

## 10 Fiscal and Monetary Policies after the Crises

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### **Abstract**

We review the recent literature on macroeconomic stabilization policy, with a particular focus on two major challenges that are particular to the post-crisis landscape. These are, first, how to provide meaningful economic stimulus when the zero lower bound on nominal interest rates is binding. Second, how to design a stabilization policy for the Eurozone that will remedy the large macroeconomic imbalances among member states.

### **10.1 Introduction**

European policy-makers are currently facing formidable policy challenges. First, while many other economic regions in the world have shown tangible signs of economic recovery already in 2014, the Eurozone as a whole slipped into a downturn with high unemployment and current and expected inflation falling well below the 2 per cent target. Monetary policy will be constrained by the zero lower bound for the foreseeable future, giving the European Central Bank (ECB) little alternative to engaging in policy experimentation such as quantitative easing. Second, the progress towards the correction of internal imbalances has been very slow, with the questionable exception of the reversal of previous current account deficits, essentially driven by large and costly recessions in the high debt countries. Reform efforts have been frustrated by low economic activity and financial fragility, forcing governments in need of change to implement costly initiatives with scarce tax and financial resources. The inward-looking precautionary approach to fiscal policy adopted by surplus countries has ensured that the overall fiscal stance of the currency area is contractionary, at an inappropriately tight level for the Eurozone as a whole. Third, the Eurozone as an incomplete monetary union needs to ensure its sustainability via institutional development that requires strong political cohesion. Lack of sufficient institutional development has undermined timely and intense policy responses to the crisis, and created mistrust and conflict over viable solutions, as policy-makers are having to design stabilization mechanisms, at the same time

as reaching agreement on the fundamental contracts and mutual insurance rules governing banking union, monetary backstops for public debt, and the credibility of the no-bailout principle. The process of overcoming the insufficient institutional development during a severe crisis has exacerbated policy credibility problems at country and union-wide level, and arguably created room for destabilizing speculative behaviour. Last but not least, growth rates across the Eurozone are disappointingly low, at the same time as the income and wealth distributions have become more concentrated. On the one hand, demographic and structural factors weigh on the dynamics of these economies, suggesting a far-reaching reassessment of the stability of their public finance and welfare state institutions is needed. On the other hand, the low growth rates may themselves have resulted from past policy choices regarding investment in human capital and knowledge. More recently, they reflect the accumulation of public and private debt. Assessing changes in the long-run trends is bound to have a first-order impact on the design of stabilization policy.

This chapter provides a compact survey of the academic and policy debate on fiscal and monetary policy after the crisis, in and outside the Eurozone, with the goal of identifying areas of policy research that can directly contribute to addressing the three main challenges mentioned above: (a) economic stabilization at the zero lower bound constraint on monetary policy; (b) correction of imbalances; and (c) the complementarity of stabilization policy and reforms. The survey is meant to be neither exhaustive, nor technical. Yet we have tried where possible to structure the arguments around a common stylized analytical framework, so as to obtain a clearer understanding of the questions and issues that require further analytical and empirical work.

In doing this, we make sure to relate the policy debates before and after the eruption of the global crisis, trying where possible to account for the complexity of these debates, and for the heterogeneity of ideas and models that are currently being deployed. The crisis has naturally led to a very deep reconsideration and redevelopment of the pre-crisis consensus regarding stabilization policy, bringing forward lines of research that were previously marginal to that consensus. Simultaneously, innovation and experimentation in the design of practical stabilization policy have become both necessary and desirable. This is particularly true of policy in the Eurozone, where it is now evident that there are important gaps in the ability of policy-makers to deal with asymmetric economic performances among countries. Academic research in Europe and beyond provides many important insights into the direction that policy reform should take in light of these new challenges. Rather than allowing a new consensus to form around experimental decision making, it would be far more preferable to incorporate this literature actively into the reform agenda. The aim of this survey is to take a helicopter view over the most important insights that current academic research has to offer.

We are fully aware that many issues raised by the crisis have not, so far, found a satisfactory answer in theory and policy-making. Yet our focus is on what the academic literature does provide, rather than what it does not. Even allowing for this, space constraints have forced us to interpret our remit narrowly, and two omissions should be singled out upfront. First, while we analyse the consequences of sovereign risk crises for the design of stabilization policy, we do not delve into a comprehensive analysis of debt sustainability and issues in debt default. Second, we do not go in detail on the specific roots of the financial crisis, although we devote a long section to stabilization policy in the wake of such a crash.

The chapter is structured as follows. Section 10.2 synthesizes the academic debate predating the crisis, documenting substantial heterogeneity in views and theories at odds with popular media accounts. Section 10.3 provides the macroeconomic context for the crisis and briefly introduces key challenges to the design of stabilization policy. A long section follows with an account of the debate on what has caused policy rates to fall to, and be constrained at, their zero lower bounds, and how to stabilize the economy via forward guidance, fiscal policy, or central bank purchases of assets. In Section 10.5 we account for models and mechanisms that have been recently proposed, to account for large and persistent periods of low economic activity and inflation. Section 10.6 focuses on issues that are specific to the Eurozone, including low risk sharing, the role of fiscal policy and economic reforms.

## 10.2 The Pre-Crisis Consensus, and Heterogeneity

Our starting point is the strengthening consensus among policy-makers, up to the eruption of the global crisis, that the most important questions relating to macroeconomic stabilization were essentially resolved. Developed economies were benefitting from the steady, low-inflationary period of growth known as the ‘Great Moderation’, with improved monetary policy-making widely believed to have been a contributory factor in engineering this.<sup>1</sup> The launch of the euro, the greatest monetary experiment in recent history, went far more smoothly than even optimistic observers were expecting. The newly created European Central Bank appeared to be able to steer the European economy in the ‘*uncharted waters*’ of the newly created economic space defined by the common currency without substantial problems. Possible issues foreshadowed by the body of literature loosely referred to as Optimum Currency Area theory did not seem to materialize. More generally, the ongoing process of rapid trade and financial globalization, with the growth in supply chain and global and international banking, did not seem to alter in any substantive way the best practice of monetary and fiscal stabilization, essentially focused on inward-looking objectives such as inflation and the output gap at the national level. Of course

there was considerable debate on the emergence of large current account imbalances, and/or financial vulnerability. But the experience of the Greenspan era – and particularly the ease with which the world economy endured the dot-com collapse of the early 2000s – suggested there was a tried and tested strategy for maintaining macroeconomic stability even in the wake of significant financial turbulence.

At the level of academic research, the policy literature was similarly tranquil. Macroeconomists had devised a suite of interconnected Dynamic Stochastic General Equilibrium (DSGE) models that could account for observed, calmer business-cycle dynamics, and monetary policy, in turn, played a crucial controlling role in these models.<sup>2</sup> It would have been clear even to an outsider that important disagreements remained in the academic discipline, for instance over the role of sticky-price New Keynesian models in explaining the business cycle,<sup>3</sup> but these did not have the same direct connection with day-to-day stabilization policy as, say, the debates surrounding monetarism in the 1970s and 1980s. From the late 1990s on, few academic macroeconomists publicly advocated – or analysed the implications of – major innovations in the conduct of stabilization policy. It is easy to see how, from a policy-maker's perspective, academic research was seen as formalizing what was already widely considered to be best practice.

The crisis has, by contrast, placed policy innovation at the centre of the political agenda. As we will argue, this is partly a product of necessity: monetary policy has become less effective as nominal interest rates have approached their apparent lower bound of zero. But it is also partly a product of the apparent inadequacies of pre-crisis conduct. In order to understand the forces driving innovation, it is useful to sketch the pre-crisis 'consensus' regarding stabilization policy. This is necessarily an exercise in simplification, and some policy-makers would no doubt consider their pre-crisis views as departing from it, but the aim is to capture the essence of mainstream opinion. We would argue that this ran roughly as follows:<sup>4</sup>

1. Monetary policy should play the primary role in economic stabilization.
2. The appropriate monetary policy instrument is the short-term nominal interest rate.
3. Policy should pursue a modestly positive, stable rate of inflation, to the exclusion of other goals.
4. Active fiscal policy is of limited additional usefulness.
5. Financial crises should be addressed via provision of abundant liquidity to contain the propagation of financial instability into macroeconomic instability.

Importantly the connections between these consensus views and formal theoretical modelling ran in both directions. Some components were certainly a product of earlier developments in the academic literature. The emphasis on price stability as a policy objective, for instance, ultimately derived from the

work of Milton Friedman and Edmund Phelps on inflation dynamics and the natural rate of unemployment, subsequently updated to a New Keynesian setting for the purposes of policy analysis.<sup>5</sup>

What we want to stress, however, is that in other regards the focus of research arguably followed from the received policy wisdom. This was particularly noticeable in the development of a theory of optimal interest-rate setting, which replaced the more traditional focus in the academic literature on the money supply as the object of policy choice. The switch in focus was popularized by the work of Woodford (2003), who argued that monetary policy could meaningfully be analysed in ‘cashless’ settings, where money was used as a unit of account but not actively traded. Thus the money supply was no longer viewed as a relevant policy variable, and outcomes could be controlled by interest rates alone.<sup>6</sup> This was an important development from the perspective of the third part of the consensus too, because optimal policy in models *with* money very often required the central bank to induce permanent deflation, consistent with the so-called Friedman rule – a conclusion plainly out of line with actual central bank choices. Optimal interest-rate rules in a cashless setting instead stressed the merits of low – but non-negative – inflation.<sup>7</sup> In both regards, however, these developments in the theoretical literature took place after the associated developments in policy-making. Interest-rate setting had already become the dominant instrument of monetary policy conduct in OECD economies by the late 1980s, and by the late 1990s a large number of central banks had already moved to formal inflation targeting regimes – a trend that was reinforced in 1999 when the new European Central Bank was given a mandate that gave principal emphasis to price stability. Whilst the monetary framework of the European central bank, initially based on the ‘two pillars’ of monetary and economic analysis, could in principle have stimulated work developing an alternative theoretical and institutional paradigm, this was not considered a relevant priority in the contemporary intellectual environment.

The Great Moderation thus generated a clear symbiosis between the priorities of policy-makers and the academic work *that attained prominence in policy-making circles*, but this work was not necessarily representative of developments in the subject as a whole. Many of the innovative post-crisis modelling developments that we survey have built on pre-crisis work that was widely discussed in academic circles, but sat apart from any pre-crisis ‘consensus’. Thus the common view that macroeconomics entered 2008 as an excessively homogenized discipline is, at best, an over-simplification.

### 10.3 The Context and Challenges Posed by the Crisis

The purpose of this section is to revisit in simple form the basic facts of the crisis, laying out in very broad terms what any new academic analysis of stabilization policy should be seeking to address. Focusing on the headline

macroeconomic trends in leading OECD economies over the past decade, we will draw attention both to the initial homogeneity of experiences across countries, and to substantial differences in their subsequent performances (particularly stark in outcomes across Eurozone members).

### 10.3.1 *Headline Macroeconomic Trends*

The ultimate purpose of stabilization policy is to ensure steady growth, low unemployment and stable prices. Any diagnosis of the problems that the crisis has raised must start with these aggregates.

#### *Output*

The consequences of the crisis for global production are well known, though no less striking for it. 2009 remains the only year since the Second World War in which gross world output fell in real terms. This fall was particularly severe for advanced economies, though the growth rates of emerging market and developing economies also slowed very substantially.

Looking across developed economies, what was particularly unusual about the crisis was the uniformity with which its effects were felt. Of the 34 OECD members, 29 saw lower real output in 2009 than 2008. Poland was the only EU member state to see output grow that year. In this regard 2008–2009 was by far the most synchronized downturn since the 1930s. Even Canada, which did not see any major domestic financial crisis, suffered a year-on-year contraction of around 2.7 per cent during this period.

But if the early post-crisis years were distinctive for the *similarity* of experiences across countries, the years since 2009 are far better characterized by their differences. Some contrasts stand out across the G7 economies. By the end of 2014 real output in the US was around 8 per cent above its pre-crisis peak, and in Canada more than 10 per cent. In Italy a long period of stagnation has instead left GDP 10 per cent below its level in early 2008.

With respect to the Eurozone member countries, the story is both one of divergence within the bloc, and relative stagnation by comparison with other leading economies. It has become common to draw a distinction between northern and southern members when discussing the problems of the currency area.<sup>8</sup> Yet whilst it is true that the group of five countries most commonly grouped together as the ‘South’ – Greece, Ireland, Italy, Portugal and Spain – have performed far worse than most others since the crisis, there are also important laggards in the North – notably Finland and the Netherlands, whose production levels remain stuck below the pre-crisis peak at the time of writing. Overall, it is notable that no Eurozone country has yet experienced a recovery in aggregate production of a similar magnitude to that of the US and Canada.

Germany, the zone's best-performing large economy, had exceeded its pre-crisis real GDP level by a little under 4 per cent by the end of 2014.

Alongside this, the Greek crisis has operated on a different scale from problems elsewhere. Greece's real output in the second quarter of 2015 remained more than 25 per cent below its pre-crisis peak, the effects of the bitterly-contested July 2015 bailout agreement still to be felt. In proportional terms the magnitude of this contraction is almost identical to the estimated decline in GDP in the US between 1929 and 1933, through the worst years of the Great Depression. In terms of lost output, the Greek depression is unrivalled in its magnitude and duration among advanced economies throughout the postwar era.

### *Unemployment*

A similar overall picture emerges from viewing unemployment data – that is, of a common economic shock during the 2008–2009 period, followed by very diverse dynamics as some economies recovered from the crisis and others saw their difficulties compound. Yet labour market outcomes also indicate important new disparities. For instance, measured in terms of unemployment Spain's post-crisis experience stands out as much as that of Greece among Eurozone states, both countries having experienced long periods during which the headline unemployment rate exceeded 25 per cent. By contrast, Germany's performance stands out as a far clearer success – particularly when viewed over the entire decade since 2005. Its unemployment rate has fallen by more than half over the Merkel years, from a peak of over 11 per cent to less than 5 per cent at the time of writing – moving from the highest to the second-lowest rate in the G7.

It is also striking just how far the dispersion of unemployment rates across Eurozone countries has increased by comparison with the immediate pre-crisis period. In January 2008 the lowest rate among the original 12 members of the currency area was the Netherlands' 3.8 per cent, and the highest was Spain's 9 per cent. By July 2015 the equivalent range ran from 4.6 per cent in Germany to 25 per cent in Spain. If it was possible to argue prior to 2008 that stabilization policy need only be designed for the currency area as a whole, the case is insupportable now.

### *Inflation*

Turning next to prices, there was again a very clear correlation between consumer-price inflation rates across G7 economies during the initial months of the crisis. In July 2008 all seven economies were experiencing year-on-year inflation rates in excess of 2 per cent, with US annual price increases approaching 7 per cent. By July 2009 all bar the UK were experiencing deflation. These aggregate price trends were driven in part by large simultaneous

changes in commodity prices, particularly oil prices. Since 2009 there has been less apparent divergence in inflation rates than output levels, with a particularly notable downward trend in headline inflation rates across OECD economies since 2012 – with the result that the Eurozone, US and UK were all flirting with negative inflation rates over the course of 2015. Indeed, it was the common Eurozone trend towards deflation that justified the ECB's decision to embark on quantitative easing in January 2015.

Greece is once more an outlier when it comes to post-2008 inflation trends, though to a lesser extent than in output and unemployment data. Consumer prices in Greece have been falling since early 2013, whereas the Eurozone as a whole did not experience deflation until December 2014. The Greek year-on-year inflation rate has been one to two percentage points below the Eurozone average persistently since early 2012.

### *10.3.2 Market Impairment and the Transmission of Stabilization Policy*

Matching these headline trends in macroeconomic aggregates have been important developments in the operation and scope of conventional stabilization policy. The first relates to the transmission of monetary policy to the wider economy. This transmission is heavily dependent on the smooth working of the interbank markets. Before August 2007 a large share of interbank transactions involved unsecured loans, but risk premia nonetheless remained low. This meant there was a tight link between headline policy interest rates and interbank rates.

This changed radically with the crisis, in two steps. First, between August 2007 and August 2008 significant risk premia emerged in interbank lending markets, caused by a mixture of liquidity and default risks. There was some reduction in the quantity of unsecured interbank lending. However, there was not yet a mass exodus to secured interbank lending. The default and liquidity risks were perceived to be bank-specific concerns, with lenders judging the creditworthiness of a borrowing counterparty on a case by case basis.

Second, the failure of Lehman Brothers in September 2008 resulted in *systemic* default and illiquidity risk emerging as a significant concern across financial systems in mature economies. This change led to an effective closure of unsecured interbank markets in both the Eurozone and the US: the quantity of unsecured interbank lending fell significantly. Investors sought safer and more liquid assets. Banks sought refuge in secured interbank markets and recourse to central bank lending and deposit facilities.

Following the initial market panic, central banks effectively substituted themselves for the core of the interbank market, offering lending and deposit facilities to banks that would not otherwise be able or willing to trade bilaterally with one another. This succeeded in reducing risk premia, and placed

significant downward pressures on a range of interest rates, particularly the short-term cost to private banks of obtaining funding.

Yet these initial improvements were set back in Europe by the sovereign debt crises that set in from 2010 onwards. These triggered significant fragmentation in money markets in the Eurozone. A particular source of difficulties was the link that emerged between fears for the solvency of a country's banking sector, and fears for its sovereign. The national focus of banking sectors in Eurozone states meant that private banks tended to have large holdings of their domestic sovereign's debt. Concerns about the sovereign thus led directly to questions about the health of the banking sector. But the early experience of the crisis worldwide had been one of domestic sovereigns providing an ultimate backstop to the financial sector in times of turmoil. Thus an impaired banking sector increased the likely liabilities of the state. The result was a vicious circle that affected Greece, Ireland, Portugal, Spain and Cyprus in turn, the flow of credit to the private sector becoming severely impaired in these states as a consequence.

The associated financial turmoil and deterioration of the economic outlook led the European Central Bank to embark on a range of unconventional policy measures to overcome perceived financial market illiquidities. These included in particular the Securities Markets Programme (SMP), launched in May 2010, the three-year maturity Long Term Refinancing Operations (LTROs) of December 2011, and the Outright Monetary Transactions (OMT) programme announced in August 2012. Together these measures appeared to have reduced funding costs both for private-sector banks in most of the impaired southern European states, and for the domestic sovereigns whose debt these banks bought. The one exception has again been Greece, where fears of default and even a much-hyped Eurozone 'exit' necessitated capital controls to prevent a collapse of the banking sector in the summer of 2015. At the time of writing conditions for Greek banks appear to have improved, but remain precarious.

### *10.3.3 The Zero Bound on Nominal Interest Rates*

At the same time as the usual transmission mechanism from central bank interest rates to the wider economy became impaired, a more direct constraint has come to limit conventional monetary policy: the zero – or near-zero – lower bound on nominal interest rates. This arguably poses the most universal, global challenge for stabilization policy at present. Where exactly the lower bound on nominal interest rates falls is the subject of ongoing debate and policy experimentation,<sup>9</sup> but there is near-unanimous agreement that there is some limit to savers' willingness to pay depository institutions for the privilege of holding their funds. This is ultimately due to the availability of cash as an alternative savings instrument, with a guaranteed zero rate of return.<sup>10</sup> The policy

instrument that was considered the most important stabilization device prior to the crisis – the nominal interest rate – no longer seems capable of injecting additional stimulus, despite continued economic weakness. Policy innovation is the only possible response to this, and a large part of this survey is concerned with the theoretical and empirical literatures that are emerging to understand (a) why the zero bound has come to matter – in a way that was not foreseen before the crisis (outside of Japan) – and (b) what channels stabilization policy can now exploit.

The Japanese experience is particularly noteworthy from the perspective of part (a) of this. As we shall see, in large parts of the macroeconomic literature it is common to treat the zero bound as a temporary concern, driven by a short-term desire by consumers to delay purchases for some particular reason. This perspective is very difficult to reconcile with the fact that Japan's zero bound episode has now lasted two decades, and shows no signs of ending soon. The central hypothesis of the fast-growing '*secular stagnation*' literature – that global long-term real interest rates are now permanently lower – provides an intriguing alternative.<sup>11</sup>

Our survey will focus principally elsewhere, reflecting the majority of the post-crisis academic literature to date. But we do wish to highlight here that a central concern for ongoing research should be to ask whether Japan will remain an outlier, or whether other OECD economies are following in its path.

#### 10.4 The Zero Lower Bound: Implications for Stabilization Policy

This section provides a detailed analysis of the literature analysing the policy implications of the zero bound on nominal interest rates. There is a substantial body of work suggesting that if interest rates are constrained from falling, this may have a causal role in worsening economic conditions. A number of different mechanisms have been proposed in this regard. They hinge on the idea that the zero lower bound may interfere with an adjustment process that would otherwise ensure an efficient level of production. In particular, it may not be possible to provide individual consumers with the incentives to spend an adequate fraction of their current incomes. This will depress aggregate demand relative to the production capacity of the economy, as a decline in income becomes the only means for the economy to adjust to the low level of consumer spending. We will examine both the alternative mechanisms that have been identified as potential causes of depressed output, and the alternative policy options that are available for stimulating the economy in the face of these dynamics. Where possible, we try to frame the main contributions to the literature through the lens of the workhorse equation at the heart of modern dynamic macroeconomics, the consumption Euler equation. This is not intended as a particular endorsement of the Euler condition, whose empirical relevance has often been challenged.

It simply proves the easiest device for unifying and understanding the key theoretical contributions that have so far been made to the academic debate on post-crisis stabilization policy.

#### 10.4.1 *Savings Decisions and Nominal Interest Rates*

We start, then, by revisiting the savings decision of a consumer in an environment where interest rates may be constrained by a zero bound. This is well summarized by the famous consumption Euler equation:

$$\frac{u'(C_t)}{p_t} = \beta_t (1 + i_t) \mathbb{E}_t \frac{u'(C_{t+1})}{p_{t+1}}, \quad (10.1)$$

where  $u'(C_t)$  is the marginal subjective loss to the consumer at time  $t$  from reducing their period- $t$  consumption,  $C_t$ , by a unit;  $p_t$  is the monetary price of a standardized unit of consumption in period  $t$ ;  $i_t$  is the nominal interest rate that is paid on savings between  $t$  and  $t + 1$ ; and  $\beta_t$  is the subjective discount factor that consumers attach to welfare in period  $t + 1$  as distinct from period  $t$ .<sup>12</sup> If the consumer values current welfare more than future welfare,  $\beta_t < 1$  will hold. The nominal interest rate is set by the central bank.

The theoretical literature on the zero bound generally studies stochastic economies that last for an indefinite amount of time, but the main distinctions among the different contributions can be well understood by placing alternative restrictions on this two-period condition.<sup>13</sup> To keep the discussion simple we can assume for now that the only source of aggregate demand in the economy is consumption – that is, investment, government spending and the trade balance are all zero. Under this assumption, and to the extent that (10.1) captures (if only in a stylized way) the process governing *aggregate* consumption choice in the economy, then we can rewrite the equation in terms of per-capita output, using the GDP identity that aggregate expenditure and aggregate income must be equal:

$$u'(Y_t) = \beta_t (1 + i_t) \mathbb{E}_t \frac{1}{1 + \pi_{t+1}} u'(Y_{t+1}) \quad (10.2)$$

where  $Y_t$  is realized per-capita output in period  $t$ , and  $\pi_{t+1}$  is inflation in period  $t + 1$ . Alongside the actual level of production  $Y_t$ , there is a ‘full capacity’ production level  $\bar{Y}_t$ , which would be obtained in the event that all productive resources in the economy were used efficiently. There is also an optimal level of inflation in each time period, which minimizes the distortions that are induced by price changes. We can treat this as fixed in all periods, equal to some value  $\pi^*$ . The exact process that determines inflation will depend on how the supply side of the economy is assumed to work; for now we remain agnostic on this.

Suppose first that there were no zero bound on the nominal interest rate. Absent any other complications, the policy problem in period  $t$  amounts to setting  $i_t$  so that the following equation is true:

$$u'(\bar{Y}_t) = \beta_t (1 + i_t) \mathbb{E}_t \frac{1}{1 + \pi_{t+1}} u'(Y_{t+1}). \quad (10.3)$$

That is, given what consumers expect to observe tomorrow in terms of inflation and output, and given the value of the discount factor  $\beta_t$ , the nominal interest rate should be set so that it is just optimal for consumers to want to spend  $\bar{Y}_t$  in the current time period. Notice that the question of what exactly consumers expect in period  $t + 1$  can largely be left to one side here. So long as inflation and output expectations do not depend significantly on the current choice of  $i_t$ , there will exist a current nominal interest rate that clears the market for goods – setting  $C_t = \bar{Y}_t$ .

The problem comes from the fact that this market-clearing nominal interest rate may be negative. This could happen for a number of different reasons, and policy conclusions hinge critically on the exact mechanism at work. A number of important disagreements in the literature rest on the precise causal mechanisms that are operational in Equation (10.2). We first follow the bulk of the New Keynesian literature, in assuming that the force driving the economy to the zero bound is an exogenous shock to the ‘natural’ real rate of interest that equilibrates the economy. Having outlined this device, we consider the main stabilization options that are available to address it. We then turn to alternative approaches for understanding the source of the zero bound problem.

#### 10.4.2 Shocks to the ‘Natural’ Rate of Interest

The simplest analytical device for ensuring a zero bound is to assume that current consumers have an unusually high desire to save, for some subjective reason whose cause lies outside of the model.<sup>14</sup> Following the terminology of Woodford (2003), this is commonly referred to as a fall in the ‘natural’ interest rate that equilibrates the economy – that is, a fall in the real interest rate that would set aggregate savings equal to aggregate investment, in a world without any monetary imperfections.<sup>15</sup> The resulting policy problem involves important trade-offs that would be absent if the zero bound could be ignored, but these trade-offs are generated by factors (i.e., a forcing process) not directly explained by the model. This is to be distinguished from the possibility of an endogenous ‘*expectations trap*’ with multiple equilibria, which we will discuss in more detail later.

In the present setting the ‘exogenous shock’ approach essentially means assuming the value of  $\beta_t$  – the intrinsic value placed on future welfare – is unusually high for a random length of time. This mode of analysis was first

adopted by Eggertsson and Woodford (2003), in a major early contribution to the current literature. The influential papers by Eggertsson (2011), Christiano et al. (2011), Werning (2012), Wieland (2014) and Cochrane (2015) all follow such an approach, as does the work of Eggertsson et al. (2014) – which focuses specifically on the implications of proposed structural reforms in Europe when the zero bound is binding.

The basic argument starts from the observation that if  $\beta_t$  is sufficiently large, the following inequality can hold:

$$u'(\bar{Y}_t) < \beta_t \frac{1}{1 + \pi^*} \mathbb{E}_t u'(\bar{Y}_{t+1}). \quad (10.4)$$

What this implies is that there cannot be a market equilibrium in which (a) output is equal to its efficient level in both  $t$  and  $t + 1$ , and (b) inflation is equal to the target value in  $t + 1$ . At least one of these desirable goals will have to be missed. The basic problem is that if consumers expect only modest future inflation and value the future highly, they will usually want to hold a sizeable share of their current earnings in cash. But this willingness to hold cash would constrain aggregate demand below productive capacity: unspent earnings imply unsold production. Some adjustment mechanism needs to overcome this demand deficiency.

The key question is whether the mechanism can be expected to operate through changes in prices – in particular the rate of inflation at  $t + 1$  – or changes in current production. With the notable exception of Cochrane (2015), most papers in the literature treat the latter as a ‘benchmark’ case, in the absence of any active policy to the contrary. This relies on a view that once normal times return to an economy there need not be any effect of prior outcomes on current price-setting, and thus inflation at  $t + 1$  should be fixed independently of whether a zero bound was encountered at  $t$ .

The implication of this is that the real interest rate on savings from  $t$  to  $t + 1$  is fixed at  $-\pi^*$ . Consumers would remain too willing to save at this interest rate if pre-tax incomes were to equal  $\bar{Y}_t$ , meaning that the only way for current aggregate demand to equal output is for output to fall. The realized production level  $Y_t$  occurs where the Euler condition is satisfied with equality:

$$u'(Y_t) = \beta_t \frac{1}{1 + \pi^*} \mathbb{E}_t u'(\bar{Y}_{t+1}). \quad (10.5)$$

Under the standard assumption of diminishing marginal utility, this equality will hold for  $Y_t < \bar{Y}_t$ . Thus there is a temporary recession that ensures the path of production mirrors the desired path for consumption: higher in the future than in the present. But this is not an optimal outcome as it comes at the cost of unrealized current production.

### 10.4.3 Forward Guidance as a Solution?

The focus of the literature is then on the policy options that might help mitigate the recession, as well as highlighting those that could unexpectedly do damage. An important starting point is that there does appear to be a relatively painless alternative to a current recession, namely a higher future inflation rate. The anticipation of this inflation should reduce the expected real returns to saving in zero-interest instruments, raising current demand. Policies that are found to be good potential stimulus devices often operate more or less explicitly through such a channel.

The most direct approach is for monetary policy explicitly to promise future inflation above target. The early work of Eggertsson and Woodford (2003) suggested that a central bank could reduce the output gap by several percentage points if it committed to holding interest rates low over an extended period of time *after* underlying economic conditions had recovered from the shock to savings. The widely-cited contribution by Werning (2012) also suggests such a strategy would be optimal. The approach has come to be known as ‘*forward guidance*’, with Campbell et al. (2012) adding the adjective ‘*Odyssean*’ to draw attention to the binds that are placed on the choices of the monetary authority in the future.<sup>16</sup> If there has been a consensus in the recent theoretical literature behind any form of policy innovation, it is not quantitative easing, structural reform, or fiscal stimulus, but this.

This begs the question why experiments with forward guidance have been much tamer than experiments with various forms of quantitative easing. A number of central banks have sought to do more to communicate a likely future path for policy – most notably in the cases of the Federal Reserve and Bank of England, both of which informed market participants to expect low rates until the unemployment rates in the US and UK respectively fell below critical thresholds. But none has gone so far as to make an explicit commitment for a rate of *inflation* above target for an extended period of time, even after recovery has taken hold. The unemployment thresholds used were 6.5 per cent in the US, and 7 per cent in the UK – both of which are still above standard estimates of the ‘natural rate’, or full employment conditions.

One explanation for the disparity between research and practice is that this sort of guidance is time-inconsistent. It requires the central bank to overshoot its inflation target *ex-post*, at a time when the economy may be operating close to full capacity. Since the benefits from acting in such a manner will already have accrued, the credibility of the plan is questionable.<sup>17</sup> Indeed, some policy-makers have gone so far as to suggest that their experiments with forward guidance should not be seen as binding. Speaking in December 2013, during the period when the Bank of England’s forward guidance policy was in operation, one member of its Monetary Policy Committee (MPC) stated: ‘I find it

inconceivable that, without forward guidance, I, or any of my colleagues, would have already voted to raise Bank Rate and that the only thing that has stopped us is forward guidance.’<sup>18</sup> The strong implication is that past commitments are not to be treated as binding.

Another possibility, noted by Campbell et al. (2012), is that to promise high future inflation would violate formal price stability mandates. Indeed, the same policy-maker, Martin Weale, noted that the MPC had been ‘keen to implement forward guidance *in a way which did not take risks with inflation expectations*’.<sup>19</sup> Yet to do so is to undermine the most important mechanism through which the strategy is predicted to work. In this regard it seems that the pre-crisis consensus in favour of inflation targeting has itself generated an institutional bias that prevents more effective stimulus. With the notable exception of the Federal Reserve, most independent central banks have some form of price stability objective as their primary delegated goal; this is true of all states within the EU. The most influential justification for granting independence to monetary policy-makers is, in turn, that doing so ensures a credible commitment to inflation stability. Allowing central banks actively to use inflation as a stabilization tool is not easy to square with an inflation-fighting mandate, and no doubt many central bankers would find it hard to justify to themselves.

From a theoretical perspective, however, it seems important for the literature to take a more practical turn. If legal constraints do indeed rule out inflation promises as stimulus devices, are there other sorts of guidance that could be useful at the zero bound? How far do the potential gains from forward guidance *rely* on the ability of policy-makers to increase inflation expectations? What are the implications for the economy if and when forward guidance is misinterpreted? It would be a shame if a form of intervention that receives wide support among academic macroeconomists were to be discarded because the gap between theoretical assumptions and practical constraints could not be bridged.

A particularly understudied question theoretically is how gains could best be achieved from state-contingent forward guidance – that is, linking nominal interest rates to observed economic outcomes. This is despite the experiments that have been taken with such an approach, and the attention that it has received in policy discussions.<sup>20</sup> Campbell et al. (2012) provide the most detailed analytical investigation. They consider the economic implications of unemployment-contingent rate increases, of the form tried by the Bank of England and the Federal Reserve. Yet their choice both of thresholds and of critical values was relatively arbitrary: why the unemployment rate, and why 6.5 or 7 per cent? In the event the recovery in unemployment in both the US and the UK has been far stronger than the recovery in real output, and this has meant the attempted guidance has proved redundant. It is clear that further experiments with the approach will be limited unless a more coherent case can

be made in favour of specific, implementable rules, and this should be a focus of the literature.

An alternative to state-contingent forward guidance is to promise that nominal interest rates will remain at a specified level over a specified period of time – an approach the Federal Reserve experimented with in 2011 and 2012. Yet as Woodford (2012) has argued, a risk associated with this is that it may be misinterpreted by market participants as a signal that the central bank is more pessimistic about the future evolution of the economy than previously believed. This may in turn induce greater uncertainty about the variables that matter – output and employment – than in the absence of such ‘guidance’. The more uncertain is future income, the higher are the marginal benefits from saving, and the natural rate shock is exacerbated rather than mitigated.<sup>21</sup> Practical measures for ensuring guidance operates as intended ought to be a focal point for future research.<sup>22</sup>

An issue of specific relevance to the Eurozone is the interaction between exchange rate policy and the effects of forward guidance. Corsetti et al. (2011) and Cook and Devereux (2014) have drawn attention to the similarities between the role played by future rate commitments in the canonical Eggertsson-Woodford framework, and the impact on future price expectations of membership of a currency union. Suppose that a small, open economy were to be affected by a negative natural rate shock, of the sort discussed above. So long as demand remains suppressed, the likely effect of this shock is to keep domestic inflation below levels elsewhere. If the country is a member of a currency union, however, the gradual effect of low *current* inflation is to raise consumer beliefs about the rate of price growth that must obtain when normal times return – and domestic prices return closer to the levels of other countries within the union. This high expected price growth is precisely what forward guidance in a closed economy is seeking to engineer. Thus in theory a commitment to be – and remain – a member of a currency union should help in placing a limit on the deflationary consequences of negative natural rate shocks. Of course, an obvious question raised by this research is why southern countries in the Eurozone, in particular Greece, do not appear to have benefitted from this automatic cushion. A likely possibility is that Greece was widely perceived to have had an overvalued real exchange rate prior to the crisis, and thus consumer expectations are far from the point where relatively high inflation is seen as a likely consequence of continued membership of the currency area – quite the opposite.

We end the discussion of forward guidance on a more cautionary note, which has been sounded by the recent work of McKay et al. (2015). These authors emphasize that the overwhelming share of research advocating forward guidance as a normative option has been conducted in New Keynesian models, assuming that financial markets are complete and households are perfectly able

to insure themselves against future income shocks. McKay et al. (2015) instead assume that households face uninsurable, idiosyncratic income risk (the income risk associated with unemployment, for instance), together with credit constraints that limit their capacity to borrow. In such an environment, long-run promises about the level of nominal interest rates once normal times return are dominated by short-run fears about income risk.

More specifically, McKay et al. (2015) show that the usual mechanism by which the economy responds to forward guidance in a complete markets New Keynesian setting is through a reduction in household savings as confidence in the future grows. When there is idiosyncratic income risk, however, the scope for this to happen is more muted. In terms of the Euler condition (10.5), at the household level earnings in  $t + 1$  are substantially more variable than aggregate income,  $Y_{t+1}$ . This variability gives households an incentive to retain a ‘*buffer stock*’ of savings, which they can run down in the event that they are unfortunate enough to draw a low income shock in the future. The sensitivity of this buffer stock to promised changes in future nominal interest rates is generally quite low, and this reduces the scope for forward guidance to work.

It should be stressed that these results remain contingent on the particular experiment considered by McKay et al. (2015). In particular, their paper does not attempt to analyse an *optimal* forward guidance strategy in the manner of Eggertsson and Woodford (2003) or Werning (2012). Thus it is possible that more effective stabilization could be achieved by a policy better tailored to the circumstances. Overall, forward guidance remains the ‘ideal’ strategy for addressing natural rate shocks in the literature, but it remains an open question whether – and how best – its gains can be obtained through clear, practicable policy rules.<sup>23</sup>

#### 10.4.4 *Fiscal Stimulus as a Solution?*

The other major policy option at the zero bound that is given emphasis in the theoretical literature is fiscal stimulus. Numerous papers have shown that the multipliers associated with increased government spending are potentially much larger when the zero bound is binding than during normal times. Eggertsson (2011), for instance, found that if the fraction of government spending in GDP were increased by 1 percentage point, GDP would rise by 2.3 per cent. Similar results go through in the influential paper by Christiano et al. (2011), and Coenen et al. (2012) confirm the point in a meta-analysis of seven influential macroeconomic models, including the ECB’s NAWM model and a version of Smets and Wouters (2007). Importantly, all of the main contributions that take shocks to desired savings as their starting point find that multipliers are substantially higher when the zero bound binds than when it does not.<sup>24</sup>

What exactly is the mechanism at work here? Again it is useful to start from the consumption Euler equation, augmented now for the fact that we must allow for government spending to be a feature of the economy – consuming some of the final output good. This implies that consumption will equal output less government spending:  $C_t = Y_t - G_t$ . Unlike the simpler exposition of forward guidance, we will also now assume that the economy will only recover from the savings ‘shock’ in  $t + 1$  with some positive probability. Thus it is possible that the economy will remain at the zero bound in the future, and be faced with the same policy dilemmas. Policy decisions made today may be mirrored in the future, if the ‘state of the world’ remains bad.

When nominal interest rates are zero the Euler condition will now read:

$$u'(Y_t - G_t) = \beta_t \mathbb{E}_t \frac{1}{1 + \pi_{t+1}} u'(Y_{t+1} - G_{t+1}). \quad (10.6)$$

The basic argument for the effectiveness of fiscal stimulus runs as follows. Suppose that government spending,  $G$ , were increased both in period  $t$  and in all ‘bad’ states of the world in  $t + 1$  – that is, those for which the zero bound remained binding. If consumers’ savings rates have returned to normal by  $t + 1$ , so can government spending.<sup>25</sup> The central policy problem is that when the zero bound binds, output is below capacity. It follows that it should be *technologically* possible to raise  $Y_t$  one-for-one with  $G_t$ , at least for low enough increases in government spending, keeping  $C_t$  constant throughout. Simple resource feasibility is not an issue if demand starts out below productive capacity.

Suppose a joint increase in  $G_t$  and  $Y_t$  of this kind were to happen. If inflation at  $t + 1$ ,  $\pi_{t+1}$ , were to remain unaffected across all states of nature, then by construction Equation (10.6) would remain satisfied. Thus we would have constructed an alternative feasible equilibrium, with aggregate consumption unchanged, but higher output and higher government spending. Whether this is a desirable change ultimately depends on whether consumers value the extra government spending more than the extra resources that are used to produce it. Presumably this is more likely to be true if the higher total output comes from employing workers who would otherwise lack jobs, but in any event it is not a given. Notice that the government expenditure multiplier,  $\frac{dY_t}{dG_t}$  would be exactly one in these circumstances.

What Eggertsson (2011), Christiano et al. (2011) and others *additionally* show, however, is that there will be a beneficial pricing effect from the fiscal expansion. Higher government spending implies higher output, and this in turn puts some upward pressure on firm costs: the labour market will become tighter, for instance, increasing real wages relative to their level without the fiscal expansion. These higher costs will be passed through to consumer prices, meaning that inflation will be higher with the fiscal expansion than without it. Since the higher public spending is expected to last into  $t + 1$  with some

probability – whenever desired savings remain high – the result is a higher ex-ante expected value for inflation at  $t + 1$ . This reduces the real interest rate in period  $t$ , meaning  $C_t$  will also rise, and  $Y_t$  will increase still further with it. Symmetrically, higher expected consumption can be expected in ‘bad’ states at  $t + 1$ , and this further reduces the benefits from saving in  $t$ : in mathematical terms, the value of  $u'(C_{t+1})$  is no longer so high in expectation. This feeds back into still more consumption and output in period  $t$ . The overall consequence is a multiplier,  $\frac{dY_t}{dG_t}$ , that is significantly greater than one. It is not just employment and public consumption that rise – private consumption does so too.

An important lesson from this is that the theoretical case for high multipliers at the zero bound – that is, multipliers in excess of one – relies on an inflation expectations channel. Without the effect of higher  $G_{t+1}$  on  $\pi_{t+1}$ , a rise in  $G_t$  could increase  $Y_t$  but not  $C_t$  – at least in our basic setting. Yet large fiscal stimulus packages seem a very blunt instrument for increasing inflation expectations. It may be the case that *conditional on underemployment*, resources are better used by the public sector than standing idle, but this seems too readily to give up on the idea that output could be restored to the level of productive capacity by other means.<sup>26</sup> Given that the political direction of travel in EU states at present seems to be towards reduced fiscal deficits, the headline results on the multiplier – though important – have perhaps attracted more attention than is now warranted.

### *Fiscal Stimulus in Stressed Economies*

Indeed, a number of authors have highlighted that the benefits to fiscal expansion could easily be undone if the fiscal solvency of the government comes to be questioned – an issue that is of obvious relevance to southern European countries at present. The paper by Corsetti et al. (2013) explores theoretical mechanisms that would generate a spread between the nominal interest rate set by the central bank and the nominal rate that is of relevance to consumer saving and borrowing decisions. Their framework allows for multiple countries and multiple consumers, some of whom borrow and some save.<sup>27</sup> But the essential point can again be made by reference to the Euler equation. The nominal interest rate faced by consumers is now  $i_t^c = i_t + \omega_t$ , where  $i_t$  is again the central bank rate and  $\omega_t$  measures the period- $t$  interest rate spread. This spread is in turn assumed to depend positively on the size of the fiscal deficit: higher deficits raise the interest rate spread, and the marginal effect of the current deficit on the spread is in turn increasing in the existing size of outstanding government debt. Returning to the Euler condition, and assuming that the central bank’s interest rate is zero, we will have:

$$u'(Y_t - G_t) = \beta_t \mathbb{E}_t \frac{1 + \omega_t (G_t - \tau Y_t)}{1 + \pi_{t+1}} u'(Y_{t+1} - G_{t+1}), \quad (10.7)$$

where  $\tau$  is a marginal income tax rate, capturing the idea that the total fiscal deficit,  $G_t - \tau Y_t$ , will tend to rise in recessions due to a fall in tax collection.

If the effect of a higher government deficit on  $\omega_t$  exceeds the effect on future inflation expectations,  $\pi_{t+1}$ , higher government spending will tend to raise real interest rates at the zero bound rather than lower them. This in turn will feed back into a multiplier that is lower than one:  $C_t$  falls when  $G_t$  rises. This can rationalize the notion that countries whose fiscal position is initially strong will benefit from government spending at the zero bound, but countries where the deficit starts at a high level could do better from budgetary discipline instead.

What Corsetti et al. (2013) additionally show is that this sort of framework is conducive to multiple equilibria. Suppose there is a bout of pessimism regarding the future level of output,  $Y_{t+1}$ , in 'bad' states at  $t + 1$ . In general this should raise the incentives to save in period  $t$ , contracting aggregate demand and thus output,  $Y_t$ . Lower output, in turn, implies lower tax revenue, and a higher current budget deficit. This raises the spread, contracting  $Y_t$  still further. If this effect is sufficiently large, the lower level of output can be supported as an equilibrium in all 'bad' states of the world, now and in the future, and this justifies the initial pessimism.

An implication of this logic is that there may be a case for asymmetries across countries in the cyclical properties of fiscal policy. Those that start with a high level of debt are likely to see more responsiveness of interest-rate spreads to the current budget deficit. Other things being equal, they will therefore be more susceptible to self-fulfilling pessimism bouts. Those countries that start with low levels of debt, by contrast, will be far less vulnerable:  $\omega_t$  will respond only slightly to a recession-induced reduction in tax revenues. Thus high-debt economies will be better advised to follow pro-cyclical fiscal policies, contracting spending as the economy shrinks, and thereby mitigating the impact of the recession on spreads. Low-debt economies, by contrast, will benefit from the more conventional expansionary effects of fiscal expenditure at the zero bound analysed by Eggertsson (2011), Christiano et al. (2011) and others.

Corsetti et al. (2013) calibrate their model to the Eurozone economy in 2012, divided into two regions: '*stressed economies*' (Cyprus, Greece, Ireland, Italy, Portugal, Slovenia and Spain), and others. Their results confirm that procyclical fiscal policy for the stressed economies, and countercyclical for the rest, should indeed be sufficient to avoid self-fulfilling bouts of pessimism.

### *Fiscal Stimulus, Tax Evasion and Corruption*

Recent work by Pappa et al. (2015) has considered a further practical dimension to the use of fiscal policy from the perspective of southern European countries. This is how best to choose among different fiscal instruments in economies that are subject to widespread tax evasion. This question is particularly relevant to

Greece and Italy: the shadow economy exceeded 25 per cent of GDP on average in both of these countries from 1999 to 2010,<sup>28</sup> whilst the modalities of fiscal consolidation remain an important issue for both. To what extent should the scope for (a) tax evasion and (b) corruption in the public sector influence the optimal balance to strike between achieving consolidation through tax increases and through government spending cuts?

Pappa et al. (2015) start by presenting empirical evidence that economies with high levels of corruption and tax evasion appear to differ in their responses to tax increases and expenditure cuts, relative to other economies of a comparable size. Tax increases in particular seem to be associated with higher output losses when corruption and tax evasion are high. Italian data on employment in the informal sector additionally indicate that there are important reallocation effects of fiscal policy, with more workers being driven into the '*black economy*' the higher income taxes are.

The authors then construct a theoretical model to rationalize these effects. In their setting, higher taxes have larger negative effects on productivity when evasion is high, because higher evasion implies that an ever-larger burden of any consolidation must fall on the subset of workers that have chosen not to evade taxes. Those in the official sector thus face large tax disincentives to work, and this only serves to increase further the relative merits from working in the informal sector instead – by assumption at a lower level of efficiency. Spending cuts, by contrast, allow for lower taxes that raise consumers' disposable income, and this increases production and employment in the official sector. The presence of corruption in the government expenditure process reinforces the relative merits of expenditure reductions. The multipliers associated with tax-based consolidations are thus far larger than spending-based consolidations.

Of course, these results raise the question of whether tax evasion and corruption ought to be treated as fixed features of the economic landscape, or outcomes that policy has the scope to change. At the time of writing, heavy emphasis is being given to the importance of reducing tax evasion as a means to remedy Greece's fiscal difficulties. There remains an important gap in the macroeconomic literature for thinking through the implications of this for the wider economy. A further issue, central to our wider discussion, is that the analysis of Pappa et al. (2015) does not incorporate a zero lower bound on nominal interest rates. As discussed below, Eggertsson (2011) and Eggertsson et al. (2014) have shown that 'conventional' results about the efficacy of different stimulus instruments can fail to go through at the zero bound, due to the perverse implications that they can have for inflation expectations. Similar logic may well apply in the setting that Pappa et al. (2015) adopt, in which case tax increases may not be so detrimental in the short run. This would be a useful area for further work to explore.

*Government Expenditure or Taxation as an Instrument?*

Returning to the specific problem of providing stimulus at the zero bound, an insightful paper by Correia et al. (2013) suggests an alternative stimulus strategy to the use of headline government spending, based on manipulating consumption taxation. Their main argument relies on the observation that if consumer goods are taxed at proportional rate  $\tau_t^c$  in period  $t$ , the inflation rate in  $t + 1$  will satisfy the following relationship:

$$(1 + \pi_{t+1}) = \frac{1 + \tau_{t+1}^c}{1 + \tau_t^c} (1 + \hat{\pi}_{t+1}), \quad (10.8)$$

where  $\hat{\pi}_{t+1}$  is the rate of inflation in pre-tax prices. If the concern is that inflation in period  $t + 1$  is too low to incentivize consumption at  $t$ , an obvious strategy is to raise  $\tau_{t+1}^c$  relative to  $\tau_t^c$ . This strategy for escaping a liquidity trap had been previously advocated by Feldstein (2002) for the Japanese case. The contribution of Correia et al. (2013) has been to clarify that the policy can go all the way to eliminating the problems caused by the zero bound, provided there are appropriate offsetting changes in other tax instruments. Most notably this means a cut in the labour income tax rate, so that the overall tax burden on workers is unaffected. Importantly, an appropriately-designed policy of this form can be revenue-neutral – the cuts to the labour income tax and the increase in the sales tax offset one another. This seems a substantial advantage in the current European context.

Yet it is vital to this argument that the correct tax instruments should be chosen, with the explicit aim in mind of generating future inflation so as to stimulate current demand. When taxation is used imprudently as a stimulus device, it could have very detrimental consequences – a point highlighted by Eggertsson (2011). Suppose that a government were to try to conduct fiscal stimulus by cutting the marginal tax rate on labour income, in an economy constrained by the zero bound and a high desire to save. The main consequences can again be understood through the Euler condition. For simplicity we can now revert to ignoring government spending in this condition, giving:

$$u'(Y_t) = \beta_t \mathbb{E}_t \frac{1}{1 + \pi_{t+1}} u'(Y_{t+1}). \quad (10.9)$$

Suppose that the income tax rate were to be reduced in period  $t$ , and in all ‘bad’ states of the world in  $t + 1$  – symmetrically to the analysis of higher government spending above. In ‘good’ states at  $t + 1$  outcomes would remain essentially unaffected: there is no change to the income tax rate, and desired savings are sufficiently low to keep the economy away from the zero bound. But in ‘bad’ states – where the desire to save remains high – the incentives for would-be workers to seek employment are higher than they would be without the tax cut. This is likely to put downward pressure on the real wage: the lower

the marginal tax rate, the lower the pre-tax wage that workers will be willing to work for. If the real wage is lower, this will reduce firms' costs, which in turn should put downward pressure on inflation. This will increase the real returns to holding cash in period  $t$ , further contracting aggregate demand so long as  $\beta_t$  remains high.

Again, therefore, any programme for engineering a stimulus when interest rates are at the zero bound must be designed with proper regard to its effects on the real interest rate. Tax cuts that may well be expected to stimulate the economy in normal times could have the opposite effect at the zero bound. It would be particularly harmful, for instance, for policy-makers to take from the Correia et al. (2013) paper the idea that labour taxes should be cut relative to consumption taxes, but to believe that this could be done by cutting labour taxes up front, and waiting until a recovery has 'taken hold' before introducing the offsetting consumption tax increases. At the zero bound, stimulus comes from engineering increases in inflation expectations, and a credible promise that consumption taxes are on the rise can be a very expansionary device.

### *Transfers or Government Purchases?*

An important feature of the 'headline' studies of fiscal multipliers conducted by Eggertsson (2011), Christiano et al. (2011) and others is that government expenditure increases are modelled as increases in government purchases of final goods. Expansionary fiscal policy thus consists of classic 'public works' style projects, directly responsible for generating employment. Yet, as Oh and Reis (2012) have argued, the large wave of fiscal stimulus packages that were rolled out across OECD countries between 2007 and 2009 were dominated by increases in targeted transfers – these comprised 64 per cent of the increase in expenditure in the median case. A large body of empirical work has documented evidence that suggests fiscal multipliers and marginal propensities to consume out of such transfers are large, but the theoretical literature is only gradually providing ways to model this process satisfactorily. The interaction between transfer policy and the zero bound remains particularly understudied.

Recent empirical work provides a strong motivation for more theoretical analysis of the decisions of illiquid households in particular. Studies of the US fiscal stimulus payment episodes of 2001 and 2008 suggest not only that, overall, households spend a non-negligible share of a cash transfer on nondurable goods, but there is significant heterogeneity in consumption responses due to differences in wealth liquidity and the degree of indebtedness of homeowners. Misra and Surico (2014), for instance, find a large propensity to consume out of the US tax rebates among homeowners with high mortgage debt. More generally, the evidence points to large consumption responses from transfer payments. In their study of the 2001 tax rebate, Johnson et al. (2005) estimate the cumulative change in expenditures on nondurable goods during the quarter

of the tax rebate and the subsequent three-month period to be roughly 70 per cent of the amount rebated. Between 20 and 40 per cent of the rebate is spent in the quarter when funds are received. In regard to the 2008 episode, Parker et al. (2013) and Broda and Parker (2014) find that the share of the stimulus payment spent on nondurable goods is large in the quarter in which it is paid out, in line with the estimates for the 2001 stimulus. Furthermore, there is also a significant increase in spending on durable goods.

This US evidence is consistent with analyses of European data – where again there appear important interaction effects with the degree of household liquidity. For instance, Jappelli and Pistaferri (2014) find that the MPC out of rebate cheques in Italy is 0.65 for the lowest cash-on-hand households, and 0.30 for the highest.

The basic difficulty in incorporating these sorts of effects in a theoretical model is that for transfers to have a significant impact, there must be some device for overcoming Ricardian equivalence. In any representative-agent macroeconomic model, higher government transfers to consumers today will raise their tax liabilities in the future, so that total wealth is left unaffected – as are broader economic outcomes. The theoretical research agenda has thus increasingly focused on environments with multiple types of consumers, usually with a subset facing a liquidity restriction of some kind. Transfers can enhance the liquidity of constrained households, and this raises overall aggregate demand. This is the approach taken by Oh and Reis (2012), who argue that transfers operate through two distinct channels. The first, which they label a ‘neoclassical’ channel, is due to the fact that higher transfers imply a redistribution away from more productive workers. This generates a negative income effect, raising the willingness of more productive agents to work, which in turn raises output. The second channel is a ‘Keynesian’ one. Transfers tend to redistribute income from wealthier individuals, whose marginal propensity to save is high, to poorer individuals, whose marginal propensity to save is low. The overall effect is that aggregate willingness to save falls, and aggregate demand is increased. In terms of the discussion above, it is as if the natural rate of interest has increased.

Oh and Reis (2012) thus show that higher targeted transfers can increase private consumption and investment, but they ultimately struggle to generate a fiscal multiplier of the same order of magnitude to those obtained by Eggertsson (2011) and Christiano et al. (2011): they obtain an overall increase in GDP of \$0.06 for every dollar increase in transfers. Yet they do not consider the possibility that aggregate output could be inefficiently low due to the zero bound, and given the nature of their ‘Keynesian’ effect this seems an important extra dimension to consider. When the basic stabilization problem is that the natural rate is too low, transfers ought to be an effective policy device for increasing it.

Another perspective on the transfer issue is provided by Kaplan and Violante (2014). These authors are motivated by the fact that the increases in household consumption observed in response to fiscal stimulus packages are too widespread to be accounted for by the relatively small fraction of low-wealth consumers that are conventionally assumed to be liquidity-constrained in heterogeneous-agent consumption analyses.<sup>29</sup> In their setting, households with a large fraction of their wealth in illiquid assets (such as housing) are labelled ‘*wealthy hand-to-mouth*’: though their wealth is significant, its illiquidity stops the households from using it to smooth their consumption response to economic shocks such as unexpected job loss. Using data from the Survey of Consumer Finances, Kaplan and Violante (2014) document that these households are substantial in number, and their consumption indeed responds significantly to transitory income shocks – their focus being on the 2001 US tax rebates. Again, this was not a period in which the zero bound was binding, and the authors do not consider its potential role in the response of consumption to transfer spending.

Related evidence is provided by Surico and Trezzi (2015), who exploit the unexpected redesign of the municipal tax on residential and nonresidential properties in Italy at the peak of the Sovereign risk crisis (the ‘IMU’ tax) as an effective increase in transfers *away* from households. They find an average 25-cent reduction in spending per euro of tax increase overall, but with vast differences across groups with different degrees of wealth liquidity. The consumption of owner occupiers with a mortgage and just one residential property dropped by 90 per cent of the tax. The effects on richer households – real estate owners with multiple properties – were instead negligible.

#### 10.4.5 *Central Bank Asset Purchases as a Solution?*

The policy area that has arguably seen the most innovation since the crisis is the use of large-scale asset purchases, both by central banks and national governments, to try to influence macroeconomic outcomes. This has taken two forms. First, central banks have experimented with ‘*quantitative easing*’ as a substitute for cuts to nominal interest rates once the zero bound has been reached. This was the justification for the European Central Bank’s decision to embark on a programme of asset purchases in January 2015, mirroring earlier programmes by the Federal Reserve and Bank of England. Second, governments and central banks have shown willingness to buy up problem assets, in attempts to calm erratic movements in financial markets – sometimes known as ‘*credit easing*’. This was the reasoning behind the ECB’s Outright Monetary Transactions programme, announced in August 2012, as well as the US government’s \$700 billion Troubled Asset Relief Programme of 2008. The main distinction between the two approaches is that the first is perceived to be effective even when the

assets purchased are widely perceived to be risk free – effects come from the expansion of the central bank's balance sheet *per se* – whereas the second is specifically targeted at problems associated with risky debt. We will consider both in turn.

### *Quantitative Easing*

What is most remarkable about the widespread experiments with '*quantitative easing*' is the absence of a widely-agreed-upon mechanism through which such a policy should work. Woodford (2012) provides a useful discussion of the main candidates. These are, first, that an expansion of the central bank balance sheet is equivalent to an increase in the money supply, and a higher money supply should – according to various versions of the traditional quantity theory – stimulate an increase in nominal expenditure in the economy, and hence inflation. Higher expected future inflation reduces the current real interest rate, stimulating spending. Second, there is the possibility of a so-called '*portfolio balance effect*'. If central banks purchase large quantities of long-term assets, issuing short-term debt (or money) as a counterpart, the relative scarcity of long-term assets should drive up their price. This lowers the long-term interest rate even whilst the short-term rate is stuck at zero, potentially stimulating investment and current consumption.<sup>30</sup>

Yet both of these arguments encounter conceptual difficulties. The problem with the quantity theory channel is that it is unclear why raising the supply of one zero-interest asset (money) whilst contracting that of another (nominal bonds, which pay  $i_t = 0$  when the zero bound binds) should make any difference to the economic decisions of consumers. The textbook case for a higher money supply raising the price level relies on the idea that consumers wish to hold money only for short-term, transaction purposes. This is because in normal times bonds dominate money in rate of return. Any increase in the money supply can only be absorbed if there is an increase in the demand for money for transaction purposes, and this can occur through an increase in the price level. But if money and bonds are paying an equivalent rate of return, the logic breaks down. A higher supply of money can be absorbed without requiring an increase in transactions demand. This is precisely the case when the zero bound binds. It follows that there need not be any direct pass-through from the money supply to the price level.

The difficulty with the portfolio balance channel comes when trying to square it with modern asset pricing theory, as applied in macroeconomics. Since Lucas (1978) the conventional approach has been to treat financial assets as claims on future consumption, priced according to the present value of this consumption in terms of some numeraire. This delivers asset pricing formulae in which values reflect market outcomes, but do not have a significant role in determining them. The price of long-term assets falls in recessions, for instance, because

demand for future consumption is low relative to current consumption. But these demand patterns follow from production and preference patterns in the real economy, not asset market developments. The result is that the value of any given asset can be determined without knowing its overall net supply. In other words, demand is perfectly elastic. It follows from this that any active intervention to change the relative supplies of short-term and long-term assets ought not to change their prices, nor have any significant impact on overall economic allocations. Wallace (1981) was the first to show the irrelevance of the central bank balance sheet as an instrument in such circumstances.

It should be stressed that this is a far more contingent argument than the case against a quantity theory channel, as it relies on the particular conclusion that the demand for assets should be perfectly elastic. This is a property that is common to all models in which financial markets are ‘complete’, in the sense that all conceivable gains from financial trade are being realized – a convenient assumption for modelling purposes, but hardly a realistic one. A number of authors have therefore built models in which large-scale asset purchases have an impact because of limitations on the set of trades available to consumers and/or financial firms. These can deliver some successes in linking the price of long-term assets to their relative supply. Chen et al. (2012), for instance, explore a setting in which different households face differing restrictions on their capacity to purchase long- and short-term bonds. A contraction in the supply of long-term assets causes a reduction in an assumed ‘transaction premium’ associated with purchasing long-term assets, driving up their price. This lowers the long-term real interest rate. When estimated on US data, they show that the model is capable of delivering some impact on the real economy from large-scale asset purchases, but of a relatively small magnitude. Expanding the Federal Reserve’s balance sheet by \$600 billion should, according to their formulation, have less of an effect on the US economy than a 25 basis point cut in the short-term nominal interest rate (were this available).

Similar stories based on segmentation of the markets for long- and short-term assets are explored in Vayanos and Vila (2009), Harrison (2011), Harrison (2012), and Ellison and Tischbirek (2014). Yet there remains no widely-accepted conceptual approach for understanding why a portfolio balance effect might deliver meaningful stimulus. Woodford (2012) concluded that such a mechanism could *conceivably* be a way for central bank asset purchases to affect the real economy, but that this does not follow from ‘hypotheses that seem likely to be true’. A number of empirical papers have nonetheless found apparent effects of the US and UK quantitative easing programmes on the respective countries’ term premia – suggesting that there is some pass-through from central bank actions to prices in practice.<sup>31</sup> There is a real gap in the policy literature for a model that can rationalize this on the basis of more appealing hypotheses about the functioning of financial markets.

There is a final transmission mechanism for quantitative easing that gains significant support in the empirical literature. This is the so-called ‘*signalling channel*’, by which large-scale asset purchases are found to reduce expected future short-term interest rates. Work by Krishnamurthy and Vissing-Jorgensen (2011), Christensen and Rudebusch (2012), Bauer and Rudebusch (2014) and Lloyd (2015) all find significant evidence of these expectational changes, with Lloyd (2015) attributing 70 per cent of the fluctuations in yield on announcement days to signalling.

It is straightforward to tell a heuristic story that captures this result. Since the work of Clarida et al. (2000), numerous researchers have observed persistence in the nominal interest rates chosen by central banks, in the sense that the interest rate in period  $t$ ,  $i_t$ , satisfies a relationship of the form:

$$i_t = \rho i_{t-1} + (1 - \rho) i_t^*, \quad (10.10)$$

where  $i_t^*$  can be thought of as an optimal nominal rate given current economic conditions alone, and  $\rho$  is a parameter between 0 and 1. What this means is that whenever  $\rho$  is positive, any reduction to nominal interest rates today will imply lower expectations for nominal interest rates over the immediate future – since future policy-makers will inherit a lower lagged rate.

Suppose now that the nominal interest rate reaches the zero bound, so that the central bank is constrained from setting the negative nominal rate that it would ideally like. It may be that it is nonetheless able to convey a signal about its desired rate to market participants through its asset purchase policy. Market participants will infer that the desired nominal interest rate is lower, the larger the asset purchase programme is. If a recursion of the form (10.10) applies not just to the actual rate when the zero bound does not bind, but also to the desired rate when it does, any decision to embark on quantitative easing (QE) provides a signal for the market that desired rates have fallen, and thus to expect the desired short-term rate to remain low for longer. This lengthens the period of time over which rates can be expected to remain at zero, delivering the sort of expectational stimulus implied by forward guidance.

In more practical terms, by taking a decision to embark on an asset purchase programme the central bank generally ensures that the next meeting of its rate-setting committee will debate whether or not to continue with that programme, rather than whether or not to increase nominal interest rates. Policy rates thus remain near zero for longer.

Whether this or some other story best captures the exact dynamic, the very fact that QE may operate principally through a signalling channel is troubling. As Woodford (2012) notes, ‘the signal would seem more likely to have the desired effect if accompanied by explicit forward guidance, rather than regarded as a substitute for it’. The balance sheet of the ECB is increasing at a rate of €60 billion per month at the time of writing, as a consequence of

the quantitative easing programme announced in January 2015. If the principal mechanism by which this will have an impact on the economy is by reducing expectations of future policy rates, there seem far more direct means to the same end – namely forward guidance.

### *Credit Easing*

The alternative form for large-scale asset purchases to take is so-called '*credit easing*', whereby the government or central bank purchases private-sector securities from markets that are widely considered to be malfunctioning. An example from the recent crisis is the Federal Reserve's Term Asset-Backed Securities Loan Facility (TALF), launched in November 2008, under which the US central bank purchased \$71 billion-worth of private-sector securities backed by small business loans, automobile loans, credit card loans and similar. These actions reflected fears of substantial liquidity problems in markets for asset-backed securities following the subprime crisis and collapse of Lehman Brothers. The ECB's Securities Markets Programme (SMP), launched in May 2010, was motivated by similar concerns, though it also allowed for the purchase of public-sector debt as part of its remit.

Unlike quantitative easing, the purpose of these interventions was not to substitute for broader monetary policy operations at the zero bound, but rather to intervene in markets that were suffering from specific malfunctionings. In this regard they could be viewed as following the famous prescription of Bagehot (1873), who advocated central bank assistance to private-sector banks that were illiquid but not insolvent. The twist was that entire markets were perceived to be facing liquidity problems – not just individual institutions.

On one level this could be seen as the 'microeconomic' functioning of the central bank, and thus of little relevance to stabilization policy. But when impaired credit markets are affecting funding conditions for a large share of potential investment projects in the economy, it is clear that there could be wider macroeconomic effects. Gertler and Karadi (2011) consider just such a case. They assume that there are frictions in the private provision of credit to productive investment projects, driven by the fact that financial intermediaries are limited in the leverage positions that they are able to take.<sup>32</sup> This means a large spread can exist between the interest rate paid to households on deposits and the interest rate at which investors are able to obtain funding for projects. The larger this spread, the more productive investment projects are inefficiently curtailed through lack of funding – despite the fact that their expected returns exceed the interest rate households are willing to accept on their savings.

Direct intervention by the central bank can reduce this friction. If the monetary authority promises to conduct direct purchases of asset-backed securities issued by financial intermediaries, it ensures banks have an incentive to create more new loans at the margin: they now know that these loans need not enter on

to their balance sheets, and so will not cause them any difficulties with the maximum leverage ratio. Gertler and Karadi (2011) consider a scenario in which the net worth of financial intermediaries is negatively affected by an exogenous reduction in the quality of the assets they hold, providing them with a need to reduce leverage and restrict loans – an attempt to capture the main features of the subprime crisis. They show that an aggressive policy of credit easing by the central bank is capable of substantially reducing the depth of the associated recession.

One advantage of this policy is that it is not impeded by the zero bound constraint. The higher the price that the central bank pays to buy loans securitized by private-sector banks, the lower the nominal interest rate faced by borrowers. There is no economic reason why the interest rate for borrowers need not turn negative. As discussed above, difficulties come when *savers* face a negative rate, and instead switch to holding cash. The central bank may be losing money on asset holdings that pay a negative nominal return, but this could simply be understood as the price of more effective stabilization. Provided the central bank is only willing to purchase securities backed by real investment projects, the scope for arbitrage should be limited.

Yet Gertler and Karadi's mechanism has received some criticism, since it implicitly grants the central bank greater technological capacity to operate in financial markets than the private sector. The essential point is the following: why should leverage restrictions constrain the ability of private banks to channel funding to borrowers, but not the central bank?<sup>33</sup> Ongoing work by Gaballo and Marimon (2015) explores a channel through which credit easing can have an effect without relying on asymmetries of this form – operating instead through the impact of policy on information about investment conditions.<sup>34</sup> Their framework is one in which firms have a choice between risky and safe investment projects. Because of limited liability, the relative benefits of risky investment increase in the interest rate that banks charge firms. Intuitively, when required repayments are high, it is better to gamble on a high return than to obtain a near-zero profit margin for sure. But the interest rate that banks charge firms to borrow is, in turn, increasing in the perceived riskiness of the investment projects that the firms will embark upon.

Gaballo and Marimon (2015) show that this setting is consistent with the existence of a '*self-confirming*' equilibrium, in which investment is inefficiently risky and output inefficiently low. Banks observe that the typical investment projects undertaken in the economy are risky, and for this reason they only offer high interest rates to borrowers. Borrowers respond to this by selecting riskier projects. A central bank policy of credit easing can '*break the spell*' by making banks willing to offer (and sell on to the monetary authority) lower-cost loans, which in turn incentivize investing firms to embark on safer projects. According to this theory, the role of credit easing is to provide an informational benefit to

the wider market, demonstrating that low-cost loans can indeed be profitable. The private sector lacks the incentives to carry out similar experimentation with low-cost lending given competition in the banking sector, because a successful innovation in lending behaviour will soon be mimicked by rival firms, reducing the profits it delivers. Gaballo and Marimon argue that this mechanism can account for the successes of the TALF in the US. What remains unclear is how far the gains from such a policy are a ‘one-off’ benefit from credit easing, or whether they could provide the basis for an alternative approach to stabilization policy when the zero bound is binding.

#### 10.4.6 *The Benefits and Risks of Structural Reform*

Structural reform is often viewed as a complement to ‘demand-side’ measures – such as fiscal policy or unconventional monetary policy – as an adjustment instrument. The recent paper by Müller et al. (2015), for instance, analyses the role that such reforms could play in the context of the sovereign debt problem facing Europe at present. They predict an interesting nonmonotonic relationship between reforms and the scale of outstanding debt: when debt levels increase from low levels, countries have higher incentives to reform in the face of a recession. This is because reforms speed up recovery. But at high debt levels, reform efforts merely increase the welfare of creditors, without debtor countries gaining much at all. This reduces the incentives to embark upon reforms in the first place.

In the context of the zero bound problem, however, work by Eggertsson et al. (2014) has questioned whether structural reforms would increase the speed of recovery at all. This is based on a very similar argument to that of Eggertsson (2011). The specific measures that Eggertsson et al. (2014) consider are those intended to raise the degree of competition in product and labour markets. In the long run they concur that these are likely to raise output – largely by reducing the inefficiencies that come with market power. In terms of the Euler condition, this is equivalent to an increase in the economy’s productive potential,  $\bar{Y}$ . But again, whether this increase in productive *potential* will be passed through into actual output will depend on its implications for consumers’ desire to save. There are two channels at work. First, the long-run improvement in productivity should give consumers greater confidence in their lifetime income trajectories, reducing their need to save. In terms of the Euler condition, this can be viewed as an increase in expectations of  $Y_{t+1}$  for states of the world in  $t + 1$  that are ‘good’. The implication will be an increase in aggregate demand at  $t$ , and hence in  $Y_t$ .

Against this is the risk of a negative effect operating through expected inflation. Reforms to labour and product markets make it likely that price and wage inflation will be lower, for any given level of current output. If desired savings

remain high at  $t + 1$  – that is, the economic state remains ‘bad’ –  $\pi_{t+1}$  is likely to be lower for any given level of  $Y_{t+1}$ . Intuitively, an increase in productive potential reduces inflation pressure. But once more, lower expected inflation implies a higher real interest rate when the nominal rate is constrained at zero, and this serves to reduce aggregate demand.

Eggertsson et al. (2014) calibrate their model to match salient features of the Eurozone economy, and find that the second of these effects dominates when the zero bound is binding. The long-run implications of structural reforms remain positive: output in reforming countries increases by as much as 5 per cent as a consequence, with positive spillovers additionally felt by the wider region. The short-run consequence, however, is a worsening of the recession.

Fernández-Villaverde et al. (2014) place a slightly different emphasis on a similar result. They show that supply-side reforms can help the economy to emerge from a zero-bound trap, provided these reforms are only implemented *after* the zero bound has ceased to bind. This overcomes the negative pricing effect, so that current demand is affected only by an income effect. Here too, the lesson for policy design is that crucial attention must be given to pricing dynamics. There are beneficial effects to be had from structural reforms, just as there may be from lower labour income taxes, but these can easily be dominated if an effort is not made to offset deflationary consequences.

#### 10.4.7 Empirical Evidence on the ‘Expectations Channel’

Coming in to the crises, very few economies had recent experience of the policy trade-offs implied at the zero bound, of the sort that could be brought to bear on the choice among alternative instruments. It is for this reason that much of the debate has centred around theoretical exercises. Wieland (2014) provides one of the few empirical attempts to understand whether the policy models – particularly the New Keynesian framework – make the right predictions. He studies the observed dynamics of output and inflation at the zero bound, based on a combination of post-2008 data from the US, Eurozone, UK, Canada and Sweden, and post-1995 data from Japan. His motivation is to investigate whether ‘negative supply shocks’ – that is, unanticipated reductions in economies’ productive potential – are expansionary at the zero lower bound. This is one of the counterintuitive predictions that emerges in the New Keynesian framework, and it operates for very similar reasons to those that mean structural reforms can be contractionary. A negative shock to an economy’s productive capacity, such as an earthquake or an oil price shock, will tend to reduce long-run income, and this ought to have a negative impact on aggregate demand. But at the same time there will be a positive effect on expected future inflation so long as the zero bound binds: for any given level of actual output,  $Y_{t+1}$ , a lower level of productive capacity will mitigate disinflationary pressure. Wieland (2014) shows that this pricing effect can dominate dynamics at the

zero bound, causing negative supply shocks to be expansionary, so long as the zero bound episode is expected to last sufficiently long.

The paper then asks whether there is empirical support for this paradoxical outcome. This is of interest beyond the positive question of how best to analyse supply shocks, because the dynamics that cause supply shocks to be expansionary in theory are identical to those that imply structural reform could be contractionary in Europe. Indeed, they constitute the central mechanism in the New Keynesian literature on policy at the zero bound: the interaction between expected future inflation on current aggregate demand. The results of Wieland's study sound a cautionary note. In a first exercise he extracts a data series of international oil price shocks, and shows that these shocks do indeed generate increases in expected inflation, but are nonetheless associated with short-run increases in unemployment and reductions in production – contrary to the prediction that economic activity should expand. A second part of the analysis draws similar conclusions from the economic developments that followed the Japanese earthquake in 2011.

These results certainly present challenges for the New Keynesian framework, though there are different ways to read them. The analysis is complicated by the presence of two simultaneous economic shocks. First, there is a shock to desired savings, which takes the form of a higher value for  $\beta_t$  in Equation (10.4). Second, there is a shock to productive capacity. The overall outcome will depend on whether the income effect of lower capacity dominates the effect due to expected inflation increasing. As Wieland (2014) shows, this hinges on which of the two shocks will have a longer duration. The supply shock is only guaranteed to be expansionary if its duration is known to be shorter than the shock to desired savings. More generally, the theoretical predictions can go either way. Wieland's data have not falsified the inflation expectations channel per se – just the contention that this channel ought to dominate the effects of oil price shocks and earthquakes on the macroeconomy.

Complementary to this work is the paper by Bachmann et al. (2015). These authors use US micro data to examine the link between expected inflation and consumers' willingness to spend on durable goods. During 'normal' times, when the zero bound does not bind, they find no significant relationship – though this can easily be explained by the fact that monetary policy responds endogenously to higher inflation, preventing the real interest rate from being significantly affected. More worryingly for the theoretical literature, the data do point to a significant *negative* effect of inflation expectations on durables spending when interest rates are constrained at zero. This is the opposite of what theory would predict, as lower future inflation should lower the relative benefits to holding cash.

Ongoing work by Bahaj and Rendahl (2015) partially reinforces these conclusions. Using data from the US Survey of Professional Forecasters, these authors study the role of inflation expectations in the macroeconomic

transmission of fiscal policy. As discussed above, the New Keynesian mechanism adopted by Eggertsson (2011) and Christiano et al. (2011) posits that higher spending is associated with higher future inflation, which reduces the *ex ante* real interest rate and raises current output more than one-for-one with the increase in  $G_t$ . Bahaj and Rendahl instead find evidence that unanticipated increases in government spending are associated with *decreases* in inflation. This means that the inflation expectations channel works against stabilization: the real interest rate is higher when future government spending is expected to be higher. Consequently, Bahaj and Rendahl show that the fiscal multipliers would be higher without the inflation expectations channel. Unlike Wieland (2014), these results do rely on data from periods when the zero bound was not binding, and for this reason they cannot be viewed as a direct contradiction to the New Keynesian mechanism. It is possible that expectations react differently during a liquidity trap, due to the role of monetary policy counteracting any fiscal stimulus. Nonetheless, strong evidence in favour of the New Keynesian mechanism remains notably absent.

Given the central role of inflation expectations in the policy conclusions surveyed above, this is an area where further contributions are urgently needed. If it is the case that changes in inflation expectations do not deliver large inducements to spend, or if the empirical relationship between real economic developments and inflation expectations departs from the New Keynesian model, conclusions ranging from the size of the fiscal multipliers to the role of forward guidance will need to be rethought. This would not rule out the possibility of, for instance, fiscal multipliers being higher at the zero bound than during normal times, but it may have very important implications for the appropriate ranking of policies. When the inflation expectations channel is weak, forward guidance in particular does not appear such a useful option.

## 10.5 Policies and Diagnoses of the Crisis

In keeping with the bulk of the literature, our analysis so far has assumed that the main reason for nominal interest rates reaching their zero bound is an exogenous increase in the willingness of consumers to save. This is often interpreted as a reduction in the ‘natural’ real rate of interest that equates aggregate savings and aggregate investment in the economy, but it is unclear what economic phenomenon could be driving such a drop. A more recent literature has sought to account for this development in a more detailed manner.

### 10.5.1 What Causes ‘Savings Shocks’?

Work by Guerrieri and Lorenzoni (2015) has formalized the idea that large increases in aggregate net savings rates could be driven by a need for households

to deleverage when faced with a tightening of their borrowing constraints. They take as their motivation the detailed evidence of Mian and Sufi (2011), who showed that a contraction in the borrowing capacity of US households in the wake of the subprime crisis, mainly driven by declining house prices, was largely responsible for the large fall in US consumer spending in 2008–2009.

Guerrieri and Lorenzoni (2015) highlight that if consumers face uninsurable income risk, an unanticipated reduction in their borrowing capacity affects far more households than the fraction whose borrowing is directly required to fall to meet the limit. This is because a precautionary motive tends to drive the net asset position of households above its lower limit, so that when a worker is laid off there will remain some scope to incur extra borrowing (or run down savings) and prevent consumption from falling one-to-one with labour income. This additional precautionary motive provides precisely the increase in desired savings that was proxied above by increases in  $\beta_t$ . The consequence is a lower equilibrium real rate of interest. If nominal rigidities additionally mean that the zero bound matters, Guerrieri and Lorenzoni (2015) show that a reduction in borrowing capacity associated with a 10 per cent fall in the economy-wide debt-to-GDP ratio will induce a drop in output of the order of 1 to 2 percentage points. Effects can be much larger if the model is expanded to allow for durable goods and variable credit spreads.

Similar logic has been applied by Eggertsson and Krugman (2012) in a model that abstracts from the insurance motive for saving. They focus instead on a setting where some consumers are simply more impatient than others, and seek to borrow as a consequence. The imposition of tighter borrowing constraints again raises the effective level of desired savings in the economy as a whole, but it does more than this. Eggertsson and Krugman work in a setting with nominal debt, and this allows for changes in the current price level to affect spending, independently of the expectations channel – a ‘Fisherian’ debt deflation effect. The argument can be seen heuristically by considering the budget constraint of a typical household:

$$p_t C_t + B_{t+1} = (1 + i_{t-1}) B_t + p_t Y_t, \quad (10.11)$$

where  $p_t$  is the nominal price level and  $B_t$  is the quantity of nominal assets that the household carries forward from  $t$  to  $t + 1$ . In addition to this, a borrowing constraint limits the expected *real* value of debt that the household will be scheduled to repay at  $t + 1$ . This can be treated as placing a lower bound on the value of  $\frac{B_{t+1}}{p_t}$ :

$$\frac{B_{t+1}}{p_t} \geq -D, \quad (10.12)$$

where  $D$  is some positive value, capturing the household’s long-run capacity to repay its obligations.

Suppose that the household enters period  $t$  with outstanding nominal debt, so that  $B_t$  is negative. The maximum level of consumption available to it in  $t$  will be given by substituting (10.12) into (10.11), assuming the inequality is binding:

$$C_t = D + Y_t + (1 + i_t) \frac{B_t}{p_t}. \quad (10.13)$$

If the zero lower bound binds in  $t$  and  $Y_t$  is below full capacity, a mechanistic fall in consumption must follow. The additional effect that Eggertsson and Krugman highlight is that unexpectedly low output in  $t$  generally implies a low value for  $p_t$ , relative to past expectations. This raises  $\frac{B_t}{p_t}$  in absolute value, and since  $B_t < 0$  this in turn implies a further fall in consumption. The result is that households who are borrowing-constrained reduce their consumption more than one-for-one with the fall in their incomes. The only way for aggregate demand to be restored to the level of productive potential would be for unconstrained households to run down their savings, but with the real interest rate kept high by the zero bound there is no policy scope to engineer this.

Thus the impact of borrowing limits on the analysis of stabilization policy is twofold. First, they provide a possible explanation for the ‘natural’ rate of interest in the economy falling: as credit conditions worsen, mechanistic and precautionary motives drive would-be borrowers to accumulate assets instead. Second, they suggest policy-makers should be concerned about falling prices not just to the extent that these imply lower expectations for *future* inflation, but also for the impact on current debt repayments. Eggertsson and Krugman (2012) show that this second implication has important knock-on effects for the merits of expansionary fiscal policy. As we saw above, in the influential studies by Christiano et al. (2011), Eggertsson (2011) and Werning (2012), fiscal policy was particularly effective at the zero lower bound because it raised expectations of inflation – thus lowering the real interest rate. With nominal debt constraints, higher government spending can have additional beneficial effects by mitigating current price falls, keeping the value of outstanding debt more manageable in real terms. Eggertsson and Krugman show that this effect can imply a significant reduction in the length of time that the economy spends at the zero bound.

Other papers have sought to embed these mechanisms in large models of the economy, so as to conduct more realistic policy experiments. Notable is Benigno et al. (2014), who study the optimal conduct of monetary and fiscal policy in a generalized version of the Eggertsson-Krugman setting. They consider the best response to an unanticipated requirement for borrowers to deleverage, and show that an optimal strategy should induce a high initial inflation rate, gradually falling back to target from above. Again, this serves both

to lower the real interest rate through its effect on  $\pi_{t+1}$ , and to deflate the real value of outstanding debt. The effect of the latter is to reduce net savings incentives, and thus raise the natural rate of interest, relative to an inflation-targeting policy regime.

Importantly, optimal policy in the Benigno et al. (2014) setting is qualitatively different from a case in which the natural rate of interest is exogenous, as in the original contribution by Eggertsson and Woodford (2003). There, it is best to promise above-target inflation after the exogenous negative shock to the natural rate (positive shock to  $\beta_t$ ) has disappeared, but not before. This suggests some care should be taken in interpreting optimal policy results from papers that treat the natural rate as exogenous. Few observers would attribute the fundamental cause of Europe's current weakness to a psychological shift in preferences towards saving – though higher net savings rates may have followed from disruption in financial and real estate markets. More work is needed to understand exactly what the mechanisms driving a reluctance of consumers to spend are, and how best to overcome them.

### 10.5.2 *The Possibility of Secular Stagnation*

Yet even when allowing for these richer explanations for 'savings shocks', there is a growing concern in the literature that an account of low equilibrium interest rates dependent on *shocks* to the natural rate is, by its very nature, too temporary. As highlighted above, the nominal interest rate has now been near zero for more than six years in the US and much of Europe, and for around two decades in Japan. It is extremely hard to account for such long-lasting episodes by reference to a transitory disturbance, whether a deleveraging process or a short-term shock to individuals' willingness to save. The challenge that the incipient secular stagnation literature is attempting to meet is how to explain long-lasting liquidity traps.<sup>35</sup>

The central secular stagnation thesis is that a binding zero bound can be explained by long-term ('secular') downward pressures on the equilibrium real rate of interest, rather than transitory shocks. Among the candidate explanations for this downward trend are: (1) a lower population growth rate; (2) a permanent tightening of credit conditions; (3) a decline in the relative price of investment goods; and (4) a decline in the relative supply of safe assets. The paper by Eggertsson and Mehrotra (2014) treats the first three of these, whilst the work by Caballero and Farhi (2015) addresses the fourth. In both cases the modelling approach departs from the common assumption of infinitely-lived consumers, in order to allow for meaningful variations in consumers' demand for assets over the life cycle.

Eggertsson and Mehrotra (2014) consider a simplified economy in which individuals belong to three distinct generations: young, middle-aged and old.

Knowing their income will be higher in later life, the young have an incentive to borrow to finance their initial consumption. Middle-aged consumers repay these early loans, and save for retirement. For simplicity it is assumed that the old leave no bequests.

An implication of this structure is that at any given point in time there will be a meaningful credit market. Middle-aged consumers seek profitable investment vehicles for their savings, whilst young consumers look to borrow. Firms may also borrow to carry out capital investment projects. The main results that Eggertsson and Mehrotra obtain really hinge on changes in the relative importance of these groups in the savings and loans market. A reduction in the population growth rate, for instance, has the effect of reducing the total demand for funds from the young. This corresponds to a reduction in investment opportunities for middle-aged savers, and – in line with the logic of intertemporal substitution captured by the Euler condition – the equilibrium response of the market real interest rate is to fall. This contracts the supply of loanable funds in line with the lower demand.

A tightening of credit conditions has a similar effect. The assumption is that young consumers face limits on their ability to borrow against their future earnings, due to a lack of collateral. A tightening of lending conditions implies a reduction in the quantity of funds they are able to borrow at any given point in time, without significantly influencing the desire of middle-aged workers to save.<sup>36</sup> The same consequences play out, pulling down the equilibrium real rate.

The contrast here with deleveraging shocks of the Eggertsson and Krugman (2012) or Guerrieri and Lorenzoni (2015) form is instructive. In both of these cases a tightening of credit conditions only necessitated a temporary adjustment in consumers' borrowing and savings patterns. In the case of Guerrieri and Lorenzoni (2015), for instance, consumers were required to build up a higher '*buffer stock*' of savings to elevate themselves sufficiently above their new, tighter borrowing limits. With this accumulation completed, the real interest rate could be restored close to its prior equilibrium level. Credit constraints in the Eggertsson and Mehrotra setting, by contrast, imply a permanent reduction in the demand for funds on the part of the young. There is no endogenous dynamic that gradually mitigates the effect of the tighter constraints on the savings market, akin to the gradual building up of assets in Guerrieri and Lorenzoni (2015).

Finally, Eggertsson and Mehrotra (2014) show that a fall in the relative price of investment goods pushes the equilibrium real interest rate down. The basic idea here is that if investment goods are cheaper, a given quantity of real capital investment will absorb a lower stock of savings, again leaving a glut that must be accommodated by a lower real interest rate. Eichengreen (2015) has highlighted a significant fall in the relative price of investment goods in the

US at least since the 1980s, making this an important candidate explanation for what has occurred.

An important policy implication of Eggertsson and Mehrotra's work is that an exogenous increase in the demand for loanable funds can be a way to restore equilibrium at a positive real interest rate in the savings and loans market. This is notable because precisely such a role can be provided by government debt. If the public sector expands its borrowing requirements at the same time as demographic, credit market or investment price factors cause the demand for funds elsewhere to fall, this may be enough to stop the zero bound from binding. Since around 2010 there has been a very noticeable shift in government attitudes towards fiscal policy, away from the stimulus injections of the early post-crisis years and towards fiscal consolidation and debt reduction. If Eggertsson and Mehrotra are correct in their account of low real interest rates, this may have been a very significant error.

A similarly stylized approach to the problem of low real interest rates is provided by Caballero and Farhi (2015). These authors construct a model with a sharp distinction between 'safe' and 'risky' assets, the former constructed by 'tranching' the losses on an underlying risky prospect. They allow for a corresponding binary distinction between risk-neutral and (extremely) risk-averse savers,<sup>37</sup> with the risk-averse only willing to hold safe assets. Caballero and Farhi (2014) provide evidence to suggest that the supply of safe assets dropped significantly in the US from 2007 to 2011, and this is the underlying motivation for analysing a similar contraction in their full model. They focus their analysis on long-run steady states, and show that the safe and risky real interest rates must depend on the size of the two groups in the population, relative to the supplies of safe and risky assets.

When the supply of safe assets is low relative to the share of risk-averse savers, some mechanism must prevent excess demand for safe assets. The equilibrium outcome that would usually ensure this, according to Caballero and Farhi's model, is for risk-averse savers to end up holding a relatively low share of total wealth in the economy. This arises in the long run when there is a low average rate of return on safe assets relative to risky, meaning risk-neutral savers earn a premium – and come to be the largest source of asset demand.

Yet, as Caballero and Farhi show, this mechanism may rely on the real interest rate on safe assets turning negative. When this is not possible, because of a zero bound, some 'disequilibrium' dynamic must play out: the demand for safe assets from risk-averse savers will otherwise exceed its supply. In the usual Keynesian tradition, the authors allow for total output to play the role of adjustment, in lieu of a price channel. A permanently low production level arises, at the level where incomes of all agents have fallen by enough to choke off the excess safe asset demand. Caballero and Farhi show that in these circumstances a quantitative easing policy may be successful, in contrast with the usual

irrelevance results. This is because QE can increase the relative supply of safe assets available to savers, thus raising the output level at which their safe asset demand equals safe asset supply (at a zero real interest rate).

It is indicative of the early character of the secular stagnation literature that both of the papers surveyed here remain very stylized exercises, and it is unclear how far their insights can be generalized. In the case of Eggertsson and Mehrotra (2014), a possible objection to the model is that it cannot explain how a permanent zero (or negative) real interest rate can coincide with perpetual assets, such as land. When future income is negatively discounted by the market, such perpetuities ought to be of infinite value. Either their model must be one in which stagnation is secular but still temporary – a perfectly reasonable hypothesis – or there are some risk factors affecting ‘perpetual’ assets that are outside of their model. In the case of Caballero and Farhi (2015) the modelling device used to generate relative asset demands is deliberately tailored to ensure changes in the risky interest rate cannot entice risk-averse savers to place some of their savings in these instruments. This may be justifiable if regulatory constraints limit risky investments, but it seems an important restriction to relax if their analysis is to fit into larger macroeconomic models. These are promising starts, but there is much work to be done if secular stagnation is to become established as a central macroeconomic phenomenon of our age.

### 10.5.3 *Dynamic Interactions through the Labour Market*

A small but growing literature has emerged since the crisis reinvestigating the fundamental role played by aggregate demand in macroeconomic models, and particularly the possibility that aggregate production may be impaired because of demand-side confidence crises or excessive uncertainty about the future. Much, though not all, of this work is based around the idea that search frictions may impede the functioning of goods or labour markets, with wider macroeconomic implications.<sup>38</sup> Perhaps more fundamentally, the literature divides between papers that allow self-fulfilling bouts of pessimism to generate recessions by themselves – suggesting policy could have a useful coordinating role – and papers that instead emphasize the *amplification* role for uncertainty and search frictions, given an exogenous disturbance to the economy. Examples of the former type include Farmer (2013, 2014), Chamley (2014), Kaplan and Menzio (2015), Michaillat and Saez (2015), and Heathcote and Perri (2015).<sup>39</sup> Examples of the latter include Ravn and Sterk (2013), den Haan et al. (2014) and Rendahl (2015). The last of these places particular focus on amplification effects due to the zero lower bound, and how an expansionary fiscal policy can best exploit these. This makes it of particular interest in the present context.

The main point made by Rendahl (2015) is again well understood by reference to the Euler condition, with the zero bound imposed:

$$u'(Y_t) = \beta_t \mathbb{E}_t \frac{1}{1 + \pi_{t+1}} u'(Y_{t+1}). \quad (10.14)$$

Suppose, as before, that some shock causes an increase in consumers' desire to save – that is, a higher value for  $\beta_t$ . To keep matters as simple as possible we can imagine that this shock will last only for the current period. In  $t + 1$  a return to 'normal times' is guaranteed. If  $\pi_{t+1}$  were to equal some target value  $\pi^*$ , and  $Y_{t+1}$  equal to a full capacity output level  $\bar{Y}_{t+1}$ , we would be back to the starting point for our discussion:  $Y_t$  is determined by the demand side of the economy alone, and will generically be below  $\bar{Y}_t$ . The dynamic that Rendahl (2015) emphasizes is that if  $Y_t$  is below  $\bar{Y}_t$ , fewer unemployed workers will find jobs in period  $t$ , and some existing hires will be laid off. These additional unemployed workers will take time to find new jobs, and many will not have been successful in doing so by the time the liquidity trap has ended (here, period  $t + 1$ ). If this is true, the 'full capacity' level of output in  $t + 1$  will itself be reduced by the fact that there is an abnormally large pool of unemployed workers, not yet matched to an appropriate job. Heuristically, it is as if  $\bar{Y}_{t+1}$  is given by a weighted average of  $Y_t$  and some fixed, steady-state output level  $\bar{Y}$ . This reduction in expected income at  $t + 1$  raises the marginal benefits from saving still further, worsening the initial unemployment problem. The end result is a more substantial recession than would be predicted if the labour market were neglected.

As in the paper by Eggertsson and Krugman (2012), the addition of this extra recessionary dynamic strengthens the benefits from expansionary fiscal policy. A higher level of government spending does not just put upward pressure on inflation at  $t + 1$ : it additionally increases the total level of hiring in period  $t$ , and this means that the labour market will have far less slack once the liquidity trap has been exited. This means workers in period  $t$  are much more confident about their prospects for  $t + 1$ , and this reduces their overall desire to save – through a fall in  $u'(Y_{t+1})$ . Rendahl (2015) shows that the government spending multiplier can be well above 1 for conventional calibrations of the model's parameters – implying that consumption indeed rises as government spending increases.

Given the dependence of Christiano et al. (2011) and Eggertsson (2011) on an inflation expectations channel to generate large fiscal multipliers, and given that clear evidence for this channel at the zero bound remains elusive, Rendahl's results are an important contribution. There is a vast empirical literature on the size of the fiscal multiplier, some of which finds that output increases more than one-for-one with government spending, some of which points to a smaller response.<sup>40</sup> If it is the case that higher government spending raises aggregate consumption, but this does not operate through an inflation expectation channel,

an important open question is why it does occur. Dynamic propagation through the labour market seems an important possibility. Moreover, the precise reason for fiscal expenditure's effectiveness could have important implications for the way policy should be conducted – and, indeed, whether government spending is the best instrument to use at all. If the main purpose of a stimulus policy is to raise inflation expectations, government spending would seem a very indirect means to achieve this. A promised increase in future consumption taxation, as proposed by Correia et al. (2013), is a far more targeted instrument. If instead the purpose is to sustain employment and prevent unnecessary separations in the labour market, public spending could be much better suited to the job.<sup>41</sup>

#### 10.5.4 Deflation Traps, Self-Fulfilling Dynamics and Equilibrium Selection

For all that there are substantial differences in the theoretical treatments of the zero bound discussed so far, they share one common methodological thread. The basic thought experiment is that some exogenous shock has forced the 'natural' rate of interest in the economy to be lower than normal, and this implies there is no equilibrium such that  $i_t > 0$ , future inflation and output are at their target levels, and a current recession is avoided. But it has long been recognized that 'fundamental' shocks of this kind might not be the only cause of a zero bound episode. Influential work by Benhabib et al. (2001) highlight the risk of self-fulfilling 'deflation traps'. The basic mechanism works as follows: Suppose that, for some reason, consumers are pessimistic about the future state of the economy, expecting a low level of output and inflation at  $t + 1$ . *By itself* this will tend to imply a low level of current demand, as both forms of pessimism should increase the benefits to current consumers from saving. Without the zero bound this should not be a problem: the nominal interest rate can be cut sufficiently far to raise demand by an offsetting amount.<sup>42</sup> When the zero bound interferes with this policy, however, there is no means left for stimulating aggregate demand. The economy could be forced to stay at a lower level of output and inflation, both now and in the future. This justifies the initial pessimism.

Benhabib et al. (2001) show that if the central bank followed standard feedback rules when setting nominal interest rates, there were two possible long-run inflation rates that could rise.<sup>43</sup> The first was the central bank's target rate  $\pi^*$ , implying a nominal interest rate  $i^*$  that satisfies the Euler equation:

$$u'(Y^*) = \beta \frac{1 + i^*}{1 + \pi^*} u'(Y^*), \quad (10.15)$$

where  $Y_t = Y_{t+1} = Y^*$  is the level of output associated with this long-run equilibrium. This collapses simply to:

$$\beta^{-1} = \frac{1 + i^*}{1 + \pi^*} \quad (10.16)$$

which is a version of the well-known Fisher equation – linking expected inflation and the nominal interest rate to the real interest rate, here  $\beta^{-1}$ .

The second alternative long-run inflation rate,  $\tilde{\pi}$ , will satisfy the same Euler condition, but with  $i = 0$ . This implies:

$$u'(\tilde{Y}) = \beta \frac{1}{1 + \tilde{\pi}} u'(\tilde{Y}) \quad (10.17)$$

where  $\tilde{Y}$  is the level of output associated with this long-run equilibrium. Again, this simplifies:

$$\beta^{-1} = \frac{1}{1 + \tilde{\pi}} \quad (10.18)$$

Provided consumers are somewhat impatient, preferring current consumption to future, we will have  $\beta^{-1} > 1$ . This implies  $\tilde{\pi} < 0$ : there is deflation at a rate equal to the steady-state real interest rate. According to some analyses, this may be desirable. It is consistent with the famous ‘*Friedman rule*’ that stipulates that the opportunity cost of holding money,  $i$ , should optimally be driven to zero.<sup>44</sup> This derives from a view that money matters because it adds an extra dimension to households’ portfolio choice problems. Purchasing goods requires holding cash in advance. If holding cash means foregoing interest on alternative assets, consumption demand will be negatively affected by this. Driving the nominal interest rate to zero is a way to iron out this needless inefficiency.

Against this, however, is the New Keynesian approach linking inflation rates to output, and overall economic efficiency. Broadly speaking, this posits that a positive relationship will exist between the steady-state inflation rate in an economy and the steady-state level of production. Thus deflation equal to  $\tilde{\pi}$  could only occur if  $\tilde{Y} < Y^*$ . This derives from an explicit link between firms’ price-setting decisions and the aggregate state of the economy. If output is below its full capacity level, wage pressure in the economy will be low, limiting firms’ marginal costs and causing price-setters to exercise restraint. High output, by contrast, drives up real marginal costs and the prices of those firms that reset. Instead of low inflation causing high money holdings and high consumption demand, it is inefficiently low output that causes low inflation (or deflation).

This self-fulfilling dynamic has particular appeal in accounting for recent trends in Europe and beyond, because it implies that the nominal interest rate should remain at zero for an extended length of time. The ‘fundamental’ story, with the exception of the secular stagnation literature, assumes interest rates must fall to equilibrate domestic savings and investment, given an increase in consumers’ intrinsic readiness to save. But there is a limit to how long desired savings can be expected to remain high. If the shock to savings rates is ultimately driven by a tightening of borrowing constraints, as analysed by Eggertson and Krugman (2012), Benigno et al. (2014) and Guerrieri and Lorenzoni

(2015), it will take some time for the economy to adjust to the more restrictive credit conditions, but this dynamic should last no longer than a few quarters. This contrasts with the practical experience of Japan in particular, where nominal interest rates have been at or near zero since 1995. The experiences of the UK, US and Eurozone, where rates have been very close to zero since 2009, are likewise becoming difficult to account for by the ‘fundamental’ approach.<sup>45</sup>

If the reason for nominal interest rates being at zero is simply that consumers and firms are pessimistic, expecting low inflation (or deflation) and low output in the future, there is no reason to believe that this should be a short-term outcome. Indeed, it is precisely an expectation that the deflationary trap will persist that causes it to arise in the first place. The longer nominal interest rates remain at or close to zero in major developed economies, the more it seems possible that the underlying problem is a confidence trap, not a shock to the natural rate.

Crucially, the monetary policy options for escaping from this sort of trap are limited, even via forward guidance. Low current output is caused by a self-fulfilling perception that there will be low future output and inflation. This is not easily overcome by issuing the sort of policy promise that Eggertsson and Woodford (2003) advocate – that is, to raise inflation above its target value for an extended period of time even after ‘normal’ times have returned. Such an approach does not address the central confidence problem, which is that consumers do not believe circumstances *will* return to normal with a sufficiently high likelihood any time soon. In addition, the relationship between stimulus policy and pessimism about future economic outcomes may not be a straight-forward one. It is quite possible, for instance, that an announcement of unconventional forward guidance policy by the central bank may reinforce a belief on the part of consumers that deflation will persist.

Recent work by Mertens and Ravn (2014) has investigated whether fiscal policy offers a viable alternative for expanding the economy in such circumstances. In particular, they investigate whether fiscal multipliers ought to be as large when the main economic problem is a pessimism crisis, as they are when the problem is that the natural rate is too high. They show quite the opposite.<sup>46</sup> Provided the fiscal expansion does not alter the likelihood of the confidence trap persisting, higher government spending at the zero bound will tend to be deflationary, and output will increase less than one-for-one with the increase in government spending. Their setting is a little more complex than the original analysis of Benhabib et al. (2001), as they allow for the evolution of confidence in the economy to be random – meaning that a current pessimism crisis always has some probability of ending tomorrow. Again, the result is best seen by reference to the Euler condition:

$$u'(Y_t - G_t) = \beta \mathbb{E}_t \frac{1}{1 + \pi_{t+1}} u'(Y_{t+1} - G_{t+1}). \quad (10.19)$$

Suppose that there is a commitment to increase government spending for as long as pessimism – and thus a zero nominal interest rate – persists. As in the case of natural rate shocks, a good starting point for analysing the consequences is to suppose that  $Y_t$  increases one-for-one with  $G_t$ , leaving the marginal utility of consumption unaffected. If this were to happen, the higher value for  $Y_{t+1}$  in ‘bad’  $t + 1$  states would tend to put upward pressure on  $\pi_{t+1}$ , as firms are faced with a comparatively tight labour market. This is familiar: it was precisely this effect that generated a higher fiscal multiplier when the zero bound episode was driven by a shock to the natural rate, as higher  $\pi_{t+1}$  implies a lower real interest rate in  $t$ . But in the present setting it is not possible for  $\pi_{t+1}$  to increase without undermining the confidence trap. The very reason that output is below its efficient level is that there are expectations of substantial future deflation. The only way to make sure that the confidence trap persists is for output to increase less than one-for-one with government spending. This will reduce the inflationary pressure at  $t + 1$ , though it will also imply that aggregate consumption,  $Y - G$ , will fall in both periods.

For very similar reasons, Mertens and Ravn additionally show that supply-side policies such as cuts in labour income tax rates should be expansionary, where they are contractionary under natural rate shocks. This is because lower marginal tax rates in future periods raises workers’ willingness to find jobs, putting downward pressure on inflation. The confidence trap now needs a higher output level to be consistent with deflation at the required rate.

Thus the deflationary effects of fiscal spending obtained by Mertens and Ravn (2014), as well as the low multipliers that are associated with them, follow quite subtly from the exercise they conduct. They ask what the effects of fiscal policy would be were the economy automatically to adjust to that fiscal policy, so as to leave the confidence trap intact in all states of the world where it previously existed. What this does not address, therefore, is the possibility that expansionary fiscal policy could itself reduce the likelihood of pessimism persisting. When the logic behind the Mertens and Ravn result is considered, this seems an intuitive alternative: their model predicts that output will adjust to remain consistent with (unchanging) sentiments, rather than changing sentiments being an important driving force behind output adjustment. The latter possibility has some recent empirical support: Bachmann and Sims (2012) show that at times of economic slack, fiscal expansions tended to have important positive effects on consumer confidence – in contrast with the negative effects implicit in Mertens and Ravn (2014).

To summarize, it seems ever more plausible that Mertens and Ravn (2014) are drawing attention to the relevant *problem* for stabilization policy. Interest rates have been at or near zero for so long, particularly in Japan, that the notion of a natural rate shock is harder and harder to endorse. A pessimism crisis seems a sensible alternative way to rationalize the zero-bound episode. Where further work would be of great use is in clarifying the complex relationship that exists

between changes in policy and the state of expectations. This is an intrinsically difficult issue, with theory providing very little guidance. By their nature, self-fulfilling crises occur for no reason other than that they do. Additional empirical work building on Bachmann and Sims (2012) seems the obvious direction to take.

An alternative multiplicity argument is explored in ongoing work by Brendon et al. (2015). These authors take as their starting point the observation that potential output,  $\bar{Y}$ , has proved very difficult to measure in many developed economies since the crisis. This matters for monetary policy, because interest rates must generally be set based on some estimate for how much inflationary pressure is implied by the ‘output gap’,  $Y - \bar{Y}$ . If potential output is unknown, or measured only with great uncertainty, policy-makers may instead look to an alternative measure of current economic conditions, such as the growth rate.

What Brendon et al. (2015) show is that this can be a dangerous strategy, given the zero bound constraint. Suppose there were a collapse in output in period  $t$ , driving the nominal interest rate to the zero bound in response. At some point a recovery will follow, during which output grows back to trend. But if monetary policy is designed to feed back on growth rather than the output gap, this recovery will immediately induce policy tightening, which in turn will put downward pressure on the rate of inflation. When growth feedback is sufficiently high, the result is that consumers in  $t$  can reasonably expect low future inflation, conditional upon a collapse in  $Y_t$ . This means the real interest rate in  $t$  will be high, conditional upon a collapse in  $Y_t$  – given that  $i_t$  is constrained at the zero bound. A high real interest rate is enough to cause the collapse in output in the first place.

In an empirical exercise based on an estimated model of the US economy with housing and leveraged borrowing by some consumers,<sup>47</sup> Brendon et al. (2015) show that the likelihood of exposure to this form of crisis is around two-thirds, given the observed strength of policy feedback. When interest rates respond to an estimate of the output gap rather than output growth, the likelihood of exposure instead falls below 10 per cent. The main lesson is broader though: if monetary policy-makers give the impression that large recessions will cause them to revise downwards their future estimate of ‘full capacity’ output, this can reinforce a state of pessimism that drives the economy to collapse in the first place.

A final important paper on the problem of equilibrium selection at the zero bound is Cochrane (2015). This work revisits the standard framework of Eggertsson and Woodford (2003), in which the zero bound binds because of an exogenous increase in consumers’ desire to save – that is, a high value for  $\beta_t$  in the Euler condition:<sup>48</sup>

$$u'(Y_t) = \beta_t \frac{1 + i_t}{1 + \pi_{t+1}} u'(Y_{t+1}). \quad (10.20)$$

Cochrane starts by asking what the response to such a shock would look like if there were no pricing frictions in the economy whatsoever – essentially the textbook case of a vertical ‘aggregate supply’ curve. When this is true, aggregate demand below capacity can never be an equilibrium outcome. We can treat it as implying  $Y_t = Y_{t+1} = \bar{Y}$  for some constant capacity output level  $\bar{Y}$ . The result is a version of the Fisher equation:

$$\beta_t \frac{1 + i_t}{1 + \pi_{t+1}} = 1. \quad (10.21)$$

As before, if the shock to  $\beta_t$  is sufficiently large, this equation may not be possible to satisfy for a positive value of  $i_t$  and an inflation rate equal to the central bank’s target,  $\pi^*$ . Once  $i_t$  has reached zero, the only possibility is for expected inflation to exceed its target.

Taken on its own terms this is a perfectly benign outcome. Output remains at the level of productive capacity, and aggregate welfare is not substantially affected. Of course, this occurs by construction: it is not possible for output to depart from  $\bar{Y}$  when investigating a frictionless Walrasian general equilibrium. Cochrane’s main point, however, is that a very similar equilibrium remains a possibility in the New Keynesian model studied by Eggertsson and Woodford (2003) and numerous subsequent authors. That is, it is quite possible for a rise in consumers’ desire to save to be associated with an increase in inflation expectations, and an output level that departs very little from its capacity level. The assumption that rules this out in the New Keynesian literature is that the rate of inflation tomorrow should depend only on the state of the economy tomorrow – not any past outcomes, such as consumers’ historic willingness to save. This essentially means that  $\pi_{t+1}$  is fixed at  $\pi^*$  in expectation, and only output is available to adjust to the savings shock – as analysed at length above. Whether this is an appropriate assumption remains very debatable. As we have seen, empirical evidence on the relationship between economic conditions and inflation expectations is very partial, particularly for periods when the zero bound is binding. A number of the policy prescriptions of the New Keynesian model at the zero bound appear counterintuitive, as the work of Eggertsson et al. (2014) on structural reforms highlights. If nothing else, Cochrane’s paper reiterates still further the importance of more empirical work on the expectations channel.

## 10.6 Risk Sharing and Fiscal Policy in a Monetary Union

So far we have been discussing the debate on macroeconomic stabilization of economies hit by large shocks, that cause policy rates to be constrained by their zero lower bound, impairment and/or malfunctioning of financial markets, and

the emergence of disruptive sovereign risk crises. We now focus our discussion on issues that are specific to stabilization of the Eurozone.

### 10.6.1 *Imbalances and Imperfect Risk Sharing*

The birth of the euro gave rise to a fast integration of the money market and large cross-border banking flows. While these developments at the time were considered positive steps towards increasing cross-border risk sharing, financial markets remained insufficiently developed at the union level, and cross-border risk remained severely limited. In light of modern theory and the experience from the crisis, we are now in a better position to understand the implications.

Under perfect risk sharing, markets allocate financial funds up to the point that a unit of currency has the same marginal utility across agents and countries under any circumstances. Since agents in different countries consume different baskets of goods, the same unit of currency tends to be more valuable where, over the business cycle, prices are relatively low, that is, the real exchange rate is depreciated. A key implication of perfect insurance is therefore that, under mild conditions on preferences, consumption tends to rise more in countries where domestic inflation is relatively low. In other words, a domestic consumption boom, causing an external deficit, cannot occur simultaneously to a hike in relative inflation, causing real appreciation.

Consider an exogenous unexpected increase in the *future* demand for services produced in a country, say, tourism, raising the profitability of domestic firms supplying these services. If markets in the union are perfect, there are enough instruments for domestic and foreign households in the union to achieve perfect risk diversification. By way of example, through a well-diversified equity portfolio, both the residents in the country and the residents in other areas of the union can share the benefits from the higher stock market value of these firms. As a result, wealth and demand tend to move symmetrically across countries in response to the shock: more demand moves domestic and foreign prices in the same direction.

Conversely, if markets are not perfect (diversification is low), the higher profitability of domestic firms will tend to benefit mainly domestic residents. By consumption smoothing, these will borrow to raise their current expenditure consistent with their new perceived level of wealth, feeding an external deficit. Domestic demand rises asymmetrically with respect to the rest of the union, driving domestic inflation above foreign inflation. Hence the country will simultaneously experience a widening of the external deficit and a loss of competitiveness. Ex-post, the accumulation of noncontingent debt instruments will in turn increase the vulnerability of the country to adverse shocks – if, for instance, the demand for tourism services turn out to be weaker than initially anticipated.

Recent work by Brunnermeier and Sannikov (2014) and Heathcote and Perri (2015), or the results by Corsetti et al. (2010), suggest examples of incomplete market economies in which trade in more assets is actually welfare-reducing. ‘Demand’ or ‘pecuniary’ externalities are the ultimate cause of these results. These models are typically read as theoretical justifications for limiting capital flows and introducing some form of capital controls, if only as a consequence of desirable regulation.<sup>49</sup>

But overall the arguments in this subsection provide a strong motivation, from a macroeconomic perspective, to improve cross-border risk sharing in (well supervised and regulated) capital markets. While the mechanism just described is active whether or not the nominal exchange rates can adjust, it is especially relevant in a currency union.

### *10.6.2 Complete Markets are not a Substitute for Risk Sharing via Transfers*

Complete markets and efficient risk sharing address an important source of inefficiency in a monetary union, but are not sufficient to prevent undesirable business cycle movements at the national level. In particular in the presence of nominal rigidities that prevent adjustment to asymmetric business cycle shocks, contingent financial flows from efficient markets do not provide enough redistribution of income and demand for smoothing out recessions and overheating. Market-based risk sharing is no substitute for cross-border transfers compensating for lack of demand at national level.

Recent work has reconsidered the mechanism by which cross-border transfers can overcome insufficiency of aggregate demand in part of the union. Fahri and Werning (2014) build on the following argument. When prices are sticky in nominal terms, and the exchange rate cannot adjust, the relative price of tradable goods in terms of nontradable goods is sticky in real terms, at least in the short run. If preferences are homothetic, given this relative price stickiness, any change in overall consumption demand will move the demand for both goods in proportion. This means that if one country transfers tradable resources to another, the consumption of this transfer will have a ‘multiplier’ effect on local output, via a rise in the demand for nontradables. Domestic aggregate demand will increase more than one-to-one relative to the size of the transfer.

This elegant example clarifies a key requisite for the transfer programme to work: the resources transferred across borders must be immediately spent, feeding current demand at given relative prices. To the extent that the transfer is partly saved and spent in the future, and price adjustment takes place over time, the multiplier effect will be smaller. Indeed, in the simulations proposed by Fahri and Werning, and according to a vast body of quantitative literature developed in academic and policy institutions, transfers are more consequential, the more persistent (the shock and) the transfers are. Temporary transfers

have a limited effect on current consumption of tradables, since they do not imply a significant increase in permanent income. The multiplier is correspondingly muted.

The overall message is nonetheless worth repeating: well-functioning financial markets, generating state-contingent financial flows that accrue to regions hit by adverse output or price shocks, do not dispose of the need for setting up some mutual insurance mechanism working through a common budget or a nonmarket allocation mechanism. Whether or not markets are complete, agents do not completely internalize the effects of their spending and saving decision on the level of demand and economic activity. There are demand externalities associated with nominal rigidities and an inflexible exchange rate. With this in mind, an important practical subject for current research is how best to design an insurance system of contingent transfers at the Eurozone level. Ongoing work by Ábrahám et al. (2015) is making important steps in this direction, paying particular attention to the need to structure future transfers in a way that gives all countries an ex-ante incentive to participate in the scheme.

### 10.6.3 *Fiscal Devaluation*

In the traditional approach, national fiscal policy is seen as a regulator of the level of spending on final goods and services (as discussed in the previous sections). Recent literature has, however, proposed a new approach, more in line with the theory of monetary policy, stressing the need to identify welfare-reducing distortions (or wedges) and design instruments to correct them. A leading example is the work by Correia et al. (2008, 2013), showing that taxes and subsidies can completely compensate for nominal price and wage rigidities, making monetary policy de facto irrelevant. Building on this early contribution, the elegant model by Fahri et al. (2014) establishes the conditions under which exchange rate adjustment may be completely replaced by ‘fiscal devaluation’.

An effective fiscal devaluation may have demanding informational and administrative requirements. The government needs to collect timely information about fundamental shocks and the state of the economy, and have the administrative capacity to vary tax and subsidy rates for firms to dispose of the need to alter production prices. The interventions need to alter the relative valuation of nontraded and traded goods enough to facilitate a shift in resources and economic activity across sectors. They need to influence incomes enough to correct undesirable consequences on the trade balance. The tax and subsidy regime must be put in place credibly, such that, in each period, agents can formulate their investment and consumption plans under reasonable expectations that there will also be efficient stabilization in the future – under the constraint that debt and the deficit are sustainable.

The benefits from fiscal devaluation are often interpreted in a narrow sense, as a correction of the international price of a country’s output and the internal

price of its nontradables, to restore 'competitiveness'. It is appropriate to stress, however, that as long as risk sharing is not perfect, a fiscal devaluation, like any exchange-rate movement, also has strong income effects. Real depreciation not only tends to make domestic firms more competitive and imports more expensive. It also reduces domestic residents' relative income.<sup>50</sup>

Recent empirical work substantiates this point. Bems and di Giovanni (2014) study the 'internal devaluation' experiment carried out by Latvia, where at the height of the crisis (2008–2009) the government cut public wages, resulting in a drop in private wages and, among other effects, in a large current account adjustment. These authors document that consumption demand expenditure switched from expensive imports into cheaper local goods, with little change in their relative prices. They conclude that 'the conventional price channel plays little role' by comparison with income effects.<sup>51</sup>

Finally for this section, we should note an important issue raised by the work both on transfer unions and on fiscal devaluations. This is whether stabilization policy should be seen as a substitute for market adjustment or as a facilitator of it. By way of example, the transfers analysed by Fahri and Werning (2014) are effective in redressing insufficient domestic demand to the extent that transfers are quite persistent. But should a monetary union rely on persistent transfers to address business cycle shocks that are by their nature transitory? By the same token, a systematic resort to fiscal devaluation would require a reform of the tax code and the welfare state, setting up a consistent system of state-contingent taxes and subsidies by which a country would dispose of the need for relative price adjustment. Should countries permanently adapt their welfare state in light of this goal? A word of caution is clearly necessary in this area. For one thing, the literature has long clarified that lack of price flexibility may be only one of the distortions that prevent an efficient reallocation of resources in response to shocks (say, from nontradables to local tradables). In practice this shift may also be hampered by administrative and bureaucratic constraints, and may be particularly difficult in the absence of smooth financial support by intermediaries. Intervening on these distortions would require quite a different set of instruments to the ones underlying fiscal devaluation.

Recent contributions have indeed focused on how to design a stabilization problem in conjunction with reforms facilitating market-based adjustment. Instances are provided by Cacciatore et al. (2016), who analyse stabilization strategies to accompany product and labour market deregulation, or Müller et al. (2015), focusing on structural reforms under the threat of a sovereign debt crisis.

## 10.7 Conclusions

The new economic questions that surfaced during the recent crises have profoundly challenged existing economic and policy theory. In this chapter, we

have identified what we see as some of the most important developments in the academic debate on stabilization policy since 2008 – a debate that has seen the roles for, and boundaries between, fiscal and monetary policy fundamentally redefined by comparison with the pre-crisis consensus. On the one hand, fiscal policy can be expected to play a much larger role in macroeconomic stabilization than previously envisioned, but at the same time it has also become more closely interconnected with financial stability. On the other hand, monetary theorists and policy-makers are currently reflecting on a radically redefined role for central banking, in which balance sheet policies are bound to play a much larger role than in the past.

Given its central role in motivating a departure from ‘business as usual’ in macroeconomic stabilization, we have devoted a large section of our survey to the design of policies at the zero lower bound. In spite of the accumulated experience and evidence we have reviewed, a fair conclusion from our survey is that vast, uncharted economic waters lie ahead of us. Many critics may find the theoretical models most commonly deployed in the current policy debate not appropriate to capture observed outcomes, particularly the length of time that the zero bound has now remained binding. Models of secular stagnation that could account for persistently low real interests remain very much in their infancy, and the appropriate policy conclusions to take from them are not yet clear. One trend that does emerge is a noticeable tendency since the crises for theoretical work to deploy quite stylized assumptions, tailored to the particular effect that is being demonstrated. This can be very useful for illustrating the central driving force behind particular results, but the cost can sometimes be a lack of generalizability. A priority for future work must surely be to identify robust policy recommendations that could be expected to work well independently of the specific models employed in their analytical formulation.

### **Acknowledgements**

The task of surveying the academic literature on fiscal and monetary policy since the crisis has been a daunting one, particularly given the sheer number of topics that could fall under this umbrella. Although our text includes an extensive list of works, space limitation made it impossible to provide a satisfactory account of the many papers, topics and ideas relevant to our subject.

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## Notes

1. Stock and Watson (2002) first coined the term Great Moderation to describe the characteristics of the US business cycle since 1984.
2. The canonical policy model remains that developed by Smets and Wouters (2003, 2007). This built on the New Keynesian idea that macroeconomic fluctuations were propagated and amplified through wage and price rigidities, adding numerous additional frictions so as better to capture the properties of observed data series. Unlike previous authors in the DSGE literature, Smets and Wouters were able to estimate their model directly, applying Bayesian statistical techniques. Variants upon this model remain commonly used by central banks for forecasting purposes: examples include the ECB's NAWM model, the Bank of England's COMPASS model and the Riksbank's RAMSES model.
3. See Chari et al. (2009), for instance.
4. See Blanchard et al. (2010) and Mishkin (2011) for fuller discussions of the pre-crisis view.
5. In a widely-cited piece applying the textbook New Keynesian model, Blanchard and Galí (2007) confirm that price stabilization *requires* output to be stabilized at an augmented version of the natural rate, describing this as a '*divine coincidence*'.
6. This latter conclusion remains controversial. Cochrane (2011) has argued that the nominal interest rate should not be considered as effective an instrument as Woodford claims.
7. See Schmitt-Grohé and Uribe (2011) for a comprehensive analysis of the optimal rate of inflation.
8. Ireland is a geographical anomaly among the latter.
9. The interest rate paid by the ECB on overnight deposits by financial institutions is slightly negative at the time of writing. The central banks of Denmark and Switzerland also charge negative deposit rates, whilst the Swedish Riksbank has successfully cut its main policy rate to -0.25 per cent.
10. Some authors have therefore considered the relative merits of abolishing cash, or changing its properties in a manner that removes the impediment. Buiter (2009) considers the relative merits of different proposals.
11. See Baldwin and Teulings (2014) for a collection of nontechnical pieces on the idea of secular stagnation.
12. The operator  $\mathbb{E}_t$  simply denotes that the consumer's expectation across possible outcomes in  $t + 1$  is relevant to choice.
13. This fact was first exploited by Krugman (1998), in a piece widely acknowledged to have launched the modern literature on policy options at the zero bound.
14. We discuss endogenous mechanisms that can generate this 'shock' below.
15. The term 'natural rate' derives from Wicksell (1898).
16. Campbell et al. distinguish this from '*Delphic*' forward guidance, whereby the monetary authority may influence outcomes by issuing forecasts for the future evolution of the economy, but without these forecasts having any binding influence on future policy.
17. Svensson (2001) attempts to address this problem by proposing a '*foolproof*' mechanism for institutionalizing the desired commitment, including a short-term commitment to an (increasing) price-level target in place of any inflation target, and

- a currency devaluation. Such a complete – albeit short term – overhaul of the central bank's objective has not been engineered in any major country since the crisis.
18. See Weale (2013).
  19. See Weale (2013).
  20. See, in particular, Evans (2011) and Woodford (2012).
  21. This is captured mathematically by fact that greater dispersion in  $Y_{t+1}$  raises the term  $\mathbb{E}_t u'(Y_{t+1})$  in the Euler condition (10.5).
  22. Related work by Akkaya (2014) considers the role for forward guidance in reducing uncertainty about future interest rates. Yet for similar reasons it is unclear whether this also implies reduced uncertainty about key policy variables – particularly output and inflation. This point is modelled explicitly in recent work by Andrade et al. (2015).
  23. Del Negro et al. (2012) stress a problem with DSGE monetary models in accounting for forward guidance. These models tend to predict unreasonably large responses of key macroeconomic variables to central bank announcements about future interest rates. This phenomenon is labelled the '*forward guidance puzzle*'.
  24. Again, Cochrane (2015) is an exception.
  25. Recall that the underlying 'shock' is an unusually high value for  $\beta_t$ , which captures a subjective preference for later consumption.
  26. Once there, the appropriate level of government spending may of course be high or low: this is a matter for democratic choice. The issue here is whether resource misallocation – relatively low employment, and relatively high government spending – is the least-bad option when the zero bound binds.
  27. This builds on Cúrdia and Woodford (2009), who develops a simple device for incorporating financial frictions between borrowers and savers into an otherwise traditional New Keynesian model.
  28. These estimates are based on Schneider and Buehn (2012).
  29. See Heathcote et al. (2009) for a survey of heterogeneous-agent consumption models.
  30. Such a mechanism was identified by MPC member David Miles (2009), for instance, as a justification for the Bank of England's first experiment with quantitative easing.
  31. See, for instance, the widely-cited study by Gagnon et al. (2011) for the US, and Joyce et al. (2011) for the UK case. Bauer and Rudebusch (2014) argue that these studies rely on a decomposition of the yield curve that is biased in favour of finding too high a portfolio rebalancing effect.
  32. In Gertler and Karadi's model this leverage restriction is generated by an information friction: households are reluctant to entrust assets to financial firms without believing these firms have an incentive to manage them well. A large enough capital buffer gives intermediaries '*skin in the game*', ensuring good practice. It would be easy to rewrite the model to allow for the leverage ratio to be a direct regulatory choice.
  33. Given the precise way that Gertler and Karadi motivate their credit friction, the fundamental difference between the central bank and private-sector financial institutions is that the central bank can credibly commit not to steal depositors' funds. It is not clear where this difference in commitment technology derives from, nor that it truly accounts for the significant difference between the two types of institution that undoubtedly exists.

34. This work is part of a growing literature in macroeconomics that links aggregate fluctuations to information problems at the microeconomic level. Important contributions include Lorenzoni (2009), Angeletos and La'O (2013) and Hellwig and Venkateswaran (2014). Similar investment-information dynamics are analysed by Straub and Ulbricht (2014).
35. A very readable introduction to the secular stagnation literature is provided by Baldwin and Teulings (2014).
36. If anything the supply of savings may be expected to increase, since middle-aged workers do not inherit such large debts from their early years. This leaves them with a larger stock of funds to save.
37. Strictly, these are '*ambiguity-averse*' consumers, who assess future prospects according to the worst-case outcome.
38. Such frictions were pioneered by Diamond (1982) and Mortensen and Pissarides (1994).
39. Related is the work of Beaudry and Portier (2013), who show that changes in perceptions about *future* economic outcomes can generate changes in production in the present. (This is not quite a self-fulfilling dynamic, due to the difference in timing.) Their paper provides an alternative theory for the source of fluctuations in aggregate demand, with the property that these fluctuations have relatively little impact on inflation rates. Beaudry and Portier argue that this property is important in accounting for recent US business cycle dynamics.
40. Papers that obtain an increase in aggregate private consumption as government spending rises, and thus a multiplier above one, include Fatas and Mihov (2001) and Ravn et al. (2012). Ramey and Shapiro (1998) and Ramey (2011) find multipliers below one. See Hall (2009) for a full survey of the multiplier literature.
41. This is a nuanced area, however. It is true that the effectiveness of fiscal policy does not *depend* on the inflation expectations channel in Rendahl's model, but this does not mean that inflation expectations can have no impact on equilibrium outcomes. It should be equally possible to generate stimulus in his setting through promised changes in expected future prices – that is, forward guidance. This may provide a superior solution to the stabilization problem: private-sector consumption could be restored to more normal levels without government purchases being distorted by pure stimulus motives.
42. This claim brushes over some important technicalities, including whether the policy-maker has the ability to feed back on inflation expectations or just realized inflation. Cochrane (2011) provides a critical take on the literature that assumes feedback on current inflation is sufficient.
43. 'Long-run' here is used as shorthand for a situation in which output and inflation are constant.
44. Friedman (1969) was one of the first to see potential merits in this outcome.
45. Guerrieri and Lorenzoni (2015)'s main exercise exploring the zero bound predicts just a 5-quarter stay at zero. Benigno et al. (2014) prescribe a stay of up to 24 quarters under an optimal policy response, but this is associated with output and inflation levels that are above their normal values, which makes this an unlikely positive explanation for why rates have stayed low for so long. Rates rise faster under automatic policy rules. None of these cases can account for the 20-year episode of near zero rates that Japan has witnessed.
46. Similar results are established by Aruoba, Cuba-Borda and Schorfheide (2016), who analyse the effects of a fiscal expansion that is calibrated to the 2009 American

- Recovery and Reinvestment Act, comparing outcomes between fundamental and self-fulfilling equilibria.
47. This model is due to Iacoviello and Neri (2010).
  48. As before, for simplicity we assume that all production is used for private consumption. We also suppose outcomes at  $t + 1$  are known with certainty, in line with Cochrane's own assumptions.
  49. See Benigno et al. (2012) for a more sceptical interpretation of the scope for capital controls.
  50. See Corsetti et al. (2008, 2013).
  51. See also Burstein et al. (2005) on this issue.

## References

- Ábrahám, A., Carceles-Poveda, E., Liu, Y., and Marimon, R. 2015. On the Optimal Design of a Financial Stability Fund. Manuscript.
- Akkaya, Y. 2014. Uncertainty of Interest Path as a Monetary Policy Instrument. Manuscript.
- Andrade, P., Gaballo, G., Mengus, E., and Mojon, B. 2015. Forward Guidance and Heterogeneous Beliefs. Manuscript.
- Angeletos, G. M., and La'O, J. 2013. Sentiments. *Econometrica*, **81**, 739–779.
- Aruoba, S. B., Cuba-Borda, P., and Schorfheide, F. 2016. Macroeconomic Dynamics at the ZLB: A Tale of Two Equilibria. Manuscript.
- Bachmann, R., and Sims, E. R. 2012. Confidence and the Transmission of Government Spending Shocks. *Journal of Monetary Economics*, **59**, 235–249.
- Bachmann, R., Berg, T. O., and Sims, E. R. 2015. Inflation Expectations and Readiness to Spend at the Zero Lower Bound: Cross-Sectional Evidence. *American Economic Journal: Economic Policy*, **7**, 1–35.
- Bagehot, W. 1873. *Lombard Street: A Description of the Money Market*. Henry S. King & Co.
- Bahaj, S., and Rendahl, P. 2015. Deconstructing the Fiscal Multiplier. Manuscript.
- Baldwin, R., and Teulings, C. 2014. *Secular Stagnation: Facts, Causes and Cures*. published at <https://voxeu.org>.
- Bauer, M. D., and Rudebusch, G. D. 2014. The Signaling Channel for Federal Reserve Bond Purchases. *International Journal of Central Banking*, **10**, 233–289.
- Beaudry, P., and Portier, F. 2013. Understanding Non-Inflationary Demand Driven Business Cycles. Manuscript.
- Bems, R., and di Giovanni, J. 2014. Income-Induced Expenditure Switching. CEPR Discussion Paper 9887.
- Benhabib, J., Schmitt-Grohé, S., and Uribe, M. 2001. The Perils of Taylor Rules. *Journal of Economic Theory*, **96**, 40–96.
- Benigno, G., Chen, H., Otrok, C., Rebucci, A., and Young, E. R. 2012. Capital Controls or Exchange Rate Policies? A Pecuniary Externality Perspective. Centre for Economic Performance Discussion Paper No 1160.
- Benigno, P., Eggertsson, G. B., and Romei, F. 2014. Dynamic Debt Deleveraging and Optimal Monetary Policy. NBER Working Paper 20556.
- Blanchard, O., and Galí, J. 2007. Real Wage Rigidities and the New Keynesian Model. *Journal of Money, Credit, and Banking*, **39**, 35–65.

- Blanchard, O., Dell'Ariccia, G., and Mauro, P. 2010. Rethinking Macroeconomic Policy. *Journal of Money, Credit and Banking*, **42**, 199–215.
- Brendon, C., Paustian, M., and Yates, A. 2015. Self-Fulfilling Recessions at the Zero Lower Bound. Manuscript.
- Broda, C., and Parker, J. A. 2014. The Economic Stimulus Payments of 2008 and the Aggregate Demand for Consumption. NBER Working Paper 20122.
- Brunnermeier, M. K., and Sannikov, Y. 2014. A Macroeconomic Model with a Financial Sector. *American Economic Review*, **104**, 379–421.
- Buiter, W. H. 2009. Negative Nominal Interest Rates: Three Ways to Overcome the Zero Lower Bound. *The North American Journal of Economics and Finance*, **20**, 213–238.
- Burstein, A., Eichenbaum, M., and Rebelo, S. 2005. Large Devaluations and the Real Exchange Rate. *Journal of Political Economy*, **113**, 742–784.
- Caballero, R. J., and Farhi, E. 2014. On the Role of Safe Asset Shortages in Secular Stagnation. In: Baldwin, R., and Teulings, C. (eds), *Secular Stagnation: Facts, Causes and Cures*. published at <https://voxeu.org>.
- Caballero, R. J., and Farhi, E. 2015. The Safety Trap. Manuscript.
- Cacciatore, M., Fiori, G., and Ghironi, F. 2016. Market Deregulation and Optimal Monetary Policy in a Monetary Union. *Journal of International Economics*, **99**, 120–137.
- Campbell, J. R., Evans, C. L., Fisher, J. D. M., and Justiniano, A. 2012. Macroeconomic Effects of Federal Reserve Forward Guidance. *Brookings Papers on Economic Activity*, **44**, 1–80.
- Chamley, C. 2014. When Demand Creates Its Own Supply: Saving Traps. *Review of Economic Studies*, **81**, 651–680.
- Chari, V. V., Kehoe, P. J., and McGrattan, E. R. 2009. New Keynesian Models: Not Yet Useful for Policy Analysis. *American Economic Journal: Macroeconomics*, **1**, 242–266.
- Chen, H. V., Cúrdia, and Ferrero, A. 2012. The Macroeconomic Effects of Large-Scale Asset Purchase Programmes. *Economic Journal*, **122**, F289–F315.
- Christensen, J. H. E., and Rudebusch, G. D. 2012. The Response of Interest Rates to US and UK Quantitative Easing. *Economic Journal*, **122**, F385–F414.
- Christiano, L., Eichenbaum, M., and Rebelo, S. 2011. When is the Government Spending Multiplier Large? *Journal of Political Economy*, **119**, 78–121.
- Clarida, R., Gali, J., and Gertler, M. 2000. Monetary Policy Rules and Macroeconomic Stability: Evidence and Some Theory. *Quarterly Journal of Economics*, **115**, 147–180.
- Cochrane, J. H. 2011. Determinacy and Identification with Taylor Rules. *Journal of Political Economy*, **119**, 565–615.
- Cochrane, J. H. 2015. The New-Keynesian Liquidity Trap. Manuscript.
- Coenen, G., Erceg, C. J., Freedman, C., Furceri, D., Kumhof, M., Lalonde, R., Laxton, D., Lindé, J., Mourougane, A., Muir, D., and Mursula, S. 2012. Effects of Fiscal Stimulus in Structural Models. *American Economic Journal: Macroeconomics*, **4**, 22–68.
- Cook, D., and Devereux, M. B. 2014. Exchange Rate Flexibility under the Zero Lower Bound. CEPR Discussion Paper 10202.
- Correia, I., Nicolini, J. P., and Teles, P. 2008. Optimal Fiscal and Monetary Policy: Equivalence Results. *Journal of Political Economy*, **116**, 141–170.

- Correia, I., Farhi, E., Nicolini, J. P., and Teles, P. 2013. Unconventional Fiscal Policy at the Zero Bound. *American Economic Review*, **103**, 1172–1211.
- Corsetti, G., Dedola, L., and Leduc, S. 2008. International Risk Sharing and the Transmission of Productivity Shocks. *Review of Economic Studies*, **75**, 443–473.
- Corsetti, G., Dedola, L., and Leduc, S. 2010. Optimal Monetary Policy in Open Economies. Chap. 16 of: Friedman, B. M., and Woodford, M. (eds), *Handbook of Monetary Economics*, vol. 1. Elsevier, pp. 861–933.
- Corsetti, G., Kuester, K., and Müller, G. 2011. Floats, Pegs and the Transmission of Fiscal Policy. In: Cespedes, Luis Felipe, and Gali, Jordi (eds), *Fiscal Policy and Macroeconomic Performance*. Santiago, Chile: Central Bank of Chile.
- Corsetti, G., Martin, P., and Pesenti, P. 2013. Varieties and the transfer problem. *Journal of International Economics*, **89**, 1–12.
- Cúrdia, V., and Woodford, M. 2009. Credit Spreads and Monetary Policy. *NBER Working Paper 15289*.
- David Miles. 2009. Money, Banks and Quantitative Easing. *Speech given at the 14th Northern Ireland Economic Conference, Belfast, 30 September 2009*.
- Del Negro, M., Giannoni, M., and Patterson, C. 2012. The Forward Guidance Puzzle. Federal Reserve Bank of New York Staff Report No. 574, Revised May 2013.
- den Haan, W. J., Rendahl, P., and Riegler, M. 2014. Unemployment (Fears), Precautionary Savings, and Aggregate Demand. Manuscript.
- Diamond, P. A. 1982. Aggregate Demand Management in Search Equilibrium. *Journal of Political Economy*, **90**, 881–894.
- Eggertsson, G. B. 2011. What Fiscal Policy is Effective at Zero Interest Rates? *NBER Macroeconomics Annual*, **25**, 59–112.
- Eggertsson, G. B., and Krugman, P. R. 2012. Debt, Deleveraging, and the Liquidity Trap: A Fisher-Minsky-Koo Approach. *Quarterly Journal of Economics*, **127**, 1469–1513.
- Eggertsson, G. B., and Mehrotra, N. R. 2014. A Model of Secular Stagnation. NBER Working Paper 20574.
- Eggertsson, G. B., and Woodford, M. 2003. The Zero Interest-Rate Bound and Optimal Monetary Policy. *Brookings Papers on Economic Activity*, **1**, 139–211.
- Eggertsson, G. B., Ferrero, A., and Raffo, A. 2014. Can Structural Reforms Help Europe? *Journal of Monetary Economics*, **61**, 2–22.
- Eichengreen, B. 2015. Secular Stagnation: The Long View. *American Economic Review: Papers & Proceedings 2015*, **105**, 66–70.
- Ellison, M., and Tischbirek, A. 2014. Unconventional Government Debt Purchases as a Supplement to Conventional Monetary Policy. *Journal of Economic Dynamics and Control*, **43**, 199–217.
- Evans, C. L. 2011. The Fed's Dual Mandate Responsibilities and Challenges Facing US Monetary Policy. *Speech delivered at the European Economics and Financial Centre Distinguished Speaker Seminar, London, September 7, 2011*.
- Fahri, E., and Werning, I. 2014. Fiscal Unions. Manuscript.
- Fahri, E., Gopinath, G., and Itskhoki, O. 2014. Fiscal Devaluations. *Review of Economic Studies*, **81**, 725–760.
- Farmer, R. E. A. 2013. Animal Spirits, Financial Crises and Persistent Unemployment. *Economic Journal*, **123**, 317–340.
- Farmer, R. E. A. 2014. The Evolution of Endogenous Business Cycles. *Macroeconomic Dynamics*, 1–14.

- Fatas, A., and Mihov, I. 2001. The Effects of Fiscal Policy on Consumption and Employment: Theory and Evidence. CEPR Discussion Paper 2760.
- Feldstein, M. 2002. Rethinking Stabilization. Manuscript.
- Fernández-Villaverde, J., Guerrón-Quintana, P., and Rubio-Ramírez, J. F. 2014. Supply-Side Policies and the Zero Lower Bound. *IMF Economic Review*, **62**, 248–260.
- Friedman, M. 1969. *The Optimum Quantity of Money*. London: Macmillan.
- Gaballo, G., and Marimon, R. 2015. Breaking the Spell with Credit-Easing: Self-Confirming Credit Crises in Competitive Search Economies. Manuscript.
- Gagnon, J., Raskin, M., Remache, J., and Sack, B. 2011. The Financial Market Effects of the Federal Reserve's Large-Scale Asset Purchases. *International Journal of Central Banking*, **7**, 3–43.
- Gertler, M., and Karadi, P. 2011. A Model of Unconventional Monetary Policy. *Journal of Monetary Economics*, **58**, 17–34.
- Guerrieri, V., and Lorenzoni, G. 2015. Credit Crises Precautionary Savings and the Liquidity Trap. Manuscript.
- Hall, R. E. 2009. By How Much Does GDP Rise If the Government Buys More Output? *Brookings Papers on Economic Activity*, **10**, 183–231.
- Harrison, R. 2011. Asset Purchase Policies and Portfolio Balance Effects: A DSGE Analysis. In: Chadha, J. S., and Holly, S. (eds), *Interest Rates, Prices and Liquidity: Lessons from the Financial Crisis*. Cambridge: Cambridge University Press, pp. 117–143.
- Harrison, R. 2012. Asset Purchase Policy at the Effective Zero Lower Bound for Interest Rates. Bank of England Working Paper 444.
- Heathcote, J., and Perri, F. 2015. Wealth and Volatility. Manuscript.
- Heathcote, J., Storesletten, K., and Violante, G. 2009. Quantitative Macroeconomics with Heterogeneous Households. *Annual Review of Economics*, **1**, 319–354.
- Hellwig, C., and Venkateswaran, V. 2014. Dispersed Information, Sticky Prices and Monetary Business Cycles: A Hayekian Perspective. Manuscript.
- Iacoviello, M., and Neri, S. 2010. Housing Market Spillovers: Evidence from an Estimated DSGE Model. *American Economic Journal: Macroeconomics*, **2**, 125–164.
- Jappelli, T., and Pistaferri, L. 2014. Fiscal Policy and MPC Heterogeneity. *American Economic Journal: Macroeconomics*, **6**, 107–136.
- Johnson, D. S., Parker, J. A., and Souleles, N. S. 2005. Household Expenditure and the Income Tax Rebates of 2001. *American Economic Review*, **96**, 1589–1610.
- Joyce, M. A. S., Lasaoa, A., Stevens, I., and Tong, M. 2011. The Financial Market Impact of Quantitative Easing in the United Kingdom. *International Journal of Central Banking*, **7**, 113–161.
- Kaplan, G., and Menzio, G. 2015. Shopping Externalities and Self-Fulfilling Unemployment. *forthcoming in Journal of Political Economy*.
- Kaplan, G., and Violante, G. L. 2014. A Model of the Consumption Response to Fiscal Stimulus Payments. *Econometrica*, **82**, 1199–1239.
- Krishnamurthy, A., and Vissing-Jorgensen, A. 2011. The Effects of Quantitative Easing on Interest Rates: Channels and Implications for Policy. *Brookings Papers on Economic Activity*, **43**, 215–287.
- Krugman, P. R. 1998. It's Baaack: Japan's Slump and the Return of the Liquidity Trap. *Brookings Papers on Economic Activity*, **1998**, 137–206.
- Lloyd, S. P. 2015. Unconventional Monetary Policy and the Interest Rate Channel: Signalling and Portfolio Rebalancing. Manuscript.

- Lorenzoni, G. 2009. A Theory of Demand Shocks. *American Economic Review*, **99**, 2050–2084.
- Lucas, R. E. Jr. 1978. Asset Prices in an Exchange Economy. *Econometrica*, **46**, 1429–1445.
- McKay, A., Nakamura, E., and Steinsson, J. 2015. The Power of Forward Guidance Revisited. NBER Working Paper 20882.
- Mertens, K., and Ravn, M. O. 2014. Fiscal Policy in an Expectations-Driven Liquidity Trap. *Review of Economic Studies*, **81**, 1637–1667.
- Mian, Atif, and Sufi, Amir. 2011. House Prices, Home Equity-Based Borrowing, and the US Household Leverage Crisis. *American Economic Review*, **101**, 2132–2156.
- Michaillat, P., and Saez, E. 2015. Aggregate Demand, Idle Time, and Unemployment. *Quarterly Journal of Economics*, **130**, 507–569.
- Mishkin, F. 2011. Monetary Policy Strategy: Lessons from the Crisis. NBER Working Paper 16755.
- Misra, K., and Surico, P. 2014. Consumption, Income Changes, and Heterogeneity: Evidence from Two Fiscal Stimulus Programs. *American Economic Journal: Macroeconomics*, **6**, 84–106.
- Mortensen, D. T., and Pissarides, C. A. 1994. Job Creation and Job Destruction in the Theory of Unemployment. *Review of Economic Studies*, **61**, 397–415.
- Müller, A., Storesletten, K., and Zilibotti, F. 2015. Sovereign Debt and Structural Reforms. CEPR Discussion Paper 10588.
- Oh, H., and Reis, R. 2012. Targeted Transfers and the Fiscal Response to the Great Recession. *Journal of Monetary Economics*, **59**, S50–S64.
- Pappa, E., Sajedi, R., and Vella, E. 2015. Fiscal Consolidation with Tax Evasion and Corruption. *forthcoming in Journal of International Economics*.
- Parker, J. A., Souleles, N. S., Johnson, D. S., and McClelland, R. 2013. Consumer Spending and the Economic Stimulus Payments of 2008. *American Economic Review*, **103**, 2530–2553.
- Ramey, V. A. 2011. Can Government Purchases Stimulate the Economy? *Journal of Economic Literature*, **49**, 673–685.
- Ramey, V. A., and Shapiro, M.D. 1998. Costly Capital Reallocation and the Effects of Government Spending. *Carnegie-Rochester Conference Series on Public Policy*, **48**, 145–194.
- Ravn, M. O., and Sterk, V. 2013. Job Uncertainty and Deep Recessions. Manuscript.
- Ravn, M. O., Schmitt-Grohé, S., and Uribe, M. 2012. Consumption, Government Spending, and the Real Exchange Rate. *Journal of Monetary Economics*, **59**, 215–234.
- Rendahl, P. 2015. Fiscal Policy in an Unemployment Crisis. Manuscript.
- Schmitt-Grohé, S., and Uribe, M. 2011. The Optimal Rate of Inflation. In: Friedman, B. M., and Woodford, M. (eds), *Handbook of Monetary Economics*, vol. 3B. Elsevier, pp. 653–722.
- Schneider, F., and Buehn, A. 2012. Shadow Economies in Highly Developed OECD Countries: What Are the Driving Forces? IZA Discussion Papers 6891, Institute for the Study of Labor (IZA).
- Smets, F., and Wouters, R. 2003. An Estimated Dynamic Stochastic General Equilibrium Model of the Euro Area. *Journal of the European Economic Association*, **1**, 1123–1175.

- Smets, F., and Wouters, R. 2007. Shocks and Frictions in US Business Cycles: A Bayesian DSGE Approach. *American Economic Review*, **97**, 586–606.
- Stock, J. H., and Watson, M. W. 2002. Has the Business Cycle Changed and Why? *NBER Macroeconomics Annual*, **17**, 159–230.
- Straub, L., and Ulbricht, R. 2014. Endogenous Uncertainty and Credit Crunches. Manuscript.
- Surico, P., and Trezzi, R. 2015. Consumer Spending and Property Taxes. Finance and Economics Discussion Series 2015-057, FRB.
- Svensson, L. E. O. 2001. The Zero Bound in an Open Economy: A Foolproof Way of Escaping from a Liquidity Trap. *Monetary and Economic Studies*, **19**, 277–312.
- Vayanos, D., and Vila, J.-L. 2009. A Preferred-Habitat Model of the Term Structure of Interest Rates. NBER Working Paper 15487.
- Wallace, N. 1981. A Modigliani-Miller Theorem for Open-Market Operations. *American Economic Review*, **71**, 267–274.
- Weale, M. 2013. Forward Guidance and its Effects. *Speech given to the National Institute for Economic and Social Research, London, 11 December 2013*.
- Werning, I. 2012. Managing a Liquidity Trap: Monetary and Fiscal Policy. Manuscript.
- Wicksell, K. 1898. *Interest and Prices*, English translation by R.F. Kahn. London: Macmillan.
- Wieland, J. 2014. Are Negative Supply Shocks Expansionary at the Zero Lower Bound? Manuscript.
- Woodford, M. 2003. *Interest and Prices: Foundations of a Theory of Monetary Policy*. Princeton: Princeton University Press.
- Woodford, M. 2012. Methods of Policy Accommodation at the Interest-Rate Lower Bound. Manuscript.