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Size of the Government Spending Multiplier in the Recent Financial Crisis

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Anna Louhelainen

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Department of Economics
Aalto University
School of Economics

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ABSTRACT
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SIZE OF THE GOVERNMENT SPENDING MULTIPLIER IN THE RECENT FINANCIAL CRISIS

In this thesis I study the size of the fiscal multiplier in the economic conditions of the recent financial crisis. The objective is to find out how large the fiscal multiplier can be expected to be in the 2008 crisis and what are the main factors affecting its size. The thesis is conducted in the form of a literature review, where I base my analysis on previous studies and relevant theory.

Throughout the thesis I follow a New Keynesian perspective assuming some degree of price and wage stickiness. The assumption is essential for achieving higher multipliers and is widely used in academic literature on fiscal stimulus.

I find that in a financial crisis with zero interest rates, fiscal multipliers can be clearly higher than during normal times. Provided that the stimulus measures meet certain requirements, the multiplier can reach values greater than 1. These requirements state that stimulus needs to be purely temporary and accompanied by accommodative monetary policy, and higher fiscal spending should be followed by spending cuts in the future. Fiscal measures should preferably not be subject to considerable implementation lags and the stimulus period should last precisely as long as the financial distress continues. The announcement of upcoming stimulus measures has to be credible.

The 2008 crisis and the Great Depression share similarities, the most important ones being the magnitude and global nature of the crises. Fiscal policy could have contributed more to the recovery from the Great Depression had it been used more extensively, and the resulting multipliers could have been larger too. Therefore, the multipliers for the current recovery period could be higher than in the 1930s and fiscal policy's contribution might be more significant in the recent crisis.

Keywords: fiscal stimulus, New Keynesian, zero interest rates, Ricardian equivalence, the Great Depression

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1 Introduction

The world economy is recovering from a crisis that has been described as the worst since the Great Depression of the 1930s. After striking the financial sector it moved on to affecting the real economy by lowering GDP and increasing unemployment rates. As a response, several countries adopted fiscal packages of varying sizes, the U.S. having the largest of all OECD countries (OECD 2009). What is not necessarily so clear, though, is the effect of fiscal stimulus on GDP, and it remains uncertain if fiscal stimulus in reality is such a wise response to the crisis as some policymakers argue.

Despite the amount of academic discussion concerning fiscal policy, there is little if any agreement among economists on its effectiveness. For instance, while most would agree that an exogenous increase in money supply will lead to an increase in prices at some point in time, economists can and do disagree even on the *sign* of the response of private consumption to an exogenous increase in government purchases. Also, by the time a change in fiscal policy has been decided, implemented and takes effect, the cyclical economic conditions might have changed radically and the changes might start working against the recovery. Even so, politically fiscal stimulus has very often been a popular way of trying to boost the economy. (Perotti 2002)

Besides being concerned about the efficiency of fiscal stimulus, economists and analysts have been increasingly worried about the state of public finances in the U.S. and several European countries. A large stimulus package can easily lead to a high level of government debt, which can have quite severe and long-lasting consequences when it comes to output and economic growth.

1.1 Previous Research

Since the 1930s and the ideas of John Maynard Keynes on fiscal policy, fiscal stimulus and its effects have been a popular topic of debate among economists. Although during the past few decades there has been notable convergence of views in macroeconomics with some fundamental issues, this is not the case when it comes to fiscal policy (Woodford 2009). In fact, surprisingly little is known about the effects of fiscal policy as many more resources have been devoted to studying monetary policy. The advanced DSGE[1] models developed during the past decade (e.g. Smets and Wouters 2003) are continuously used by central banks worldwide to assess the effects of monetary policy but surprisingly few of them have been used for fiscal policy purposes (Hall 2009).

One reason why relatively little empirical work has been done on the effects of fiscal policy is probably the difficulty of obtaining all the data needed, especially over sufficiently long periods of time. The vast majority of the studies have been done using U.S. data (e.g. Blanchard and Perotti 2002, Hall 2009) the reason being simply that there is not enough data on other OECD countries from the 1930s onwards. A few exceptions can be mentioned here, such as Cwik and Wieland (2009), who assess the stimulus programs announced by Euro area governments in 2008 using five different models all estimated with euro area data and Perotti (2002), who has estimated the effects of fiscal policy measures using a structural vector autoregression (VAR) model for five OECD countries, one of them being the U.S.

The Great Depression of the 1930s and the effectiveness of fiscal policy measures taken then has been studied quite extensively (e.g. Romer 1992), mostly using U.S. data for reasons mentioned above. Many of these studies have been done by using variations in *defense spending*, that is, the part of government spending associated with buildups and aftermaths of wars, as a proxy for total government spending (e.g. Almunia et al. 2009, Barro and Redlick 2009). The main reason for this is that changes

[1] DSGE refers to a Dynamic Stochastic General Equilibrium model and will be explained in more detail in chapter 3.1.

in defense spending are more suitable for empirical purposes since they can often be treated as purely exogenous shocks. On the contrary, changes in total government spending, which includes also non-defense spending, are typically endogenous, at least to some extent, and are not completely determined by factors outside the model. However, using defense spending can incur some additional problems that will be discussed in more detail in chapter 7.

Lately the trend in macroeconomic research has been the use of VAR models, since they allow including more variables in the analysis than simple regression models. For example Blanchard and Perotti (2002) and Perotti (2002) have studied fiscal policy effects using a VAR approach. Apart from the modern and complex VAR methods, a theoretical analysis on a more general level using structural models has been done by some authors. Structural models also serve better for identifying information and differentiating between separate fiscal instruments (Coenen et al. 2010). For instance Christiano et al. (2009), Eggertsson (2009) and Woodford (2010) all use a structural model to study the effects of fiscal policy under differing assumptions about monetary policy and interest rates. Whatever the model in use, it should be chosen so that it corresponds to a crisis-like environment; in particular, one should be extremely cautious when applying estimations made under normal business cycle conditions to financial crises.

1.2 Research Question and Method

In this thesis I will study the effect that an increase in government purchases has on GDP in the economic conditions of the latest crisis. This can as well be interpreted as finding out whether fiscal stimulus is effective in helping the economy to recover from a recession or not. I attempt to do this by studying the size of what has been known since Keynes as *the fiscal or government spending multiplier*, that is, the proportional change in GDP when public expenditure is increased by a certain amount. My research question will be as follows: *How large (or small) is the fiscal*

multiplier in the recent crisis and under which conditions can the multiplier be expected to be large? I will try to identify the most important factors affecting the size of the multiplier and explain the mechanisms through which they operate, focusing on the special conditions created by the crisis. I will restrict my analysis to government spending on goods and services so my concern will be with government *purchases*, not all of government spending, which would also include taxes and other transfers.

The research will be conducted in the form of a literature review and I will go through some relevant theory behind fiscal stimulus as well as present results from previous studies. I will discuss the effects of monetary policy, duration and financing of the stimulus. What I will use as a reference and a comparison with the recent crisis is the Great Depression of the 1930s, namely I will study what the two crises have in common and try to apply the results from the Great Depression to the 2008 crisis.

I shall start with a brief overview of the characteristics and magnitude of the recent crisis, which will be followed by a comparison with the Great Depression. The idea is to find out whether the two crises have enough in common to be compared with each other and whether or not the results from the Great Depression can be applied to the current situation.

In the third chapter I will present the theoretical framework for fiscal stimulus. I will discuss the differences between the two most frequently used theories, Neoclassical and New Keynesian, and take a look at the differences in their views concerning the effects of fiscal stimulus. I will concentrate more here on New Keynesian theory, as it is more commonly used for studying fiscal policy. I will also mention some challenges that modern macroeconomic models in general are facing and their restrictions. Then I will take a look at zero interest rates and liquidity traps, which are both common in financial crises, and see what effects they have on the size of fiscal multipliers. Last, I will briefly go through findings on the multiplier effects of tax cuts.

In the fourth chapter I will take a look at the size of fiscal multipliers under three alternative assumptions about monetary policy and interest rates. I will move on from the simplest case of a constant real interest rate to first consider a policy where

nominal interest rates are set according to the Taylor rule and then the case of constant nominal interest rates. The last scenario is particularly interesting for the analysis of this thesis, as the assumption of a constant nominal interest rate applies to the case of zero interest rates, which in turn is closely related to the conditions of the recent crisis.

In the fifth chapter I will study the optimal timing and duration of an effective stimulus package. First I will explain what factors determine how long the stimulus period should last. Then I will see what happens to the short-term multiplier if the stimulus measures become permanent, and discuss the long-term crowding-out effects resulting from a high level of public debt. Finally I will consider the role of implementation lags and anticipation.

In the sixth chapter I will discuss topics related to government debt. I first consider the Ricardian equivalence theorem and its implications, which will be followed by more realistic cases that allow for the existence of non-Ricardian households alongside with Ricardian households. I will also take a look at the possibility of financing the stimulus with spending reversals instead of higher taxes and see what an effect changing to this strategy has on the size of the multipliers.

In the last chapter I will take a step back and analyze the recovery from the Great Depression in more detail. I will present some views on the factors that contributed the most to the end of the Great Depression. Since most of the multiplier estimations have been done using defense spending, I will discuss this approach and comment on some issues regarding the use of defense spending in the estimates. Then I will review some fiscal multipliers estimated from the recovery period after the Great Depression. Finally I will finish the thesis by presenting the conclusions.

2 Overview of the Crisis

The world is recovering from its worst economic crisis in several decades. What started mainly as a housing sector crisis and deepened into a severe credit crunch has become a real economy crisis with increasing unemployment and substantial decreases in production. The deterioration of public finances is notable not only in advanced economies but also in developing countries and the world as a whole (IMF 2009a).

According to OECD (2009) virtually all OECD countries have taken measures in supporting the economy with fiscal stimulus packages, the U.S. having the largest fiscal package of 5,6 % of 2008 GDP and four other OECD countries amounting to fiscal packages of 4 % or more of 2008 GDP.[2] However, empirically there is mixed evidence about the effectiveness of fiscal stimulus in stimulating the recovery.

One of the characteristics that are distinctive compared to previous crises and that sets challenges for the policymakers is the collapse of the financial system and liquidity, and the financial nature of the crisis can weaken the response to traditional monetary expansion. In addition, some countries might have already used monetary expansion, which limits the central bank's room to lower interest rates. In such a situation, the role of monetary policy should be more in supporting fiscal stimulus by avoiding increases in interest rates until output begins to recover. (IMF 2008)

2.1 Background and Special Characteristics

In the first three quarters of 2008, the following year after the U.S. subprime crisis in August 2007, economic activity in advanced countries slowed down but did not yet collapse, while developing economies still continued to grow. It was not until

[2]Sizes of the fiscal packages are measured by the cumulative impacts on fiscal balances over the period 2008- 2010.

September 2008 and the default of the U.S. investment bank Lehman Brothers when the situation started to deteriorate rapidly and overall confidence and liquidity were practically lost in the financial markets. Banks experienced large write-downs and tightened their lending standards. Financial market distress could be seen in strong demand for liquid assets, increased volatility, falling equity prices and widened spreads for corporate bonds. (IMF 2009a)

By the end of 2008, the credit crunch had already moved on to the real activity as production and international trade collapsed in both advanced and emerging economies, which was followed by increased unemployment. The fact that firms and consumers had little confidence in economic prospects and the credibility of the policy responses magnified the reactions and the scale of the problems. Even though towards the end of the crisis policy responses have been more efficient in fighting financial market problems, conditions on the financial markets have remained highly stressed. (IMF 2009a)

What makes this crisis distinct from some previous, severe crises is first its overall impact on the world economy: in 2009 the world economy as a whole experienced its first contraction since the Second World War, as the world GDP fell by 2,0 % (UN 2010). As opposed to some other, more regional crises, the recent crisis has had an impact on almost every country in the world. Also, the fact that the U.S. was the epicenter and actually the starting point of the crisis is worth mentioning, since this is the case for the first time after the Great Depression. The global aspect also means that any export-led recovery strategy does not work in stimulating the economy (IMF 2008).

Also the scale of the financial system problems is exceptional, since the liquidity in the financial markets was at some point almost completely lost (e.g. IMF 2009b). Because of this, policy measures taken should be focused not only on stimulating aggregate demand and employment and restoring confidence but also on repairing the financial system failures (IMF 2008).

2.2 Comparison with the Great Depression

The 2008 crisis has been widely compared to the Great Depression of the 1930s, mainly because of the magnitude and global aspect that distinguish them from other severe crises. Also, both crises have the U.S. economy as the center of the crisis, while many other important crises have developed in smaller, often emerging economies (Helbling 2009). Globally the fall in output in the recent crisis is comparable to that of the 1930s, even though for example in the U.S. the output collapse was greater during the Great Depression (Almunia et al. 2009).

As opposed to today, in the 1930s production was concentrated mainly in the U.S. and Europe, which created a strong distinction between the industrialized products of the north and the primary products of the south. Since it was mainly industrialized production that collapsed during the recession, the production collapse was a concern in the industrialized countries, while the production in Asian and Latin American developing countries remained more stable. On the contrary, today the industry is spread around the whole world and the output fell rapidly everywhere during the first year of the crisis. (Almunia et al. 2009)

In the 1930s, regardless of the more stable production in developing countries, commodity prices fell more sharply there than in industrialized countries. This was due to the fact that international trade in manufactured goods fell more sharply than for primary goods, which resulted in relatively lower prices for primary goods and made the developing countries worse off regardless of a more stable level of production. This worked as a key mechanism in lowering incomes in the countries of the south. As a consequence, the developing countries were also badly affected and the nature of the crisis was strongly global, as in the recent crisis. (Almunia et al. 2009)

During the recent crisis, trade fell much more rapidly than in the 1930s, which implies a greater elasticity of trade with respect to production (Almunia et al. 2009). This could be attributed to the global fragmentation of production or, as Tanaka (2009) refers to it, vertical specialization, which means that manufacturing firms are

increasingly specializing in certain stages of the production process. This also means that a product can cross national borders several times before reaching its final consumer. If production is more fragmented globally, then trade flows respond more sharply to changes in global demand.

Almunia et al. (2009) argue that while the growth of vertical specialization can explain the *absolute* decline of trade, it remains unable to explain the *percentage* decline or greater elasticity of trade with respect to production. They therefore refer to another explanation, which is the changing composition of trade: since it was output and trade of manufactured goods that collapsed in the 1930s and since the proportion of manufactured goods in the world trade has risen from 44 % in 1929 to 70 % in 2007[3], the decrease in world trade was undoubtedly greater in the 2008 crisis. If manufacturing had been as important a share of world trade as it is today, total world trade would have fallen at a rate comparable to the current situation.

In the recent crisis interest rates were cut down more rapidly and from a lower initial level than in the 1930s, the Bank of England and the Fed having both reacted faster than the ECB. Monetary expansion has also been more rapid now than during the Great Depression. In addition, it seems that not only advanced economies but also developing countries are using fiscal policy more aggressively as opposed to the 1930s. (Almunia et al. 2009) All in all it looks as if policy measures were taken faster and more aggressively than in the 1930s.

Also, because of different types of exchange rate obligations in the 1930s (e.g. the gold standard), several countries were unable to practice expansionary monetary policy and reluctant to apply fiscal stimulus fearing it could attract more imports and lead to a drain of reserves. Since now all major economies have flexible exchange rates, also the central banks have the possibility to respond aggressively. There are some exceptions, namely countries that are pegging their currency to some other currencies. These commitments can sometimes lead to adverse policy responses or prevent the use of monetary policy in stimulating the economy, since in order to maintain the commitment the central banks may be obliged to, for instance, raise

[3] 1929 data is available in http://unstats.un.org/unsd/trade/imts/historical_data.htm and 2007 data in http://www.wto.org/english/res_e/statis_e/its2008_e/its08_merch_trade_product_e.htm.

interest rates despite the lower aggregate demand. In general, however, because of the broader use of flexible exchange rates in the recent crisis, the monetary authorities have had more power in fighting the recession than in the 1930s. (Almunia et al. 2009)

Liquidity and funding problems have played a key role in the financial sector transmission in both crises. Concerns about the net worth and solvency of financial intermediaries were at the root of both crises, although the specific mechanics were different, given the financial system's evolution. In the Great Depression, in the absence of deposit insurance, the problems resulted from the weakening of the deposit base of US banks. In four waves of bank runs, about one third of all US banks failed between 1930 and 1933. The bankruptcy of the Austrian bank Creditanstalt in 1931 finally resulted in bank runs also in European countries. In the recent crisis, the existence of deposit insurance has largely prevented bank runs by the public. Instead, funding problems have been created by financial intermediaries relying on wholesale funding, particularly those issuing or holding, directly or indirectly, U.S. mortgage-related securities whose value was hit by increasing mortgage defaults in 2007. With large international linkages, the problems were immediately global despite their U.S. origins. In contrast, the spillover effects were more gradual in the 1930s, with the U.S. funding problems transmitting through increased capital flows to the U.S. and money supply contraction in the source countries. (Helbling 2009)

During the Great Depression, there was a similar near-zero interest rate type of a situation, with signs of a liquidity trap, as in the 2008 crisis (Almunia et al. 2009). In short this refers to a situation where additional interest rate cuts are no longer possible, because the nominal interest rate has already been cut down close to zero. In the case of a liquidity trap the demand for money becomes infinitely elastic, so expansive monetary policy is not useful in stimulating consumption either. In conditions like these, fiscal policy is often viewed as a good way of stimulating the economy, since traditional monetary policy cannot be used and crowding out of private investment becomes less likely with interest rates close to zero. It has also

been argued that the reason why fiscal policy did not work well in stimulating the recovery in the 1930s was that it was hardly used (Almunia et al. 2009).

In conclusion, the recent crisis is similar enough to be compared with and, to some extent, analyzed based on the Great Depression. What the two crises have in common is the already mentioned global magnitude and rapid decline in trade of manufactured goods as well as financial sector distress. It seems as if policy measures to recover from the crisis had been taken more quickly in the recent crisis, which may also be due to the fact that it has been easier to do so.

3 Basic Facts about Fiscal Stimulus

In this chapter I review some general facts and findings on shocks to government spending and their effects on output. I will present some relevant theory and go through previous literature in order to find theoretical support for fiscal stimulus. I will then discuss other topics related to fiscal stimulus, mainly restrictions and special conditions that a crisis situation creates on the use of monetary policy. Finally I will briefly consider the effects of tax cuts on output and compare them with those of increased government purchases.

3.1 Theoretical Framework

3.1.1 Different Theories

The traditional Keynesian theory suggesting high fiscal multipliers is nowadays quite unanimously regarded as an insufficient tool in analyzing the economic environment. Traditional Keynesian models that aim to explain the short-run effects of alternative

government policies fall short in one important aspect: they do not include forward-looking consumers and their preferences or firm objectives in their preliminary assumptions.

On the contrary, Neoclassical models explain the macroeconomic environment by building on micro foundations and assume rational, utility-maximizing consumers and profit-maximizing firms that make their decisions based on full and perfect information. Neoclassical models assume prices and wages to be fully flexible and do not include market rigidities in their general framework. Lately the Neoclassical theory has been increasingly merged with modern Real Business Cycle (RBC) theory that builds macroeconomic models for quantitative analysis using optimizing behavior at the individual level. Neoclassical RBC models assume fully flexible prices and wages and study the effects that real economic shocks have on business cycle fluctuations.

Since in the real world there are always some market frictions, it is quite optimistic to assume perfect information and fully flexible prices. New Keynesian models try to approach this problem by allowing for market frictions, namely sticky prices and wages, as in the Old Keynesian theory, but adding the microeconomic aspect and forward-looking, utility-maximizing consumers in their framework. They use traditional, Old Keynesian theory as a basis and attempt to provide micro foundations for key Keynesian concepts. More recently New Keynesian theory has been greatly influenced by RBC theory and by combining the theoretical basis of RBC models with traditional Keynesian ingredients, New Keynesian models provide a framework that has become the basis of a new generation of models used increasingly for analysis and forecasting purposes (Galí 2008).

New Keynesian models have adopted many of the tools originally associated with RBC theory, such as the use of Dynamic Stochastic General Equilibrium (DSGE) models that are based on optimizing consumer and firm behavior and rational expectations. One of the more general characteristics of the New Keynesian framework is its flexibility when it comes to accommodating to different extensions made to the basic model. (Galí 2008) As opposed to the classical Keynesian view,

New Keynesian theory assumes consumers to be forward-looking and rational and firms to be profit-maximizing and is in that sense a lot more similar to the Neoclassical view than the Old Keynesian theory.

As always when it comes to economics, there is disagreement on whether New Keynesian theories are adequate for evaluating the effects of economic policies. New Keynesian models have been used widely in estimating the effects of monetary policy (e.g. Smets and Wouters 2003, Christiano et al. 2005), but not as extensively when it comes to fiscal policy. Indeed, in attempts to estimate the government expenditure multiplier empirically the results vary drastically depending on the initial assumptions made as well as the type of model used.

Also, few macro models of any kind involve a monetary sector. In the majority of these models households choose the optimal level of consumption according to the life-cycle-permanent-income principle and depending on their intertemporal budget constraint. In turn, firms choose inputs to maximize profit, subject to wage and capital rental. On the contrary, monetary sector is not formally modeled, but instead, consistent with modern central bank practice, the economy is supposed to have a Taylor rule relating the interest rate to the rate of inflation. In addition, recently one more problem has been recognized when it comes to modern general-equilibrium macro models: they miss important features of financial markets, especially the widened spreads between safe government interest rates and private rates, which have occurred in the recent crisis, for example. (Hall 2009)

3.1.2 Suggestions of the Different Theories

The reason why Old Keynesian models yield such high multipliers lies in their non-dynamic nature: since they assume consumers make their consumption decisions based solely on current disposable income instead of taking into account the present value of future disposable income, there is no crowding out effect of private consumption. Consumers do not anticipate the decrease in future income caused by

the government's need to finance the higher level of expenditure and they consume all the additional income they get. An analogous interpretation goes for the private sector firms as well.

As soon as the assumption of forward-looking consumers and firms and maximization of life-cycle utility is added into the model, the situation changes quite dramatically. When the government increases expenditure, the private sector anticipates that the spending needs to be financed with higher taxes at some point in the future or with a higher level of debt, which would in turn result in higher interest rates, and they save some fraction of the additional income. This is the reason why in practically all the modern empirical and theoretical studies there is crowding out of private consumption to some extent when public spending is increased. Empirically, New Keynesian models yield considerably lower multipliers than Old Keynesian models (see e.g. Cogan et al. 2009). It is worth mentioning, though, that even when consumers are forward-looking, the fraction of consumption entering into the life-cycle consumption theory is not 100 %, since there is always a part of consumers who would be willing to borrow and to smooth their consumption, but are not able to do so and are constrained to spending their current income. (Hall 2009)

The assumption of rational expectations and intertemporal optimization is what the New Keynesian and Neoclassical models have in common. Where they differ is the interpretation of price and wage flexibility. In purely neoclassical models full employment follows implicitly from the assumption of perfectly flexible prices and wages. Therefore increases in government purchases crowd out private investment and consumption and do not raise output substantially. The output multiplier, which is the effect of increased government purchases on aggregate output is only slightly positive and the consumption multiplier clearly negative. The reason is that even with full employment, an increase in output and aggregate demand can only come from increased employment. With no employment reserves available, any increase in employment must necessarily drive the wage down, which in turn will result in less labor supply. The attempt to stimulate aggregate demand by any means that raises product demand and consequently employment and output must decrease consumption, contrary to common sense. (Hall 2009)

Woodford (2010) finds, quite consistently with the reasoning above, that in the case of Neoclassical theory with perfect competition the multiplier is always positive but necessarily less than one which means private expenditure is crowded out to some extent. The higher the degree of intertemporal substitutability and the more sharply rising the marginal cost of employing additional resources in production, the smaller the multiplier. If there is monopolistic competition on the market, it follows that if there is any delay in the adjustment of prices and wages, the multiplier can be slightly larger than with perfect competition.

According to Hall (2009), the two main ways of obtaining higher multipliers are related to (1) the margin of price over cost, or the *markup ratio*, and (2) the elasticity of labor supply. If the markup ratio is not constant but falls during expansions, the markup declines as output increases and prices stay constant during a boom that increases production costs. This can also be expressed as price stickiness, one of the main assumptions behind New Keynesian models. During an expansion, the declining markup allows for the wage to rise or at least not to fall as much as it would in the case of a constant markup. In this sense, it allows households to supply much more labor when the government increases expenditure than in the case of fully flexible wages. Elastic labor supply can in turn be associated with sticky wages. However, in an economy with sticky wages and *without* sticky prices, the government spending multiplier is always negative, that is, in order to obtain high multipliers, both of the conditions expressed above need to hold.

3.2 Liquidity Trap and the Zero Interest-rate Lower Bound

A situation where government spending multipliers are both theoretically and empirically higher than usual is when the nominal interest rate is restricted by a zero lower bound. This refers to a situation where it is impossible for the central bank to stimulate aggregate demand by lowering short-term nominal interest rates, since they cannot be lowered below zero, or some other small lower bound. This in turn

leads to a situation, where the real interest rate is higher than it should be for the economy to be able to recover. The zero interest-rate lower bound is typically accompanied with a liquidity trap, where attempts to increase liquidity in the market by supplying more money are useless, since all the additional liquidity is absorbed and it does not affect the level of interest rates or economic activity (Benigno 2009).

The liquidity trap and zero lower bound on interest rates also imply that conventional monetary policy in the form of lowering interest rates is no longer effective when it comes to stimulating aggregate demand, which has sometimes been used as a factor supporting the use of fiscal stimulus. Also, in earlier studies it has been found that fiscal multipliers are higher and fiscal policy is more effective if it is carried on when the zero lower bound binds. (e.g. Christiano et al. 2009) In a normal situation, if public demand is increased, it will lead to a rise in interest rates, which will result in crowding out of private investment. With the zero lower bound this need not be the case, that is, the real interest rate and the nominal interest rate do not need to rise in response to fiscal stimulus. Since the increase in government spending is often associated with higher inflation expectations, the real interest rate can actually decrease as a result of fiscal stimulus. Government purchases should thus be expected to have an especially strong effect on aggregate output if the zero interest-rate lower bound is binding. (Woodford 2010) Accordingly, Christiano et al. (2009) find that the multiplier is a lot larger if the nominal interest rate does not rise in response to increased government spending and they find multipliers as high as 2 if the nominal interest rate remains constant while government spending goes up for eight quarters.

There is also another view on the effectiveness of monetary policy in a liquidity trap, pointed out by Krugman (1998) and also discussed in Benigno (2009), which does not see monetary policy as completely ineffective. Since in a liquidity trap, lowering the real interest rate creates expectations for future inflation, it can offer a solution when more conventional monetary policy does not work. Since people anticipate the price level to be higher in the future, the real interest rate will decrease based solely on expectations of higher prices. It is worth pointing out, though, that in practice it may be hard for the central bank to commit to future inflation (Christiano et al.

2009). A liquidity trap is always the product of a credibility problem where the public believes that the monetary expansion will not be sustained. Without the ability to carry on credible monetary policy it seems logical that committing to high inflation in the future is not too credible either. For structural reasons inflationary expectations can sometimes be necessary but that should never imply that *credibly* sustained monetary expansion is ineffective. (Krugman 1998)

Eggertsson (2009) has also studied the effectiveness of different fiscal policy measures when the short-term nominal interest rate has been cut down to zero. Using a standard New Keynesian DSGE model he finds, that the most effective ways are increasing public spending and committing to future inflation. He argues them to work ideally together, since government spending itself creates inflationary expectations and should not suffer from credibility problems in that sense. When the zero bound on interest rates is binding, insufficient demand is the main problem and different policies should mainly focus on increasing aggregate demand instead of tackling with the supply side. When it comes to tax cuts on wages and capital, Eggertsson finds quite surprisingly that they can have contractionary effects on consumption and can induce more saving. However, since tax cuts tend to increase budget deficits, he raises one channel through which tax cuts can be effective in stimulating the economy: by creating inflationary expectations. This and other findings from the effects of tax cuts will be discussed in more detail in the next chapter.

3.3 Multiplier Effects of Tax Cuts

Even though in this thesis I restrict my analysis to public spending on goods and services, for motivationary reasons and in order to have a point of comparison I will briefly review some findings on the multiplier effects of tax cuts as well.

Tax cuts and government spending operate on aggregate demand through different channels: government spending (consumption and investment) affects directly

aggregate demand while tax cuts operate primarily through their effects on the disposable income of the private sector. It is widely accepted in the literature that fiscal measures that have a direct impact on the demand side have larger multipliers than those that operate mainly through affecting the households' spending behavior. (Coenen et al. 2010) Indeed, when comparing the effects of different fiscal measures several studies have found that increasing government spending, especially government investments, generates larger multipliers than cutting taxes or increasing transfers (see e.g. Roeger and Veld 2009, Freedman et al. 2010).

Eggertsson (2009) finds, using the DSGE model mentioned in the previous chapter, that tax cuts can deepen a recession under the economic circumstances that characterized the crisis of 2008. His key assumption is that the short-term nominal interest rate has been cut down to zero, so that the economy experiences excess deflation and output contraction. In these circumstances he argues tax cuts on wages and capital to have contractionary effects on output. When labor income taxes are cut, they create deflationary pressures by reducing the marginal costs of firms, which in turn causes the real interest rate to rise. When the nominal interest rate has already been lowered to zero, the central bank is not able to lower the nominal interest rate more in order to stimulate the economy. When it comes to capital taxes, in normal circumstances they would increase investment and have an expansionary effect. However, in the circumstances of the recent crisis the problem is not that the capacity of the economy is inadequate, but rather that the aggregate demand is insufficient. This means that cutting capital taxes gives people the incentive to save instead of spending, which obviously deteriorates the situation.

On the contrary, sales tax cuts and investment tax credits Eggertsson finds to be effective, since they stimulate spending and aggregate demand instead of focusing on the supply side. In conclusion, when interest rates are positive tax cuts are expansionary, but as soon as the interest rates are cut to zero, the effect becomes contractionary. As a comparison, while the effect of government spending on output is already positive when the nominal interest rate is above zero, it becomes eight times larger with zero interest rates. Eggertsson also points out that many of the previous results on the effects of fiscal policy may not be directly applicable to the

current situation, since in the samples used interest rates remain positive all the time.

Blanchard and Perotti (2002) study the effects of both government spending and taxes on output using a VAR model and event-based sets of U.S. postwar data. Their results consistently show positive tax shocks to have a negative effect on output, which implies that in their model tax cuts have stimulative effects on output. The size and persistence of the effect depend on the specifications, which include deterministic and stochastic trends as well as different subperiods, such as the Korean War buildup. Positive government spending shocks they find to have a consistent positive effect on output and private consumption, but a negative effect on private investment.

An interesting observation is also that the GDP response to fiscal policy has become substantially weaker during the past 20 years for both tax and government spending multipliers and especially the post-1980s tax multipliers are significantly negative. The decline in the efficiency of fiscal policy might be in part due to the world economy becoming more open. Also, during the past decades major economies have been moving from fixed exchange regimes to flexible exchange rates, which can reduce the power of fiscal policy. When interpreting the results from previous studies it is worth noting that because of lack of availability of European data, the vast majority of studies have been done using U.S. data. Since the U.S. is an outlier in many dimensions, the results may not be representative of the average OECD country. (Perotti 2002)

3.4 Discussion

The more advanced and sophisticated macroeconomic models developed during the last decade have made the analysis of fiscal policy decisions more extensive and more realistic. New Keynesian DSGE models that enable a dynamic analysis are increasingly used in several macroeconomic studies, but to a wider extent when it

comes to monetary policy. What the models are still lacking is a formalization of the monetary sector and very often interest rates and inflation are simply assumed to be related to each other according to the Taylor rule. Also, especially when it comes to analyzing the 2008 crisis, including features of the financial sector would be useful, since the financial sector collapse has played such an important role in the crisis.

New Keynesian models consistently yield higher fiscal multipliers than Neoclassical models, and allowing for any market rigidities, such as monopolistic competition, increases the multipliers in Neoclassical models. The New Keynesian assumption of sticky prices and wages is a key factor in obtaining high multipliers. Another important assumption when it comes to observing high multipliers, which can easily be related to the latest crisis, is that the zero lower bound for interest rates binds. When the zero lower bound and liquidity trap-like conditions prevail, nominal interest rates do not have to rise in response to increased public spending and private spending is not substantially crowded out. Fiscal policy is especially effective if the zero nominal interest rate is accompanied by inflation expectations. In turn, private investment is normally crowded out to some extent when government expenditure is increased, even in New Keynesian models. The increasing international trade and capital movements as well as wider use of flexible exchange rates have made the response to fiscal policy weaker during the past decades.

When it comes to tax cuts as a means of fiscal policy, they can be contractionary especially with zero nominal interest rates. When evaluating the results of previous studies on tax cuts one should keep in mind that many of the studies have been done using data with positive interest rates and can therefore yield estimates that are not directly applicable. In brief, it is preferable to concentrate on aggregate demand instead of aggregate supply when conducting fiscal stimulus policies.

4 Interest Rates and Monetary Policy

In this chapter I will study the size of the government spending multiplier under differing assumptions of monetary policy. Consistently with many of the empirical DSGE models, I primarily assume prices and wages to be sticky, so that monetary policy has an effect on real activity and the consequences of an increase in government purchases depend on the monetary policy response. According to the Neoclassical theory this would not be the case since fully flexible prices and wages would adjust to any changes in monetary policy.

4.1 Constant Real Interest Rate Multiplier

As a first step in the analysis concerning multipliers under different monetary policy schemes, a useful benchmark is to assume that the central bank maintains an unchanged path for the *real* interest rate, regardless of the path of government purchases. It is worth bearing in mind though that under realistic assumptions about monetary policy, the real interest rate may well change. The advantage of this multiplier is that it is easier to calculate and that it remains the same under differing assumptions of price and wage stickiness. (Woodford 2010)

Woodford (2010) uses a New Keynesian model to analyze the size of the multiplier. In his model, variations in the level of government purchases are assumed to be purely temporary and monetary policy brings out a zero rate of inflation in the long run, so that the economy converges to a steady state in which government purchases equal $\overline{G}$, inflation is equal to zero and output is equal to some constant level $\overline{Y}$. Note that the essential assumption here is that the monetary policy is chosen in such a way that the *real* interest rate is held constant. The operating target for the *nominal* interest rate can be chosen according to the Taylor rule, for instance, where the nominal interest rate is adjusted based on the rate of inflation, but the central bank

may as well choose a path for money supply that is consistent with zero inflation in the long run, or the equilibrium can be implemented in some other way.

The economy consists of a large number of identical, infinite-lived households that seek to maximize

$$\sum_{t=0}^{\infty} \beta^{t} [u(C_t) - v(H_t)], \tag{4.1}$$

where C_t is the quantity consumed in period t, H the hours of labor supplied, the utility functions satisfy $u' > 0$, $u'' < 0$, $v' > 0$, $v'' < 0$, and the discount factor satisfies $0 < \beta < 1$. The output Y_t is consumed either by households or by the government, so in equilibrium

$$Y_t = C_t + G_t. \tag{4.2}$$

Optimization by households requires that in equilibrium,

$$\frac{u'(C_t)}{\beta u'(C_{t+1})} = 1 + r_t, \tag{4.3}$$

where r_t is the one-period real rate of return. It follows from (4.3) that in the long-run steady state, $r_t = \overline{r} \equiv \beta^{-1} > 0$ for all t. Now it also follows that $C_t = C_{t+1}$ for all t, so the representative household must be planning a constant level of consumption, at whatever level is consistent with its intertemporal budget constraint. Convergence to the steady state implies that $C_t \to \overline{C} \equiv \overline{Y} - \overline{G}$ for large t, hence in equilibrium $C_t = \overline{C}$ for all t. It then follows from (4.2) that

$$Y_t = \overline{C} + G_t,$$

(4.4)

for all t. Now the government spending multiplier (dYt/dGt) is equal to 1. There is neither crowding out of private expenditure nor any stimulus of additional private expenditure.

Even though the simple result obtained here does not require very specific assumptions about wages or prices and their adjustments, the crucial assumption made here is that it is possible for the central bank to maintain the real interest rate constant regardless of the short-run level of government spending (Woodford 2010).

4.2 Interest Rate Governed by a Taylor Rule

Next I consider a slightly more realistic assumption of monetary policy, where the interest rates are set in accordance with the Taylor rule, that is the nominal interest rate is adjusted according to variations in the inflation rate. As opposed to the previous chapter, the real interest rate is not assumed to stay constant during the fiscal expansion. Nominal interest rates will rise as a response to an increase in government spending, which puts upward pressure on inflation.

Christiano et al. (2009) use a New Keynesian model to analyze the government spending multiplier when interest rates are governed by the Taylor rule. They find that the multiplier is given by:

$$\frac{dY_t}{dG_t} = \frac{1}{g}\frac{\hat{Y}_t}{\hat{G}_t} = 1 + \frac{1-g}{g}\frac{\hat{C}_t}{\hat{G}_t},$$

(4.5)

where Y_t, G_t and C_t denote output, government spending and private consumption, respectively, $\hat{Z}_t$ denotes the percentage deviation of Z_t from its non-stochastic steady state value[4] and $g = G/Y$. The equation implies that the multiplier is less than 1 whenever consumption falls in response to an increase in government spending, that is when private consumption is crowded out by increased public spending.

The baseline parameter values chosen by the authors imply that the government spending multiplier is 1,05. The result might seem quite surprising, since by intuition some crowding out of private spending should be expected because of the negative wealth effect caused by an increase in government spending[5]. However, this perspective would neglect two key features of the model, the price rigidity and the complementarity between consumption and leisure in preferences. Since prices are sticky in the model, they stay constant when the demand rises, but at the same time production costs increase resulting in a lower price over marginal cost (the markup). The rise in aggregate demand is followed by a rise in employment. Given the complementarity of consumption and leisure in preferences the marginal utility of consumption rises with the increase in employment. As long as this rise in marginal utility of consumption is large enough, it is possible for private consumption to rise as a result of fiscal expansion, which explains the size of the multiplier calculated with the parameter values.

To further assess the importance of the preference specification the authors recalculate the multiplier using a different specification for preferences, where the marginal utility of consumption is independent of hours worked. Across a wide set of parameters they find that the multiplier is always less than 1 with this preference specification.

Next they calculate dY/dG for various parameter configurations and analyze the multiplier effects of changes in the parameters. Their first observation is that the

[4] The authors use a linear approximation around the non-stochastic steady state of the economy in order to solve for the equilibrium.

[5] In the model Ricardian equivalence holds so that from the perspective of the representative household, the increase in the present value of government purchases equals the increase in the present value of taxes and they both have a negative wealth effect. Ricardian equivalence and its implications on fiscal stimulus are discussed in chapter 6.1.1.

more the marginal utility of consumption rises with the increase in employment, the higher the multiplier, which seems quite reasonable considering the discussion above. Also, the higher the degree of price stickiness, the larger is the multiplier. The observation of a multiplier growing with more price stickiness reflects the fall in the markup when aggregate demand and marginal cost rise, and the effect is even stronger with more price stickiness. For comparison, if prices are perfectly flexible, the markup is constant and the multiplier less than 1 always.

If the real interest rate rises substantially in response to a rise in output, the multiplier is smaller, which seems clear by intuition, since a rise in the real interest rate has a contractionary effect on output. The time it takes for the monetary authorities to react to inflation and higher marginal costs also play a role: the less rapid the central bank's interest rate response to inflation caused by an increase in government purchases the higher the multiplier. The result is consistent with the traditional view that the government spending multiplier is greater in the presence of accommodative monetary policy, which refers to monetary authorities raising interest rates slowly in the presence of a fiscal expansion.

Based on their results, Christiano et al. (2009) conclude that from the perspective of their model and with a monetary policy governed by a Taylor rule, it is quite plausible to have multipliers above 1. However, multipliers above 1,2 are quite difficult to obtain. The reasons for obtaining such high multipliers they claim to be the frictions in price setting and the complementarity between consumption and leisure in preferences mentioned above.

Woodford (2010) finds that under a corresponding monetary policy and with a New Keynesian model the multiplier is less than 1 and necessarily higher than in the case of flexible prices, but smaller than under the constant-real-interest-rate policy. This is simply because the real interest rate rises in response to increases in inflation and the output gap, which leads to crowding out of private spending. In the limiting case of an extremely strong response to variations in either inflation or the output gap, the multiplier is equal to that under flexible prices.

Consistently with Christiano et al. (2009), Woodford finds the multiplier to increase with the degree of price stickiness. In conclusion, he finds that while larger multipliers are possible according to a New Keynesian model, they are predicted to occur only with a sufficient degree of monetary accommodation, and they will also require the central bank to allow for an increase in the rate of inflation.

4.3 Constant Nominal Interest Rate

In this chapter I will move on to consider a situation where the *nominal* interest rate stays constant during fiscal expansion, which means that the central bank does not tighten its monetary policy in response to an increase in public spending. This assumption is especially plausible in the presence of a zero lower bound on interest rates. Since the zero bound-like situation applies well to the conditions of the recent crisis, I will concentrate here on its analysis.

To see why the assumption of zero nominal interest rates is plausible, let us consider a situation where the central bank would, in the absence of the zero lower bound constraint, wish to drive its short-term nominal interest rate target below zero but instead it has to settle for a target rate of zero. Now we can assume that even with fiscal expansion the desired interest rate will remain non-positive and the central bank's target rate will remain at zero. Since the nominal interest rate does not rise in response to fiscal stimulus, the real interest rate can actually decrease, since fiscal stimulus normally creates inflationary expectations, and government purchases should have an especially strong effect on output. (Woodford 2010)

Eggertsson (2009) uses a New Keynesian DSGE model to consider the effects of temporary fiscal expansion at zero interest rates, so that during the fiscal expansion $Gt > 0$ and in the steady state $Gt = 0$. That is, the government increases spending in response to a deflationary shock and then reverts back to steady state once the shock is over. Increasing government spending causes a rise in aggregate demand, stimulating both output and prices. At the same time, however, it increases

aggregate supply, which has some deflationary effects[6], but this effect is too small to overcome the stimulative effect of higher government expenditure.

When solving for the AS and AD equations together, he finds that the effect of increased government spending is always positive and greater than 1. In his numerical example he finds the multiplier to be as large as 2,45. Obtaining such a large multiplier can be explained by the expectations of the model: since the main cause of the decline in output and prices following the shock is the expectation of a *future* slump and deflation, committing to increased future government spending in all states of the world where the zero bound is binding will reverse contractionary expectations in every period where the zero bound binds, which in turn has a large effect on spending in a given period. Thus, expectations about future policy play a key role in explaining the effect of government spending, and the key element of making it work is to *commit to sustaining the higher level of public spending until the recession is over*. Since in the model expectations are the driving force of the effectiveness of government spending, it is the announcement of the fiscal stimulus that matters rather than the exact timing of its implementation. Thus, it is not of great importance if there is a lag of a few quarters in the implementation.

Woodford (2010) analyses the size of the multiplier using an example (based on Eggertsson 2009) where the temporary shock to the economy and the crisis situation are caused by financial disturbance, namely elevated credit spreads between the policy rate and the rate of intertemporal allocation of expenditure used by households. Furthermore, the spread between the two interest rates varies over time, owing to changes in the efficiency of financial intermediation and is assumed to be unaffected by either monetary or fiscal policy choices. With a high enough spread the zero bound becomes binding and it will bind for any level of government purchases lower than the critical level, that is, when $G_L \leq G^{crit}$. Now the economy is in equilibrium, where there is both deflation and an output gap. Since the deflation and economic contraction can be quite severe, it can be highly desirable to stimulate

[6] Government spending takes out resources from private consumption, which makes people want to work more in order to make up for lost consumption, shifting out labor supply and reducing real wages.

aggregate demand by increasing government spending. Figure 1 illustrates the relation between the level of government purchases and output.

The multiplier when government purchases are below their critical level is necessarily greater than 1. The main reason for this is that with the nominal interest at zero, an increase in G_L increases expected inflation (given some positive probability of elevated credit spreads continuing for another period) and lowers the real rate of interest. Therefore monetary policy is even more accommodative than in the analysis of the previous chapter.

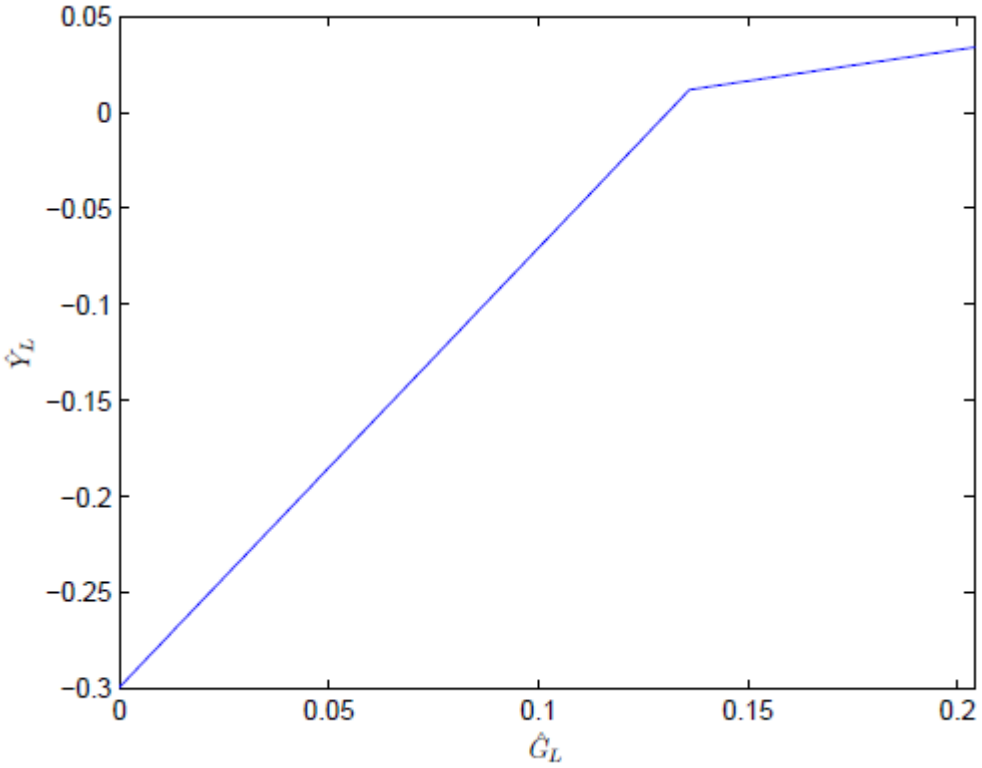


Figure 1: Output as a function of the level of government purchases during the period when the credit spreads remain elevated (Woodford 2010).

The degree to which the multiplier exceeds 1 can in this case be quite considerable. In fact, given a high enough value of the parameter μ, which is the probability that the credit spreads remain elevated during the following period and for any given values of the other parameters, the multiplier while the central bank's policy rate

remains at zero bound can be unboundedly large. In general, though, the multiplier is not too much greater than 1 except when μ is fairly large. Figure 2 plots the multiplier as a function of μ. Note that the case in which μ is large is precisely the case in which the multiplier dY/dr is also large, that is when a moderate increase in the size of credit spreads can cause a severe output collapse. Thus, at the zero lower bound increased government purchases should be a powerful means to help the economy recover from a crisis, especially when there is little confidence that the disturbance in the credit markets is short-lived (when μ is large).

Christiano et al. (2009) assume that the shock that makes the zero bound binding is an increase in the discount factor, which can be seen as representing a temporary

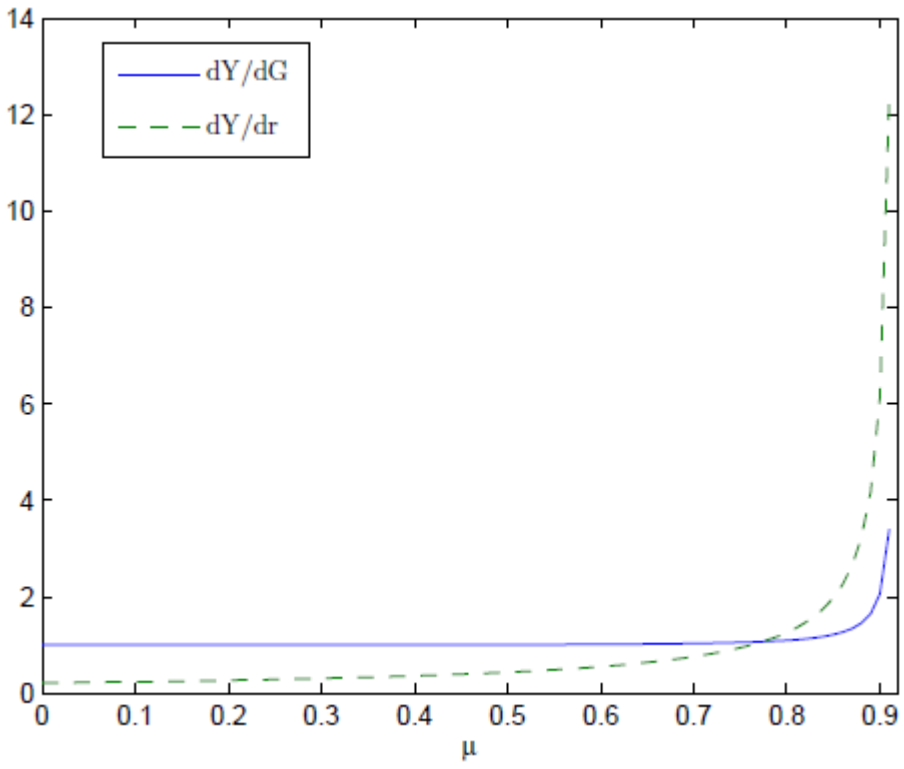


Figure 2: The derivatives of output Y with respect to real policy rate r and G for alternative values of μ (Woodford 2010, based partly on the parameter values of Eggertsson 2009).

rise in the agent's propensity to save. In the model investment in the economy is assumed to be zero, so that aggregate saving must also be zero in equilibrium. If there is a large enough increase in the discount factor, the zero bound becomes binding before the real interest rate falls by enough to make aggregate saving 0. The only force that can induce the fall in saving required to re-establish equilibrium is a large transitory fall in output.

The explanation for such a large fall in output is as follows. Since the nominal interest rate is zero and expected inflation is negative, the real interest rate is positive. Both the increase in the discount factor and the rise in the real interest rate increase the agent's desire to save. There is only one force remaining to generate zero saving in equilibrium, a large transitory fall in income, which will lead to reduced desired saving as agents attempt to smooth their intertemporal consumption. Since this effect caused by a reduced desired level of saving has to counterbalance for the two factors leading agents to save more, the fall in income has to be very large.

With their benchmark specifications, the numerical value of the government spending multiplier is 3,7, which is roughly three times larger than in the previous chapter, where the interest rate was governed by a Taylor rule. The size of the multiplier does not depend on the size of the shock to the discount factor. The intuition for why the multiplier can be so large is that since an increase in government spending leads to a rise in output, marginal cost and inflation, and since with zero nominal interest rates the rise in expected inflation makes the real interest rate fall, private spending increases. This rise in expenditure generates a further rise in output, marginal cost and expected inflation and a further decline in the real interest rate, which will all result in a large rise in inflation and output.

When it comes to the sensitivity of the multiplier values to changes in different parameters, the longer the expected duration of the shock to the discount factor the higher the multiplier. Also, the multiplier is especially large in economies where the drop in output associated with the zero bound is large. In other words, fiscal policy is particularly powerful in economies where the output costs of being in the zero state bound are very large.

4.4 Discussion

In this chapter I have analyzed the size of the multiplier under three different assumptions about monetary policy. As a benchmark, I first considered a policy where the path of the real interest rate is held constant regardless of the level of government spending. In this case the multiplier equals 1 and there is no crowding out of private spending. The result, however, is not very useful since under realistic assumptions about monetary policy the real interest rate may change and it is hardly possible for the central bank to commit to a policy of this kind.

I then considered a situation, where the nominal interest rate is adjusted according to the Taylor rule and the real interest rate also varies along with the inflation rate. According to the model used by Christiano et al. (2009), private spending might not necessarily be crowded out in this case, but it can actually increase and the multiplier can be greater than one. The key assumption here is that consumption and leisure are complementary in preferences so that the marginal utility of consumption rises with employment and whenever this rise is large enough, multipliers larger than 1 are possible. The stickier the prices in the economy and the lower the central bank's response to increased inflation, the larger the multiplier.

After I moved on to consider perhaps the most interesting case when it comes to the analysis of the crisis, that is, when the nominal interest rate remains constant, which is relevant in the case of zero nominal interest rates. In all the three models considered here the multiplier is larger than 1 while the reasons behind the shocks are distinct. In the model by Eggertsson (2009) the crisis is caused by a deflationary shock, while Woodford (2010) considers a shock caused by financial disturbance and Christiano et al. (2009) a shock to the agents' discount factor, which leads to increased saving.

Based on the analysis seen here, fiscal stimulus can be useful in a crisis situation, especially if the government commits to sustaining a higher expenditure level as long as the crisis lasts, if there is disturbance in the financial markets which is experienced in the form of elevated credit spreads and the disturbance is likely to last for some

time, or if the output costs of being at the zero bound-like situation are large for the economy. If these conditions are met, and if the short-term nominal interest rates are at zero, it should be possible to experience fiscal multipliers up to 3,7.

5 Duration and Timing of the Stimulus

In this chapter I will try to identify the conditions for an optimal fiscal package when it comes to the duration and timing of the stimulus measures. I will see how persistent the stimulus should be and what happens to the size of the multiplier if the change in a fiscal instrument becomes permanent. I will also briefly consider the long-term effects of an increased level of government debt and discuss the implications of lags in the implementation of fiscal policy changes.

5.1 Persistence of the Stimulus

For fiscal stimulus to be effective, it has to be temporary, otherwise the crowding out effects will become too relevant and they will end up depressing the multipliers. The next question of interest is how long the temporary change in a fiscal instrument should last, so that the fiscal multiplier would be as large as possible.

Woodford (2010) concludes that stimulus is most effective when it lasts precisely as long as credit spreads remain elevated, that is, as long as the zero lower bound on interest rates is a binding constraint. The probability that government purchases G_t remain at their elevated level G_L after the credit spreads have returned to their normal level is λ. Correspondingly, each period the probability that the economy returns to its normal state, where $G_t = G_L$, is $1 - \lambda$.

Figure 3 illustrates how the multiplier dY_L/dG_L depends on λ. When $\lambda = 0$, the multiplier is around 2,3, but falls quite steadily when λ increases. When λ reaches a value of 0,8 (corresponding to an expected duration of fiscal stimulus for 4 quarters after the financial disturbance has ended), the multiplier falls below 1 and when λ reaches 0,91 (an expected duration of 10 quarters) the multiplier turns negative. If the increase in the level of government purchases is permanent ($\lambda = 1$), the multiplier is strongly negative. Hence, a long-lasting fiscal stimulus is predicted to increase output only slightly, but a well-targeted fiscal stimulus can be very effective. (Woodford 2010)

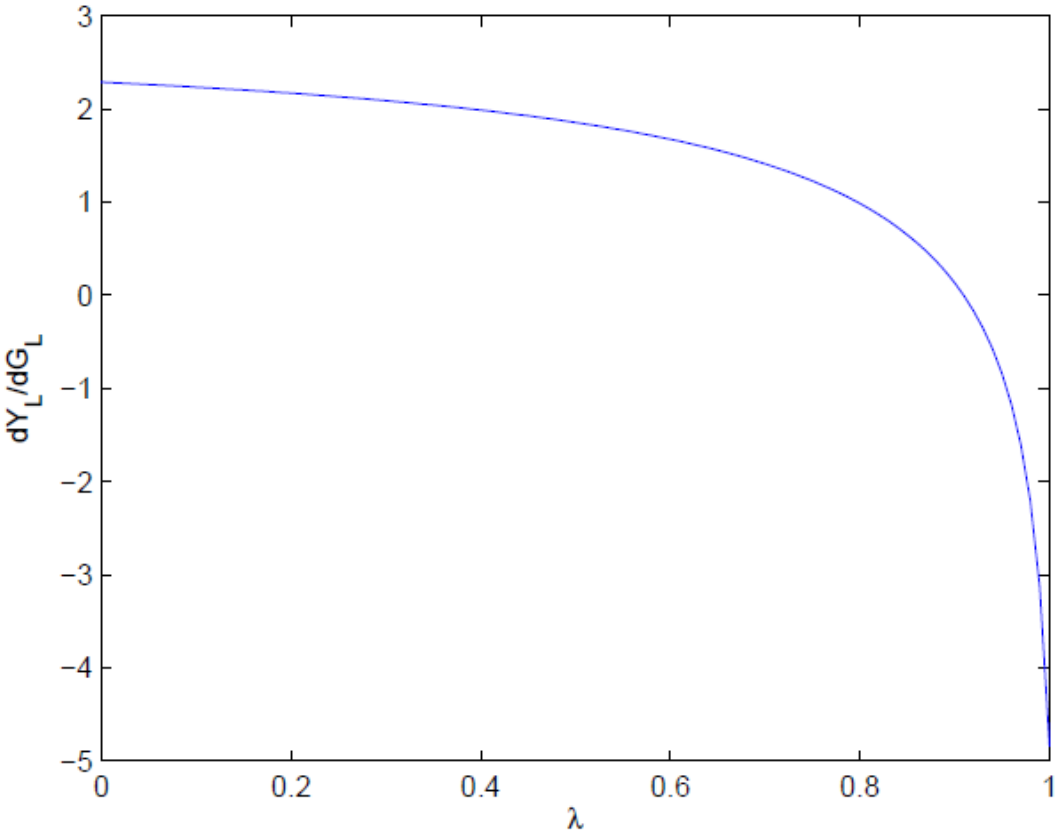


Figure 3: The multiplier dY_L/dG_L for alternative degrees of persistence λ of the fiscal stimulus after the end of financial disturbance (Woodford 2010, based partly on parameter values by Eggertsson 2009).

Coenen et al. (2010) address the persistence based on an analysis using seven different structural models and conclude that when fiscal stimulus is (and is perceived to be) purely temporary, a two-year expansion will have significantly larger multiplier effects than a one-year expansion even during the first year. This, however, holds only if monetary policy is accommodative and interest rates do not rise in response to the increase in aggregate demand created by the fiscal expansion. The reason for the greater effect of two-year stimulus is that a more persistent increase in aggregate demand results in a higher inflation over a longer period of time, which causes a stronger reduction of real interest rates[7]. If the stimulus measures become permanent, the corresponding multipliers typically are much smaller, a case that will be discussed in the next chapter.

5.2 Temporary versus Permanent Fiscal Shocks

While most stimulus measures are meant to be strictly temporary, it is possible that the temporary shock turns into a permanent change in a fiscal instrument. As seen in the previous chapter, the output response can be quite dramatically smaller and even strongly negative.

Freedman et al. (2010) compare the effects of one-year fiscal stimulus to those of a permanent change in the U.S. government consumption[8]. The size of the shock is the same in both cases, one percent of baseline-year GDP. For the permanent change, the government's deficit-to-GDP ratio also increases permanently by one percentage point, which leads to a 20 percentage point long-run increase in the debt-to-GDP

[7]In the models considered here, there is a reduction in general transfers after the withdrawal of temporary fiscal stimulus. This will bring the debt-GDP ratio back to its baseline value, so that the fiscal policy is sustainable and there is no problem with respect to the credibility of fiscal authorities.
[8]A one-year stimulus period is chosen to maximize the contrast between temporary and permanent shocks.

ratio[9]. Higher long-run debt implies that additional interest payments will eventually exceed the one percentage point increase in the deficit ratio. Therefore labor income taxes will be increased to cover for the interest charges as well as the higher government spending in the long-run. Since this is a long-run scenario, there is no monetary accommodation.

Figure 4 displays the results and illustrates the differences between the multipliers. The temporary fiscal stimulus has a first-year multiplier of slightly over 1 that goes to zero in year 2 and falls below zero after that. The permanent stimulus has a lower multiplier on impact, about 0,7, and the decline after the first year is more gradual. The crowding-out effect of permanent stimulus is primarily due to two factors. First, higher labor income taxes needed to service the additional interest payments result in a negative wealth effect that immediately starts to crowd out private demand. Distortionary taxes exacerbate the crowding-out effect and the more distortion in the taxes, the greater will be the crowding-out effect on GDP. This is the main reason behind the much smaller first-year multiplier for the permanent measure. Second, due to finitely lived households, part of the increase in government debt is perceived as net wealth[10], which crowds out alternative investments.

Roeger and Veld (2009) find correspondingly that the effects of permanent changes in fiscal instruments are smaller than those of temporary ones and, when financed by increases in labor taxes, generally become negative in the long run. The private consumption response to a permanent increase in government consumption is negative already on impact, while the overall GDP effect is positive in the first years but turns negative later on. On the contrary, the long-run output effect of a permanent increase in (productive) government investment they find to be positive, as the productivity enhancing effect of a higher capital set is large enough to offset the negative impact of labor taxes. However, the result depends crucially on the productivity of public investment projects. The benchmark assumption of the model

[9]The relationship between the long-run target government-deficit-to-GDP ratio $gdss_t^{rat}$ and the long-run target government-debt-to-GDP ratio bss_t^{rat} is $bss_t^{rat} = \frac{\bar{\pi}gn}{\bar{\pi}gn-1}\ gdss_t^{rat}$, where $\bar{\pi}$ is the inflation target of the central bank and $\frac{\bar{\pi}gn}{\bar{\pi}gn-1}$ is the trend nominal growth rate of inflation.

[10] For more discussion on the topic, see chapter 6.1

is that the rate of return of public capital equals that of private capital, when in fact it might be smaller and this would make the results too optimistic.

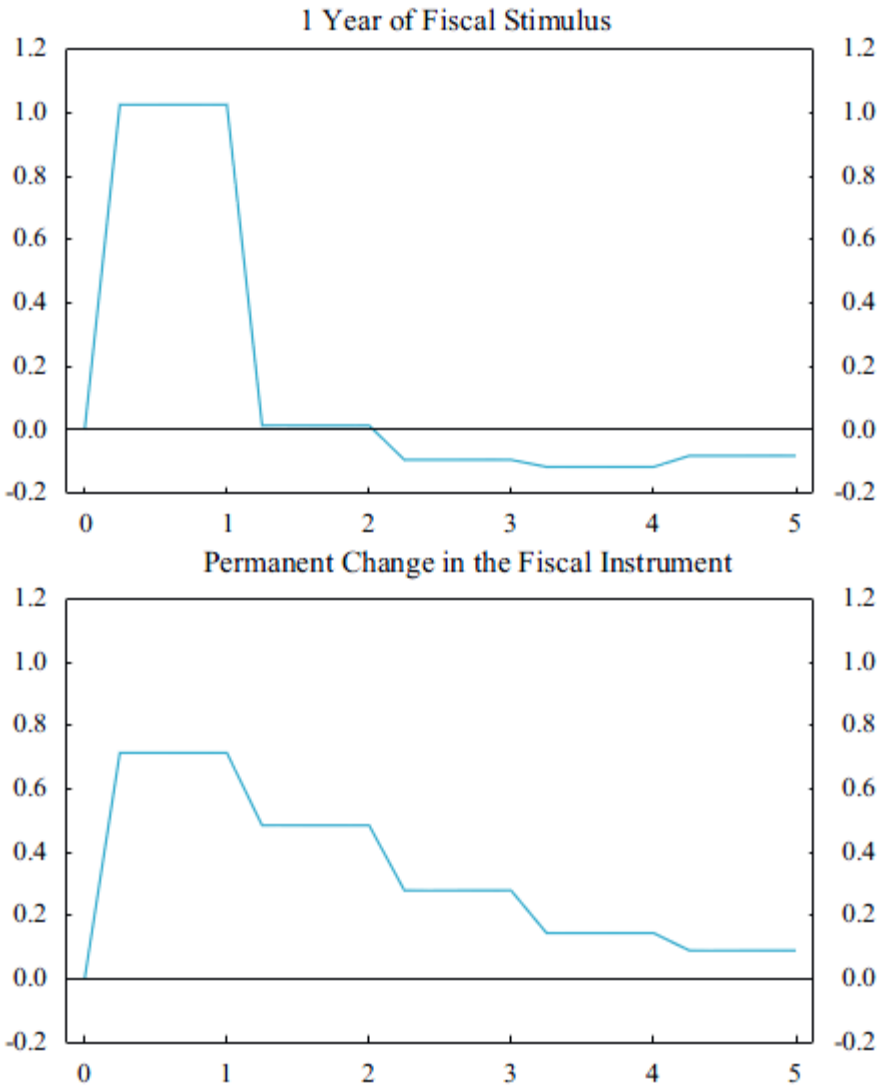


Figure 4: Effects of one-year U.S. fiscal stimulus and a permanent change in the U.S. government consumption, in percent of GDP (Freedman et al. 2010).

While permanent changes in government spending generate smaller multipliers than temporary shocks, mainly because they create expectations about higher taxes in the future, they also increase the level of public debt, an implication that has several adverse effects for economic growth. Based on this, for fiscal stimulus to be most effective, it is of great importance that temporary shocks do not become permanent, and that this policy is credible.

5.3 Long-term Effects of the Accumulation of Public Debt

As we saw in the previous chapter, permanent changes in fiscal instruments have an effect on short-term multipliers. In addition, the possible need for fiscal stimulus has once again raised discussion concerning the sustainability of the public finances of several European countries and the U.S. Since the accumulation of public debt is a common byproduct of fiscal stimulus, in this chapter I will very briefly comment on some long-term crowding-out effects of a high level of public debt.

In the short run fiscal stimulus can increase aggregate demand, but in the long run it has adverse effects on the economy. First, budget deficits decrease public saving. At the same time private saving increases but most probably by a smaller amount than public saving falls, which means national saving and total investment decrease. Over a longer period of time, reduced investment will result in a smaller capital stock, implying lower output and income. Second, government debt can affect monetary policy: a country with a large debt is more likely to face higher interest rates, which may make monetary authorities want to lower interest rates with expansionary monetary policy. As a result, interest rates may fall in the short run, but in the long run inflation will increase and real interest rates will remain roughly unchanged. Finally, large levels of public debt reduce the fiscal flexibility of the government and are costly for the economy. (Elmendorf and Mankiw 1998)

Gale and Orszag (2004) find empirical evidence that deficits reduce national saving and future national income, and raise long-term interest rates: each percent-of-GDP

in current deficits reduces national saving by 0,5 to 0,8 % of GDP and each percent-of-GDP in anticipated future unified deficits raises forward long-term interest rates by 25 to 35 basis points. In fact, deficits and public debt both increase interest rates, but through different channels. Deficits may crowd out private capital, but in addition, in normal circumstances, they raise interest rates by stimulating aggregate demand and increasing output. In the long run, government debt crowds out private capital, which also puts upward pressure on interest rates. (Engen and Hubbard 2004)

Freedman et al. (2010) calculate the long-run crowding out effects of a permanent, 0,5 percentage point increase in the U.S. deficit-to-GDP ratio corresponding to a 10 percentage point increase in the U.S. debt-to-GDP ratio. Servicing the higher level of debt raises the U.S. tax burden and world real interest rates in the long run, eventually permanently reducing U.S. output by between 0,27 and 0,64 %, the size of the output loss depending on the fiscal instrument used to finance the debt payments (cuts in transfers versus increases in labor income, capital or consumption taxes). The rest of the world is affected by the real interest rate movements and the non-U.S. output loss is around 0,2 %[11].

A well prepared stimulus package exerts less upward pressure on public debt and if fiscal multipliers are large enough, an increase in government spending translates into much higher tax revenues (Erceg and Lindé 2010). While government's possibilities to finance public spending shocks by raising taxes are limited, there is another balanced-budget strategy for financing fiscal stimulus, that is, the use of spending reversals, which will be discussed more in detail in chapter 6.2.

[11]An identical increase in deficits in another region that accounts for a similar share of world GDP as the U.S. would have very similar effects on the world economy.

5.4 How Important is the Timing of Fiscal Stimulus?

Fiscal stimulus measures are typically subject to *implementation lags*, that is, lags between the announcement of an increase in government spending and its implementation. Therefore, it is useful to see how sensitive fiscal stimulus measures are to these lags and what effects expectations of upcoming stimulus measures have on the results.

Woodford (2010) stresses the role of anticipation and argues that for fiscal stimulus to be effective, it does not need to occur immediately. The expectations of higher future public spending are more relevant than the exact timing of the stimulus. In his model an increase in government expenditure that is expected to last for the current quarter only, so that the expected level of future government purchases does not change, has a multiplier of 1,0 (assuming that interest rates remain at zero)[12]. This means that if the multiplier has a value of 2,3, for instance, only 1,0 of the value is due to an increase in current public spending, while the remaining 1,3 is a result of higher anticipated government spending in the future.

Even if there were no increase in government purchases in the current quarter at all, an expectation of higher government purchases in all future quarters prior to date T, when the zero lower bound ceases to bind, would increase output *immediately* by an amount 1,3 times as large as the promised future increase in the level of public spending, so implementation lags alone do not lead to the loss of efficiency of fiscal stimulus. Instead, a stimulus package is ineffective, and can even be counter-productive, if a large part of the stimulus measures is expected to occur in a post-crisis environment, since monetary policy will not be accommodative and higher interest rates will lead to more crowding out. (Woodford 2010) In other words, an implementation lag does not necessarily risk the efficiency of fiscal stimulus, but a prolonged stimulus period will be more likely to do that.

[12]Since there's no change in expected fiscal policy, expected future output or inflation do not change and the expected real interest rate remains the same. As long as the temporary increase in G_t remains in such a level that the current nominal interest rate is at zero, there's no change in the current real interest rate either and the multiplier is defined as in the chapter 4.1.

Erceg and Lindé (2010) find that implementation lags can depress fiscal multipliers and can even turn them negative if the delay is substantial enough. The main feature of their approach is that the multiplier varies with the level of fiscal spending or more precisely, the multiplier declines in the level of government spending, so they distinguish between the average and the *marginal* multiplier. Rather than being fixed arbitrarily, they allow for the economy's exit from the recession-induced liquidity trap to be determined *endogenously*. It then follows that the multiplier depends on the size of the fiscal response and an overly large fiscal package pushes the economy out of a liquidity trap more quickly.

Erceg and Lindé assume that the government announces the stimulus plan immediately in response to a demand shock, but that it takes some time for spending to peak. An increase in government spending that peaks after 8 quarters depresses the potential real interest rate, which encourages saving and the resulting output multiplier is negative, reflecting the fact that aggregate demand is lower during the entire period that the economy is in the liquidity trap. Even a lag of only 6 quarters may have severe effects on the marginal multiplier, since it pushes the economy out of the liquidity trap more quickly. The reasoning behind the negative effect of implementation lags is that if fiscal action is delayed to the point where the economy is already recovering from the recession, the multiplier decreases very quickly as additional spending is implemented. In other words, if the implementation lag is substantial, the multiplier can be very small already for relatively low levels of government spending.

One implication of this approach is also that the multiplier can differ for various types of government spending: projects that can be implemented quickly in a recession may have a high marginal multiplier that declines slowly with the size of the fiscal response and, on the other hand, projects that have a significant delay in their implementation may have a much smaller multiplier that declines quickly with the level of expenditure. The duration of the zero lower-bound period also plays a role, and Erceg and Lindé find that if it lasts for at least two years, increasing government spending on a temporary basis is well-justifiable and can have much larger effects than under normal conditions. For short-lived liquidity traps of less than two years,

the multiplier is larger than in normal times for relatively small increases in spending but falls quite quickly with rising spending levels. For instance, if the duration of the liquidity trap is 8 quarters, the marginal multiplier is less than unity already for a spending increase above 2 % of trend output and decreases with the size of the fiscal package.

Note that again the essential assumption in both cases is that the stimulus measures occur when interest rates are at the zero lower bound. If this were not the case, the multipliers would be lower because of more crowding out. Also, when interpreting the results from empirical estimations special attention should be paid to the identification of the shocks: because of implementation lags, what is identified as a fiscal shock may in fact be the result of earlier policy changes that are anticipated by the private sector (Blanchard and Perotti 2002). For example, Ramey (2009) argues that VAR models do not capture the timing of the stimulus announcement very well, which means the shocks are captured too late and the VAR approach can miss initial responses of consumption and real wages relevant for the multiplier estimates.

5.5 Discussion

Fiscal measures are most efficient when they are purely temporary. If the increase in public spending becomes permanent, consumers anticipate that higher taxes will be raised at some point in the future, which leads to crowding out of private consumption. Even if the stimulus period is temporary, attention should still be paid to the duration: the stimulus should last only as long as monetary policy is accommodative and as long as interest rates do not rise in response to the spending shock. If the stimulus measures are continued after the accommodative period, private demand will be subject to crowding out, which will decrease the multipliers. For instance, when interest rates are at the zero lower bound, stimulus measures should last as long as the zero interest rates are effective.

Fiscal stimulus measures can quite easily lead to a higher level of government debt, especially since the government's possibilities to raise taxes are limited. Accumulation of public debt has adverse consequences on the economy: national saving is likely to fall, which will result in lower output and income, and interest rates will be higher, which will crowd out private investment.

Implementation lags in stimulus measures can depress multiplier values, especially if the multipliers are assumed to vary according to the level of spending. Therefore, for stimulus purposes, it may be more efficient to start projects that can be implemented quickly as they will have larger marginal multipliers than projects that take a long time to be implemented.

6 Financing the Stimulus

In this chapter I will study how the changes in public debt are related to determining the size of fiscal multipliers. First I will study how the households' spending behavior and willingness to smooth consumption over time affect the consumption and output responses to fiscal stimulus. In the medium term I will take a look at fiscal exit strategies, that is, the different ways to finance the stimulus, and see which strategies generate larger multipliers.

6.1 Debt Neutrality Issues

The size of the fiscal multiplier depends highly on the households' possibilities and willingness to smooth consumption and it is very unlikely that all the extra income from a government spending shock will be spent on consumption; instead some of it

will be saved. In fact, most probably after a spending shock private consumption will decrease, and in the most extreme theories increasing government spending has absolutely no impact on GDP, as the increase in public expenditure will be completely offset by a decrease in private consumption. The latter case is known as the *Ricardian equivalence theorem*, which will be discussed in this chapter along with less restricted cases allowing for the co-existence of Ricardian and non-Ricardian households.

6.1.1 Ricardian Equivalence

Ricardian equivalence is a view in economics that was first theoretically brought up by David Ricardo in the 19th century and has since then been researched by several economists, such as Robert Barro. It is a government debt neutrality proposition stating that from the point of view of the representative household, the timing of a tax increase needed to finance an increase in government spending does not have any effect on the household's net wealth or consumption. It then directly follows that it does not matter whether the additional government expenditure is financed by increasing debt or by a balanced budget, that is, by raising taxes with a corresponding amount. If taxes are not raised simultaneously with the increase in spending, consumers anticipate that taxes will be raised at some point in the future. In other words, consumers internalize the government's budget constraint so that the timing of a tax change does not have any effect on their spending decisions and the total demand in the economy remains unchanged. Consequently, increasing government expenditure does not affect consumption and GDP or other macroeconomic variables.

Barro (1974) was the first to present a practically applicable model for studying the neutrality of government debt, although he did not directly refer to the Ricardian equivalence theorem in his paper. Barro studied whether or not an increase in government debt is perceived as an increase in net wealth by households. He found

that as long as there is an operative chain of intergenerational transfers[13] connecting current to future generations, households act as if they were infinitely lived and issuing government bonds has no effect on household wealth, total demand or the level of interest rates. In other words, since consumers internalize the government's budget constraint they are aware that the increase in spending will be financed with higher taxes at some point in the future. Therefore, the positive wealth effect of issuing government bonds is offset and increasing government debt does not increase the level of consumption. According to Barro, social security payments are analogous to changes in government debt in the sense that marginal changes in social security payments or other intergenerational transfers have no real wealth effect. In case the government is more efficient in carrying out a loan from low-discount-rate to high-discount-rate individuals[14] than the private capital markets, public debt issue can have a positive wealth effect.

Even if Ricardian equivalence holds, it does not automatically mean that all fiscal policy is irrelevant. For instance, if the government increases spending today, and the increase in spending is expected to be met with lower level of government purchases in the future, the households' permanent income will rise, stimulating consumption and reducing national saving. However, in this case it is the expected cut in government purchases rather than the actual increase in spending that stimulates private consumption and the lower level of government spending would affect permanent income and consumption even if the current level of spending remained unchanged. (Elmendorf and Mankiw 1998)

While most economists agree that Ricardian equivalence hardly describes real consumer behavior and in fact Ricardo himself had doubts about the accuracy of the theorem in practice, it still serves as a theoretical benchmark for further analysis. In reality, though, there is reason to believe that increasing government debt does have an effect on consumption. First of all, government debt represents a redistribution of

[13]The transfer could be in the form of parental expenditure on children's education or a gift from the young to the old generation, for example, which means that the transfers can be either in the direction from the old to the young or vice versa.

[14]Loans to high-discount-rate individuals are considered more risky and involve high transactions costs, which will be reflected in higher borrowing rates to these individuals.

resources across different generations of taxpayers and the future tax increases might fall on taxpayers who are not yet living. This redistribution of resources from future to current taxpayers enriches those who are now living and they most probably respond by consuming more, even if there is linkage to future generations. (Elmendorf and Mankiw 1998) To defend his view, Barro (1974) deals with this argument by stating that since future generations are descendants of the current taxpayers, they should not be viewed as independent factors as they will not necessarily take advantage of the opportunity to consume all their disposable income at the expense of future generations.

Capital market imperfections lead to departures from the Ricardian equivalence theorem. Households may face borrowing constraints and might not be able to smooth their consumption as much as they would prefer, which means they will be restricted to spending more or less than what they would if the financial markets were perfect. In addition, households in general hold a considerably small wealth level compared to the level of government debt, so it seems that government debt actually has allowed many households to consume more than they otherwise would. (Elmendorf and Mankiw 1998)

In his paper Barro assumes that the increase in public spending will ultimately be financed with lump-sum taxes. However, if taxation is progressive, the results will not be in accordance with Ricardian equivalence. If tax liabilities do not fall on named individuals but instead are related to circumstances (such as income, wealth or consumption), anticipated taxes depend on expectations of those circumstances. This means that tax liabilities are at least as uncertain as the circumstantial factors they are based on and anticipating future tax liabilities becomes more challenging (regardless of whether the planning horizon is infinite or not). Also, distortionary taxes affect relative prices of leisure and investment, and may induce substitution in favor of leisure, which will also lead to deviations from Ricardian equivalence. (Tobin 1978)

6.1.2 Co-existence of Ricardian and Non-Ricardian Households

Perhaps the most evident problem regarding the validity of the Ricardian equivalence theorem is that the share of households able to smooth their level of consumption in whichever way they prefer is not 100 %. A fraction of households might face borrowing constraints or be restricted to consuming their current income even when they would be willing to save instead. One way to include the borrowing constraints into the model is to divide households into Ricardian and non-Ricardian; the former consume based on the permanent-income hypothesis and the latter face liquidity constraints and therefore have to settle for consuming their current disposable income in each period.

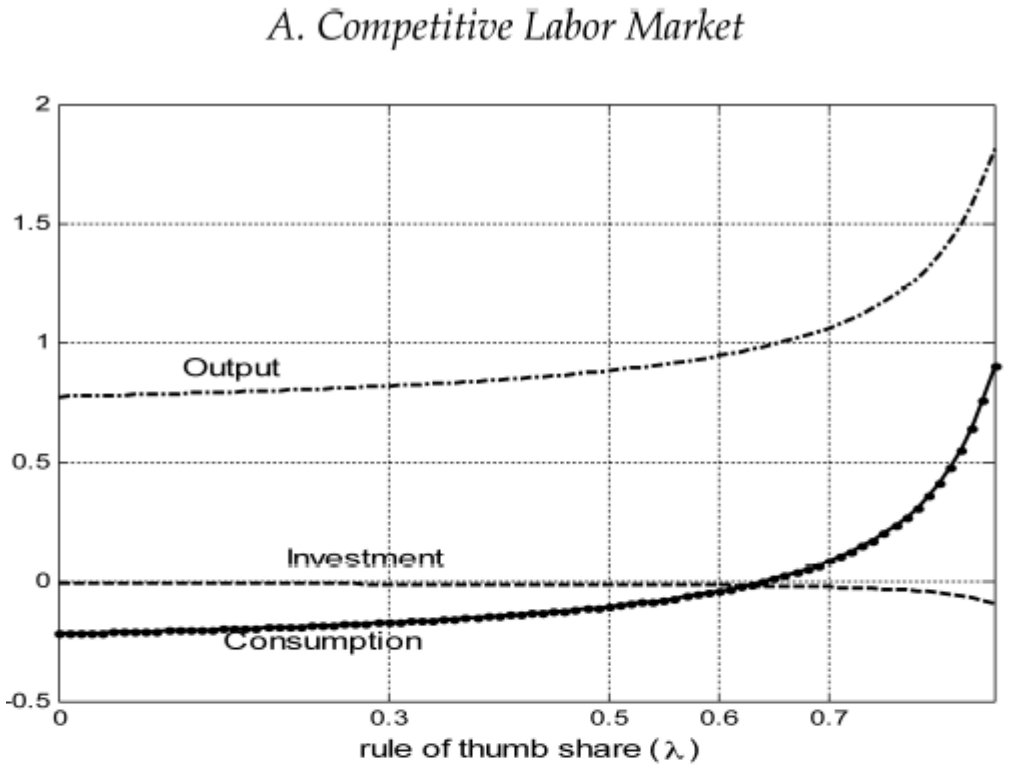
Following Campbell and Mankiw (1989), Galí et al. (2007) divide consumers into two groups: some are considered Ricardian and they follow the permanent-income hypothesis while others follow the simple rule-of-thumb of consuming their current income (referred to as *rule-of-thumb consumers*). As mentioned above, the rule-of-thumb behavior might be explained with the fact that some consumers face borrowing constraints and cannot smooth their consumption the way they want. Another point of view is that consumers do not necessarily behave in a rational matter or they might weigh their current disposable income much more heavily than future income, which would also lead to deviations from the permanent-income hypothesis.

Figure 5 shows the response of output, consumption and investment (all normalized by the steady state output) to a positive government spending shock, as a function of λ, the fraction of rule-of-thumb consumers. The size of the shock is normalized to 1 % of steady state output. Consumption is the largest component of aggregate demand, so its response is a key factor determining the size of the fiscal multiplier. Two alternative labor market structures are considered: a competitive labor market, where each household chooses the quantity of hours worked given the market wage, and a non-competitive market, where wages are set in a centralized manner by an

economy-wide union. Figure 5(A) illustrates the case of competitive labor markets while Figure 5(B) corresponds to non-competitive labor markets.

In the case of competitive labor markets the consumption response is negative, except when λ is fairly large (higher than 0,6). However, the size of the decline is decreasing in λ, which reflects the offset of intertemporal substitution effects when the share of rule-of-thumb consumers rises. If labor markets are imperfect, the consumption response turns positive already when λ is around 0,25, a value that is much more plausible. The investment response is declining and non-positive in both cases.

The existence of rule-of-thumb households makes aggregate demand more sensitive to changes in current disposable income and decreases the impact of the negative wealth effect caused by fiscal expansion. In a New Keynesian model prices are sticky, which makes it possible for real wages to increase even if the marginal product of labor drops, assuming that the price markup adjusts sufficiently downwards to absorb the resulting gap in labor productivity. Higher real wages stimulate consumption of the rule-of-thumb households and help to offset the negative wealth effect. Therefore, the introduction of rule-of-thumb consumers together with sticky prices makes it possible to generate an increase in consumption in response to a rise in government spending. If these results are compared to those generated by a neoclassical economy, which corresponds to a calibration of the same model but without price rigidities and rule-of-thumb households ($\lambda = 0$), output and consumption response is systematically smaller. Note that also when *either* the share of rule-of-thumb consumers is zero *or* prices are fully flexible, consumption is crowded out in response to a rise in government spending. (Galí et al. 2007)



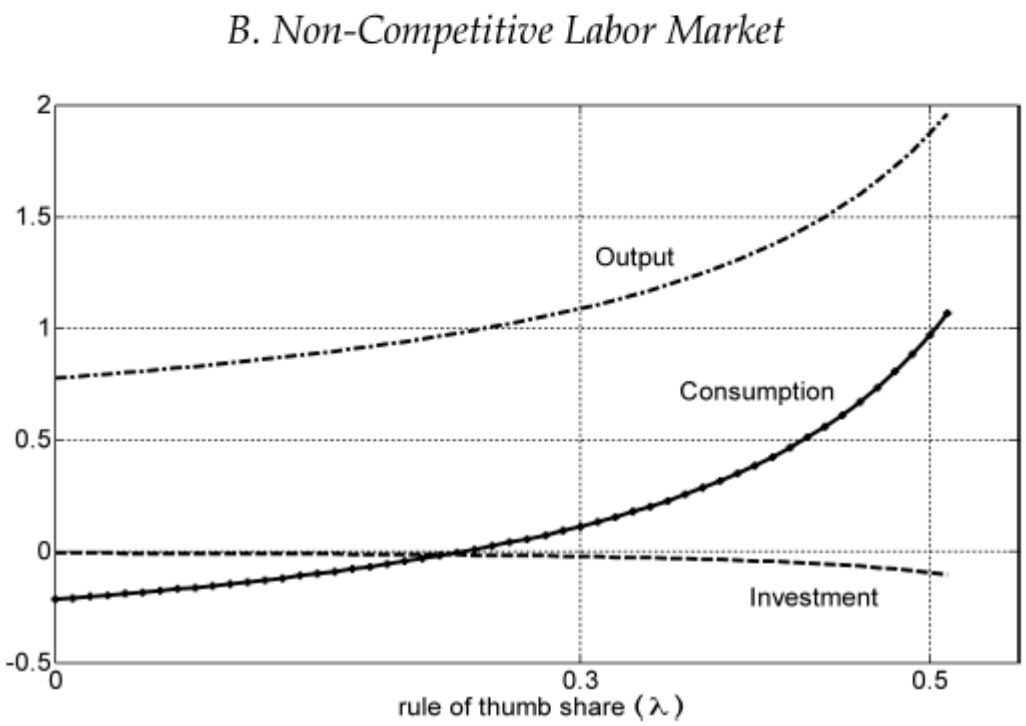


Figure 5: Output, consumption and investment multipliers as functions of λ (Galí et al. 2007).

Galí et al. (2007) find that there is evidence of a rise in asset market participation over the postwar period, which in their model can be interpreted as a decline in the fraction of rule-of-thumb consumers. This would correspondingly result in a decrease in government spending multipliers on consumption and output. Indeed, for example Perotti (2002) has empirically found that the effects of fiscal policy have become weaker during the last couple of decades, which might in part be due to the declining share of credit constrained households. Overall it seems that the share of non-Ricardian households is relatively small, which might in part be due to financial deregulation over the last two decades and the resulting lower financial-market participation costs (Coenen and Straub 2005). However, in a crisis the share can be higher than normal, since financial market disturbance increases the fraction of credit constrained households.

Coenen and Straub (2005) use the euro area DSGE model of Smets and Wouters (2003) as a benchmark, and compare the estimates of the benchmark model with those of an extended model that includes both Ricardian and non-Ricardian households. They find that the inclusion of non-Ricardian households has a noticeable impact on the parameters that influence the consumption decisions of Ricardian households. In particular, the estimated intertemporal elasticity of substitution of the Ricardian households, $1/\varsigma$, is larger than in the benchmark specification without non-Ricardian households, which implies a lower willingness to smooth consumption on the part of Ricardian households[15]. Similarly, the estimated degree of habit formation is significantly smaller than in the benchmark model, which means changes in the short-term interest rate should have a relatively strong impact on the consumption choices of Ricardian households.

Figure 6 shows the responses of selected variables to a government spending shock equal to 1 % of steady-state output with the benchmark specification and three alternative specifications, all of which include non-Ricardian households but have different tax schemes in place. In specification I both Ricardian and non-Ricardian

[15] ς denotes the coefficient of relative risk aversion. A smaller ς (and a larger $1/\varsigma$) implies less risk aversion and therefore less consumption smoothing by the Ricardian households.

households pay lump-sum taxes in equal proportions, while in specification II non-Ricardian households are completely exempted from paying taxes, in other words Ricardian households carry the entire tax burden. Specification III extends specification I by also including distortionary taxes (an income tax, a payroll tax and a tax on consumption).

As can be seen in the upper left corner of Figure 6, aggregate consumption falls in the benchmark specification as in all the three different tax schemes that include non-Ricardian households. That is, spending shocks fail to crowd in consumption and therefore do not generate fiscal multipliers greater than 1. On the part of non-Ricardian households (the middle panel on the right), the government spending shock succeeds, at least on impact, in stimulating consumption regardless of the tax scheme in place. However, consumption starts falling below its steady-state level already after a few quarters and only with specification II, where the non-Ricardian households are exempted from paying lump-sum taxes, the consumption never falls below its steady-state level. Thus, while an increase in government spending positively affects consumption spending of non-Ricardian households, the increase tends to be offset by a fall in consumption on the part of Ricardian households.

As seen in the lower panel, the government spending shock and the higher labor demand following the shock result in a substantial rise in hours worked. On the contrary, the real wage increases relatively little, which Coenen and Straub explain to be due to the high degree of rigidity in the wage-setting decisions managed by labor unions. As a comparison, in the previously discussed model of Galí et al. real wage increases more sharply and helps to offset the negative wealth effect of the Ricardian households[16]. Coenen and Straub believe this to be the reason why their model does not generate a positive aggregate consumption response to a spending shock, as opposed to that of Galí et al.

[16]In the model of Galí et al. the wage-setting process in more simple: in the case of imperfect competition and wage-setting by labor unions, the households are willing to meet the firms labor demand at the real wage offered, which causes a sharp rise in the real wage and obviously boosts disposable income and consumption.

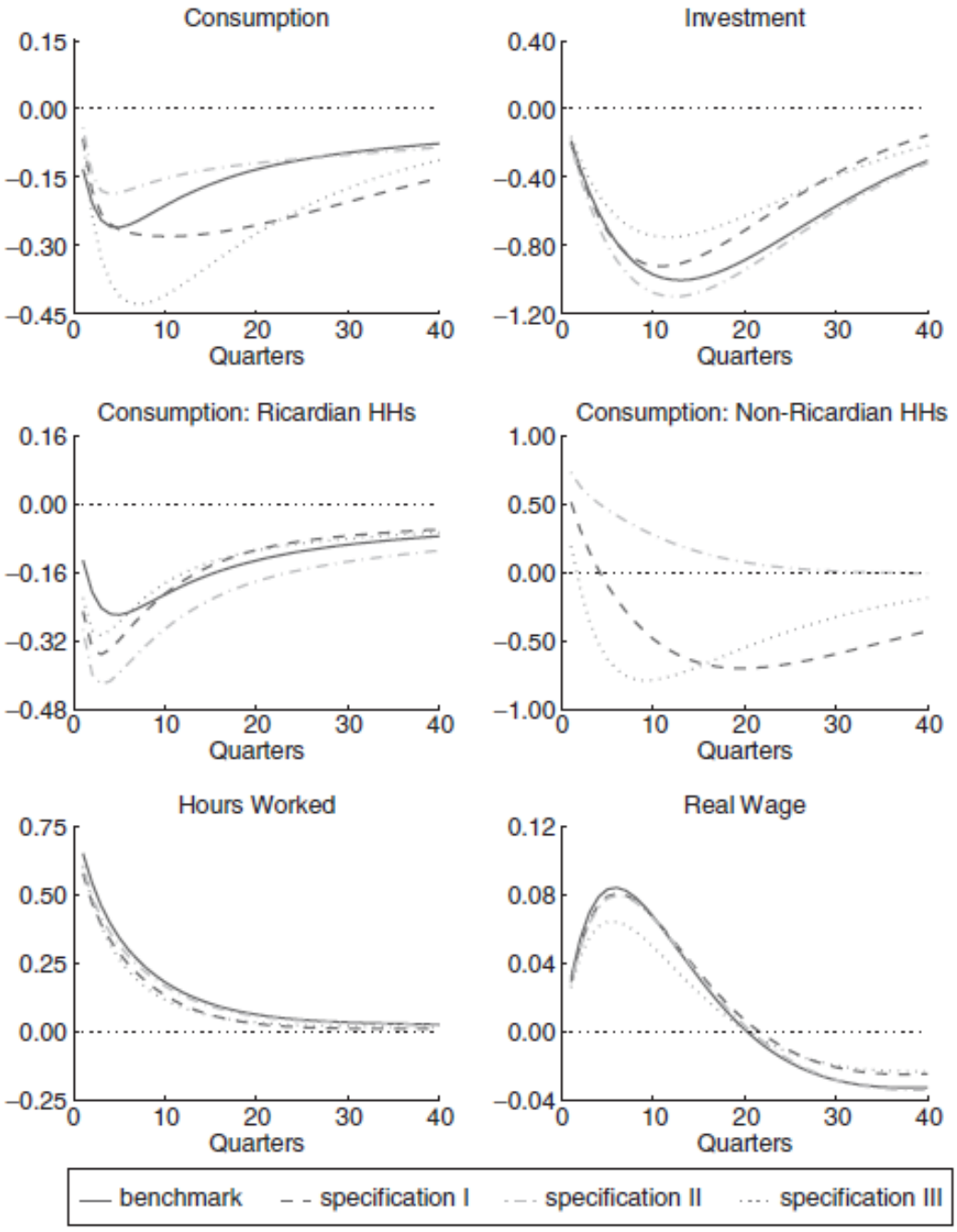


Figure 6: Responses of consumption, investment, hours worked and real wage to a government spending shock equal to 1 % of steady-state output. All responses are depicted as percentage-point deviations from steady state (Coenen and Straub 2005).

Coenen and Straub conclude that there is only a fairly small chance that government spending shocks actually crowd in consumption or produce large consumption multipliers. Likewise, the chance that spending shocks generate an overall fiscal multiplier larger than 1 is small. The main reason for this is that the estimated share of non-Ricardian households is relatively small, around one quarter, while in their model it should exceed 0,35 in order to generate a positive aggregate consumption response. While including non-Ricardian households in the model does raise the consumption response to spending shocks when compared with the benchmark specification, the negative wealth effect that falls on the Ricardian households remains too strong.

Roeger and Veld (2009) go one step further and divide households into 3 groups: liquidity constrained, Ricardian and credit constrained. Liquidity constrained households do not optimize their consumption but simply consume their entire labor income at each period, so they correspond to the rule-of-thumb consumers of Campbell and Mankiw and Galí et al. Ricardian households have full access to financial markets and they make their consumption decisions according to the permanent-income hypothesis. The third group, credit constrained households, have a higher rate of time preference than Ricardian households (the discount factor $\beta^c < \beta^r$) and they face a collateral constraint on their borrowing, so they can smooth their consumption only up to a certain point. Since they optimize an intertemporal utility function, their consumption decisions will be based on a concept of permanent income. They borrow exclusively from Ricardian households.

In the model, temporary and permanent fiscal expansions have only a negligible effect on Ricardian consumers, since they respond to changes in permanent income. Liquidity constrained households on the other hand cannot smooth their consumption, so the essential question is how credit constrained households respond to fiscal policy. Since a financial crisis leads to a higher share of credit constrained households in the economy through higher risk premia and credit rationing for households and firms, it makes the reactions of the credit constrained households even more essential for the analysis of the multiplier.

Roeger and Veld use two models to examine the effect of a temporary increase in government spending, a model including all the three groups of consumers described above (CC model) and a model including only Ricardian and liquidity constrained consumers (RIC model). The main difference between the results of the two models is the response of private consumption: in the RIC model private consumption falls in response to an increase in public consumption whereas in the CC model there is a positive co-movement between private and public consumption. This difference is driven by the consumption response of the credit constrained households, who, equally as liquidity constrained households, react strongly to temporary changes in disposable income. The on-impact effect on GDP of an increase in government consumption of 1 % of GDP for one year is 1 % in the CC model and 0,95 % in the RIC model.

The negative response of private consumption in the RIC model is consistent with the results of Coenen and Straub, but contradicts with the findings of Galí et al. This is most likely due to the fact that Galí et al. assume no nominal wage rigidities and no labor adjustment costs, while especially the labor adjustment cost parameter is significantly different from zero. When these parameters tend to zero, as assumed in Galí et al. (2007), the consumption response to a government spending shock tends to become positive in a model such as the one used by Roeger and Veld, too. The interpretation for the result is that very low wage and labor adjustment costs imply a stronger positive short-run impact of a government spending shock on labor income, which in turn results in a stronger response of private consumption. (Ratto et al. 2008)

An economy with credit constrained households responds more strongly to temporary fiscal policy measures and including credit constrained households in the model is the key to achieving positive consumption multipliers. Both an increase in public consumption and an increase in public investment have stimulative effects, while the GDP effect of an increase in investment is slightly larger and remains positive for a longer period of time. Without including the constrained households, a

realistic estimate of the share of liquidity constrained households is not enough to turn the total consumption response positive. (Roeger and Veld 2009)

6.2 Fiscal Exit Strategies and the Size of the Multiplier

Based on the analysis of the previous chapter, government debt is very unlikely to be neutral, which means that changes in the level of government spending and the way they are financed have an effect on private consumption. Now I will take a look at the medium-term effects and try to find out how the chosen debt strategy affects the size of the multiplier and how the multiplier response is affected if, instead of financing the current spending increase with higher taxes in the future, higher government spending is followed by future spending cuts.

According to the standard RBC model and its view on the macroeconomic transmission of government spending, an unexpected, temporary increase in government spending that is ultimately financed by higher taxes, depresses private consumption below the trend level. The fall in consumption reflects two factors that work in the same direction. First, an exogenous rise in government spending increases the tax burden for the consumers. Second, inflationary pressure raises real interest rates and the intertemporal substitution effect makes households postpone spending. The role of intertemporal substitution means that the efficacy of short-run stimulus depends on the following fiscal adjustments and on the households' possibilities to smooth consumption. (Corsetti et al. 2010) By contrast, if consumers are expected to behave in a non-Ricardian manner, the effect of an increase in government spending depends highly on how it is financed, and the multiplier increases with the amount of deficit financing (Galí et al. 2007).

When a government spending increase is financed contemporaneously with tax increases, the contractionary effects of the tax increase will outweigh the expansionary effects of the increased expenditure after a very short time (Mountford

and Uhlig 2009). For example, Blanchard and Perotti (2002) find in their VAR analysis that private investment is consistently crowded out by both government spending and, to a lesser degree, by taxation, which implies a strong negative effect on private investment of a balanced-budget fiscal expansion.

The both cases described above assume that the stimulus is ultimately financed with raising taxes. However, in response to current stimulus government expenditure can also be cut in the future, and this strategy has quite different implications for the size of the multiplier. Corsetti et al. (2009) find that in an economy with sticky prices, a policy that systematically reduces spending over time in response to rising public debt enhances the expansionary impact of short-run fiscal stimulus. They claim that many of the existing studies assume higher current deficits to lead directly to one-for-one tax increases in the future and do not consider any adjustments in government spending according to the level of public debt. They instead assume that both future taxes and public spending respond to the level of public debt, so that a current increase in deficit spending will partially be offset through future reductions in government spending. The view is more realistic, since government's capacity to raise taxes is limited, and ignoring the possibility of spending reversals in the analysis might lead to distorted results.

As a result of allowing government spending to respond systematically to the level of public debt, current episodes of deficit spending are systematically followed by a decline in government spending below trend. These dynamics are referred to as "spending reversals". The stimulative impact of a short-term increase in government spending is due to spending reversals and, most importantly, the resulting long-term interest rate response in the presence of price rigidities. With flexible prices both short- and long-term rates will rise on impact after a spending shock in order to allocate consumption from present to future periods, when the government will demand less resources. With sticky prices, however, short-term rates will rise by less on impact under same assumptions about monetary policy[17] and long-term interest rates do not need to rise. In fact, in the case of spending reversals, they can actually

[17]The central bank determines the nominal short-term rate following a Taylor-type rule $R_t = R + \phi\left(\Pi_{\mathrm{H,t}} - \Pi_{\mathrm{H}}\right)$, where $\Pi_{\mathrm{H,t}} = \mathrm{P}_{\mathrm{H,t}}/\mathrm{P}_{\mathrm{H,t-1}}$ measures domestic inflation.

decrease because of expectations of future spending cuts, which will crowd in private consumption. (Corsetti et al. 2009)

Consistently with most of the authors mentioned in the previous chapter, Corsetti et al. allow for the possibility that a fraction λ of the households are non-Ricardian, that is, they cannot borrow or save and therefore consume all their disposable income. While non-Ricardian consumers are not directly affected by the interest rate movements that play the most important role in the analysis, including spending reversals still has an impact on the results. Without spending reversals, the response of aggregate private consumption to fiscal expansions might be dominated by the behavior of Ricardian households, and could therefore be negative. With spending reversals and the following interest rate response, the demand effects of fiscal policy across different types of households are aligned and higher government spending crowds in private consumption.

Figures 7 and 8 present the variable responses with a model specification where all households participate in asset markets ($\lambda = 0$). In both figures, quantity variables are measured in percent of steady state output, price variables (the real exchange rate, real interest rates) are measured in percentage deviations from the steady-state level and horizontal axes measure time in quarters.

Figure 7 displays the spending-shock effects with sticky- and flexible-price allocations. The upper left chart shows the dynamics of a spending shock that includes a partial spending reversal, which means spending rises on impact, but decreases in response to higher level of debt and falls below the trend level some 12 quarters after the initial shock. In the flexible-price allocation both short-term and long-term real interest rates rise quite sharply on impact and private consumption falls. With nominal rigidities interest rates are lower and private consumption increases on impact. Note that in this model calibration all households are considered Ricardian and have access to financial markets. Anticipation effects are the key to the transmission of fiscal policy displayed in Figure 7: the assumption of sticky prices is

crucial for the short-run effects of the temporary spending increase, but the long-run effects have more to do with the expected cuts in public spending.

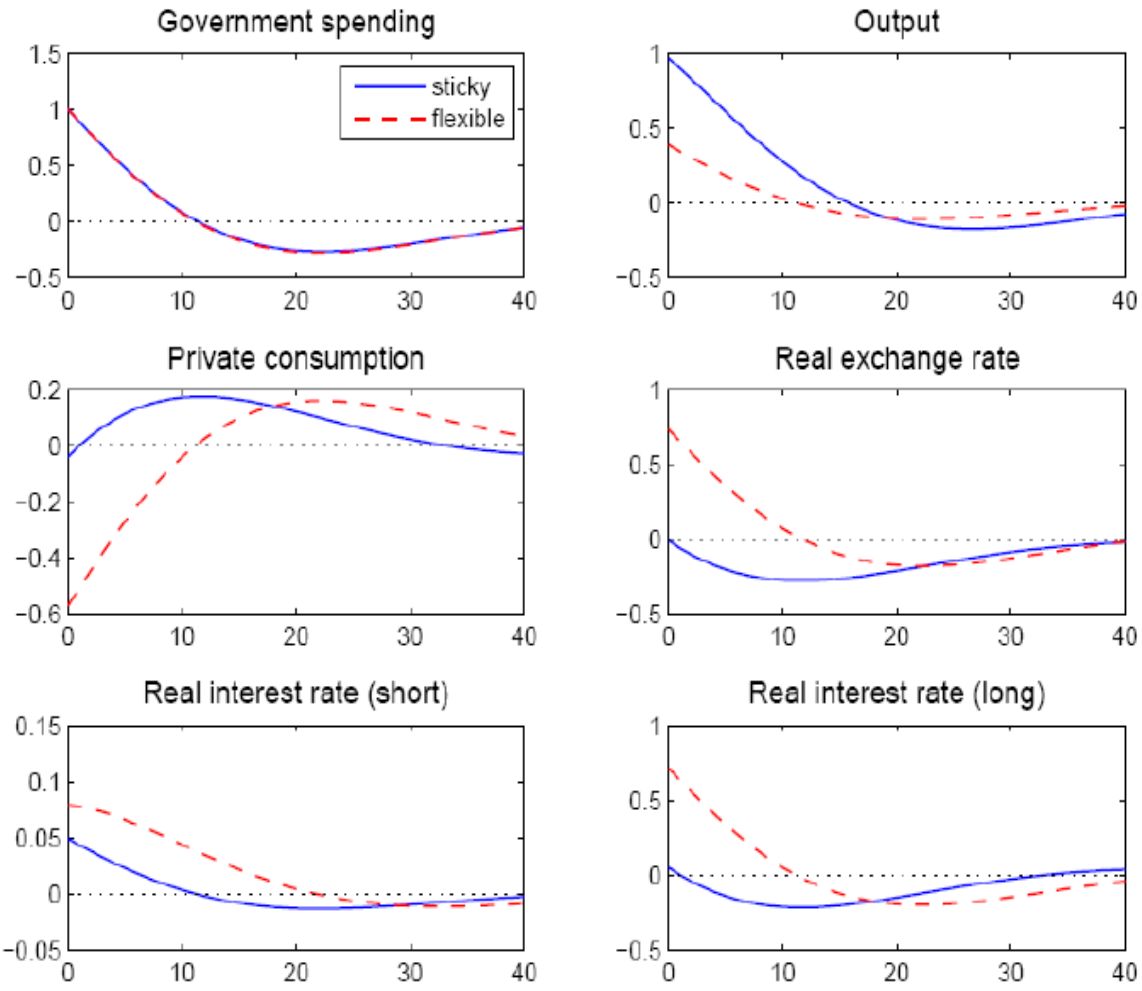


Figure 7: Effects of a government spending shock of one percent of GDP with sticky- and flexible-price allocations (Corsetti et al. 2009).

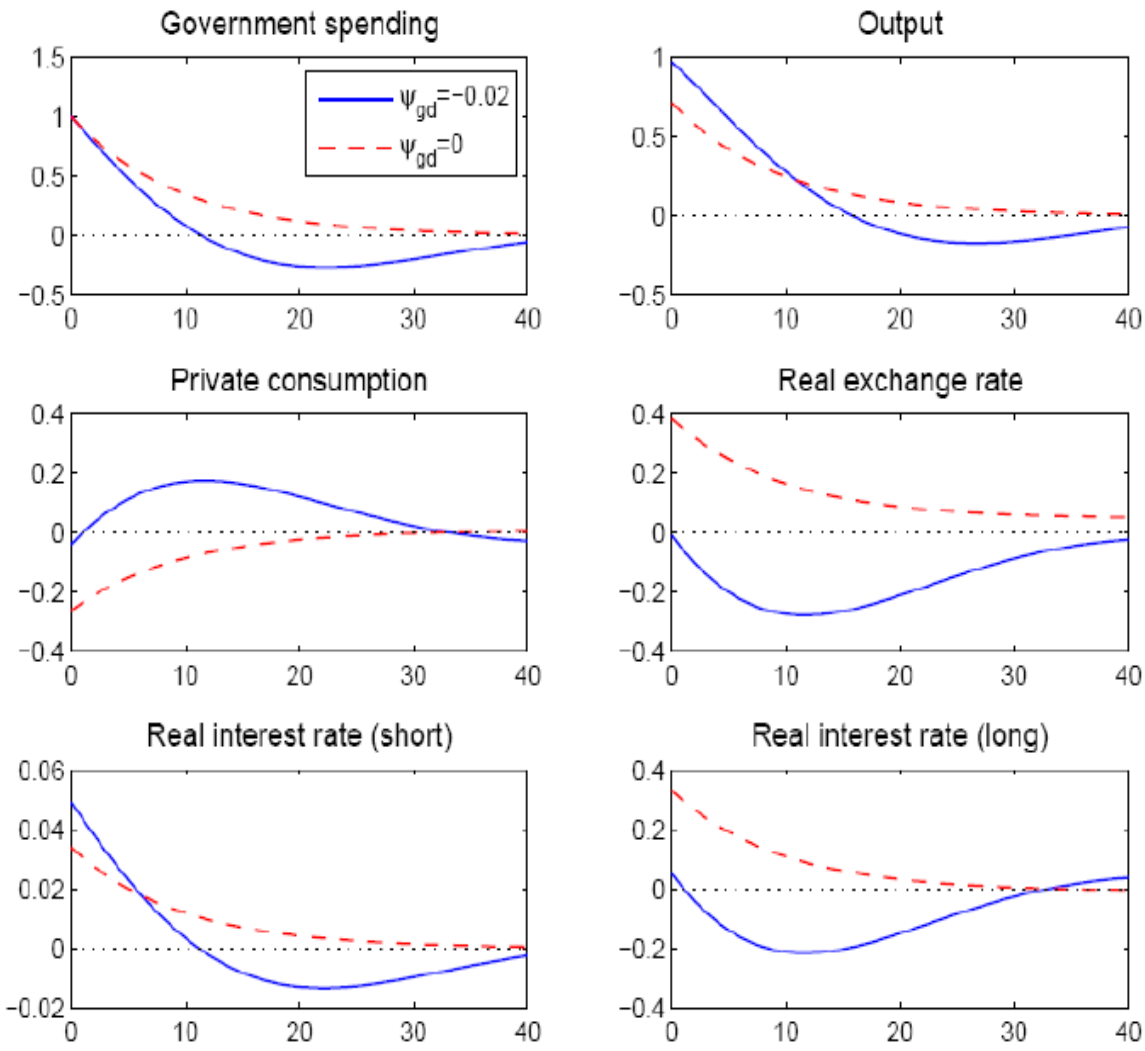


Figure 8: Effects of a government spending shock with debt-stabilizing and debt-insensitive spending rules (Corsetti et al. 2009).

Figure 8 contrasts the baseline specification of spending reversals with the case of a debt-insensitive spending rule (without spending reversals). In the model ψ-parameters capture the responsiveness of government spending (g) and taxes (t) to government spending (g) and debt (t). In the baseline parameterization with spending reversals, $\psi_{td} = -\psi_{gd} = 0{,}02$. In the debt-insensitive rule, $\psi_{gd} = 0$, which means that government spending follows an exogenous process. Note that if $\psi_{tg} = 1$, changes in government spending lead to a one-for-one increase in taxes, leaving government debt unchanged. In both cases prices are considered sticky. In the debt-insensitive case real short-term interest rates never fall below their steady-

state level. Also, private consumption falls but returns to its trend level some 30 quarters after the shock. In the baseline case private consumption response is clearly more positive.

The next step is to turn to a model specification, where a fraction of households is without access to financial markets ($\lambda = 1/3$). The results show that, without spending reversals, the presence of non-Ricardian consumers is not sufficient to generate a positive consumption multiplier, which might have to do with their relatively low fraction, as discussed in the previous chapter. With spending reversals, however, adding non-Ricardian consumers into the model amplifies the effects of fiscal stimulus. Private consumption rises much more on impact, implying a multiplier of around 0,4, whereas in the case of no credit constrains (Figure 8) the private consumption multiplier never reaches such a value. Output also rises somewhat more than in the previous specifications. The anticipation of spending reversals ensures that the effects of fiscal expansion via credit-constrained consumers will not be reversed by the response of unconstrained consumers, which in turn enables larger fiscal multipliers.

A VAR time series analysis for U.S. data covering the last three decades provides empirical evidence of the existence of spending reversals. Corsetti et al. find that government spending falls below its trend level after an initial increase that can be quite persistent, the switch occurring after about four years. Also, while long-term interest rates rise on impact, they fall below their pre-shock level during the second year after the shock.

In conclusion, for expenditure-side fiscal stimulus to be most effective, short-term fiscal expansion should be accompanied with a credible commitment to adjust the expenditure downwards in the medium term. However, such commitment may be relatively hard to achieve since fiscal authorities often face political constraints, namely voters' resistance to higher taxes. (Corsetti et al. 2009) The greater challenge, however, is the zero lower-bound environment that is very typical to financial crises. In a normal situation, spending reversals have a deflationary effect that leads to

lower real interest rates. Yet, when nominal rates are already at the zero bound, lower inflation increases real interest rates, and spending reversals risk undermining the effectiveness of fiscal stimulus. (Corsetti et al. 2010)

In order to understand the effect of the zero lower bound, Corsetti et al. (2010) modify the earlier specification by introducing a severe recessionary shock in the form of an increase in the consumers' time-discount factor (following the analysis of Christiano et al. 2009). They assume that half of the stimulus is offset by a subsequent spending reversal and investigate how the timing of the reversal affects the short-run effect of the stimulus. They find that the beneficial effect of stimulus is quite sensitive to when the reversal starts as well as to the duration of the reversal period: a very early or intensive reversal period may even lower output and consumption multipliers and lengthen the zero lower-bound period. Spending reversals lower aggregate demand and if reversals are started too early when nominal interest rates are still very close to zero, the zero lower bound might become binding again. However, postponing the reversal too much can again reduce its short-run effect. For example, with a spending reversal of 4 quarters, multipliers are largest when the reversals are started about eight quarters after the initial stimulus has phased out.

6.3 Discussion

According to the Ricardian equivalence theorem government debt is neutral, that is, consumers internalize the government's budget constraint and anticipate the need to finance the increase in spending with higher taxes at some point in the future. This means that fiscal stimulus or the way it is financed does not have any effect on aggregate demand. There are several reasons why in practice Ricardian equivalence does not hold, the most obvious of them being the financial market imperfections, which restrict the households' possibilities to smooth consumption. In general, the smaller is the share of Ricardian households the larger the multiplier. Since in

financial crises households normally face increasing credit constraints because of financial market disturbance, the share of credit constrained households is likely to be larger, which implies that multipliers can be expected to be higher than in normal times.

In the models considered here, for the consumption response to be positive the share of non-Ricardian households, that are restricted to spending their current disposable income in each period, has to be between 0,25 and 0,6. However, a realistic estimate of the share would be around one quarter-one third, which means most of the models seen here do not generate a positive private consumption response to an increase in government spending. In order to reach output multipliers greater than 1, a positive consumption multiplier is normally needed. If the multiplier is negative, private consumption is crowded out and the output multiplier will be less than 1.

Committing to financing an increase in government expenditure with spending reversals instead of higher taxes can increase the efficiency of fiscal stimulus. However, such a commitment may be hard to make and special attention has to be paid to the timing and the duration of the reversal period.

7 Findings from the Great Depression

In this chapter I will take a look at the sources of recovery from the Great Depression and the multipliers estimated from that period. During the Great Depression, in the U.S. output declined by 30 % between 1929 and 1933 whereas years 1933-1937 registered an output growth of 39 % (Eggertsson 2008). Several economists have studied the reasons behind this exceptional recovery and the multipliers related to it and the 2008 crisis has again revived these controversies as more and more attention has been paid to the Great Depression. I will review some of the previous findings

and explain the special circumstances that prevailed at that time, namely the buildup of World War II, and the restrictions the ongoing war situation created on the availability of resources.

7.1 What Ended the Great Depression?

There are differing views among academics about the factors that contributed the most to the end of the Great Depression. While most agree that the recovery was due to both monetary and fiscal policy innovations, there are much stricter opinions as well.

Romer (1992) argues that the substantial GDP growth rates of the 1930s were due to conventional aggregate-demand stimulus, which was almost completely in the form of monetary expansion. Money supply measured as M1 grew at an average rate of nearly 10 % per year between 1933 and 1937 and at an even higher rate in the early 1940s which according to Romer was primarily because of large gold inflows to the U.S. These were partly due to a historical accident, the political instability in Europe after 1934 which resulted in a capital flight, and partly to policy, a devaluation of the currency by the Roosevelt administration in 1934. The very rapid growth of money supply lowered real interest rates through growing inflation expectations, since nominal interest rates were already very low and could not decrease substantially, and thus stimulated investment spending.

There are differing views, however, and for example Gordon and Krenn (2010) state that while the monetary base did increase because of gold inflows, banks ended up holding excess reserves and the increase in the monetary base did not translate directly into increases in M1. They argue that the money multiplier was particularly endogenous in the late 1930s and was directly impacted by changes in income and employment, for instance. Therefore, gold inflows by themselves hardly contributed to the recovery and the endogenous nature of the money multiplier actually provides evidence against the power of monetary expansion.

While Romer believes that fiscal policy had little contribution to the recovery and that the way in which World War II may have played a role was through monetary developments, since the war declaration in Europe caused the capital flight to the U.S., Vernon (1994) argues that it was World War II fiscal policies and defense spending that actually made the difference. According to Vernon about half of the total recovery was experienced in 1941 and 1942 and World War II fiscal policy was the most important factor in the recovery during these two years. Monetary policy contributions he claims to have been restricted to the period 1933-1940, which accounts for less than a half of the total recovery.

To calculate the 1941-1942 share of the recovery as a whole, Vernon uses the same method as Romer (1992) which is estimating potential real GNP by projecting the growth rate of real GNP in 1923-1927 forward until 1942. To apply this method, the measure of output change used is the deviation of the growth rate of real GNP from its average annual growth rate during 1923-1927. The idea here is to show how fast the economy would have grown (relative to normal) if monetary and fiscal changes had not occurred. In his calculations Vernon locates the end of the Great Depression on the restoration of the potential output, which was reached in 1942 in the sense that the unemployment rate approximated the natural rate of unemployment. As he points out, this is not to say that economic well-being was at its potential level.

According to the estimates of Vernon, 81,3 % of the increase in real GNP for 1941 owed to federal fiscal policies. This net contribution he has estimated by the increase in government purchases of goods and services, plus the multiplier effect of those purchases, less the contractionary effects on demand caused by increases in federal net taxes[18]. The fiscal policy contributions have been estimated without including accommodation from monetary policies in the estimates. While the figure is clearly an approximation, in his opinion the result is so strong that even sizable errors in the components would not affect the final conclusion. Vernon argues that whereas the increases in government purchases and taxes are concrete, the inflation expectations and real interest rate perceptions emphasized by Romer are mostly speculative and

[18] Federal net taxes equal the increase in federal taxes less the increase in the sum of federal transfers and federal interest payments.

that it is more reasonable to view the increase in money supply in 1941 as being mostly responsive and accommodative rather than the actual source of recovery.

Gordon and Krenn (2010) take a similar view to that of Vernon and argue fiscal policy to have been the dominant factor in the recovery. By using VAR forecasting they find that 89,1 % of the recovery in 1939-1941 can be attributed to fiscal policy innovations and 34,1 % to monetary policy. The remaining -23,2 % they attribute to capacity constraints experienced in many of the key manufacturing industries in the U.S. Monetary policy innovations they argue to have had a greater impact than fiscal policy until the end of 1940, but even so, despite their late appearance, fiscal policy actions related to World War II were the dominant factor while monetary policy played a supporting role.

Eggertsson (2008) in turn argues that appropriate monetary policy was essential in ending the Great Depression, and could even have prevented it[19]. Fiscal policy also played a prominent role in the recovery, mainly by influencing expectations about future money supply. The recovery from the Great Depression in the U.S. was driven by a shift in expectations, which was triggered by President Roosevelt's policy actions. Eggertsson estimates that without these policy actions, the economy would have continued the free fall also after 1933 and output would have been 30 % lower in 1937 than in 1933 and that the regime change accounted for about 70-80 % of the output recovery in 1933-1937.

According to Eggertsson, the most important single factor was the shift in expectations about future money supply, while the shift in expectations about the government's real consumption of goods and services played a role as well. On the monetary policy side, the gold standard was abolished and an explicit policy objective of inflating the prices to pre-depression levels was announced. On the fiscal policy side, government real and deficit spending were expanded, which helped making the policy objective of higher inflation credible. In conclusion, the key to the recovery was a successful management of expectations about *future* policy.

[19]In their book "A Monetary History of the United States, 1867-1960" Milton Friedman and Anna Schwarz argue that excessively tight monetary policy exacerbated the Great Depression of the 1930s or might even have caused it.

The recovery policies implemented by President Roosevelt in 1933 violated three policy dogmas of the time: (1) the gold standard, (2) a balanced budget and (3) that the public sector's contribution to the GDP should be small. Since the spending spree was not financed by tax increases but through the violation of the balanced budget dogma, the deficit during Roosevelt's first fiscal year was the highest in the U.S. history outside war. This fiscal expansion helped making a permanent increase in the money supply credible, since according to Eggertsson at the time increasing money supply was a crucial strategy to finance the government's debt payments, and resulted in higher inflation expectations.

Eggertsson argues that the substantial growth rates cannot be explained by either an increase in the money supply or interest rate cuts, since around the turning point in 1933 monetary base remained practically unchanged and the short-term nominal interest rates were already close to zero. Instead, what changed was *expectations about how the interest rate and money supply would be set in the future*, leading to a dramatic change in inflation expectations. One way to observe this would be to study short-term real interest rates, that is, the difference between the nominal interest rate and expected inflation.

Eliminating the gold standard he believes to have been essential when it comes to sustaining the recovery because maintaining it would have created an upper bound for money supply in the future. Most likely the expansionary fiscal policy played an important role in firming up inflation expectations, since at the time it was understood that deficit financing could lead to future inflation. In fact, the belief that deficits cause inflation was one of the reasons behind the balanced budget dogma mentioned earlier, since some feared that deficit spending could be even too inflationary.

7.2 Defense and Non-defense Spending

The majority of multipliers estimated from the recovery period after the Great Depression have been calculated using defense spending as a proxy for total government spending. Many economists argue that defense spending provides a better opportunity for estimating the size of government spending multipliers than government spending in total, and for example Almunia et al. (2009), Barro and Redlick (2009) and Hall (2009) have used defense spending when estimating fiscal multipliers. This is mainly due to the fact that the principal changes in defense spending can mostly be treated as exogenous with respect to the determinants of the real GDP. On the contrary, changes in non-defense spending are more likely to be affected by the aggregate economic conditions, since the fluctuations in state revenues are strongly affected by expansions or contractions of the overall economy. (Barro and Redlick 2009)

A common assumption is that government spending does not respond to changes in output in the current period, that is, in a certain period government spending can be considered exogenous with respect to output. However, if government spending decisions are made with future output movements in mind, this assumption will be problematic since the variable cannot be considered independent anymore. It can be argued that before the Great Depression and the Keynesian ideas of the 1930s government spending decisions were not made with future output movements in mind. Therefore, treating government spending as an exogenous variable during that period might be more plausible, but even in this case the assumption is strong and treating total government spending as exogenous might cause problems and biased results. (Almunia et al. 2009)

Using U.S. defense spending data has proved to be especially useful in multiplier estimations, the reason being that the changes in defense spending, especially during World War II, are very large and include both sharply positive and sharply negative values. In addition, in the U.S. data, demand effects of defense spending should be dominant since, unlike many European countries, the U.S. did not experience massive

destruction of physical capital and suffered only moderate loss of life during the Second World War. (Barro and Redlick 2009)

However, some economists argue that the defense spending multipliers estimated from 1930s and 1940s are not too useful for policy analysis. Because of the Second World War, the government was imposing several restrictions on the normal, free-market conditions: private consumption goods, such as food and clothes, were rationed so that consumption growth slowed down, there were restrictions on investment and construction required special permits. The government was essentially suppressing private spending through direct controls[20]. If the World War II multipliers are used as a reference for evaluating the efficiency of fiscal stimulus in the recent crisis, it should at least be taken into account that the situation from 2008 onwards is not directly comparable to that of the 1940s.

7.3 Estimates of the Size of the Multiplier

In this chapter I will move on and review the size of some of the multipliers estimated from the period of the Great Depression. The results vary quite considerably, so at the same time I will do my best to analyze the differences in the assumptions of the models, the data and other factors that might affect the size of the estimates.

Romer (1992) has calculated the fiscal and monetary policy multipliers separately and her estimates yield a fiscal policy multiplier of -0,233 suggesting a contractionary effect of fiscal stimulus on output. The monetary policy multiplier she finds to be 0,823. The calculations she has done based on two years, 1921 and 1938, which she claims to be the most suitable for the analysis since they are episodes with large movements of real output that can be mostly ascribed to monetary and fiscal policy decisions. This approach can be misleading though, since it is quite risky to assume

[20]Paul Krugman has commented on this topic in his blog for the New York Times; see for example http://krugman.blogs.nytimes.com/2009/11/10/depression-multipliers/ or http://krugman.blogs.nytimes.com/2009/10/01/multiplying-multipliers/.

the shocks in 1921 and 1938 to have been completely due to policy decisions. Also, Romer points out that fiscal stimulus was used very little at the time of the Great Depression and that its contribution to the recovery would have been greater had it been used more extensively.

Gordon and Krenn (2010) have developed a VAR model to estimate multipliers for the U.S. from different time periods around the World War II, out of which they argue the period 1940:Q2-1941:Q2 to be the most relevant. First, the second quarter of 1940 is where the authors locate the start of fiscal stimulus[21]. Second, by the end of 1941 capacity constraints in important areas of manufacturing had become effective and including the last two quarters of 1941 in the calculations might yield too low multipliers, as during these quarters military spending ended up crowding out civilian spending.

For the period mentioned above the resulting multipliers are 1,80 and 2,19, depending on the calculations[22]. If they also include the last two quarters of 1941 in the calculations, the corresponding multipliers are clearly lower, 0,88 and 1,28 respectively, which they see as a consequence of the capacity constraints mentioned above. After a robustness check, they find that the results remain the same after several alterations to the VAR specifications, such as changing the VAR time period, using the source data of Ramey (2009) instead[23] or changing the ordering of the VAR variables in numerous ways.

Gordon and Krenn argue that a significant shortcoming of recent literature on fiscal multipliers is that they are derived by comparing actual changes in GDP relative to actual changes in government spending. Instead, they should both be stated *relative* to some model of an alternative scenario without a fiscal shock. In other words, instead of using raw changes in the variables, the measuring should be done using

[21]Gordon and Krenn argue that the American economy went to war starting in June 1940, since the share of government spending increased from 11,5 % in 1940:Q2 to 25,6 % in 1941:Q4 and all of this increase was in the form of government military expenditure.

[22] The authors argue that the right way to calculate the multiplier is to subtract out the baseline VAR forecast that suppresses all innovations in any variable. Subtracting the baseline forecast will yield the first multiplier, which in this case is 1,80.

[23]Since Ramey uses a very different method to arrive to her quarterly data of the components, as a part of the robustness check the authors compare the results from the two different data sets for the time period 1939:Q1-1941:Q4.

the marginal changes in both variables caused by variations in public spending. This methodology difference might in part explain why their calculations yield higher multipliers than many of the other studies done with U.S. data.

Barro and Redlick (2009) in turn find defense spending multipliers around 0,6-0,7 for three samples that all include World War II[24], when evaluated at the median unemployment rate of 5,6 %. For a sample starting in 1950 and including the Korean War buildups but not World War II, they do not get statistically significant results. They find some evidence that the multiplier rises with the amount of economic slack and that it reaches 1 when the unemployment rate is around 12 %.

Since the estimated multipliers rely only on the variations in defense spending associated with major wars, they exclude more moderate variations in defense spending, such as those associated with the defense buildups under Reagan and George W. Bush that could also be exogenous and therefore suitable for the analysis. This can cause problems, since major episodes of war are typically characterized by capacity constraints and government spending may crowd out private consumption. Indeed, since the multiplier is clearly less than 1 in long samples and at the median unemployment rate, it seems that an increase in defense spending crowds out other components of GDP, mainly gross private domestic investment. (Barro and Redlick 2009)

In order to be able to estimate the fiscal stimulus programs of the recent crisis, it would obviously be more interested to study the size of non-defense spending multipliers. Lacking reliable estimates for them, Barro and Redlick try to find out whether or not the defense spending multipliers provide an upper or lower bound for the non-defense multiplier. Their conclusion is that the defense spending multiplier, which is mostly dominated by behavior during wartime, exceeds the non-defense multiplier.

First of all, wars typically feature command-and-control techniques, such as drafting people to work in the military and forcing companies to manufacture products for

[24] The samples start in 1917 (including WWI and the 1921 contraction), in 1930 (including the Great Depression) and 1939 (including WWII) and they all end in 2006.

military purposes, without any consideration for explicit market prices. These actions tend to raise the responsiveness of real GDP to changes in government purchases, making the resulting multipliers higher. What evens out the effect, however, is that output controlled by the government may be undervalued in the computation of GDP, if the military products have unrealistically low prices and if the wages fall short of normal, private sector wages. Second, especially during a war such as World War II, patriotism is likely to shift labor supply outwards, which again tends to increase the size of the wartime multiplier. (Barro and Redlick 2009)

On the contrary, Hall (2009) argues that multipliers estimated with data containing World War II are biased downwards rather than upwards. He estimates fiscal multipliers with both simple regression and VAR methods using fluctuations in U.S. military spending during several subperiods between 1928 and 2008. His conclusion on the regression evidence from big wars is that the government spending multiplier is at least 0,5, given his hypothesis of downwards biased multipliers. Based on the VAR analysis, fiscal multipliers are in the range 0,5-1,0, while his evidence does not rule out multipliers above 1 either.

Unlike the authors mentioned above, who have estimated the multipliers using only U.S. data, Almunia et al. (2009) use a panel data set for 27 countries[25] between 1925 and 1939. Using two alternative VAR approaches to estimate the multipliers and having defense spending as their fiscal policy variable, their first approach gives multipliers of 2,5 on impact and 1,2 after the initial year, and the second gives multipliers of 2,1 on impact and 0,9, 0,4 and 0,2 in years two, three and four, respectively. When using total government spending as the fiscal policy variable, the multipliers are 0,43 on impact and 0,13 after one year. After repeating the analysis using instrumental variables and OLS regression, they accordingly find fiscal shocks to be expansionary and that government expenditure has a positive and significant effect in seven out of eight cases. Even in the eighth case the coefficient is positive

[25] Argentina, Australia, Austria, Belgium, Bulgaria, Canada, Chile, Colombia, Czechoslovakia, Denmark, Finland, France, Germany, Greece, Hungary, India, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom and United States.

and large and the loss of statistical significance is rather due to larger standard errors than a much smaller coefficient.

Based on the results, Almunia et al. argue that the reason why fiscal policy made little difference in the 1930s was because it was not used on a large enough scale, not because it was inefficient. Where fiscal stimulus was applied, output and employment responded accordingly, which was the case for example in Italy during 1936-1937, when, as a result of a war in Ethiopia, the country ran a deficit of 10 % of GDP and experienced a GDP growth of 6,8 % in 1937. In France the GDP also grew during years of increasing deficits.

What remains uncertain, however, is whether or not any of these results can be applied to the recent crisis. Gordon and Krenn (2010) argue that estimates of fiscal multipliers for 1940-1941 are not relevant to situations like 2008-2010 when there is ample excess capacity. The fiscal stimulus in 1940-1941 was partly crowded out not by an increase in interest rates, but rather by capacity constraints in critical areas of manufacturing that became increasingly acute in the second half of 1941. Since the unemployment rates were high in 1941, similarly as during the 2008 crisis, previous studies have been misled into thinking that multipliers calculated in 1940-1941 could be applied to 2008-2010. While the 1941 economy did have excess capacity in its labor market, at the same time it experienced capacity constraints in many of the key manufacturing industries. Because of these capacity constraints, the authors get radically different fiscal multipliers when they extend their calculations to the end of 1941 instead of stopping them in the middle of the year.

Also, computing overall multipliers using defense spending and corresponding non-defense spending might be somewhat problematic. Since an expansion in defense spending is likely to crowd out some of non-defense spending, the increase in total government purchases is likely to fall short of the rise in defense spending. Therefore, it follows that multipliers calculated from defense spending alone tend to understate multipliers calculated for total government purchases. (Barro and Redlick 2009)

7.4 Discussion

In this chapter I have analyzed the Great Depression in order to find out how large an impact fiscal stimulus had on the recovery period. First I reviewed previous studies to get an overall image of the factors that contributed the most to the high growth rates experienced after the contraction. While most studies find that both monetary and fiscal policy played a role in ending the depression, there is disagreement about the mechanisms and also about which policy in the end contributed the most to the recovery. Where Romer (1992) argues that the most important factor was monetary policy in the form of monetary expansion, Vernon (1994) and Gordon and Krenn (2010) emphasize the role of fiscal policy and increased military spending related to World War II and argue that the role of monetary policy was mainly in supporting the fiscal expansion. Eggertsson (2008), in turn, finds that managing expectations about future money supply, inflation and interest rates was the key to the recovery and that fiscal stimulus contributed to the growth rates mostly by firming up inflation expectations.

When calculating the multipliers, many economists have used defense spending as a proxy for total government spending, mainly because of its more exogenous nature with respect to other components of GDP. However, there are some difficulties in this approach and it remains uncertain if defense spending multipliers are representative enough of total government spending multipliers. Especially multipliers estimated from the period of World War II have been argued to be biased downwards, since because of the war, the government was controlling and therefore directly affecting and suppressing several components of private consumption.

When it comes to the size of the multipliers, there are considerable variations between the different studies and the results vary from negative values to a peak of 2,5. All of the studies discussed here, except for one, have been done using U.S. data only, so the results may not be representative for other countries. Most of the U.S. multipliers are positive and less than 1, so it seems that increasing public spending crowds out private spending at least to some extent. It has also been argued that

during the Great Depression the U.S. experienced notable capacity constraints not in the labor market but in critical areas of manufacturing, which might depress the multiplier estimates.

As a conclusion, fiscal multipliers can be larger in the latest crisis than during the Great Depression, assuming that there are no notable capacity constraints crowding out the private demand side. This should not be the case however, at least not as severely as after the Great Depression. The fact that fiscal policy measures have been taken more extensively now than in the 1930s could also suggest higher multipliers for the recent crisis. Therefore, multipliers larger than 1 should be reachable, while the highest estimates of more than 2 are less likely to appear.

8 Conclusions

The objective of this thesis was to study the size of the government spending multiplier in the economic conditions that have prevailed during the recent financial crisis. The main finding is that, for obtaining multipliers as large as possible, fiscal stimulus should be carried out only when monetary policy is accommodative, it should be implemented quickly and the increases in public spending should be followed by future spending cuts. Moreover, this fiscal policy should be credible so that the higher public spending and future spending cuts will be anticipated by the private sector and will start affecting private consumption decisions even before the actual measures have taken place. If these conditions are met, fiscal multipliers can reach values greater than 1. Throughout the thesis prices are mostly assumed to be sticky, which is in accordance with New Keynesian theory and consistent with the majority of the papers used for the purposes of the thesis. The assumption of sticky prices is essential for obtaining high multipliers, for with flexible prices private consumption will adjust downwards when public spending is increased.

There are certain facts that imply that fiscal multipliers can be expected to be higher in a crisis than during normal times. First of all, stimulus measures are normally more effective in a zero interest-rate environment, which is very typical to financial crises in general. In the 2008 crisis there have been signs of a liquidity trap accompanied by very low nominal interest rates, similarly as in the Great Depression of the 1930s. Zero interest rates guarantee that monetary policy will be accommodative, since at the zero lower bound the real interest rate is already too high and does not need to rise in response to an increase in economic activity. At the same time, higher government expenditure creates inflation expectations, which will put downward pressure on the real interest rate. A lower level of interest rates means that private demand is not crowded out as heavily as would be the case with non-accommodative monetary policy. Second, financial disturbance normally increases during financial crises, which implies more credit constraints for the private sector as risk premia are higher and households and firms will be subject to more credit rationing. This

reduces the households' possibilities to smooth consumption and makes private consumption more sensitive to changes in current disposable income, making fiscal stimulus more efficient.

Fiscal stimulus is most effective when it is purely temporary, or more precisely, when it does not continue after the crisis has phased out. A prolonged stimulus period will lead to crowding out of private demand for two reasons. First, if the stimulus is carried out when monetary policy is no longer accommodative, it induces an increase in interest rates. Second, a long-lasting stimulus period will raise the tax burden for the government and lead to higher taxes in the future, which will be anticipated by the private sector. Committing to a higher level of government spending during the entire zero lower-bound period affects expectations about future output and inflation and makes stimulus more effective. On the contrary, a permanent increase in public spending depresses short-term multipliers and will most likely increase the amount of public debt, which is costly for the economy and in the long run will lead to higher interest rates and lower total investment. Even if fiscal stimulus is temporary, it will easily become ineffective if it lasts too long.

Stimulus measures are typically subject to implementation lags, because it often takes a while to implement public projects. Since stimulus should be carried out only when monetary policy is accommodative, or, when interest rates are very close to zero, a considerable lag can lower the efficiency of fiscal stimulus if it leads to increases in spending outside the crisis period. Implementation lags can also complicate the empirical estimation of the multipliers, since they make the identification of the shocks and their impacts more challenging: what is interpreted as a fiscal shock might actually be caused by earlier policy changes that are anticipated by the private sector. However, a credible announcement of upcoming fiscal measures can succeed in stimulating aggregate demand already before the actual stimulus starts. In general, though, for stimulus purposes it is preferable to choose public projects that can be implemented relatively quickly.

For analysis purposes, consumers can be divided into Ricardian and non-Ricardian depending on their consumption smoothing possibilities. Ricardian households act in

accordance with Ricardian equivalence and make their consumption decisions in compliance with the permanent income hypothesis. They anticipate the government's need to finance fiscal stimulus with higher taxes in the future, which means they do not respond to changes in current disposable income, but rather to changes in income over the entire life-cycle. Non-Ricardian households face credit constraints and cannot smooth their consumption in whichever way they want, which means they respond more strongly to changes in current disposable income. The private consumption response to fiscal stimulus depends greatly on the number of non-Ricardian households. If their share is very small, the negative wealth effect that falls on Ricardian households is too strong, so that fiscal stimulus does not generate a positive private consumption response and the output multiplier will not be greater than 1. As mentioned earlier, financial crises increase credit constraints and raise the fraction of non-Ricardian households, which enables larger multipliers.

The efficacy of fiscal stimulus can be improved if at least a part of it is financed with spending reversals instead of raising taxes. This financing strategy can be considered a bit more realistic, since government's capacity to raise taxes is limited. In short, short-term fiscal stimulus should be accompanied with a credible commitment to cut the level of expenditure in the medium term. Expectations of future spending cuts can lower real long-term interest rates, which will crowd in private consumption. Spending reversals and their implications affect the consumption response of Ricardian households, which can turn the private consumption multiplier positive even if the fraction of non-Ricardian households is small. The size of the fiscal multiplier is quite sensitive to the intensity and timing of the reversal period, which means that spending reversals should neither be too intensive nor be started too early or too late.

Multipliers from the recovery period after the Great Depression have been studied extensively, and in the papers used for this thesis the estimations vary from negative values to as high as 2,5. Most of the multipliers are positive and smaller than 1. When it comes to the methodology, a common approach has been to use defense spending as a proxy for total government spending, primarily because of its exogenous nature. This approach might cause problems, since it is not quite sure if

multipliers estimated with defense spending are representative enough of total fiscal multipliers. For instance, during World War II the government was imposing direct controls and affecting several components of private consumption, which has been argued to depress the multipliers. The multipliers in the recent crisis are likely to be larger than the ones estimates after the Great Depression, because the manufacturing sector at that time was suffering from capacity constraints, which does not seem to be the case in the current situation. Also, fiscal stimulus has been used more extensively now than after the Great Depression, which also implies larger multipliers for the recent crisis.

I conclude that, based on the analysis done here, fiscal multipliers greater than 1 can definitely not be ruled out at least, which means that fiscal stimulus can be very effective when carried out properly. Another factor in favor of fiscal stimulus is that it is often the only way through which the government can try to stimulate a recession-struck economy. Apparently, if stimulus measures are not well planned, they can be costly for the economy and can even work against the recovery.

One interesting finding is that the value of the fiscal multiplier might vary according to the level of government spending and that the marginal fiscal multiplier might become smaller when the size of the fiscal package increases. If this is the case, it could be an interesting approach for further analysis. Also, it would be useful to include a proper formalization of the financial sector in the models, since financial sector distress has played such an important role in the 2008 crisis. Empirical estimation of fiscal multipliers from the recovery period of the latest crisis is yet to be done and it will eventually enable comparing the fiscal policy of the two crises and evaluating the efficiency of the policy measures that have been taken.

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