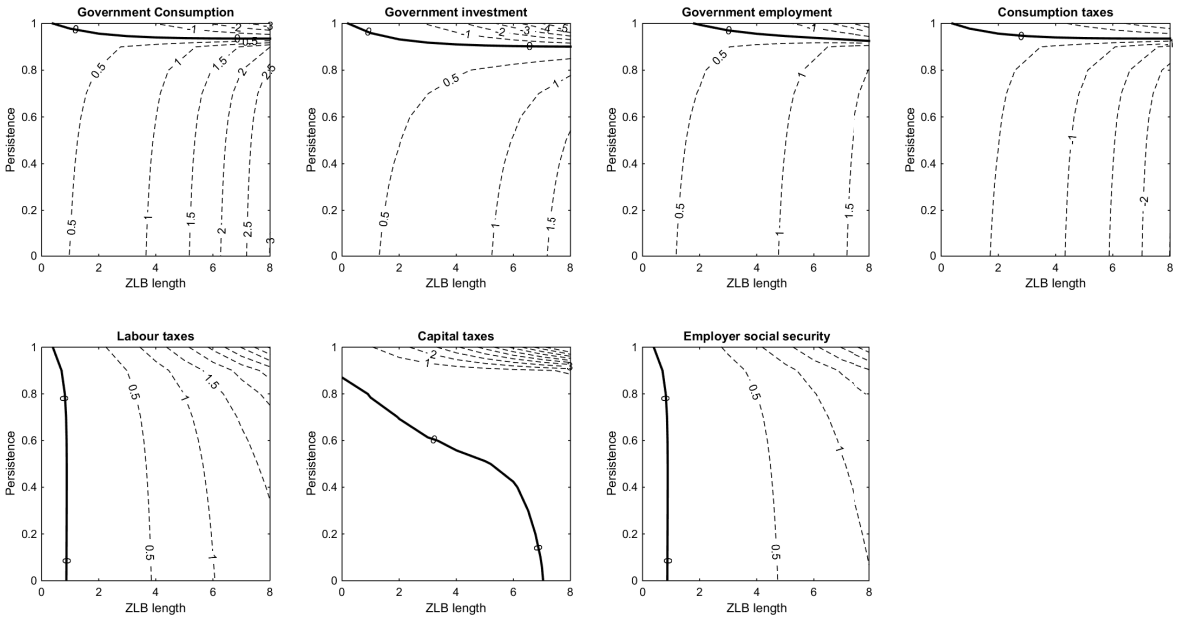
E. Tax rates and fiscal policy values/rates		
τ^c	consumption tax	0.20
τ^l	labour income tax	0.18
τ^{er}	employers contributions	0.07
τ^k	capital income tax	0.29
T/GDP	lump-sum tax to GDP	0.16
L_g	public to total labour	0.15
B/Y	debt to GDP*	2.40
ϕ_b	debt aversion	0.5

* Value implied by the calibration of other parameters.

the first three panes of Figure 1. In the case of taxes, the zero line separates the conventional negative multipliers region and the positive multipliers region associated with expansionary contractions.

The effectiveness of fiscal policy at the ZLB is determined by its role in influencing inflation. As identified by Erceg & Lindé (2014), when nominal interest rates are fixed, an increase in inflation following a fiscal expansion leads to a fall in the real interest rate which subsequently increases consumption, amplifying the impact of policy. The top row of Figure 1 demonstrates that, at low levels of fiscal persistence ($\rho_x < 0.9$), the longer the duration of the ZLB, the larger the output multipliers. This emerges in cases of fiscal expansions in either government spending (public consumption, investment and employment) or consumption taxes as a fall in consumption taxes also brings about greater inflation. This amplification of multipliers can be observed in the increasing values of multiplier contours as one moves to the right along the x-axis in the panes. Moreover, the increase which occurs in these output multipliers as a result of the ZLB across different fiscal instruments is related to their relative

Figure 1: One-year cumulative output multipliers



One-year cumulative output multipliers for the seven fiscal instruments at different levels of post shock persistence and ZLB. The solid black line represents the contour where multipliers are equal to zero, separating between regions of traditional Keynesian outcomes and expansionary contractions.

impact on inflation. Movements in government consumption and consumption taxes have only demand side consequences leading to a greater impact on inflation from policy. However, increases in public investment and employment also have supply side effects, weakening the inflationary consequences of policy, thus leading to a lower amplification of multipliers with lower multiplier values as a result of the ZLB (in the second and the third pane on the top row of Figure 1).

In contrast, the ZLB raises the multipliers associated with production taxes (a term we use to incorporate all taxes on labour, capital and employers' social security contributions); an increase in production taxes leads to higher prices, and hence lower real interest rates and thus higher output at the ZLB. This represents expansionary fiscal contractions where positive output multipliers for tax instruments are observed; a result also identified in Eggertsson (2011).[6] In Figure 1 these expansionary contractions for tax instruments are represented to

[6]Note that the weaker results for capital taxes derive from investment adjustment costs.

the right of the zero-line where multipliers go from being negative (which are typical for tax instruments) to positive.

As fiscal persistence increases, up to a certain value, these amplified impacts are reduced, as more of the fiscal activity is occurring after the period of the ZLB, when normal circumstances are resumed. Fully rational agents build this into their expectations, and subsequently a reduced impact of inflation occurs, alleviating the amplification of results the ZLB creates. When fiscal persistence is high the impact of government spending instruments and consumption taxes on output (and the broader economy) is reversed; austere fiscal actions lead to increases in output (expansionary contractions) and this is increased at longer periods of the ZLB. Fully rational agents who expect austerity to persist for a long time observe an increase in their expected lifetime income from a smaller future government, and hence in their consumption. This, in turn, leads to an increase in inflation and when the nominal interest rate does not respond, a fall in the real interest rate; leading to further consumption and further inflation. These periods of expansionary contractions are observed in the top right corner of the top row of Figure 1 which demonstrates that these episodes are possible with short ZLB horizons; however, the most important aspect in this respect is that agents expect that the cut in spending or the rise in consumption taxes is permanent.

When the fiscal intervention is more contained in the period of the ZLB (at low levels of persistence in Figure 1), high multipliers are achievable for public spending and consumption taxes. This is due to the inflationary impact of these instruments, and as such, expansions which are isolated in periods of accommodative monetary policy can have large output multipliers. The top row of Figure 1 demonstrates that the largest output multipliers are in the bottom right hand corner, where the persistence of fiscal action after the ZLB is low, and the length of the ZLB is high.

Figure 2 illustrates one-year cumulative bond multipliers for all seven fiscal instruments, where the presentation is in line with that for Figure 1; here the black line in each plot represents the contour for bond multipliers of value zero, which identifies the regions of fiscal

free lunches. In the top row of Figure 2 it can be observed that fiscal free lunches are possible in the bottom right hand corner of these plots, where bond multipliers go from being positive for spending instruments (more spending leads to more debt) to negative (greater spending lowers government borrowing). This supplements the results from Figure 1 where it was found that when the fiscal action is constrained to the period of the ZLB, and when the fiscal action is inflationary if expansionary, large output multipliers can be achieved.

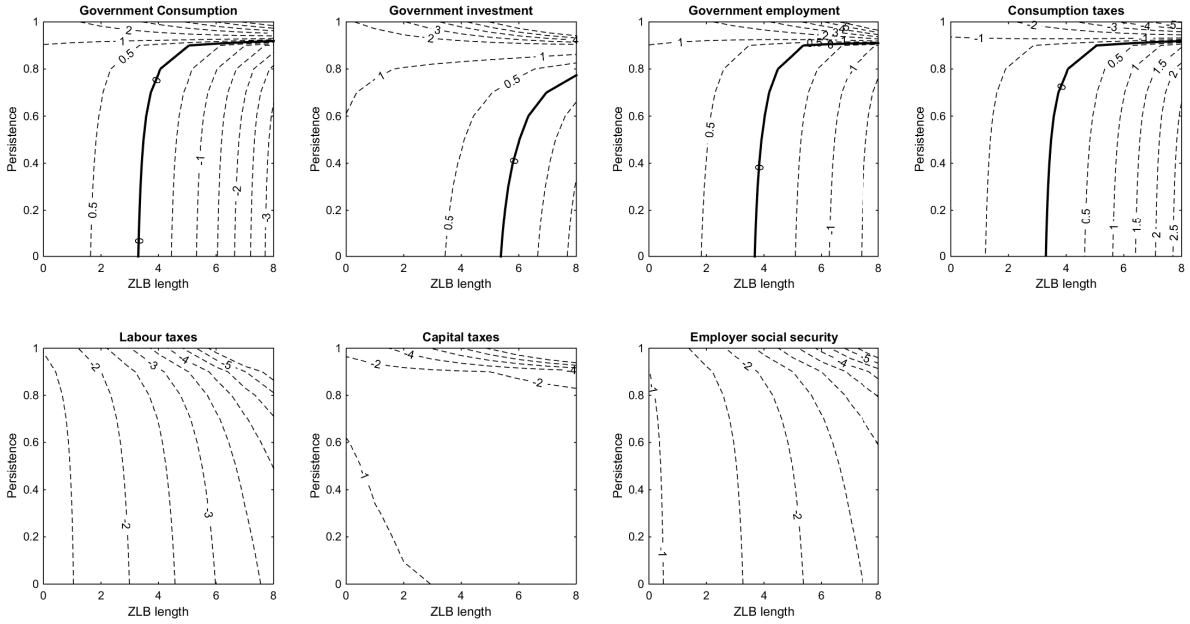
Bond multiplier results again work through the mechanism of higher inflation leading to lower real interest rates when nominal rates are fixed, which crowds in private consumption. As can be seen in Figure 2, in the case of production taxes, no fiscal free lunches are possible as these instruments have the opposite impact on inflation; an increase in production taxes increases inflation. Hence negative bond multipliers (higher taxes leading to lower government debt, the conventional scenario) become larger in absolute terms (higher taxes lead to even greater reductions in government debt as output is improved through this policy at the ZLB).

3.4 Sensitivity

To consider when each extreme fiscal outcome is most likely, Figure 3 combines and summarizes Figures 1 and 2 illustrating both the regions of expansionary contractions and fiscal free lunches under a number of different scenarios. For brevity, only results for government consumption are presented, our arguments also hold for other fiscal instruments (not reported). The first pane in Figure 3 presents the benchmark results from above. In other three panes we explore the role of the horizon over which multipliers are calculated; the degree of price stickiness and restrictions to capital market access on the possibility of extreme fiscal outcomes.

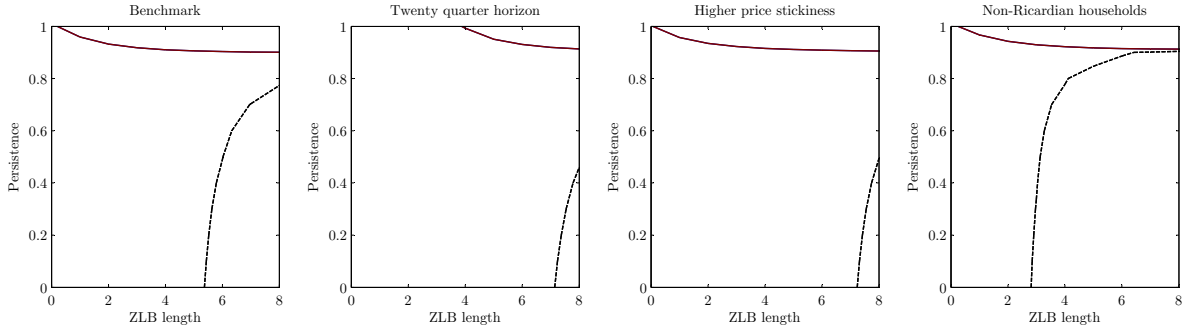
The second pane of Figure 3 demonstrates that both expansionary fiscal contractions and fiscal free lunches are short-run concepts; with cumulative multipliers calculated over twenty-quarters, the regions associated with extreme outcomes are smaller as the majority of

Figure 2: One-year cumulative bond multipliers



One-year cumulative bond multipliers for the seven fiscal instruments at different levels of post shock persistence and ZLB. The solid black line represents the contour where multipliers are equal to zero, separating between regions of fiscal free lunches and conventional outcomes.

Figure 3: Further extensions



Plots detailing output and bond contours with multipliers of zero value (the solid and dashed lines respectively) for government consumption under different scenarios as described by the pane headings.

the fiscal action and the ZLB have expired. Further, as highlighted by Erceg & Lindé (2014), these multipliers represent marginal not average values, whereby the two diverge if policy is able to alter the length of the ZLB. As stressed above, it is the fiscal instrument's interaction with inflation which is the key to the impact of the ZLB, and when this is reduced through greater price stickiness (the third pane) the regions of extreme fiscal outcomes contract.[7] Finally, restrictions to capital market access for a proportion of households (the fourth pane) raise output multipliers with favourable budgetary consequences and hence greater opportunities for fiscal free lunches.[8]

3.5 Discussion

As is seen above, our model has incorporated the possibility of both expansionary fiscal contractions and fiscal free lunches. The former occur under two situations: when conducted using production taxes at the ZLB; and, when agents expect austerity to persist such that their lifetime income is increased. We have also found that fiscal free lunches are possible with policies that increase demand during a period of the ZLB. Further, for fiscal free lunches to occur policies must respond quickly to the ZLB, and should not persist beyond the length of the monetary accommodation. We conclude therefore that both extreme fiscal outcomes are unlikely, especially during economic downturns.

Regarding austerity, the experience of the recent global financial crisis has indicated that austere policies come at a political cost which, when combined with electoral cycles, makes it unlikely for agents to believe that such policies will continue for extended periods.[9] If austerity is to be expansionary it needs to be credibly persistent. Existing empirical evidence suggests that more persistent consolidation episodes are those cutting more politi-

[7] Romer & Romer (2010) find that fiscal action has significant inflationary effects.

[8] We have simulated our model across a range of other parameter values and find that varying these has negligible qualitative and quantitative impacts on the results (not reported).

[9] Since 2012, the electorate punished the pro-austerity parties decisively in countries as diverse as Greece, Scotland, Iceland, France, Spain and more recently, Canada. Although this is not a uniform rule (for example Germany and the UK have not seen similar political swings) many of these examples relate to political parties specifically opposing austere measures. The presence and the strength of the anti-austerity opposition would have provided some doubt over the persistence of such fiscal measures.

cally sensitive transfer payments and government wages, whereas cuts in public investment are more associated with short lived budget adjustments (von Hagen et al. 2002); when a government takes a more unpopular decision (cutting specific wages and transfers versus abstract investment projects) more political credibility is obtained. Similarly, it is also shown that consolidations which are against type for a given political party (spending cuts on the political-left and tax increases on the political-right) are more likely to persist, the argument being that going against expectations buys credibility and that these actions are less likely to be reversed by a change in government (see for example Tavares 2004).

Interestingly, fiscal consolidations are more likely to be adopted with a strong domestic economy in the years up to the start of the adjustment; however, those consolidations adopted during periods of lower economic growth are more likely to be long lasting (von Hagen & Strauch 2001). This poses a clear paradox, fiscal adjustments performed during periods of weak economic conditions improve credibility such that the action is more likely to be long lasting, but are also less likely to occur given the political cost of such decisions. Hence, the credibility of fiscal austerity is key to its impact on output, as is established by our formal results.

Overall, we suggest that expansionary fiscal contractions are unlikely, an argument supported by the only rare examples of these events in practice. For example, even if the question of causality is ignored, Alesina & Ardagna (2010) finds successful expansionary contractions to be the exception rather than the rule (occurring in nine separate instances in 21 OECD countries between 1970 and 2007). The great majority of other existing work find fiscal consolidations to be contractionary (see for example Callegari et al. 2012, Bi et al. 2013, Guajardo et al. 2014, among others).

Similarly, regarding stimulus, it is well-known that fiscal authorities are slow to respond to economic circumstances and are less likely to stop expansionary policies after normal circumstances are restored (Blinder 2004). Hence, timely and short-lived expansions which are prerequisites for fiscal free lunches, are unlikely. For example, it took over a year from the

start of the crash for the American Recovery and Reinvestment Act to be passed, and then a further year for the majority of the transfers and expenditures to take place (Auerbach 2012). Fiscal free lunches are possible in our model with monetary accommodation not constrained by the lower bound, but such accommodation in a period of central bank independence with a strong focus on inflation targeting is also unlikely.

4 Conclusions

This paper has demonstrated that extreme fiscal outcomes are possible, but unlikely given political constraints. Persistent austerity (needed for expansionary contractions) is unlikely, especially during downturns when the electorate is in economic distress. Responsive and temporary expansions (required for a fiscal free lunch) are unlikely with policy-makers unwilling to reverse expansions. Recent evidence on austerity across a wide range of episodes reveals that fiscal austerity has indeed been contractionary. Regarding fiscal stimulus, there is as yet no systematic evidence to support the existence of fiscal free lunches. Our work points to the importance of budgetary outcomes arising from fiscal action as an important avenue for future research.

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A Model equations

Table A1: Model equations

Households	
FOC w.r.t.B_t :	$\frac{1}{C_t} = E_t\left[\beta \frac{R_t}{\pi_{t+1}} \frac{1+\tau_t^c}{1+\tau_{t+1}^c} \frac{1}{C_{t+1}}\right]$
FOC w.r.t. K_t :	$Q_t = \frac{E_t \pi_{t+1}}{R_t} E_t\left[Q_{t+1}(1-\delta) + \left(1-\tau_{t+1}^k\right) r_{t+1}\right]$
FOC w.r.t. I_t :	$1 = Q_t\left[1 - \frac{\phi}{2} - \frac{3\phi}{2}\left(\frac{I_t}{I_{t-1}}\right)^2 + \frac{2\phi I_t}{I_{t-1}}\right] + \beta\phi E_t\left\{\frac{Q_{t+1}C_t}{C_{t+1}}\left[\left(\frac{I_{t+1}}{I_t}\right)^3 - \left(\frac{I_{t+1}}{I_t}\right)^2\right]\right\}$
FOC w.r.t. L_t :	$w_t = C_t L_t^{\sigma_l} \frac{1+\tau_t^c}{1-\tau_t^l}$
Capital accumulation:	$K_t = (1-\delta)K_{t-1} + \left[1 - \frac{\phi}{2}\left(\frac{I_t}{I_{t-1}} - 1\right)^2\right] I_t$
Firms	
Agg. private output:	$s_t Y_t = K_{t-1}^{\alpha} L_{p,t}^{1-\alpha} K_{g,t-1}^{\sigma_g} - (\varkappa - 1)\, Y$
Wage rental ratio:	$(1-\alpha)\, r_t K_{t-1} = \alpha\left(1+\tau_t^{er}\right) w_t L_{p,t}$
Real marginal cost:	$mc_t = \left(\frac{1}{1-\alpha}\right)^{1-\alpha}\left(\frac{1}{\alpha}\right)^{\alpha}\left[\left(1+\tau_t^{er}\right) w_t\right]^{1-\alpha} r_t^{\alpha} K_{g,t-1}^{-\sigma_g}$
FOC of price setters:	$\varkappa d_{1t} = d_{2,t}$
	$d_{1,t} = mc_t\left(\tilde{p}_t\right)^{\frac{\varkappa}{1-\varkappa}-1} Y_t + \beta\theta \frac{C_t\left(1+\tau_t^c\right)}{C_{t+1}\left(1+\tau_{t+1}^c\right)}\left(\frac{\tilde{p}_t}{\tilde{p}_{t+1}}\right)^{\frac{\varkappa}{1-\varkappa}-1}\left(\frac{\pi_t}{\pi_{t+1}}\right)^{\frac{\varkappa}{1-\varkappa}} d_{1,t+1}$
	$d_{2,t} = \left(\tilde{p}_t\right)^{\frac{\varkappa}{1-\varkappa}} Y_t + \beta\theta \frac{C_t\left(1+\tau_t^c\right)}{C_{t+1}\left(1+\tau_{t+1}^c\right)}\left(\frac{\tilde{p}_t}{\tilde{p}_{t+1}}\right)^{\frac{\varkappa}{1-\varkappa}}\left(\frac{\pi_t}{\pi_{t+1}}\right)^{\frac{1}{1-\varkappa}} d_{2,t+1}$
Price index:	$1 = (1-\theta)\, p_t^{\frac{1}{1-\varkappa}} + \theta\left(\frac{\pi_{t-1}}{\pi_t}\right)^{\frac{1}{1-\varkappa}}$
Price dispersion:	$s_t = (1-\theta)\left(\tilde{p}_t\right)^{\frac{\varkappa}{1-\varkappa}} + \theta\left(\frac{\pi_{t-1}}{\pi_t}\right)^{\frac{\varkappa}{1-\varkappa}} s_{t-1}$
Fiscal and monetary policy	
Taylor rule:	$\frac{R_t}{R} = \left(\frac{R_{t-1}}{R}\right)^{\rho}\left[\left(\frac{\pi_t}{\pi}\right)^{\rho_\pi}\left(\frac{GDP_t}{GDP}\right)^{\rho_y}\right]^{1-\rho}$
Gov. constraint:	$G_t + I_t^G + T_t + \frac{R_{t-1}B_{t-1}}{\pi_t} = B_t + \tau_t^c C_t + \left(\tau_t^l + \tau_t^{er}\right) w_t L_t + \tau_t^k r_t K_{t-1}$
Fiscal policy:	$\frac{T_t}{T} = \left(\frac{B_{t-1}}{B}\right)^{\phi_b}$
Public capital accum.:	$K_{g,t} = (1-\delta_g) K_{g,t-1} + I_t^G$
Public spending:	$G_t = G_t^C + \left(1+\tau_t^{er}\right) w_t L_t^G$
Fiscal shocks:	$x_t = x\left(1+\varepsilon_{x,t}\right)$
	$\varepsilon_{x,t} = \begin{cases} \eta_x & \text{if } t = 1, ..., z \\ \rho_x \varepsilon_{x,t-1} & \text{if } t > z \end{cases}$
Market clearing definitions and shocks	
Goods clearing:	$Y_t = C_t + I_t + G_{c,t} + I_{g,t}$
Labour clearing:	$L_t = L_{p,t} + L_{g,t}$
GDP:	$GDP_t = Y_t + \left(1+\tau_t^{er}\right) w_t L_{g,t}$

Where Q_t is the shadow price of capital, and where s represents the price dispersion, p the price index and $\tilde{p}$ the price at which profit is maximised. All variables with no time subscript represents steady state values; all other variables are as defined in the main body of the paper.