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Fiscal Policy, Public Debt and the World Crisis

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Abstract. *This study summarizes a theory of the origin of the current world economic crisis and the role of fiscal policy in mitigating its effect. The perspective is dynamic stochastic general equilibrium analysis. Overall, the model analysis suggests a strong case for fiscal policy if the monetary authority is unable/unwilling to close the output gap. This remains the case, even when explicitly taking into account public debt dynamics.*

JEL classification: *E*5, *E*6, *E*.

Keywords: Fiscal policy; liquidity trap; deficits.

1. INTRODUCTION

The crisis of 2008 put fiscal policy back on the table for policy-makers. The reason was obvious: Several central banks cut nominal interest rate close to zero while there was still an urgent case for further macroeconomic stimulus. The question, then, became, what can fiscal policy do? Moreover, does the answer depend upon the debt situation of the government? This study attempts to address these questions in the light of recent research on this topic, in particular recent work such as Denes *et al*. (2013), Eggertsson and Krugman (2012) and Del Negro *et al*. (2011).

Overall, a strong case for fiscal policy emerges from the model analysis, conditional on monetary policy not stepping in to a sufficient extent. This remains the case, even with a high level of public debt. One reason for this is that government spending is to a large extent self-financing. Conversely austerity measures – cutting government spending or increasing sales taxes – can increase rather than decrease the deficit, especially in severely depressed economies. The reason for this is that cutting government spending in a crisis decreases the tax base so much that it may reduce revenues by more than is saved by the spending cut. The exact relationship between the level of public debt and aggregate demand (AD) in the short run, however, is ambiguous. It depends on the policy regime that governs monetary and fiscal policy as I will further clarify in the study.[1]

1. For example, if future public debt is paid off (once the crisis is over) via any combination of inflation, a reduction in the future size of the government and/or higher future sales taxes, then higher public debt today increases demand in the short run. Conversely, if the higher debt today is paid off (once the crisis is over) via higher income taxes in the future, then higher public debt today has a negative effect on aggregate demand in the short run (because expectations of permanently higher income taxes will reduce consumption demand of the households). Quantitatively in the basic model, however, the most important effect of fiscal policy on aggregate demand is the immediate effect of temporary austerity/expansionary policy. It is difficult to construct examples in which an increase in government spending, triggering deficits creates a sufficiently strong drag on demand via expectations of higher labor taxes to overturn this basic result: Temporarily increasing government spending is a relatively effective way of increasing demand at zero interest rates.

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I start the article by outlining a simple theory of how we got into this crisis, via a combination of financial shocks and monetary frictions. The reason why this is important when considering fiscal policy is that a proper theory of how we got into the crisis has important interactions with the role of fiscal policy, just in the same way as a cure for a sick person depends on our theory of how the patient got sick in the first place.

The theory we outline has two main elements. First, there are some frictions in financial markets, which imply that a large drop is needed in the real interest rate which is a key determinant of how much households and firms spend. Second, there are some nominal frictions – say sticky prices – that make this adjustment difficult to accomplish.

In principle, the two frictions at the heart of the theory do not need to lead to a recession. In particular, if monetary policy is able to cut the nominal interest enough, there is no recession in the model. A key element of the theory, thus, is the fact that the nominal interest rate cannot be lowered below zero (the fact that the constraint is zero is not important, what matters is that there is a limit to interest rate cuts – for whatever reason – e.g. the ECB seems reluctant to go much beyond 0.5% and the Federal Reserve beyond 0.25%). It is thus inability/unwillingness of the central bank to cut interest rates further that gives such promising role for fiscal policy in the article.

Before letting monetary policy off the hook, however, it is worth making a closely related point: If monetary policy is able to commit to future optimal policy, for example, by some combination of low future nominal interest rates and expected inflation (see, e.g. Eggertsson and Woodford (2003)), then the recession can be more or less eliminated in the model of the article. A sufficiently high inflation target, for example, of about 4–5%, would do most of the job. If one would have surveyed economists 10 years ago, most would probably have argued that monetary policy remains very powerful under any circumstances, even once the nominal interest rate collapses to zero, either via effective commitment to future policy or through the use of non-conventional monetary policy instruments. Yet with nominal interest rates close to zero, unemployment at very high levels in several countries, and central balance sheets expanded to record levels, the argument that monetary policy is all powerful may not strike the current observer as persuasive, or in any event, other options need to be analyzed. Hence, the focus here on fiscal policy.

Within the context of the theory, I will simply assume that the central bank is committed to some (low) level of inflation once the crisis has subsided. As we shall see, this assumption is sufficient to ensure that monetary policy is not – in fact – all powerful. This assumption can be motivated in two ways: the central bank cannot increase inflation expectation (e.g. due to credibility problems, see, e.g. Eggertsson (2006)) or simply that it will not do so due to some political reasons (excessive caution by the central bank or strong aversion to move away from a very stringent definition of price stability, see, e.g. Krugman (1998)). Under this assumption, fiscal policy plays a large role since there may be substantial output slack in the economy left open by the central banks inability/unwillingness to cut short-term rates (and inability/unwillingness to try something more adventurous). Any increase in demand will then not be offset

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by an increase in the nominal interest rate.[2] Perhaps even more importantly, fiscal policy does not suffer from the same credibility problem as monetary policy at the zero bound as first stressed by Eggertsson (2001). It involves direct actions today (increase government spending) rather than promises about future actions.

I have already noted several articles that closely link to the current one, the closest being Denes *et al.* (2013), Eggertsson and Krugman (2012) and Del Negro *et al.* (2011). These articles, in turn, build on a vast literature motivated by the zero bound and the current crisis, the Japanese crisis and the Great Depression (GD), for example, Krugman (1998) and Eggertsson and Woodford (2003). I will not attempt to survey this literature here, but the references above have some discussion of the related literature. Closest of the related literature in terms of the result that government spending can be self-financing is Erceg and Lindé (2010) that come to largely similar conclusions as I do here in a similar environment. In a quite different setting, DeLong and Summers (2012) also find a similar bottom line although their mechanism differs in the details.

2. A SIMPLE MODEL OF THE CRISIS

When I talk about 'a theory of the crisis' I do not mean a story for why banks become insolvent, for example, due to a bank run or bad investment strategies. Instead, I have in mind a theory of why bank insolvency (or any other type of financial turbulence) puts people out of work. In other words, the key goal is a theory of why factors of production become *underutilized* – why factories sit empty, people stay unemployed, tractors and other machines sit idle – when these very same factors of production (people and machines) were producing more stuff a few years or even months back. Even if a bank goes bust, there is in principle no reason for people and machines to produce less, given that all the tools and people remain the same as before the crisis. How does this misallocation occur? And what can be done about it?

The theory I outline here has two basic building blocks, namely a shock to the 'financial sector' that triggers a 'need' for a large drop in relative prices, i.e. the real interest rate – this is the price of spending money today relative to saving it for future spending. This adjustment is needed to get people to spend more today. The second building block is some pricing frictions at the firm level – I will be more specific shortly – that make this adjustment difficult to accomplish.

2.1 Households and firms problems

Briefly, consider a standard New Keynesian model in which household maximize utility over the infinite horizon (see, e.g. Denes *et al.* (2013) for more details and references and Woodford (2003) for a textbook treatment of most of the underlying elements), evaluating each periods utility via the utility function $\beta^t[u(C_t) + g(G_t) - v(l_t)]\xi_t$ where C_t is private consumption at time t, G_t government consump-

2. We do not here address the issue of non-conventional monetary policy, see, for example, Del Negro *et al.* (2011) for analysis of this kind.

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tion, l_t hours worked, β is a discount factor (in the t'th power) and ξ_t is a shock.[3] We imagine that the household faces the following budget constraint

$$(1+\tau_t^s)P_tC_t + B_t = (1+i_{t-1})B_{t-1} + (1-\tau_t^I)\left[\int_0^1 Z_t(i)di + P_tW_tl_t\right] - P_tT_t$$

where τ_t^s is a sales tax, P_t is the general price level, B_t is a one-period risk-free bond that pays out $(1 + i_t)$ the next period where i_t is the short-term nominal interest rate. The tax τ_t^I is an income tax that is levied uniformly on profits, $Z_t(i)$, and wages, W_t. Finally, T_t denotes lump-sum taxation. The household maximizes its utility over the infinite horizon, choosing consumption, labor supply and the optimal number of bonds it holds B_t, taking prices and wages as given. The only uncertainty in the model is given by the exogenous shock ξ_t, I will be more specific about the interpretation of that shock shortly. On the firm's side, there are firms that maximize profits over the infinite horizon. These firms have pricing power because we assume that each one of them is producing a good that is an imperfect substitute with the other goods produced. More specifically, I assume a Dixit-Stigliz style monopolistic competition so that aggregate consumption is given by $C_t \equiv \left[\int_0^1 c_t(i)^{\frac{\theta-1}{\theta}}\right]^{\frac{\theta}{\theta-1}}$ where the $c_t(i)$ denotes a consumption variety produced by each of the firms and the parameter θ greater than 1 (see, e.g. Woodford (2003) for textbook treatment). The firms take labor as input and produce the consumption via linear production function, taking the wage rate W_t as given. A key friction is that we assume that each of the firms does not continuously adjust the price of its product. Instead, each firm sets its price taking into account that it will be in effect for some (stochastic) period of time. Formally, we assume as in Calvo (1983) that there is a probability $1 - \alpha$ that each firm can revisit its price in each period, a common characterization that allows us to nest in one model the extreme Keynesian case were prices are perfectly fixed ($\alpha = 1$), and the neoclassical case in which prices are flexible at all times ($\alpha = 0$). The first-order conditions of the household and firms maximization problems, together with resource constraint[4] and a description of monetary and fiscal policy define the equilibrium of the model.

For the government, we assume that the monetary authority controls the nominal interest rate via variations in the short-term nominal interest rate i_t,[5] while the fiscal authority sets tax rates τ_t^s, τ_t^I and the lump-sum tax T_t together with aggregate government spending G_t. A key constraint on the central bank's policy is that it cannot set the nominal interest rate below zero so that $i_t \geq 0$ while fiscal policy is constrained by the government budget constraint.

Rather than spelling out the details (see, e.g. Denes *et al.* (2013) for details and references), we next summarize the linearized equilibrium conditions of the model, which are sufficient for our purposes.

3. The elements of the utility function satisfy properties, for example, $u(\cdot)$ and $g(\cdot)$ are increasing concave functions, whereas $v(\cdot)$ is an increasing convex function
4. The aggregate resource constraint is $Y_t = C_t + G_t$ where Y_t is aggregate output that is composed of private and public consumption.
5. I do not explicitly model here how the central bank controls the nominal interest rate, see, for example, Woodford (2003) for discussion.

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2.2 Linearized equilibrium conditions

The households maximization problem gives rise to a consumption Euler Equation, which once combined with the resource constraint yields.

$$\hat{Y}_t = E_t\hat{Y}_{t+1} - \sigma(i_t - E_t\pi_{t+1} - r_t^e) + (\hat{G}_t - E_t\hat{G}_{t+1}) + \sigma\chi^s E_t(\hat{\tau}_{t+1}^s - \hat{\tau}_t^s) \tag{1}$$

where π_t is inflation, E_t is an expectation operator, the coefficients σ, $\chi^s > 0$, $\hat{Y}_t \equiv \log Y_t/\bar{Y}$, $\hat{G}_t \equiv \log G_t/\bar{Y}$, while $\hat{\tau}_t^s \equiv \tau_t^s - \bar{\tau}^s$, and r_t^e is an exogenous disturbance that is only a function of the shock ξ_t. The one-period risk-free nominal interest rate, i_t, now corresponds to log $(1 + i_t)$ in terms of our previous notation once again the zero bound applies.

$$i_t \geq 0 \tag{2}$$

Aggregate supply (AS) is given by the 'Phillips curve''

$$\pi_t = \kappa\hat{Y}_t + \kappa\psi(\chi^I\hat{\tau}_t^I + \chi^s\hat{\tau}_t^s - \sigma^{-1}\hat{G}_t) + \beta E_t\pi_{t+1} \tag{3}$$

where the coefficients κ, $\psi > 0$ and $0 < \beta < 1$ and the zero bound is $i_t \geq 0$.

The government budget constraint can be approximated to yield

$$\frac{\bar{b}}{Y}\hat{b}_t - \frac{\bar{b}}{Y}(1+\bar{r})\hat{b}_{t-1} = \frac{\bar{b}}{\bar{Y}}(1+\bar{r})[\hat{i}_{t-1} - \pi_t] + (1+\bar{\tau}^s)\hat{G}_t - (\bar{\tau}^I + \bar{\tau}^s)\hat{Y}_t - \hat{\tau}_t^I - \frac{\bar{C}}{\bar{Y}}\hat{\tau}_t^s - \hat{T}_t \tag{4}$$

where $\hat{b}_t \equiv \log B_t/P_t - \log\bar{b}$ and $\hat{T}_t \equiv \log T_t/\bar{Y}$ What remains to be specified is government policy, i.e. how the government sets taxes, spending and monetary policy. I will be specific about this element of the model once I set-up the shock perturbing the economy.

Let me briefly discuss the interpretation of the IS and AS equations (1) and (3). In this model, economy output is demand determined, i.e. how much is produced is entirely determined by how much stuff people want to buy. This is pinned down in equation (1), which is sometime referred to as the 'IS equation''as it is derived by the investment–savings decision of the household. We see that the amount people buy, depends upon expectation of future income, $E_t\hat{Y}_{t+1}$ and the difference between the real interest rate i_t - $E_t\pi_{t+1}$ and the exogenous term r_t^e, which has the interpretation of being the real rate of interest consistent with the efficient allocation in the model, that is, the real interest rate consistent with output being at its first best (full employment) level. The term i_t – the monetary policy instrument – clearly has a direct impact on demand by changing relative prices (as long as it is not fully offset by changes in $E_t\pi_{t+1}$). Thus, cutting rates makes current spending cheaper and thus increases demand. We see that the fiscal policy instruments $\hat{G}_t$ and $\hat{\tau}_t^s$ also change demand, $\hat{G}_t$ by directly increasing public spending, and thus AD, while a reduction in $\hat{\tau}_t^s$ increases demand by encouraging people to spend more today relative to the future.

The rate of price changes is determined by equation (3), sometimes referred to as 'Phillips Curve' or 'AS equation', which is derived from the firms staggered pricing decision. We see that increasing output leads firms to want to increase prices (and thus leading to higher aggregate inflation) as is standard. However,

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we can also observe that the tax instruments and government spending have a direct effect on inflation according to this relationship. The reason for this is that all these policy instruments have a direct effect on the marginal cost the firms face (through the real wage rate), which thus feeds directly into the pricing of the firms. Also, observe that expected inflation plays an important role via the term $\beta E_t \pi_{t+1}$. The reason is that when firms set their price, they anticipate they may not be able to change it again for some time, and thus need to estimate the evolution of future inflation.

2.3 The crisis in the model

To solve the model and take the zero bound explicitly into account, we make use of a simple assumption now common in the literature based on Eggertsson and Woodford (2003). In period 0, there is a shock $r_S^e < \bar{r}$ which reverts to a steady state with a probability $1 - \mu$ in every period. We call the stochastic period in which the shock reverts to steady state t_S.[6] To illustrate the crisis, consider fiscal policy so that $\hat{\tau}_t^I = \hat{\tau}_t^s = \hat{G}_t = 0$ for $\forall t$ and future lump-sum taxes $\hat{T}_t$ for $t \geq t_S$ are set so that the government budget constraint is satisfied, while $\hat{T}_t = 0$ for t less than t_S. For monetary policy, we assume that short-term nominal interest rates are set so that $\pi_t = 0$. If this results in i_t less than 0, we assume $i_t = 0$ and π_t is then endogenously determined.

Under these assumptions, the model is remarkably simple to solve, but what we are primarily interested in here is the solution for output, inflation and the nominal interest rate. If $r_t^e > 0$ at all times, the solution is simply $\hat{Y}_t = \pi_t = 0$ and $i_t = r_t^e$ as can be confirmed by the equations above. Note that this solution is going to apply for $t \geq t_S$ in the example above when r_t^e is back to steady state as it will stay there forever according to the assumption made.

The interesting dynamics occur when $r_t^e < 0$ under the assumption we outlined above (i.e. there is a fixed probability it reverts back to steady state) as then the zero bound is binding because the central bank is unable to accommodate the reduction in r_t^e. Since in the period $t \geq t_S$ then $\hat{Y}_t = \pi_t = \hat{Y}_L = \pi_L = 0$ at all times, the solution at t less than t_S will look the same at all times and is given by

$$\hat{Y}_S = \mu \hat{Y}_S + \sigma \mu \pi_S + \sigma r_S^e \tag{5}$$

$$\pi_S = \kappa \hat{Y}_S + \beta \mu \pi_S \tag{6}$$

which can be explicitly solved for $\hat{Y}_S$ and π_S for the parameters and the shock r_S^e. Note that we here denote all the variables at t less than t_S with the subscript S as 'short-run'(as they remain the same at all times in this simple model) while denoting the 'long run'with the subscript L which applies to $t \geq t_S$. Note that the duration of the short run is stochastic, as it depends upon when the shock reverts back to steady state which happens with probability $1 - \mu$ in all periods t less than t_S. The key thing to observe here is that output, $\hat{Y}_S$, is now demand determined, and is going to go down with the shock r_S^e. What is particularly

6. As discussed in Eggertsson (2010a), we need to impose a bound on μ to avoid multiplicity at the zero bound. I assume that $(1 - \mu)(1 - \beta\mu) - \mu\sigma\kappa$ greater than 0. See Mertens and Ravn (2010) for a discussion of multiple equilibria in this setting.

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damaging here, is that output in the short run not only depends on the current shock r^e_S but also on expectations about *future* output (here given by $\mu\hat{Y}_S$) and *future inflation* (here given by $\mu\pi_S$), which can lead to a quantitatively large drop in output and/or inflation. Since by the second equation inflation in the short run will be below zero, this second mechanism – expected deflation – makes the problem even worse. Perhaps even disturbingly this problem gets worse – not better – the more flexible are prices, i.e. the higher is κ.[7] Some numerical examples suggest that even very small shocks r^e_t can lead to very large drops in output in a broad class of models that has similar structure as the model above. What is at the heart of the problem, is that not only does the shock r^e_S trigger an immediate drop in output but there is also a further drop in output due to the expectation about a future drop in output and deflation, which in turn also depends on expectations about outcomes further ahead, a mechanism that can result in a vicious spiral sometimes referred to as a contractionary spiral. Eggertsson (2008), for example, shows that a slightly more complicated model can match some aspect of the US Great Depression, whereas Del Negro *et al.* (2011) do the same for the US Great Recession starting in 2008 in a medium scale DSGE model.

2.4 On the interpretation of efficient rate of interest – the very root of the crisis

The key to the contraction in inflation and output outlined in the last subsection was that the nominal interest rate could not drop below zero so as to accommodate the shock r^e_t when it moved into negative territory. What is the source of this shock? In our simple model, this shock was due to a 'preference shock' – for whatever exogenous reason people did not want to spend as much today as they wanted yesterday, which means that the real interest rate needs to drop for spending to remain at its original level (because lower real interest rates make spending today relative to tomorrow cheaper, think lower interest rates on car loans, etc.).

It may seem somewhat unsatisfactory that the very root of the crisis is just some exogenous preference shock in the model. It is therefore worth clarifying better before going further what I have in mind with such a shock. To me, the most natural interpretation is that it is a reduced form representation of something that happens to a certain group of people in a model with heterogenous agents (instead of the representative agent model we assumed) where the people in the model interact through financial markets. What I think makes most sense is to think of this shock as some sort of disstress in financial markets that leads people in some part of economy to spend less (think, e.g. of all of the people that overextended themselves in the housing market precrash). In order to make up for the drop in spending by this group of people that is scaling back, somebody else has to spend more. How can these other people be induced to spend more? The price that makes this happens is the real interest rate – the price of consumption today relative to consumption tomorrow. If for whatever reason

7. This is discussed in some detail, for example, in Christiano *et al.* (2011), Werning (2011) at the zero bound and in Bhattarai *et al.* (2012) more generally.

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this price does not adjust properly, then there is a problem. Let me be more specific by giving two examples.

Eggertsson and Krugman (2012) offer a simple model in which some people are savers and some people are borrowers (in their particular example borrowing and saving is motivated by differences in preferences, but they also have examples with differences in investment opportunities across agents). A key friction in their model is that the borrowers cannot borrow more than that corresponds to some upper limit D^{high}. They then exogenously shock this upper limit D^{high} to D^{low}, which means that the borrowers need to 'deleverage' – that is pay down their debt in order to satisfy the new debt limit. The key point is that for aggregate spending to remain the same, the savers need to spend more to make up for the drop in spending by the borrowers. For this to happen, the appropriate price needs to adjust, i.e. the real interest rate needs to drop to induce the savers to spend more. In reduced form, Eggertsson and Krugman (2012) show that this shows up exactly like the preference shock we have in the baseline model (they also go on to explore various other implication, such as debt deflation, the effect this has on fiscal multipliers and so on). Another simple story for a reduction in the efficient rate of interest is provided in Del Negro *et al.* (2011). In their example, this occurs because of a drop in 'liquidity'of certain assets which implies a collapse in investment. To make up for this drop in investment spending somebody needs to pick up the slack – again the 'savers' – and the price that needs to adjust is the real interest rate.

Yet, a need for reduction in a real interest rate – driven, for example, by financial turbulence – is not enough to give a theory why people are out of work or factories stand idle. To see this note that in most models there is lurking in the background some aggregate production function $F(K, L)$, where K is capital and L labor. We need a story for why this required reduction in the real interest rate leads to a coordination failure in which the factors of production are not being used to their full extent. It is the unused factors of production that is the main element of the crisis we are interested in, the fact that the same amount of inputs (capital, labor, etc.) are suddenly producing much less output.

2.5 Why are people not employed? Keynesian frictions

The first element of the story I told in the last subsection only had to do with the shock in r_t^e in equation (1) or what is sometimes referred to as "the efficient real interest rate" (the real interest rate that would be consistent with the efficient use of all available factors of production). In the absence of anything else, however, variation in this exogenous disturbance has no effect on output, it only serves to change the real interest rate $i_t - E_t\pi_{t+1}$. A second key element of this theory of the crisis, then, is the fact that the real interest rate cannot adjust freely and thus may be different from the efficient real interest rate. The reason this happens in the model is that firms do not adjust their prices all the time giving rise to equation (3) and that the central bank cannot lower the interest rate below zero. Perhaps even more importantly, in addition to assuming that prices do not adjust all the time, I assume that firms will supply whatever amount of stuff people demand of them. Thus, we can think of the firms like a hot dog stand that is committed to serving as, many hot dogs people want at the price

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they post. As the only input in production in the model is labor, a higher demand will mean firms sell more hot dogs (hires more labor), which ultimately may drive up the wage rate and reduce profits. However, the key point is that the firm needs to supply whatever is demanded at the price posted.

One might wonder if the type of behavior at the heart of the model – that firms commit to sell whatever amount of goods people want to buy – is not very suboptimal, given that prices may be exogenously fixed for some time. Should it not be optimal for the firms to revisit their price continuously so that the model under the current assumptions implies large losses in profits by the firms? Does that not mean the underlying assumptions are implausible? One theoretical foundation for the staggered pricing 'short cut' we use that is at the core of the model dates at least back to Mankiw's (1985) classic article 'Small Menu Costs and Large Business Cycles: A Macroeconomic Model of Monopoly.' That article shows that even if it may be individually rational for each firm to leave its price unchanged (due to small menu costs), this can be very suboptimal for a society as a whole. The key point is that these models typically feature 'strategic complementarities', that is, each firm does not want to change its price 'too much' if the others are not doing the same. Hence, if there is a large fraction of firms that does not change its prices at any given time (as in Calvo (1983)), the actual gains from changing the price for each firm may not be very big (although this will in general depend on the parameterization). This gives a natural story, then, for a Keynesian 'coordination failure' in which nobody is changing their price because they do not expect anybody else to be doing it. The firm is then left with supplying whatever is demanded at the price they post and this may lead to very socially inefficient outcomes, even if no firm has any incentive to change its pricing strategy.

A key implication of the assumption that firms will supply whatever is demanded at the price they post is that equation (1) is then no longer just a 'pricing equation' for the real interest rate. Instead, it tells us how many goods people will buy in the economy, which then determines the overall level of employment. Thus, AD starts mattering. In principle, note that this equation may not be very relevant, for example, if the central bank targets zero inflation and $i_t = r_t^e$ at all times. Then this equation just tells us what the nominal interest rate needs to be for zero inflation. However, when the interest rate is zero and r_t^e is negative, this equation starts mattering a whole lot. This equation will then literally tell us how much will be produced and the amount of production may be very different from the optimal – or first best – level. The real interest rate (under our simple assumption above) is given by

$$i_t - E_t\pi_{t+1} = \sigma\mu\pi_S \tag{7}$$

For full employment, this real interest rate needs to be negative if r_S^e is negative. If prices were perfectly flexible, then they would adjust so as to make this happen (the exact way in which that would happen depends on the assumed policy rule, at zero interest rate, e.g. the only way this can happen is via *expected inflation*). However, things are not that simple under rigid prices because prices are given by the staggered pricing decisions of the firms, i.e.

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$$\pi_S = \kappa \hat{Y}_S + \beta \mu \pi_S \tag{8}$$

and this number will in general be less than zero as long as $\hat{Y}_S$ is negative. And a negative $\hat{Y}_S$ is precisely what happens according to equation (5). Note that this implies that the real interest in equation (7) is going in the wrong direction – we want it to be negative – but because of the pricing equations of the firms given by (8), we see that that inflation is negative, then we have expected deflation at zero interest rate. This means that the real interest rate is positive rather than negative, 'it becomes more economical to sit on the money rather than spending it'. Moreover, and perhaps paradoxically, this problem becomes worse as prices become more flexible as we have already noted.

In summary, then, a recession happens in the model for the following reason: Output is demand determined. This demand depends upon the real interest rate. When there are large shocks, for example, stemming from the financial sector, the required real rate may need to be negative. And Keynesian pricing frictions prevent this adjustment from happening in a policy regime like the one we study here, where inflation is in equilibrium very low so that the nominal interest rate can only decrease to a very limiting extent. The result is a recession.

3. AUSTERITY MEASURES CAN INCREASE THE SHORT-RUN DEFICIT

I have now laid out a simple theory of how a recession can take place, building on a rich previous literature. According to the theory, it is a combination of a shock that means that the economy 'needs' negative real interest rates and some Keynesian pricing frictions that makes this difficult to accomplish. However, what can fiscal policy do?

Before going further, I should clarify that the experiments I will do in what follows will not be what is the fully optimal fiscal policy. Instead, I look at the effect of incremental change in tax and spending at the margin. The hope is, of course, that these partial results give some insights into optimal policy design.[8] I also should make clear that I do not discuss here the difficult issue of policy credibility in a liquidity trap an issue that fiscal policy is actually quite naturally suited to address as already hinted at in the introduction (this is a theme of some of my earlier work, see, e.g. Eggertsson (2001, 2006)).

We can already see in equation (1) that one way to directly stimulate spending – and thus counteract the fall in r_t^e – is raising government spending or cutting sales taxes in the short run. In a simple estimation exercise in Denes *et al.* (2013), the implied multiplier of government spending – i.e. the amount output increases for every dollar of spending – is 1.2 when the model is calibrated to match Great Recession (GR) data in the US and 2.2 when calibrated to match

8. As shown in Eggertsson and Woodford (2004) then the first best can be replicated in this model if the government has access to enough policy instruments, see also Farhi *et al.* (2013) for similar results in more general settings. Yet, as the current crisis makes clear, government are quite far away from exploiting fiscal instruments to this extent, perhaps reflecting some political constraints or unmodeled rigidities in the tax system.

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the GD US data. These relatively large multipliers at zero interest rate contrast with the much lower multiplier of 0.4 at positive interest rate. The reason is that once the zero bound is binding and inflation and output are below where the central bank would ideally like these variables to be, there is no reason for the bank to offset the increase in AD triggered by government spending. Under regular circumstances, however, the central bank will increase the nominal interest rate in response. Moreover, the amplification mechanism we outlined in the past section (the interplay between current demand and expected future output and deflation) makes this policy very powerful, in just the same way as it made the financial shock potentially very contractionary at zero interest rates.

The expansionary effect of fiscal policy becomes even bigger once one takes into account the type of financial frictions we argued could give natural foundations for the exogenous shock r_t^e. Eggertsson and Krugman (2012), for example, show that fiscal policy is even more expansionary when borrowers are at their 'borrowing constraint', which is the key to derive this shock. The reason is that the borrowers will increase their spending one-to-one with every extra dollar of income in the model. The model then obtains the old Keynesian flavor that higher spending increases disposable income in a circular fashion: Higher government spending implies higher incomes for people, which implies higher spending, which again implies higher demand, again implying higher income, which then again implies spending…. etc., this is the 'classic' government spending multiplier story.

Despite large multipliers at zero interest rate, there has been much discussion in the aftermath of the crisis of 2008 of 'austerity measures' in order to improve economic outcomes. The main motivation behind austerity is to reduce budget deficits. Before proceeding further in evaluating this idea, it is worth asking in the context of our model: What happens if you cut government spending or raise sales taxes to the budget deficit? As we shall see, the usual logic that you tighten the belt to restore budget balance may be overturned at the zero interest rate bound.

To be more explicit, the thought experiment we do is the following: Suppose that tax rates, i.e. $\hat{\tau}_t^I = \hat{\tau}_t^s = 0$, stay at their steady state at all times. Suppose furthermore that the lump-sum tax $\hat{T}_t = 0$ in the short run, i.e. when $t < t_S$ and then reverts to balance the budget in the long run (how and when this happens in the long run is not of principal importance due to Ricardian equivalence).

As suggested by equation (4), the budget deficit in the short run is given by

$$\begin{aligned}\hat{D}_S &= \frac{\bar{b}}{Y}\hat{b}_t - \frac{\bar{b}}{Y}(1+\bar{i})\hat{b}_{t-1} \\ &= \left\{\frac{\bar{b}}{\bar{Y}}(1+\bar{i})[\hat{i}_S - \pi_S]\right\} - \left\{(\bar{\tau}^I + \bar{\tau}^s)\hat{Y}_S\right\} + \left\{\hat{G}_S - \hat{\tau}_S^s - \hat{\tau}_S^I - \frac{\bar{T}}{\bar{Y}}\hat{T}_t\right\}\end{aligned}$$

We can see that the last term on the right hand side is the policy driven component of the deficit, i.e. the component that depends upon what fiscal policy does with government spending and taxes. In the thought experiment we did above, this component is simply $\hat{G}_S$ because we want to understand what is the effect of government spending austerity on the budget deficit. The second component, however, is the endogenous component of the budget deficit, i.e. tax revenues from income taxes and sales taxes (kept at their steady state rate). This term will go up or down, depending on the short-term level of output. Thus, for example, if the cut in government spending reduces the deficit one-to-one according to the last 'policy driven term', this effect can be overturned by the fact that the tax base $\hat{Y}_S$ shrinks to such an extent that less taxes are collected than before and the deficit increases as a result rather then decreases. Finally, the first part on the right hand side reflects the interest rate cost of the government.

It can be shown in this model that at positive interest rate, a cut in government spending will always reduce the deficit and will do so roughly one-to-one (see Denes *et al.* (2013)). The reason for this is that demand does not contract by much even if the government cuts spending because the central bank will cut the nominal interest rate to offset it so that the endogenous component of the deficit (the second term on the right hand side) is largely unaffected. This picture changes dramatically once the nominal interest rate is zero, however. In that case, the central bank cannot offset the negative demand effect of the cut in government spending. As a consequence, the endogenous component of the deficit can take a life of its own, in particular the drop in the tax base can easily become big enough so that the gain from cutting government spending is wiped out. The exact condition for this effect to dominate is

$$\frac{\Delta \hat{D}_S}{\Delta \hat{G}_S} < 0 \text{ if } \frac{\Delta \hat{Y}_S}{\Delta \hat{G}_S} > \Gamma = \frac{1 + \bar{\tau}^s + \frac{\bar{b}}{\bar{Y}}(1+\bar{i})\frac{\kappa}{1-\beta\mu}\sigma^{-1}\psi}{\bar{\tau}^I + \bar{\tau}^s + \frac{\bar{b}}{\bar{Y}}(1+\bar{i})\frac{\kappa}{1-\beta\mu}}$$

In other words, if the multiplier of government spending, $\frac{\Delta \hat{Y}_S}{\Delta \hat{G}_S}$, is larger than Γ, then the deficit will always increase when the government cuts spending at a zero interest rate. In the numerical example from Denes *et al.* (2013), the deficit increases if government spending is cut using the US Great Depression calibration, i.e. a dollar cut in the spending increases the deficit by 30 cents. The GR scenario is much less extreme and a cut in government spending does in fact reduce the deficit. However, it does so by less than one-to-one, a one dollar cut in the government spending reduces the deficit by about 50 cents. Flipping this around, we see that, in the GD case, government spending is self-financing, whereas in the GR case the endogenous increase in output fills about half the gap created in the budget, i.e. for a dollar increase in spending, the deficit only increases by half that much.

It is worth noting that the Denes *et al.* (2013) numerical example is relatively conservative as it does not incorporate the increase in the government spending multiplier that may occur due to financial frictions as for example in Eggertsson and Krugman (2012). The point is, even without these additional channels for fiscal policy, the zero bound implies a very important effect of the 'endogenous' component of the deficit, that is the effect of the erosion of the tax base that happens if austerity is implemented at the lower bound for the short-term nominal interest rate.

Another immediate conclusion of the model is that a policy of raising sales taxes to curb the deficit faces a similar problem. Increasing sales taxes in the short run may in fact reduce the tax base to such an extent (via contractionary effect on demand) that those tax hikes increase rather than decrease the deficit.

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This, then, puts the economy squarely on the wrong side of the 'Laffer curve' when constrained by the zero bound.

This constitutes a key lesson: At zero interest rate, the scope for balancing the budget by cutting spending or increasing sales taxes is limited, and may even be so limited that it becomes counterproductive. For the southern part of Europe, which is facing an unemployment crisis of similar order as the US in the GD, this should be sobering news. That does not answer, however, how the deficit by itself affects short-run demand, an issue that we now turn to.

4. CONFIDENCE IN THE SHORT RUN AND TAXES AND SPENDING IN THE LONG RUN

So far we have only discussed how two popular policies intended to balance the budget (sales tax increases and government spending cuts) can increase rather than reduce the deficit when the zero bound is binding.

We have not addressed, however, the main motivation for these kinds of policies in the first place, that reducing deficits is important to 'increase confidence'. What proponents of this view often have in mind is that deficits, in themselves, have some important implications for expectations about the future evolution of the economy and that these expectations are critical to understand the effect of short-run policies. That is presumably what people often have in mind when they say that austerity policies are necessary to 'increase confidence'. The model has the stark prediction that deficits have *no effect on short-run demand* at positive interest rate under the policy regime we consider. This changes, however, once she short-term nominal interest has collapsed to its lower bound. In that case, deficits may have important implications, the exact effect depends upon the fiscal policy regime as we will see shortly.

Before going further, let me be clear about how I think about the effect of deficits in the model. The most logical way to think about this, in my view, is that deficits may matter in the short run because they may have an effect on expectation about future taxes, $\hat{\tau}_t^I$, $\hat{\tau}_t^s$ and government spending $\hat{G}_t$ or even the future monetary policy regime. In the context of our assumption about the temporary shock, r_S^e, we assume that a deficit may have an effect on the long-run taxes, $\hat{\tau}_L^I$, $\hat{\tau}_L^s$ or government spending $\hat{G}_L$, instead of changing only lump-sum taxes as we supposed in last section (which are neutral due to Ricardian equivalence). (If the deficit affects the future monetary policy regime, we simply suppose that this happens via change in the long-run inflation target π_L, more on that later).

Consider first any period at positive interest rate (this applies, e.g. to the long run when $t \geq t_S$ in our example above) if the central bank successfully targets zero inflation at all times. Then by equation (3), output is given by (substituting in for $\pi_t = 0$ at all times because the central bank manages to target zero inflation)

$$\hat{Y}_t = -\psi(\hat{\tau}_t^s + \hat{\tau}_t^I) + \psi\sigma^{-1}\hat{G}_t \tag{9}$$

which reveals that if the central bank successfully targets zero inflation then expectations about future taxes or spending have no effect on output. Output at time t is pinned down only by current fiscal policy at time t. This key result is what underlines the statement above that deficits have no effect in the model at

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positive interest rates. What role does AD play? Because the central bank successfully targets zero inflation, then equation (1) only serves to pin down the nominal interest rate, i.e. it is only a pricing equation for the nominal interest rate the central bank needs to set to ensure zero inflation.

The IS equation, however, plays a dramatically different role once the nominal interest rate hits zero. At that point equation (1) no longer plays the role of just pinning down the nominal interest rate needed to implement zero inflation. Instead, because the central bank has already cut the interest rate to zero, this equation tells us how many goods people buy. Thus, the economy becomes entirely demand determined. To be more specific, let us write out equation (1) taking into account our assumption of the stochastic process for r_t^e and assuming it is low enough so that the zero bound is binding. Furthermore, let us suppose that taxes, spending and inflation all stay at the same value in the long run. We then obtain an AD relationship:

$$\hat{Y}_S = \hat{Y}_L + \frac{\sigma\mu}{1-\mu}\pi_S + \sigma\pi_L + \frac{\sigma}{1-\mu}r_S^e + \hat{G}_S - G_L - \sigma\chi^s\mu\tau_S^s + \sigma\chi^s\tau_L^s \tag{10}$$

Contrast equation (10) that determines output in the short run if the nominal interest rate is zero with equation (9) that determines output in the short run at positive interest rate. One immediate and obvious implication is that in this relationship *expectations* about the long run matter, i.e. the variables $\hat{Y}_L, \hat{\tau}_L^s$ and $\hat{G}_L$ matter for the determination of short-run output. Hence, to the extent that a deficit in the short-term affects any of these variables, a deficit may either increase or decrease output in the short run. The equilibrium output is then determined by the intersection of the curve (10) and the (3) equation in the short run given by

$$(1-\beta\mu)\pi_S = \kappa\hat{Y}_S + \kappa\psi\chi^I\hat{\tau}_S^I + \kappa\chi^s\hat{\tau}_S^s - \sigma^{-1}\kappa\psi\hat{G}_S$$

Figure 1 shows the determination of equilibrium by showing the intersection of the AS and the AD curve in (π_S, $\hat{Y}_S$) space. At a positive interest rate, the AD curve is simply a horizontal line, output is completely determined by the AS equation (9) that will always intersect the AD equation at zero inflation. And the

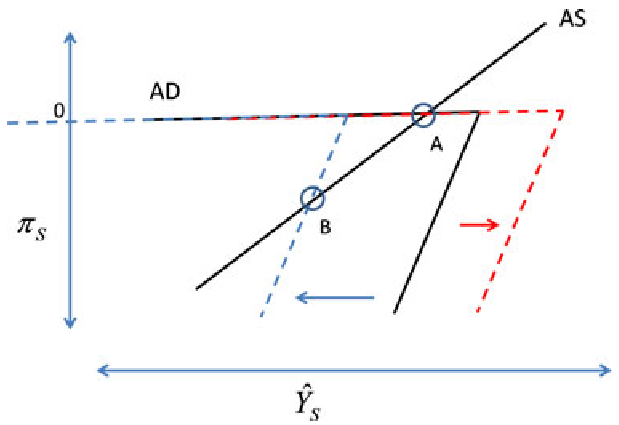

Figure 1 Aggregate demand and aggregate supply in the model

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central bank will simply set the nominal interest rate to make it so. Importantly, here, expectations about future taxes and spending are irrelevant for output and/or inflation, they only have an effect on the interest rate the central bank needs to set to achieve its goals. Once there are shocks so that the central bank is unable to cut the nominal interest rate further (due, e.g. to the zero bound), then the AD curve is no longer horizontal, but instead upward sloping and equilibrium occurs in point B.[9] Importantly, at this point, then expectations about future fiscal variables will have a direct effect on demand. In particular, we see that:

(1) Expectation of higher future labor taxes, $\hat{\tau}_L^I$, shifts the AD curve back and thus reduces output. The reason is that expectations of higher future labor taxes reduce people's expectations about future output and future income, thus suppressing their willingness to consume today since the goal is to smooth consumption over time.
(2) Expectation of lower future government spending, $\hat{G}_L$, shifts the curve forward thus increasing output. The reason for this is that lower future government spending leaves more room for private consumption in the long run, which in turn stimulates consumption demanded today since people try to smooth consumption over time.
(3) Expectation of a higher future sales tax shifts AD out thus increasing output. The reason is simply that with higher future sales taxes, people want to take advantage of the lower tax rate today thus increasing demand.
(4) Expectation of higher long-run inflation shifts AD out and thus increases output in equilibrium. The reason is that higher inflation expectations at constant interest rate decrease the real interest rate – the price of spending money today relative to that in the future – thus increasing AD.

The bottom line then is that expectations of future fiscal policy can play an important role at the zero bound. Usually the fiscal policies described above – at least under the monetary policy regime we consider – are simply offset by monetary policy. However, the zero bound is the Pandora box that brings out AD in full force, and the AD that critically depends on expectation about future fiscal policy. In this sense, then, there is something to the notion that 'confidence' matters because expectations about future fiscal policy are important.

One immediate implication of the proceeding discussion is that deficit can have an important effect on AD at zero interest rate to the extent that they trigger shifts in expectations about future fiscal variables $\hat{\tau}_L^s, \hat{G}_L$ and $\hat{\tau}_L^I$ or trigger a change in the long-run monetary policy regimes that determines π_L. However, these effects are a bit different, however, than sometimes suggested. Suppose, for example, that a higher deficit today implies that in order to pay down future debt the government will reduce $\hat{G}_L$ or increase $\hat{\tau}_L^s$. That would make deficit expansionary (thus 'increasing confidence'). The same applies if people expect that it will lead the central bank to inflate away some of the debt accumulated

9. As dicussed in more detail in Eggertsson (2010a), the fact that the AD curve is upward sloping at zero interest rates has interesting implications in itself, such as giving rise to the 'paradox of toil', see Eggertsson (2010b).

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via higher π_L. Conversely, if the deficit triggers expectations of higher future income taxes, then it is contractionary (thus 'reducing confidence').

The most pertinent question today seems to be if the possibility of higher future income taxes can possibly undo the effect of the short-run stimulus, for example, one generated by an increase in government spending. In particular, let us focus on the case in which higher government spending today may imply higher future income taxes and thus possibly undo the positive effect of a stimulus.

Let me here briefly report two thought experiments in Denes *et al.* (2013) that are aimed at getting at this issue. The bottom line is that even if one assumes that all future debt is financed by income taxes (thus suppressing long-run output), this does not have a quantitatively large effect and is thus unlikely to make austerity imposed by cuts in government spending or increases in sales taxes expansionary unless further assumptions are made, given the large fiscal multipliers already reported.

A word of caution is in order at this stage: The estimated model is incredibly simple and abstracts from a number of important features (e.g. capital accumulation, wage frictions, investment dynamics, the approximation methods applied, and so on). I do think it is still interesting to put numbers on the simple model because my personal experience is that this simple model usually gives a relatively good idea for what to expect in a more detailed model, since at least at the current state of modeling technology, most DSGE models have the same basic ingredients as the simple model presented here.

Consider first a policy regime in which at time 0 there is a one-time increase in public debt (one-time deficit) and that this debt is then paid off once the shock reverts back to steady state at a rate δ (Denes *et al.* (2013) set the δ so that the half-life of this additional debt is five years). We can think of banking crisis as one example of an event that may trigger this kind of one-time increase in public debt. Such a crisis often involves substantial one-time financial commitment by the government (that does not imply any direct variation in the instruments $\hat{\tau}_t^I, \hat{\tau}_t^s$ or $\hat{G}_t$ in the short run and can thus be modeled as direct increase in debt). In this case, each additional dollar of debt reduces short-run demand by about 20 cents in the short run in the GD scenario and 10 cents in the GR scenario.

Obviously, these effects are larger if we assume instead that this is not a one-time increase in the debt, but instead that debt increases by 1$ in every state of the world in which the zero bound is binding (i.e. we consider a deficit occurring in all crisis states in which $r_t^e < 0$). In the numerical example reported above, this raises the deficits spending multiplier to -1.9 in the GD case and to -0.3 in the GR case. However, recall that in the GD example government spending is self-financing, so this effect cannot undo the positive effect of increasing spending, since those spending increases reduce the deficit in the first place. The GR calibration is more interesting, since their government spending does imply some short-run deficit, and thus this effect could in principle overturn the case for expansionary fiscal policy. As is clear from this number, however, -0.3 and with a multiplier of real government spending of 1.2 that increases deficit by about 50 cents for every dollar spent, the numbers do not support a strong case against government spending even under this particular policy regime.

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Let me finally just note that the preceding paragraphs illustrate the effects of deficits on output under the assumption that they are financed by future income taxes. In those cases – the sort of worst case scenario for expansionary policy – there is a possible scope for drop in 'confidence' to undermine fiscal policy. If deficits trigger instead either expectations of a drop in the long-run size of the government (to finance the debt) or an increase in sales taxes, then the deficit actually becomes expansionary as we discussed above. Under those policy regimes, the case for fiscal policy becomes even stronger.

5. CONCLUSIONS

I have here reviewed the theory underlying much recent work on the origin of the current economic crisis. The two main pillars are financial shocks and Keynesian pricing friction. Added to these two pillars is the fact that the central bank cannot offset large enough financial shocks via interest rate cuts due to the zero bound and one has a coherent theory of the crisis.

Overall, this theory suggests a very strong case for activist fiscal policy, at least as long as monetary policy is not bridging the output gap. This remains the case at zero interest rates even if one explicitly takes into account that fiscal policy may imply some deficits and that those deficits could trigger expectations of future tax hikes. One important element we have not explicitly addressed, however, is the extent to which fiscal policy may affect the rates at which the government can borrow. Instead, we assumed that this rate was given by the risk-free interest rate set by the central bank.

In the current European case, however, this distinction may be important (see Denes *et al*. (2013) for further discussion of this point) because the governments of the Southern European countries face different interest rates than those set by the ECB. If – for whatever reason – fiscal policy leads to a drastic increase in this financing costs, and if those costs trigger expectations of higher future income taxes, the model suggest that this may undo some of the positive effect of the stimulus. This, then, suggests an even further argument for fiscal integration in the European context, as in principle a government that prints its own currency should always be able to peg its own borrowing rate close to or equal to the short-term nominal risk-free rate (as it can simply print money to payoff the loan).

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REFERENCES

Bhattarai, S., G. Eggertsson and R. Schoenle (2012), 'Is Increased Price Flexibility Stabilizing? Redux', NY Staff Report No. 540.

Calvo, G. (1983), 'Staggered Prices in a Utility-Maximizing Framework', *Journal of Monetary Economics* 12, 383–398.

Christiano, L., M. Eichenbaum and S. Rebelo 2011. 'When is the Government Spending Multiplier Large?', *Journal of Political Economy* 119, 78–121.

Del Negro, M., G. Eggertsson, A. Ferrero and N. Kiyotaki. (2011), 'The Great Escape? A Quantitative Evaluation of the Fed's Liquidity Facilities', Working Paper, NY Fed Staff Report No. 520.

DeLong, B., L. Summers (2012), 'Fiscal Policy in a Depressed Economy', *Brookings Papers on Economic Activity* 1, 233–297.

Denes, M., G. Eggertsson and S. Gilbukh (2013) 'Deficits, Public Debt Dynamics and Tax and Spending Multipliers', *Economic Journal* 123, F133–F163.

Eggertsson, G. (2001), Real Government Spending in a Liquidity Trap, Princeton University, Mimeo, available at http://www.econ.brown.edu/fac/gauti_eggertsson/ Accessed 22 August 2013.

Eggertsson, G. (2006), 'The Deflation Bias and Committing to Being Irresponsible', *Journal of Money, Credit, and Banking* 36, 283–322.

Eggertsson, G. (2008), 'Great Expectation and the End of the Depression', *American Economic Review* 98, 1476–1516.

Eggertsson, G. (2010a). 'What Fiscal Policy is Effective at Zero Interest Rates?', *NBER Macroeconomics Annual*, Volume 25, NBER Chapters. National Bureau of Economic Research.

Eggertsson, G. (2010b), 'The Paradox of Toil' , Fed Staff Papers, New York.

Eggertsson, G. and P. Krugman (2012), 'Debt, Deleveraging and the Liquidity Trap: A Fisher-Minsky-Koo Approach', *Quarterly Journal of Economics* 127, 1469–1513.

Eggertsson, G. and M. Woodford (2003), 'The Zero Interest-Rate Bound and Optimal Monetary Policy', *Brookings Papers on Economic Activity* 1, 139–211.

Eggertsson, G. and M. Woodford (2004), 'Optimal Monetary and Fiscal Policy in a Liquidity Trap', NBER International Seminar on Macroeconomics 2004.

Erceg, C. and J. Lindé (2010), 'Is there a Fiscal Free Lunch in a Liquidity Trap?', International Finance Discussion Papers No. 1003, Board of Governors, Washington, DC.

Farhi, E., I. Correia, J. P. Nicolini and P. Teles (2013), 'Unconventional Fiscal Policy at the Zero Boun', *American Economics Review*. (forthcoming)

Krugman, P. (1998), 'It's Baaack! Japan's Slump and the Return of the Liquidity Trap', Brookings Papers on Economic Activity 2.

Mankiw, G. N. (1985), 'Small Menu Costs and Large Business Cycles: A Macroeconomic Model of Monopoly', *Quarterly Journal of Economics* 100, 529–537.

Mertens, K. and M. O. Ravn (2010), 'Fiscal Policy in an Expectations Driven Liquidity Trap', *Centre for Economic Policy Research*, DP7931.

Werning, I. (2011). 'Managing a Liquidity Trap: Monetary and Fiscal Policy', MIT Working paper.

Woodford, M. (2003), *Interest and Prices*, Princeton University Press, Princeton, NJ.

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