The Effects of Discretionary Fiscal Stimulus: A Survey

Hristov, Atanas

ifo Leibniz-Institut für Wirtschaftsforschung an der Universität München e.V.

20 August 2012

The Effects of Discretionary Fiscal Stimulus: A Survey *

Atanas Hristov ¶

Ifo Institute for Economic Research at the University of Munich

August 20, 2012

Abstract

This paper surveys evidence on fiscal multipliers from the Euro area and the United States obtained by direct, cross-state or economywide measures of the effects of broad-based tax cuts and increases in government purchases. In view of the evidence in the literature I conclude that that fiscal policy may be substantially more effective when the proportion of households and firms that are liquidity constrained is high and when utilization of factors of production is low.

JEL: E62, E63, E24, E32, F41

Keywords: Multipliers, Fiscal policy, Monetary policy, Liquidity constraints

1 Introduction

The fiscal policy response to the recession of 2007-2009 has been significant in an historical perspective. Virtually all OECD countries have carried out discretionary measures in response to the crisis.[1] With considerable cross-country variation in the scale and compo-

*I am grateful to Michael Burda for helpful discussions and comments. This research was supported by the Deutsche Forschungsgemeinschaft through the CRC 649 "Economic Risk".

¶Ifo Institute, Poschinger Str. 5, 81679 Munich, Germany, E-mail: hristov.a@ifo.de.

[1] *Discretionary* or *activist* fiscal policy means government expenditure and/or tax policy that is changed, typically through legislation, without any anticipated reason. This is distinct from *discretionary systematic* and *automatic* policy, by which expenditures and taxation change either as a result of changes in economic activity and/or without any involvement on the part of the policy-makers.

sition of the undertaked crisis measures, the stimulus program introduced by the average OECD country had a cumulated budget impact over the period 2008-10 totaling up to more than 2.5 percent of 2008 GDP. The United States had the largest fiscal package of around 5.5 percent of 2008 GDP.[2]

Despite the recent widespread use of fiscal policy, controversy still remains about when and how to use fiscal policy as a stabilization instrument. Often both empirical estimates and theoretical predictions on discretionary fiscal expansions are ambiguous not only about the magnitude of responses of macroeconomic aggregates but also on the direction of those responses. In this work, I review multiplier estimates from the Euro area and the United States on common types of fiscal policy initiatives: mainly, broad-based tax cuts and *unproductive* spending increases.[3] The multiplier is broadly the increase in the number of currency units in total national output and income (or respectively, the increase in the number of currency units in a component of aggregate demand other than government spending) per currency unit of either a stimulus spending increase or of a particular taxation cut.[4] The exposition of the review is centered around the different methods that have been employed in estimating/simulating the fiscal multipliers; i.e. direct, cross-state or economywide measures.[5,6] I discuss each of these methods and their estimates of the various multipliers.

[2]See Table 3.1., chapter 3 in OECD (2009).

[3]Broadly, spending is unproductive if it does not affect the private sector production functions. In contrast, spending on public infrastructure improves private productivity for many years to come.

[4]The fascination with the size of the multiplier is related to the predictive power of this simple metric regarding how fast the economy may grow following fiscal stimulus actions and whether some form of direct crowding-out may be taking place. Leaving aside normative analysis considerations, the general assumption is that the larger is the multiplier, the more beneficial is the discretionary stimulus. Multipliers as a metric are not very eloquent on the consequences for overall welfare. That is, whether output increases caused by activist fiscal policy are desirable or not needs to be evaluated by other means.

[5]There are already several recent surveys on activist fiscal policy. Auerbach et al. (2010) evaluate the impact of the legislated in 2009 American Recovery and Reinvestment Act (ARRA) on the United States output and budget. The paper surveys evidence on the effects of fiscal policy on economic activity by all main approaches in the literature. Similarly, Spilimbergo et al. (2009) and Ramey (2011b) survey the literature, however, the focus is placed mainly on economywide fiscal multipliers, and not on direct micro-based ones. Hebous (2011) contains a detailed review of multipliers and responses of components of aggregate demand following fiscal shocks in dynamic stochastic general equilibrium models and vector auto-regressions. Parker (2011) highlighted the methodological difficulties with measuring the efficacy of fiscal policy.

[6]Discussing fiscal policy involves many important aspects that are left beyond the scope of this survey. Examples are the productive use of government spending related to public investment (Baxter and King, 1993), or public employment (Finn, 1998), the sustainability of fiscal policy (Uctum and Wickens, 2000), the intergenerational aspect of the public debt burden (Auerbach, 2009a), and the role of automatic stabilizers (Auerbach and Feenberg, 2000).

Comparing the estimates of the multipliers—obtained through the use of the different methods—provides a natural way of finding the consensus size of the fiscal effects. The exercise is important not only because it allows narrowing the range of the "true" multipliers, but also because it uncovers the drawbacks of the methods, and their underlying identifying assumptions. For example, finding a statistically significant partial-equilibrium effect at the micro level foreshadows the existence of the effect at the macro level. Missing to detect the effect at the macro level, however, signals the possibilty that either the effect is undercut by counteracting reactions, or that, when obtaining the macro estimate, we have failed to account for important determining factors. In view of the difficulties that both empiricist and theorist have to confront when answering the question "how effective is fiscal policy", examining the estimates from the different methods could be highly informative of which factors deserve a special attention.

Consider first the empiricist's perspective. First, fiscal policy has a variety of instruments available at its disposal.[7] And, each of the these instruments has different effects on the private sector and aggregate outcomes. Thus, measuring the efficacy of a stimulus package is dependent on properly accounting for its composition and the dynamic effects of each of its instruments. Second, policy actions and economic activity are both endogenous—in that, they affect each other simultaneously—and, thus, identifying clearly the causal link between the two is prone to mistake and bias. Third, fiscal policy changes have different effects at the time of announcement and the time of implementation, and every assessment of the policy effects has to account for these nuances. Moreover, policy assessment must take into consideration the economic conditions under which fiscal actions were taken. The theorist has to cope with other difficulties. Above all, there are important concerns regarding the degree of misspecification of current theoretical models. Given how stylized these models are, it is still a question whether they will truly be able to describe in a useful fashion the dynamics of the data.

[7]Fiscal expansions may be carried out by cutting net taxes (taxes minus transfer payments) or increasing government spending. Government spending may be divided into government investment and government consumption (purchases of goods and services for current use), where the latter is the sum of wage and non-wage consumption. The government levies both lump sum and distortionary taxes. The former is a tax on households or firms which is collected independently from the actions of the agents. For that reason, this tax has the desirable property that it does not have an effect on the choices of the agents. Lump-sum taxes, however, are typically not used by the government. Among the distortionary taxes with which the government raises most of its revenues include labor, corporate and value-added taxes.

In a recent study Ramey (2011b) concluded that the size of the multiplier following a temporary, deficit-financed rise in government purchases lies between 0.8 and 1.5. Around the same time, Parker (2011) emphasized that the efficacy of fiscal policy is conditional ultimately on the state of the economy. Inspecting the values of the multipliers of all the different measures in the literature, I conclude that that fiscal policy may be substantially more effective when the proportion of households and firms that are liquidity constrained is high and when utilization of factors of production is low; namely, fiscal multipliers are higher in a recession. Thus, the conditional effect, for example, of an unanticipated rise in government purchases in a recession may likely be higher than 1.5, the plausible upper bound suggested by Ramey (2011b).

The discussion continues as follows. In Section 2, I list some of the most important sets of reasons that have been advanced as pros and cons for the use of fiscal policy in aggregate demand stabilization. Then, in Section 3 I review briefly different definitions of fiscal multipliers and ways to obtain them. I continue by discussing separately the evidence obtained by the different methods. Finally, I conclude.

2 Reasons against and for the use of fiscal stimulus

The impetus for boosting economic activity through fiscal stimulus has not always been so strong as at the beginning of the Great Recession. From the narrative account in Blinder (2004), the progression of economic thinking on the efficacy of fiscal policy as a device for macroeconomic management and the impetus for activist fiscal actions has moved up and down over the years. The history of thought on fiscal policy started presumably with the rise of popularity of the General Theory by Keynes (1936). Beliefs in the efficacy of discretionary fiscal policy may have reached a relative peak during the sixties or early seventies. Then, a series of events cast doubts on the effectiveness of fiscal policy. In one of them, to counteract the adverse oil shocks of the seventies many governments reached towards expansionary monetary and fiscal policy. Active policies, however, did not prevent the widespread rise in unemployment but, unfortunately, left a dent in the public budgets from the resulting high deficits. As a consequence, at least until the last years, the common view among many economists was that countercyclical

discretionary fiscal policy was undesirable and/or inefficient (e.g., Eichenbaum, 1997; and Taylor, 2000).[8] Only recently, this perception on fiscal policy has shifted—not the least because of the accumulation of new evidence prompted by the renewed interest in the effects of fiscal policy—and may have begun to converge upon a more moderate point of view. For example for the United States, Auerbach and Gale (2009) uncover increased sensitivity of the fiscal policy reactions functions, those of legislated government spending and taxation, to the phase of the business cycle and the public budget in the years after the first inauguration of George W. Bush as president relative to the sensitivity during previous administrations. It appears that many economists and policy-makers may have begun to perceive countercyclical fiscal policy as a potential and timely tool for counteracting the perils of economic downturns.

Following the painful experience of high unemployment in the 1970s that was further aggravated by high inflation, the economic profession offered several widely accepted arguements against the use of discretionary fiscal policy. These arguements can be further classified into two groups. That is, activist fiscal policy is *undesirable* because it is dominated by monetary policy in stabilizing aggregate outcomes and it is in fact *inefficient*. Below, I review some of those most emphasized groups of *con* reasons.

First, fiscal policy is subject to potentially long *inside lags*, which comprise the delays between *recognition* of the need for stimulus initiatives and the *implementation* of the relevant policies. Some inside lags occur for inevitable and necessary administrative reasons (e.g. some project are easier to get started than others), other for political reasons (legislation process in parliament on whether and how to change taxes or spending is slow). Taken the average recession lasts about a year from peak to trough, using a legislated stimulus program at just the right time could at best be a lucky coincidence or at worst be potentially destabilising—a point well emphasized by Friedman (1953). Friedman believed that the economic system is eventually self-equilibrating. In addition, he stressed that timely knowledge about the economy, combined with the uncertainty surrounding the impact of policy measures, is insufficient for properly adressing short-run out-of-equilibrium events.

Second, fiscal policy's efforts to stabilize aggregate demand can be offset by the ex-

[8]Blinder (2004) and Blanchard (2006) have expressed more cautious views.

pectations and actions of rational households and firms who anticipate the future policy motives—an implication of the Lucas (1976) critique. For example, one reason why investment might drop following the legislation of a stimulus program is the expectation that a distortionary investment incentive will be enacted soon after the program expires. An extension of this line of reasoning can lead one to question whether fiscal policy may influence macroeconomic outcomes at all. For example, changes in the pattern of taxation and public spending which leave the life-time private wealth unaffected need not have an effect on private spending. The argument is known as the "Ricardian equivalence" (Barro, 1974).[9] In case the Ricardian proposition holds true in reality, economists stress that the marginal propensity to spend—a central determinant of the efficacy of fiscal policy—out of temporary tax cuts is likely to be zero.

Third, fiscal policy may have "non-Keynesian" effects, summarized recently by Giavazzi et al. (2000). That is, contractionary fiscal policy, by successfully consolidating the public budget, may have even an expansionary (stimulating) impact on the economy. This can occur by lowering long-term interest rates, as bond investors react to the decreased risks to fiscal sustainability driven by the drop in public debt and future fiscal obligations.

Last but not least, fiscal policy, to a greater extent than monetary policy, is more prone to be influenced by political constraints. That is, monetary policy is delegated in the hands of independent experts.

Monetary policy, mostly because of its shorter inside lags and because of the likely long-run economic harm poorly-crafted fiscal stimulus packages can incur—by leaving the economy, for example, with a permanently larger public debt—is generally favored as the policy of choice when it comes to fighting an economic slowdown. In addition, monetary policy is less prone to political pressures. Recently, however, Blinder (2004), Blanchard (2006) and Allsopp and Vines (2005) have reevaluated both the *undesirability* and *inefficiency* conditions for the use of activist fiscal policy, and the priority role of monetary policy as a stabilization instrument. Throughout and after the Great Recesion, the list of economists who have argued that monetary policy and the automatic fiscal

[9]Ricardian equivalence holds only if taxes are not distortionary. There are also a number of other explicit or implicit assumptions upon which the Ricardian proposition depends, among them: bequests, successive generations are linked by altruistically motivated transfers; capital markets are either perfect, or are distorted in specific ways; consumers are rational; the pattern of taxation does not redistribute resources within generations. Bernheim (1987) contains a survey and a synthesis of the work on Ricardian equivalance stimulated by Robert Barro.

stabilizers alone could be an insufficient counter-weight against strong adverse shocks—like the one that caused the Great Recession—has enlarged. Below, I examine some of the *pro* conditions under which fiscal stimulus is appropriate and effective.

First, most evidence suggest that fiscal policy's *outside lags*—the period between a fiscal policy shock and its ramifications on the economy—are significantly shorter than the respective outside lags of monetary policy actions.[10] This implies that fiscal stimulus can stimulate economic activity more quickly, once implemented, than monetary policy.

Second, one must acknowledge the possibility that the private sector may deviate from the kind of rational long-term planning envisioned by the life-cycle (Modigliani and Brumberg, 1954; 1980) or by the permanent income models (Friedman, 1957).[11] For example, if households are sufficiently shortsighted or, if a large number of them are credit-constrained, then temporary fluctuations in disposable income caused by the government may have substantial effects on aggregate spending.

Third, economic analysis of monetary and fiscal policy, and their interaction, show broadly that the enactment of the two instruments with the same goal dominates outcomes compared to using only one instrument. Blanchard et al. (2010) emphasize that relying primarily on monetary policy as a stabilisational tool is too restrictive. Macroeconomic policy must have many targets—more than inflation and output gap stabilisation—and, to achieve them, it need to resort to any of the wide array of instruments at its disposal—from "unconventional" monetary policy to fiscal instruments, to regulatory instruments. The argument goes back at least to the analysis of Brainard (1967) who finds that if the effects of policy instruments are uncertain policy-makers may better use every tool available. The rationale is that the effects of the different instruments can cancel out at least partially. However, if fiscal and monetary policy are employed together to achieve the same goal, this can reduce the uncertainty about whether the provided amount of stimulus is sufficient.

Fourth, fiscal stimulus could be critically important if the zero lower bound on nominal interest rates is reached; a relevant issue in the current macroeconomy (e.g., Hall, 2011; Christiano et al., 2011; and Woodford, 2011). In this case, as shown in Rudebusch (2009),

[10] See, e.g., Blinder (2004) and Elmendorf and Furman (2008) who report evidence from the Federal Reserve's quantitative models of the U.S. economy.

[11] Attanasio and Weber (2010) survey the recent literature on the life cycle model of consumption.

the desired easing—according to an estimated Taylor rule—of the monetary policy funds rates could be highly insufficient in view of the increase of the unemployment rate and the fall of the inflation rate. Monetary policy, though not completely powerless, is strongly constrained. In addition, in such an environment fiscal stimulus could be greatly efficient (Eggertsson and Woodford, 2006).

Based on the above considerations, several economists have suggested that the evaluation and design of activist fiscal policy have to be based on three principles (see Summers, 2007; and Elmendorf and Furman, 2008, among others). The principles state that discretionary fiscal policies should be *timely*, *targeted*, and *temporary*.[12] Timely: Policy actions should be taken in a timely fashion in times of economic slowdown. Targeted: From a macroeconomic perspective, policy-makers should ensure that first, stimulus is directed towards the ones in greatest need, and second, aggregate output and income increases the most for each currency unit spent or, respectively, for a particular tax rate decreased by a similar magnitude. Temporary: Policy actions should not increase the budget deficit in the long-run. That is, fiscal sustainability should not be put at risk.

3 Fiscal multipliers: setting the stage

The majority of the studies that measure or simulate the effect of exogenous changes in government purchases or tax revenues report the impact output multiplier defined as

$$\text{Impact multiplier(k)} = \frac{\Delta Y_{t+k}}{\Delta F_t}.$$

The measure reports the increase in the level of output Y at k periods following the change in F at time t. Thus, ΔF denotes either the increase in government purchases or the fall in tax revenues.

Following Mountford and Uhlig (2009), many studies have started to report increasingly the cumulated (present-value) multiplier. This multiplier has an advantage over the impact multipliers because of the additional information it incorporates regarding both the persistence of the exogenous fiscal event and the relative weight of the macroeconomic

[12]Blanchard et al. (2009) argue that discretionary policy should accomplish seven objectives: "timely, large, lasting, diversified, contingent, collective, and sustainable", principles that are too multi-faceted to be useful in terms of guidelines for execution.

outcomes in the future. The cumulated multiplier is calculated as the sum of discounted values of additional output over k periods that is the result of the present-value change in government purchases or revenues,

$$\text{Cumulated multiplier(k)} = \frac{\sum_{j=0}^{k} \prod_{i=0}^{j} (1 + r_{t+i})^{-j} \Delta Y_{t+k}}{\sum_{j=0}^{k} \prod_{i=0}^{j} (1 + r_{t+i})^{-j} \Delta F_{t+k}}.$$

Both of these two definitions of the multiplier provide valuable information on the efficacy of fiscal policy, and none of them is superior to the other. For example, from the impact multiplier we can find out when the effect of the policy initiative reaches its peak—an information that is valuable to assess the outside lag of the fiscal instrument. In my survey, I try to report, if available, both the impact multiplier at first quarter and two years as well as the cumulated multiplier at two or three years.

Fiscal policy actions have a widespread effect on the decisions and behaviour of individual households, businesses, regions within a country and the whole economy. The effects of these actions can broadly be divided into *direct (microeconomic)*, *cross-state* and *economywide (macroeconomic)*. Relying on this classification, one can organize the methodologies used to measure fiscal multipliers into:

- Direct effects: micro econometric studies of consumer and investment behavior in response to fiscal shocks
- Cross-state effects
- Economywide effects:
    - Large-scale macroeconomic models
    - Dynamic stochastic general equilibrium models (DSGE)
    - Dynamic simulations and vector auto-regressions (VARs)

Microeconomic studies estimate only the direct, first-round effects, without considering effects funneled through other indirect channels. In these papers, the focus is primarily on the effects of policy changes on individual consumption and private investment. *Cross-state* analysis measure the impact of differences in the variations of government purchases and transfers on the regional economies. *Macroeconomic* studies estimate the overall *economywide* multipliers, including dynamic second-round effects.

Although the literature is interested primarily in the output multipliers, both the direct

partial-equilibrium and the economywide general-equilibrium responses of consumption, investment, wages, and employment following fiscal interventions are of independent interest. Thus, when necessary, I discuss the responses of the other variables as well, as this additional evidence can help us discern the transmission mechanism of fiscal policy. For example, direct measures of the causal policy effects can ascertain the relevance of the channels integral for the tranmission of the policy initiatives in the general-equilibrium models.[13] In addition, direct estimates that document the dependence of the policy effects on the state of the various households and businesses can provide valuable information about the dependence of the effects of the different policy initiatives on the state of economy, emphasized boldly by Parker (2011). Last but not least, variation at the micro and regional level provide a rich source of information for obtaining multipliers on the fiscal policy instruments. Indeed, the advantage of the micro and cross-state analysis (over macro estimates) is the possibility to be very explicit about the origin of variation needed for the econometric identification.

Existing estimates of the multipliers, especially from the economywide studies, tend to vary greatly. Thus, it seems natural to accept not only that the methodologies to measure the multipliers have weaknesses and caveats but also that there is no unique "multiplier". As a result, any estimate of a multiplier should be tagged with information about the assumptions under which it is valid, under what state of the economy it has been obtained and what type of fiscal stimuli is considered. This has been emphasized recently by Solow (2011). In a similar vein, Ilzetzki et al. (2011) have demonstrated convincingly that the country of interest and characteristics of the economy are important determinants of the multiplier. The authors show that larger fiscal multipliers result from more closed economies, higher income per capita countries, lower public debt, and fixed compared to flexible exchange rate regimes.

Below I provide an overview of the methods employed in measuring the fiscal multipliers, followed by a summary of the estimates.

[13]There are many channels through which fiscal policy affects aggregate outcomes. I discuss some of them explicitly in Section 6.2. The behavior of real wage following a shock to temporary deficit-financed government purchases is an example of how a response of a variable can verify the importance of channel. A fall of the real wage is associated with the significance of the neoclasical channels, while a rise gives evidence to the importance of the New Keynesian channels.

4 Fiscal multipliers: direct effects

Tax cuts to stimulate investment and especially consumption have a long history. These policy initiatives have been analyzed in a substantial literature, reviewed in greater detail in Auerbach (2009b).[14]

4.1 Evidence from household responses to tax cuts

Because private consumption is the biggest component of GDP—amounting to more than 60 percent of output in the total OECD economy for the period 1970 to 2011—a sensible argument has government boost consumption demand when stabilising the economy. That is, the consumption response to policy changes is central to the transmission mechanism of fiscal stimulus.

The empirical evidence, mostly from cross-sectional and less from time series data, offer several fairly undesputed results about the marginal propensity to consume (MPC) out of tax changes. Some of the main reasons why the studies use mainly cross-sectional data are: first, time series data offer few observations on temporary taxes to provide precise estimates; and second, at the micro level one can investigate heterogeneity and nonlinearities in households' responses. Overall, the direct estimates of the effects of tax cuts vary less compared to those of other fiscal instruments and to those obtained by other estimation methods.

The results are the following. First, in agreement with standard life-cycle and permanent-income models, most of the evidence indicate that explicitly temporary changes in income have smaller impact on household consumption than permanent changes.[15] In Table 1, I report evidence on the direct effects of tax cuts. Estimates of the effects of temporary personal income tax cuts or rebates on private consumption vary from zero (Taylor, 2009) to 0.1 (Feldstein, 2009), 0.2 (Blinder, 1981; and Broda and Parker, 2008), 0.33 (Shapiro

[14]The section is to a great extent a summary of the evidence on direct fiscal effects surveyed in Auerbach et al. (2010).

[15]Okun (1971) has been the first to test empirically the plausibility of the permanent income hypothesis (PIH). In the literature he initiated the PIH was tested by asking whether consumer responses to *temporary* income changes are larger than suggested by the theoretical models. In the newer line of research, sparked by Hall (1978), Robert Hall derived testable implications of the life-cycle model by using the first-order conditions of the intertemporal optimization problem faced by the households, a method known as the Euler equation approach. As a result, Hall reformulated the question slightly by asking whether consumer responses to *easily-predictable* income changes are greater than suggested by theory.

and Slemrod, 2003b) and even 0.4 (Johnson et al., 2006). Estimates of the effects of longer-term or permanent tax cuts on private consumption vary between 0.55 (Blinder, 1981), 0.66 (Johnson et al., 2006), 0.7 (Feldstein, 2009) and 0.9 (Souleles, 1999).

Table 1: Studies of direct effects

Study	Sample; Country	Estimation/Identification	Implied consumption multiplier
Blinder (1981)	Quarterly: 1953:Q1-1977:Q4; U.S. data	Study of 1975 income tax rebate and 1968 surtax; Distributed lag estimation of a consumption equation	At first quarter: 0.16; Cumulative seven quarters: 0.55
Broda and Parker (2008)	Weekly: 2008:W1-2008:W24; U.S. data	Fixed-effect panel case study of the 2008 tax rebate	First month after receipt: 0.19
Feldstein (2009)	Monthly: 1980:M1-2008:M11; U.S. data	Single consumer expenditure equation, aggregate data	At first month: 0.13; Marginal propensity to spend: <0.70
Johnson et al. (2006)	Surveys 2000 to 2002; U.S. data	Consumer expenditure survey data to study the effect of the 2001 tax rebate	At first quarter: 0.20-0.40; Cumulative: 0.66-0.69
Parker et al. (2011)	Surveys 2007 to 2009; U.S. data	Consumer expenditure survey data to study the effect of the 2008 tax rebate	At first quarter: 0.12-0.35
Poterba (1988)	Monthly: 1959:M6-1987:M9; U.S. data	Study of 1975 income tax rebate and 1968 surtax with aggregate data; Single consumer expenditure equation	At first month: <0.12-0.24
Shapiro and Slemrod (2003b)	Surveys 2001 to 2002; U.S. data	Phone survey evidence on the propensity of consumers to spend of 2001 rebate	At first quarter: 0.34-0.37
Souleles (1999)	Surveys 1982 to 1983; U.S. data	Consumer expenditure survey data to study the effect of the Reagan tax cuts	Marginal propensity to spend: 0.66-0.87
Taylor (2009)	Monthly: 2000:M1-2008:M10; U.S. data	Single consumer expenditure equation, aggregate data	At first quarter: <0.01

Second, tax cuts may have different effect on the consumption behaviour dependent on the state of an individual household. Recent studies that have estimated the effects of predictable tax changes (such as tax rebates) on consumption find commonly that the estimates are heterogeneous among different income households, and bigger than zero (e.g., Shapiro and Slemrod, 2003a; Johnson et al., 2006; Agarwal et al., 2007; and Bertrand and Morse, 2009). According to the life-cycle model, predictable policy actions should not have an effect on spending decisions. As a result, to account for the discrepancy between theoretical and observed behavior, researchers frequently call upon the presence of *liquidity constraints*.[16] Liquidity constraints have important implications for the relation between consumption and (expected) disposable income. Binding liquidity constraints

[16]For example, Hall (1978), Hayashi (1985), and Campbell and Mankiw (1989) have suggested that the excess sensitivity of consumption to disposable income might be attributable to either a proportion of the population behaving in a Keynesian "rule-of-thumb" way, spending a fixed ratio of their disposable income, or to binding liquidity constraints.

may induce excess sensitivity in consumption if constrained households experience temporary changes in income: namely, consumption will fluctuate by more than suggested by the intertemporal optimization problem. As predicted by the theory on liquidity constraints, the above cited papers find evidence that liquidity-constrained households tend to have a larger MPC out of tax changes than do other households.

Third, while economic theory predicts that anticipated changes in taxes may affect consumer behaviour ahead of their enactment, due to forward-looking nature of economic decisions, spending reacts by relatively little to policy announcements. In contrast, most of the changes in consumption tend to happen when the tax changes are implemented (e.g., Poterba, 1988; Parker, 1999; Souleles, 1999; and Johnson et al., 2006, among others).

4.2 Evidence from firm responses to investment incentives

Gross private domestic investment is a smaller component of the GDP compared to consumption (in the United States close to 20 percent of output). It is, however, volatile and sensitive to expectations about future macroeconomic outcomes. The first characteristic makes investment an attractive target for stabilization policy, while the second introduces a difficulty with achieving the stabilization objective.

Estimating investment responses to changes in investment incentives, similar to estimating household consumption responses to temporary tax rebates, however, is a more challenging task for at least two reasons. First, because policy experiments causing changes in investment incentives have been scarce (at least in the United States). And second, because identifying clearly the change in the investment tax incentives is difficult due to reasons like the interrelationships among tax provisions. Several papers estimate the effects of corporate income tax cuts on investment decisions relying on firm-level panel data (e.g., Auerbach and Hassett, 1991; Cummins et al., 1994; and Hassett and Hubbard, 2002). These "natural experiments" focus on episodes when tax changes are comparatively sizable and explain nearly all of the fluctuations in the user cost of capital—the minumum return of an investment project above which financing the investment is worth undertaking. The studies find robust support that changes in the cost of capital affect the composition of investment, with the elasticity of equipment investment with respect to the user cost of capital varying between -0.5 and -1.0. Similarly, House and Shapiro (2008)

find that recent corporate tax changes—in the form of bonus depreciation allowances to qualifying investment—have lead to a change in the composition of investment.

Despite the above evidence, the knowledge about the responsiveness of aggregate private investment to investment incentives is scarce. For example, we know that for the majority of private firms internal and external funds are not perfect substitutes. Thus, in the absence of perfect capital markets, the availability of internal funds, which is strongly correlated with firm cash flow and sales, may affect the speed with which firms acquire the desired amount of capital (e.g., Abel and Blanchard, 1986; Gilchrist and Himmelberg, 1999; and Gilchrist and Zakrajsek, 2007). Yet, we still know very little about how fiscal initiatives affect firms' investment decisions when business losses are big (as in a recession), liquidity constraints are tight and uncertainty is high (Bloom et al., 2007).

5 Fiscal multipliers: cross-state effects

Apart from influencing households' and business decisions with tax cuts, fiscal policy can affect the economy by varying the regional (state and local) spending and tax policy. Regional fiscal policy is a powerful source for (de)stabilizing aggregate spending. Although central governments allocate on average the biggest proportion out of the total government resources, regional governments may still have huge power to shape policies and programmes.[17] In view of the fact that the majority of the sub-national government entities are supposed to run a balanced budget, facing a negative shock—which causes a drop in revenues—state and local governments may need to cut spending and raise taxes. Either of these will likely worsen the recession. As a result, federal transfers to the regional governments that are severely affected by the shock, sponsored by well-off regional governments, may ease the necessity of running a procyclical fiscal policy in recessions.

Recent work have exploited variation at the regional level to measure the income or employment effects of government spending using an instrumental variable approach. As discussed in Section 3, the opportunity to be explicit about the source of variation, and the richness of the data, provide an advantage of these "natural experiments" over time-

[17] In 2011, in the European Union (EU-27) total expenditires at the state and local government level was equal to 16.7 % of GDP, while in the United States the respective ratio was 12.2 %. Source: Eurostat's gov_a_main tables and BEA's National Income and Product Accounts tables.

series methods in terms of better econometric identification. The studies make use of the fact that sizeable components of the sub-national spending are provided by the federal government on a basis unrelated to the economic conditions in the particular region. For example, Nakamura and Steinsson (2011) observe that US military build-ups lead to proportinally different allocation of federal resources across the states.

On the other hand, the application of such cross-section and panel methods does not allow a direct comparison of the cross-state with the economywide estimates (see, e.g, Clemens and Miran, 2012). Ideally, the natural experiment will measure unexpected changes in government purchases (or transfers) that are deficit financed. In contrast, in most cases the regional changes in spending are windfall financed. Thus, both the weak regions, that receive the windfall, and the stronger ones, that do not, pay for the windfall bill. This means that policies at the national level remain constant. That said, to the extent that regional spending was accompanied by changes of the interest rates and taxes, the windfall multipliers could be quite different to the multipliers that are reported in the cross-state literature: they are most likely lower. In addition, regions within a country are more interconnected with each other than neighbouring countries. As a result, the sub-national spending is going to induce stronger leakages across regions compared to leakages across coutries caused by aggregate fiscal policy.

Despite the different identifying strategies, most of these recent studies find significant positive multipliers. The reported income multipliers on impact in Acconcia et al. (2011), Chodorow-Reich et al. (2011), Feyrer and Sacerdote (2011), Serrato and Wingender (2011) and Clemens and Miran (2012) vary broadly between 1.5 and 2.5. In addition, several works find that the fiscal effects are significantly bigger in periods when the utilization of resources is low (e.g. Shoag, 2011; Serrato and Wingender, 2011; and Nakamura and Steinsson, 2011). With the caveat that the cross-state evidence is not directly comparable to the economywide multiplier, the above result do suggest that redistributive policies can have significant effects on aggregate income and employment. As discussed in Shoag (2011) and Nakamura and Steinsson (2011), such estimates provide a direct measure of the efficacy of fiscal policy carrying out regional risk-sharing. The evidence may be highly informative for policy in the European Union, where the regions are the economies within the currency union.

6 Fiscal multipliers: economywide effects

6.1 Large-scale macroeconomic models

A number of large-scale macroeconomic models were developed during the 1950s and 1960s - the Lawrence R. Klein and Arthur S. Goldberger's model, the Data Research Institute model, the Wharton model, and a variety of Federal Reserve models, among them.[18] A distinctive characteristic of these models—among which the Klein and Goldberger's model was the first of its kind—is that they were based on the then-reigning Keynesian IS-LM framework. The models allowed for the possibility of non-clearing markets, contained both behavioral equations—in particular those for aggregate consumption and investment—and a number of important accounting identities—the GNP identity, balance sheet, flow-of-funds constraints, among others. Apart from their rich structure and the possibility of interactions between different markets, the models have had a very good empirical performance. The second generation of these models in the 1990s improved over their predecessors in regard to the treatment of expectations and intertemporal decisions, while at the same time holding to a high standard the empirical goodness of fit.

Of all macro models, large-scale macro models often predict/estimate the largest output multipliers. Looking at Table 2, the quarter or one year output multipliers for the Unites States and the Euro area estimated from the second generation models in Dalsgaard et al. (2001) and for the United States in Coenen et al. (2010) respectively are about one or slightly above. In comparison, the first generation models in Evans (1969) estimate even bigger multipliers at first quarter following government spending shocks, 1.20-2.10. It is worth noting that in Evans (1969) and in Coenen et al. (2010) the output multipliers following spending shocks are slightly higher compared to multipliers following taxation shocks at the different reported horizons.

Although it is difficult to explain intuitively the dynamics of these models, the basic mechanism generating these large output multipliers is illustrated by the so-called "Keynesian Cross Diagram". The diagram maps a positive relationship between consumer changes in demand that are driven by changes in disposable income, with the latter depending positively on total national output. With constant interest rates, the government

[18]The macroeconometric literature is described in considerable detail in Bodkin et al. (1991).

Table 2: Studies with large-scale macroeconomic models

Study	Sample; Country	Estimation/Identification	Implied output multiplier
Evans (1969)	Quarterly: 1966:Q1-1975:Q4; U.S. data	Estimation based on the Wharton-EFU model, Klein-Goldberger model and Brookings model; Except for the Brookings model, interest rates are constant	G shock, at first quarter: 1.40-2.00; at two years, 1.90-2.60; T shock, at first quarter: 0.80-1.10; at two years, 1.20-1.60;
Dalsgaard et al. (2001)	U.S. economy	Based on the OECD INTERLINK model; Constant interest rates	G shock, at one year: 1.10; cumulative at two years, 2.10
	Euro area		G shock, at one year: 1.20; cumulative at two years, 2.10
Coenen et al. (2010)	U.S. economy	Based on the FRB-US model; Different assumptions about monetary policy	G shock, at one quarter: 0.85-1.00; at two years, 0.90-1.20
	U.S. economy	Different assumptions about monetary policy	shock in labor income tax, at one quarter: 0.30; at two years, 0.30-0.45

Notes: G and T shocks in the fourth column refer to the type of fiscal policy measures analyzed: G = government spending, T = cut in taxation.

spending multiplier is given by $1/(1 - MPC)$, while the tax-cut multiplier is given by $MPC/(1 - MPC)$. With an active central bank and in an open economy set-up the the channels through which fiscal policy affects economic activity increase, however, the size of the multiplier stays intimately related to the marginal propensity to consume. Generally, with higher MPC estimated from the equation for aggregate consumption, the models predict higher spending and tax multipliers.

6.2 Dynamic stochastic general equilibrium models

Partly as a response to the Lucas critique, economists in the 1980s and 1990s lost confidence in the traditional macroeconometric models and started exploring other avenues for analyses. The three other types of macro models, which I now discuss in turn, have been the main instruments for analysis in the current macroeconomic toolkit.

One approach—the dynamic stochastic general equilibrium (DSGE) model—aims to describe the behavior of the economy as a whole by analyzing the interaction of many individual decision-makers and the choices the agents make when evaluating the consequences of their own actions, and of the others, in the future. The dependence of current choices on future uncertain outcomes assigns a central role to agents' expectations in the

determination of current macroeconomic results. Because the DSGE models specify a full economic environment, they can be used to analyze the effects of well-defined policy experiments on the economy separately from other fundamental disturbances. This stands in contrast to the identification of the effects of policy actions in the empirical data where the policy disturbances take place simultaneously with other shocks. To specify the economic environment, however, the DSGE approach builds on modeling assumptions whose validity is difficult to quantify empirically. The usual culprits include rationality of agents, the structure of markets, stickiness of wages and prices, the presence and severity of financing constraints, and so on.[19]

In fact, many of the tensions between the proponents and the opponents of the discretionary fiscal stimulus are centered around the assumptions the DSGE modeler chooses to emphasize. Conditional on initial assumptions, the importance of the channels through which government policies affects prices and quantities may vary substantially, and in turn, can lead to diametrically different predictions of the impact of policy actions on economic activity. For example, forward looking behaviour is a crucial assumption of any model examining the transmission mechanism of fiscal policy. In the absence of micro-founded forward looking agents, expected future policy changes have no effects on current period decisions. On the contrary, forward looking consumers do react in the current period to expected changes in future variables. Below, I review the theoretical predictions of the two dominant models with a micro-founded forward looking behaviour—the *neoclassical* and *New Keynesian* models.[20]

In *neoclassical* models—featuring flexible prices and perfect competition in all markets—the key channels through which fiscal policy affects the private economy are intra- and inter-temporal substitution effects, as well as a wealth effect and supply-side tax distor-

[19]Caballero (2010) provides a thought-provoking, general critique of the DSGE models.

[20]For completeness, here I sketch the extreme predictions of some models without microfounded forward looking behaviour. In a model with fully flexible prices and a vertical supply curve, fiscal policy plays no role in the economy. In the other extreme in the Keynesian model with constant prices, associated with the IS-LM and Mundell-Fleming analyses, current consumption depends intricately on current disposable income, not on expected future income. In a closed economy, an expansionary fiscal policy raises output for any given level of the interest rate and shifts the IS curve—the mapping between output and the interest rate which characterise equilibrium in the goods market—to the right. With an upward sloping LM curve—the mapping between output and the interest rate which characterise equilibrium in the money market—the economy settles at a new short-run equilibrium characterised by a higher interest rate and a higher level of income. In an open economy, the channels through which fiscal policy boosts economic activity depends on degree of openness of the economy and the embraced exchange rate regime.

tions (e.g. Barro and King, 1984; Baxter and King, 1993; Aiyagari et al., 1992; Ludvigson, 1996; and Burnside et al., 2004). To highlight the different effects, I consider shortly the seminal contribution in Baxter and King (1993) in which the authors conduct an array of fiscal policy experiments in a prototype neoclassical model. A specific reason to stress on this model is the clarity of exposition of the different effects. In Table 3, I summarize evidence on the effect of fiscal policy of some frequently cited studies using dynamic general equilibrium models.[21] In the model economy in Baxter and King (1993) with *lump-sum taxes*, Ricardian equivalence holds, thus private decision-makers are indifferent to whether the government finances its spending by current taxes or by borrowing. A four year increase in government spending, financed by an increase in lump-sum taxation with the same present discounted value, raises output on impact by a small amount: the multiplier varies between 0.17 and 0.76, depending on the elasticity of labor supply. Consumption, however, falls unambiguously. The fall in consumption occurs for two reasons. First, agents anticipate rationally that the discounted value of their future taxes will rise for the given pattern of future government spending. Under the assumption that both consumption and leisure are normal goods, the negative wealth effect induces the consumers to reduce both their private consumption and leisure. With the increase of labor supply, output expands while the real wage falls along a given labor demand. The second effect works through intertemporal substitution of future for present consumption. As interest rates rise on impact, due to the decrease of resources for private uses caused by government demand, households postpone their consumption spending. With the increase of employment the marginal product of capital rises: a predetermined capital stock is cooperating with more units of labor. Depending on value of the labor supply elasticity, private investment might rise or fall: for some values, the positive effect of higher labor supply on the marginal product of capital becomes large enough to induce the household to reduce consumption even more. With a strong increase in saving, private investment may increase.

The interplay between the two effects, i.e. wealth and intertemporal substitution of consumption, and their overall impact depends crucially on the persistence over time of the

[21] The sample of examples is in no way complete. Here, I have tried to collect evidence mainly from estimated, and not calibrated, large-scale DSGE models. The models are estimated mainly with U.S. data.

Table 3: Studies with dynamic general equilibrium models

Study	Sample; Country	Assumptions/Identification	Implied spending multiplier
Baxter and King (1993)	Calibrated to U.S. data	RBC simulations with various elasticities of labor supply; temporary fiscal spending, lump-sum taxes	After G shock, output multiplier at one quarter: 0.17-0.76; Negative consumption and investment response
		Persistent fiscal spending, lump-sum taxes	Output multiplier after G shock, at one quarter: 0.27-1.03
		Temporary fiscal spending financed through distortionary taxes	Output multiplier after G shock, at one quarter: -0.50; at two years: -0.52;
Christiano et al. (2011)	Quarterly: 1982:Q1-2008:Q3; U.S. data	New Keynesian model based on Altig et al. (2011); ZLB constraint on interest rate of two or three years	Output multiplier after G shock with different persistence, at one quarter: 1.06-2.20; at two years: 1.10-2.30
		Taylor rule and no ZLB constraint	Output multiplier after G shock with different persistence, at one quarter: 0.95; at two years: 0.7
Coenen et al. (2010)	Quarterly; Estimated with U.S. data and Euro area data	New Keynesian models of six different institutions; ZLB constraint on interest rate of two years	Output multiplier after G shock, at one quarter: 0.95-2.00; at two years: 1.00-1.50
		No monetary accommodation	Output multiplier after G shock, at one quarter: 0.80-1.20; at two years: 0.80-1.30
		Monetary accomodation of up to two years	Output multiplier after GTR shock, at one quarter: 0.00-0.60; at two years: 0.00-0.70
		Monetary accomodation of up to two years	Output multiplier after TTR shock, at one quarter: 0.10-2.00; at two years: 0.10-2.40
		Monetary accomodation of up to two years	Output multiplier after LIT shock, at one quarter: 0.00-1.00; at two years: 0.10-0.50
		Monetary accomodation of up to two years	Output multiplier after CT shock, at one quarter: 0.20-1.50; at two years: 0.20-0.70
		Monetary accomodation of up to two years	Output multiplier after CIT shock, at one quarter: 0.10-0.20; at two years: 0.07-0.45
Cogan et al. (2010)	Quarterly: 1966:Q1-2004:Q4: U.S. data	New Keynesian model based on Smets and Wouters (2007). ZLB constraint on interest rate of one or two years	Output multiplier after G shock with high persistence, at one quarter: 0.96-1.03; at two years: 0.48-0.61
Davig and Leeper (2011)	Calibrated to U.S. data	New Keynesian model with varying activity of monetary/fiscal regimes	Output multiplier after G shock, cumulative: 0.80-1.58
Drautzburg and Uhlig (2011)	Quarterly: 1948:Q2-2008:Q4; U.S. data	New Keynesian models with distortionary taxes, transfers, hand-to-mouth agents. ZLB constraint on interest rate of two years	Output multiplier after G shock, cumulative at two years: 0.30-0.60; cumulative at thirty years: -0.50-0.00

Notes: ZLB denotes zero lower bound constraint on the nominal interest rate. G, T, GTR, TTR, LIT, CT, CIT shocks in the fourth column refer to the type of fiscal policy measures analyzed: G = government spending, T = cut in taxation, GTR = general transfers, TTR = targeted transfers, LIT = cut in labor income tax, CT = cut in consumption tax, CIT = cut in corporate income tax.

change in government spending. A permament or a persistent increase in public spending is associated with a dominant wealth effect of higher future taxes. Because consumption reacts by more following more persistent shocks—as the consumer is poorer in life-time terms—and since capital is predetermined on impact of the shock, the labor effort must also rise by more. The output multiplier is necessarily larger, the more persistent is the shock.[22] For example, in Table 3 a ten year increase in government spending produces an output multiplier on impact that varies between 0.27 and 1.03. Conversely, a temporary increase in public spending drives consumption and leisure mainly by intertemporal substitution. In this case, the reduction of household's life-time wealth is small relative to the size of the expansion in government purchases of goods and services.

The predictions of the model can change substantially, however, if the government finances its consumption by levying *distortionary* taxes. Now, we have to account for whether government consumption is deficit-financed (government spending is paid for by expanding public debt) or tax-financed. Let us consider first—following Baxter and King (1993)—the case in which taxes increase in parallel to spending so that there is no change in public debt. The four year increase in government spending produces an output multiplier on impact of size -0.50. For a more persistent shock, the multiplier can be much higher. Since high taxes imply temporarily low after-tax factor rewards, there is a strong incentive to substitute work effort intertemporally away from the spending increase period and also to reduce investment during this period. Regardless of the value of the elasticity of labor supply, consumption falls as well. In this example, spending is contractionary. In contrast, with deficit-financed government spending, the postponement of the tax burden affects incentives and herewith behaviour in a very diverse manner: conditional on key substitution and persistence parameters, the distortionary intra- and inter-temporal substitution effects can generate any pattern of responses of consumption, labor and the real wage on impact (Ludvigson, 1996; Reis, 2008). That is, it is possible for labor supply and output to rise in response to the fiscal expansion.

The neoclassical literature has emphasized other conditions under which expansionary fiscal policy may produce small or even negative government purchases multipliers. For example, Giavazzi and Pagano (1990), Blanchard (1990), Sutherland (1997) discuss how

[22]This argument is developed formally in Aiyagari et al. (1992).

enlarged public budgets may undercut any effort of the policy-makers to stimulate aggregate demand. That is, expansionary fiscal policy, by persistently increasing public debt, may trigger an event requiring large fiscal adjustments in the near future. Rational agents anticipate the likelihood of such an event by cutting their own spending. As a result, the increase in fiscal spending is more than offset by the decrease in private activity. Overall, the output multiplier may be negative.

To sum up, *neoclassical* models predict both negative and positive output multipliers following a rise in government purchases. In the short run, fiscal shocks affect economic activity to a large extent by changing labor supply (Ramey, 2011b). As a result, even if agents have preferences that are non-separable between consumption and leisure,[23] a feature that reduces the displacement of consumption following expansionary fiscal actions, the multiplier cannot be bigger than one. The impact multipliers of tax cuts are in general smaller than those of government purchases. The cumulative multipliers of tax cuts at longer horizons, however, especially on labor income, can be much bigger than the government purchases multiplier, as high as 2.40 as emphasized by Uhlig (2010), mainly due to the central role of labor supply for the policy transmission in the *neoclassical* model.

Fiscal policy affects the economy in the *New Keynesian* models—incorporating sticky prices, imperfect competition and possibly other types of imperfections, for example agency costs and moral hazard issues in capital markets—both through neoclassical and non-neoclassical channels, with the latter ones being associated with imperfections in financial markets that are unrelated to price and wage rigidities.[24,25] The proponents of the New Keynesian idea emphasize that the discussed market imperfections introduce a role for monetary and fiscal policy in alleviating negative economic disturbances following which the economy may take to long to adjust without active government policies.

[23]Linnemann (2006), Bilbiie (2009) and Monacelli and Perotti (2008) analyze the importance of non-separability between consumption and leisure for the positive response of consumption following government purchases shocks. The substitutability between the two goods implies that consumption needs to increase with the fall in leisure caused by the rise in government demand.

[24]In Volume 3A of the Handbook of Monetary Economics, Boivin et al. (2010) review the importance of the neoclassical and non-neoclassical channels for the transmission mechanism of the monetary policy which are equally relevent for transmission of fiscal policy.

[25]Studies on fiscal policy in *New Keynesian* models include Rotemberg and Woodford (1992), Devereux et al. (1996), Linnemann and Schabert (2003), Ravn et al. (2006), Galí et al. (2007), Hall (2009), and Woodford (2011), among others.

Since the *New Keynesian* paradigm builds upon the neoclassical framework, however, often the neoclassical channels may tame greatly the positive effects of fiscal policy on private activity. Upon inspecting the variability of output multipliers following government consumption shocks in a variety of DSGE models, Hall (2009) argues that two main features may guarantee output multipliers of size about one. These two features that need to work simultaneously, Robert Hall concludes, are countercyclical price mark-ups—stemming from imperfect competition and rigidity in prices and wages—and elastic labor supply that needs not be related to the wage elasticity of labor in Walrasian market, as in many neoclassical models.[26] That is, the former feature which is absent in neoclassical models, on balance, may raise the size of multiplier towards one. The countercyclical mark-ups cause labor demand to shift rightward following the rise in government consumption: employment is demand-determined. Depending on the relative stickiness of prices and wages, real wages need not fall as much as in the neoclassical model, and may even rise. As a result, aggregate employment rises by more. Price rigidities alone, however, are not a sufficient condition for the wealth and intertemporal substitution effects to be offset so that following, for example, a rise in fiscal purchases private spending is crowded-in.[27]

As stressed above, the efficacy of fiscal policy may vary conditional on the relative importance of the *non-neoclassical* channels in the transmission of government's actions. A fiscal stimulus program may likely boost private spending, for example, if a large ratio of households and firms in the economy are liquidity-constrained. In general, liquidity-constrained agents have a smaller leeway to freely adjust their spending as a consequence of external disturbances. That is, their spending may likely be highly dependent on current disposable income and profits (the relative importance of non-neoclassical factors increases) and less dependent on their life-time income (the relative importance of neoclassical factors decreases). As a result, expansionary fiscal policy that presumably increases current income—in times when the ratio of the financially distressed households and firms is high—may increase overall spending, and as a consequence the multiplier.

[26] Hall (2009) models the labor market following the search and matching literature.

[27] Several studies offer a variety of mechanism that may induce crowding-in of consumption following government expansions, unrelated to price rigidities. Among them: increasing returns to scale in the production function (Devereux et al., 1996), private utility from government spending (Bouakez and Rebei, 2007), and as already discussed, complementarity in the period-utility between consumption and leisure (Bilbiie, 2009; Monacelli and Perotti, 2008).

In Galí et al. (2007), the authors show that in a New Keynesian model a very high and constant proportion of liquidity-constrained consumers may contribute to an output multiplier following government purchases of size about two. Similarly, with the financial accelerator mechanism from Bernanke et al. (1999), Fernández-Villaverde (2010) demonstrates that fiscal policy is more effective in boosting aggregate demand when firms are credit-constrained. The multiplier in the latter study is about one, bigger compared to the multiplier from the same model framework but without credit-constrained firms, since government actions exert a positive effect on the firms' ability to borrow. As a result, crowding-out of private investment is reduced.

New Keynesian models emphasize an additional element central for the efficacy of fiscal policy. Namely, the central bank reacts endogenously to developments in the economy and the embraced monetary policy regime can alter greatly the predictions of the model about the effects of fiscal policy. In small analytically tractable models, Woodford (2011) stresses that if monetary policy could, and names a number of cases when it would be inclined to,[28] target an unchanged path of the real interest rate, fiscal policy may fully determine output. In this vein, Davig and Leeper (2011) provide evidence in support of an accomodative monetary policy in the United States. The authors estimate Markov-switching nominal interest rate and tax policy rules to detect active and passive periods in the behaviour of monetary and fiscal policy for the United States. In Table 3, I report the estimates for the government purchases multiplier from Davig and Leeper (2011), in which the authors simulate a standard DSGE by imposing the estimated joint Markov-switching processes. Dependent on whether fiscal policy is active or passive, and on the interaction between fiscal and monetary policy, the multiplier may be as low as 0.80 and as high as 1.58.

Several recent papers, starting with Krugman (1998) and followed by contributions by Eggertsson and Woodford (2006), Eggertsson (2010), Christiano et al. (2011), Erceg and Linde (2010), have argued that when the nominal interest rates is constrained around the zero, in periods of severe recessions, government purchases can be highly effective. The point is that under such circumstances—when the central bank would effectively want to set a negative nominal interest rate but cannot (Rudebusch, 2009)—monetary policy is

[28] An example is a period when firms have high excess capacity which implies that inflation may be less sensitive to increases in aggregate demand.

no longer active. Then, a persistent deflationary spiral can set in and further reinforce the fall in output. Activist fiscal policy, however, can break the spiral by boosting output and expected inflation: the predicted size of the purchase multiplier is above one and can be even four.

In Table 3, I report the government purchases multiplier from Christiano et al. (2011). Using the estimated model for the United States from Altig et al. (2011), the authors examine the effects of fiscal policy under a number of assumptions about the nature of monetary policy and persistence of the stimulus program. A common important result is that with the increase of the duration of the zero lower bound constraint on the nominal interest rate the size of the multiplier increases. When the constraint binds for two years the multiplier rises to 2.30. An additional and not less important prediction is that if the the bulk of the stimulus program takes place when monetary policy is accomodative, the multiplier is necessary higher. The last point is crucial if implementing a stimulus package takes to long. For example, in Cogan et al. (2010) the size of the impact multiplier at two years is smaller than 0.61 even after the auhors consider the consequences of the binding zero lower bound constraint with a two-year duration. The point is that in this study the persistence of the fiscal shock is very high. Therefore, the bulk of the fiscal spending comes at times when the central bank is not passive and follows a Taylor rule. As a result, the efficacy of government purchases is greatly reduced. Similarly, Drautzburg and Uhlig (2011) discuss other reasons that may mute the positive effect of fiscal policy with a passive central bank. The study shows that the cumulated long-run multiplier of government spending may turn negative if the government levies labor taxes to pay for the expenditure increase.

An interesting result about the effects of taxation in a zero lower bound period is discussed in Eggertsson (2012) in realm of a stylized New Keynesian model. The author argues that under an accomodative monetary policy a temporary rise in payroll tax rates, by increasing wages and inflation expactions, may play a positive role on output, despite the distortionary effect of this instrument on aggregate supply. The significance of this finding is discussed further in Coenen et al. (2010) in a diverse variety of more realistic set-ups. The results are again reported in Table 3. The latter study employs estimated models for Canada, the Euro area and the United States to investigate the effects of

several fiscal instruments. The consensus predictions of all these models is that all types of discretionary fiscal expansions may boost output in the medium-run except for labor tax cuts. The latter fiscal initiative has only a minimal effect on economic activity. An additional finding of the study is that targeted transfers to liquidity-constrained agents, in contrast to broad-base transfers, is more beneficial in terms of stimulating output.

Taken together, the results from both the neoclassical and the New Keynesian models offer very diverse predictions on the efficacy of fiscal policy. The predictions are very sensitive to assumptions about the embraced monetary policy regime, type and duration of the stimulus fiscal intervention, the degree of price and wage rigidities, and the degree of non-neoclassical features. Nevertheless, it may be safe to conclude that under certain conditions a well-composed fiscal stimulus program may be very effective. That is, in times of a deep recession, when many households and firms are liquidity-constrained, an increase in government purchases or in targeted transfers to liquidity-constrained households may stimulate economic activity, especially if the stimulus is temporary and coinciding with an accomodative monetary policy regime.

6.3 Vector auto-regressions

The fade in popularity of the large-scale macroeconometric models in the mid-seventies, caused by the prediction failures of their policy advice around the same time, was determined to no smaller degree because of the great promise of the new econometric framework advocated by Sims (1980). Christopher Sims suggested that vector auto-regressions—a linear system of n-variables in which each variable is affected by its past realizations as well as by the current and past realization of the rest of the system variables—were able to describe and forecast the dynamics in the data adequately well. The issue with the VARs is that they cannot identify the channels through which an exogenous event, for example an unanticipated rise in government purchases, affects other variables in the specified system. Sims argued, however, that the framework can be used for policy analysis as well. Structural vector auto-regressions (SVARs), by imposing a minimum set of restrictions, can separate the actual effect of, say, the policy change from the endogenous policy reaction to developments in the economy.

The minimum amount of structure in the SVARs is simultaneously both their strength

and their weakness. That is, less structure implies that the models are less susceptible to misspecification. On the other hand, the estimate in a SVAR is only an average of an effect relevant for a particular period, under the particular historical conditions and accompanying policies at work. This sidenote is especially important in view of the recent recession when monetary policy's behaviour in many countries differed from the Taylor rule convention. The immediate implication is that the policy advice stemming from an analyses of an effect of fiscal policy with a VAR in the past is not easily transferable to the current period if important determinants of the policy effect change.

In Table 4, I collect empirical evidence on the efficacy of fiscal policy from some frequently cited papers in the VAR literature using data for the United States and other OECD countries. Below, I discuss the evidence. Prior to the advent of the VARs, studies on the economywide effects of fiscal policy on economic activity gauged most generally the comovement over time between government purchases or taxes, on one hand, and important economic variables at the national level, on the other hand. Starting with the seminal paper of Blanchard and Perotti (2002), researchers have employed increasingly SVARs to uncover the causal relationship between fiscal policy and other economic aggregates. To do that, Blanchard and Perotti imposed restrictions on the VARs suggested by institutional features specific to fiscal policy. They argued that it is safe to assume that government purchases react to economic shocks with a delay, while within the period taxation responds to economic developments, unrelated to government purchases, only as prescribed by automatic rules. These assumptions were crucial to identifying the *unanticipated* changes in fiscal policy—movements that could not have been related to the way government has reacted to economic news in the past. Blanchard and Perotti were able to gauge that a 1 percent rise in government spending (public consumption and investment) increases GDP by about 1 percent. Symmetrically, a cut in net taxes by 1 percent boosts GDP by about 1 pecent as well. Beetsma and Giuliodori (2011) obtain a government purchases multiplier of similar size for fourteen Euro area countries in a panel VAR framework with a recursive identification (government spending is not affected contemporaneously by economic activity).

The response of consumption and real wage from SVARs with a la Blanchard and Perotti (2002) restrictions is frequently emphasized as evidence in support of the relevance

Table 4: Studies with vector auto-regressions and narrative evidence

Study	Sample; Country	Assumptions/Identification	Implied output multiplier
Auerbach and Gorodnichenko (2012)	Bi-annually: 1960-2010; OECD data	Regime-switching VARs using direct projections, augmented with forecasts	Cumulated G shock, at three years, in recession: 2.30; in expansion: ≈ -1.00
Barro (1981), Hall (2009), Barro and Redlick (2011)	Annually, various samples: some starting from 1889; U.S. data	Military spending is an instrument for temporary government consumption	G shock: 0.6-0.99
Beetsma and Giuliodori (2011)	Annually: 1970-2004; 14 EU countries	Panel VARs with recursive identification	G shock, at one year: 1.20; at two years: 1.50
Blanchard and Perotti (2002)	Quarterly: 1960:Q1-1997:Q4; U.S. data	SVARs, different assumptions about trend	G shock, different frequency: 0.84-1.29; T shock, different frequency: 0.70-1.33; Positive consumption response
Gordon and Krenn (2010)	Quarterly: 1939:Q1-1941:Q4; U.S. data	VARs	G shock, at impact if slack: 1.80; at impact if no slack: 0.88
Mountford and Uhlig (2009)	Quarterly: 1955:Q1-2000:Q4; U.S. data	VARs with sign restrictions	Cumulated, deficit-spending, at impact: 0.65; after two years: -0.26; Cumulated, deficit-financed tax cut, at impact: 0.29; after two years: 5.25
Ramey and Shapiro (1998), Edelberg et al. (1999), Burnside et al. (2004)	Quarterly, various samples: starting from 1947; U.S. data	Distributed lag and VAR models; "Ramey-Shapiro" dummies identify exogenous military buildups	G shock, different frequency: 0.10-1.20; Nil or negative consumption response
Leigh et al. (2011)	Annually, 1978-2011; 17 OECD countries	Distributed lag estimation; Fiscal consolidations as narrative evidence to policy changes	Consolidation shock, at two and three years: between -0.50 and -0.65
Ramey (2011a)	Quarterly, various samples: starting from 1939; U.S. data	VARs; Expected present-value military buildups as narrative evidence to government consumption changes	G shock, different frequency: 0.60-1.20
Romer and Romer (2010)	Quarterly, 1947:Q1-2007:Q4; U.S. data	Distributed lag and VAR models; Legislated tax changes as narrative evidence	T shock, different frequency: 1.00-3.00;

Notes: G and T shocks in the fourth column refer to the type of fiscal policy measures analyzed (G = government spending rise, T = taxation cut).

of the transmission mechanism in the New Keynesian model. Impulse responses from such models show that government spending shocks boost consumption and real wage. Similarly, as discussed above, the New Keynesian models, with its price and wage rigidities as well as with other non-neoclassical features, predict more often than not that a rise in government consumption leads to a rise in private consumption and real wages.

To identify the exogenous fiscal shocks the VAR literature has exploited other restrictions than the one related to the institutional features of fiscal policy. Mountford and Uhlig (2009), and other researchers after them, have done this by imposing sign-restrictions on the impulse responses of the VAR model. One main empirical finding of this literature suggests that the effects of government spending on GDP are small and can be even negative. This stands in contrast to the effects of tax changes. Mountford and Uhlig (2009) report that the cumulated multiplier at three years of a deficit-financed spending increase is negative 0.26 while the cumulated multiplier at three years of a deficit-financed tax cut is 5.25. The result has strong implication for the composition of fiscal stimulus packages.

Hall (2009) and Barro and Redlick (2011) propose another way of identifying discretionary fiscal changes. They have argued that to estimate the effect of fiscal policy on economic activity one should exploit the fact that changes in military spending—a component of the government purchases—are exogenous to economic activity: i.e. defense spending decisions are unrelated to developments in the economy, being mainly geopolitical. Thus, by measuring the effect of defense purchases on output one is less likely to obtain inconsistent estimates: the military changes are orthogonal to unobservable components left in the residual of the econometric specification. The only problem with this type of analysis is that war periods are accompanied to a large degree by command-type interventions, for example rationing, and probably tax increases, that makes it hard to unravel the true size of the private response (negative correlation between the policy changes and the estimated statistical disturbance due to the omitted factors influencing the private sector). Hence, the estimate of the private response in this type of experiment is most probably biased downwards (see, e.g., Hall, 2009).

Several recent papers emphasize the dependence of the multiplier on the state of the economy. Using a regime-switching model which represents a weighted linear combination of two distinct VARs, Auerbach and Gorodnichenko (2012) demonstrate that the cumu-

lated government purchases multiplier can be very different in recessions that in expansion for a number of OECD countries. The authors find that a 1 percent rise in government spending increases GDP by about 2.3 percent in recessions at three years and decreases it by 1.0 percent in expansions. Analogously, using a VAR Gordon and Krenn (2010) show that the spending multiplier was 1.8 in the United States shortly before the World War II when the economy was plagued by under-utilized resources.

The estimates in the SVAR literature appear to be highly sensitive to the identification assumptions used, the choice of countries, government spending definitions, time sample, the variables in the estimation, and their lag length (see, e.g., Perotti, 2005; Caldara and Kamps, 2008; Canova and Pappa, 2011; and Ramey, 2011b). To avoid imposing strong assumptions, researchers have come up with new ideas on how to estimate the impact of fiscal policy. Recently, Romer and Romer (2010) and Ramey (2011a) have demonstrated how to estimate models that incorporate evidence from contemporary forecasts, news in the media, and the narrative government record on policy actions for unexpected reasons. For example, Romer and Romer (2010) have collected information on tax changes based on the narrative government record accompanying legislated U.S. tax bills, and demonstrated that these changes have an output multiplier of size 3. Ramey (2011a) has collected information about the expected discounted value of changes in government purchases due to U.S. foreign military interventions. The created variable is intended to measure expectations of the future government spending. Ramey finds that exogenous changes in defense spending lead to an increase in output, consistent with the previous literature, but all main components of private consumption fall, except for services consumption. The latest evidence, the fall of consumption and real wage following an increase in government purchases has frequently been emphasized as evidence in support of the relevance of the transmission mechanism in the neoclassical model.

7 Conclusion

This paper surveys multiplier estimates from the Euro area and the United States on common types of fiscal policy changes: mainly, broad-based tax cuts and unproductive spending increases. The notion of using the multiplier as a metric for the efficacy of

activist policies is related to its predictive power about how fast the economy may grow following fiscal stimulus actions: the larger is the multiplier, the more stimulative is the discretionary measure. The paper elaborates on the different methods—direct and indirect—and the estimates obtained by them with the hope of narrowing down the size of the effects of the various fiscal instruments. A parallel goal of the study has been detecting recurring factors among the surveyed studies that are important determinants for the policy efficacy.

Despite the enourmous recent effort to find the consensus multiplier values, and the increase of fiscal activism in the last decade—generating additional empirical observations—the quest for the multiplier has been as elusive as before. That is, fiscal policy is multifaceted, using many different instruments, and its effects are confounded with the reactions and influence of other factors. Thus, the hardest obstacle in view of measuring the aggregate multiplier is lack of macroeconomic data (see, e.g., Parker et al. (2011)).

Despite these difficulties, progress has been made. Several recent macro studies have found that fiscal policy can be substantially more effective in recessions. For example, they report that the conditional effect of an unanticipated rise in government purchases in a recession may likely be higher than 1.5. Indirect estimates of the multiplier, obtained from household studies such as Parker et al. (2011), can shed light on the issue. The measured cumulative MPC above 50% is difficult to reconcile with the permanent income hypothesis, and suggests that binding of liquidity constraints on households in recessions foreshadow large conditional aggregate effects of fiscal policy. Nevertheless, our understanding of the state dependent effects of fiscal policy is still incomplete.

References

Andrew B. Abel and Olivier J. Blanchard. The present value of profits and cyclical movements in investment. *Econometrica*, 54(2):249–73, March 1986.

Antonio Acconcia, Giancarlo Corsetti, and Saverio Simonelli. Mafia and public spending: Evidence on the fiscal multiplier from a quasi-experiment. CSEF Working Papers 281, Centre for Studies in Economics and Finance (CSEF), University of Naples, Italy, April 2011.

Sumit Agarwal, Chunlin Liu, and Nicholas S. Souleles. The reaction of consumer spending and debt to tax rebates-evidence from consumer credit data. *Journal of Political Economy*, 115(6):986–1019, December 2007.

S. Rao Aiyagari, Lawrence J. Christiano, and Martin Eichenbaum. The output, employment, and interest rate effects of government consumption. *Journal of Monetary Economics*, 30(1):73–86, October 1992.

Christopher Allsopp and David Vines. The macroeconomic role of fiscal policy. *Oxford Review of Economic Policy*, 21(4):485–508, Winter 2005.

David Altig, Lawrence Christiano, Martin Eichenbaum, and Jesper Linde. Firm-specific capital, nominal rigidities and the business cycle. *Review of Economic Dynamics*, 14 (2):225–247, April 2011.

Orazio P. Attanasio and Guglielmo Weber. Consumption and saving: Models of intertemporal allocation and their implications for public policy. *Journal of Economic Literature*, 48(3):693–751, September 2010.

Alan Auerbach and Yuriy Gorodnichenko. Fiscal multipliers in recession and expansion. In *Fiscal Policy after the Financial Crisis*, NBER Chapters. National Bureau of Economic Research, Inc, 2012.

Alan J. Auerbach. Long-term objectives for government debt. *FinanzArchiv: Public Finance Analysis*, 65(4):472–501, December 2009a.

Alan J. Auerbach. Implementing the new fiscal policy activism. *American Economic Review*, 99(2):543–49, May 2009b.

Alan J. Auerbach and Daniel Feenberg. The significance of federal taxes as automatic stabilizers. *Journal of Economic Perspectives*, 14(3):37–56, Summer 2000.

Alan J. Auerbach and William G. Gale. Activist fiscal policy to stabilize economic activity. NBER Working Papers 15407, National Bureau of Economic Research, Inc, October 2009.

Alan J. Auerbach and Kevin Hassett. Recent u.s. investment behavior and the tax reform act of 1986: A disaggregate view. *Carnegie-Rochester Conference Series on Public Policy*, 35(1):185–215, January 1991.

Alan J. Auerbach, William G. Gale, and Benjamin H. Harris. Activist fiscal policy. *Journal of Economic Perspectives*, 24(4):141–64, Fall 2010.

Robert J. Barro. Are government bonds net wealth? *Journal of Political Economy*, 82 (6):1095–1117, Nov.-Dec. 1974.

Robert J. Barro. Output effects of government purchases. *Journal of Political Economy*, 89(6):1086–1121, December 1981.

Robert J. Barro and Robert G. King. Time-separable preferences and intertemporal-substitution models of business cycles. *The Quarterly Journal of Economics*, 99(4): 817–39, November 1984.

Robert J. Barro and Charles J. Redlick. Macroeconomic effects from government purchases and taxes. *The Quarterly Journal of Economics*, 126(1):51–102, 2011.

Marianne Baxter and Robert G. King. Fiscal policy in general equilibrium. *American Economic Review*, 83(3):315–34, June 1993.

Roel Beetsma and Massimo Giuliodori. The effects of government purchases shocks: Review and estimates for the eu. *Economic Journal*, 121(550):F4–F32, February 2011.

Ben S. Bernanke, Mark Gertler, and Simon Gilchrist. The financial accelerator in a quantitative business cycle framework. In J. B. Taylor and M. Woodford, editors, *Handbook of Macroeconomics*. Elsevier, 1999.

B. Douglas Bernheim. Ricardian equivalence: An evaluation of theory and evidence. In *NBER Macroeconomics Annual 1987, Volume 2*, NBER Chapters, pages 263–316. National Bureau of Economic Research, Inc, September 1987.

Marianne Bertrand and Adair Morse. What do high-interest borrowers do with their tax rebate? *American Economic Review*, 99(2):418–23, May 2009.

Florin O. Bilbiie. Nonseparable preferences, fiscal policy puzzles, and inferior goods. *Journal of Money, Credit and Banking*, 41(2-3):443–450, 03 2009.

Olivier J. Blanchard. Comment on francesco giavazzi and marco pagano, "can severe fiscal contractions be expansionary? tales of two small european countries". In *NBER Macroeconomics Annual 1990, Volume 5*, NBER Chapters, pages 111–116. National Bureau of Economic Research, Inc, 1990.

Olivier J. Blanchard. Comments on 'the case against the case against fiscal policy'. In *The Macroeconomics of Fiscal Policy*. MIT Press, 2006.

Olivier J. Blanchard and Roberto Perotti. An empirical characterization of the dynamic effects of changes in government spending and taxes on output. *The Quarterly Journal of Economics*, 117(4):1329–1368, November 2002.

Olivier J. Blanchard, Carlo Cottarelli, Antonio Spilimbergo, and Steven Symansky. Fiscal policy for the crisis. CEPR Discussion Papers 7130, C.E.P.R. Discussion Papers, January 2009.

Olivier J. Blanchard, Giovanni Dell'Ariccia, and Paolo Mauro. Rethinking macroeconomic policy. *Journal of Money, Credit and Banking*, 42(s1):199–215, 09 2010.

Alan S. Blinder. Temporary income taxes and consumer spending. *Journal of Political Economy*, 89(1):26–53, February 1981.

Alan S. Blinder. The case against the case against discretionary fiscal policy. Working Papers 102, Princeton University, Department of Economics, Center for Economic Policy Studies., June 2004.

Nick Bloom, Stephen Bond, and John Van Reenen. Uncertainty and investment dynamics. *Review of Economic Studies*, 74(2):391–415, 04 2007.

Ronald G. Bodkin, Lawrence R. Klein, and Kanta Marwah. *A History of Macroeconometric Model-Building*. Edward Elgar Publishing Co., 1991.

Jean Boivin, Michael T. Kiley, and Frederic S. Mishkin. How has the monetary transmission mechanism evolved over time? In Benjamin M. Friedman and Michael Woodford, editors, *Handbook of Monetary Economics*, volume 3 of *Handbook of Monetary Economics*, chapter 8, pages 369–422. Elsevier, October 2010.

Hafedh Bouakez and Nooman Rebei. Why does private consumption rise after a government spending shock? *Canadian Journal of Economics*, 40(3):954–979, August 2007.

William C. Brainard. Uncertainty and the effectiveness of policy. *The American Economic Review*, 57(2):pp. 411–425, 1967.

Christian Broda and Jonathan Parker. The impact of the 2008 tax rebate on consumer spending: Preliminary evidence. Technical report, unpublished: University of Chicago Graduate School of Business, 2008.

Craig Burnside, Martin Eichenbaum, and Jonas D. M. Fisher. Fiscal shocks and their consequences. *Journal of Economic Theory*, 115(1):89–117, March 2004.

Ricardo J. Caballero. Macroeconomics after the crisis: Time to deal with the pretense-of-knowledge syndrome. *Journal of Economic Perspectives*, 24(4):85–102, Fall 2010.

Dario Caldara and Christophe Kamps. What are the effects of fiscal shocks? a var-based comparative analysis. Working Paper Series 877, European Central Bank, March 2008.

John Y. Campbell and N. Gregory Mankiw. Consumption, income and interest rates: Reinterpreting the time series evidence. In *NBER Macroeconomics Annual 1989, Volume 4*, NBER Chapters, pages 185–246. National Bureau of Economic Research, Inc, October 1989.

Fabio Canova and Evi Pappa. Fiscal policy, pricing frictions and monetary accommodation. *Economic Policy*, 26(68):555–598, October 2011.

Gabriel Chodorow-Reich, Laura Feiveson, Zachary Liscow, and William Gui Woolston. Does state fiscal relief during recessions increase employment? evidence from the american recovery and reinvestment act. Technical report, Working Paper, University of California at Berkeley, 2011.

Lawrence Christiano, Martin Eichenbaum, and Sergio Rebelo. When is the government spending multiplier large? *Journal of Political Economy*, 119(1):78 – 121, 2011.

Jeffrey Clemens and Stephen Miran. Fiscal policy multipliers on subnational government spending. *American Economic Journal: Economic Policy*, 4(2):46–68, May 2012.

Günter Coenen, Christopher J. Erceg, Charles Freedman, Davide Furceri, Michael Kumhof, René Lalonde, Douglas Laxton, Jesper Lindé, Annabelle Mourougane, Dirk Muir, Susanna Mursula, Carlos de Resende, John Roberts, Werner Roeger, Stephen Snudden, Mathias Trabandt, and Jan inť Veld. Effects of fiscal stimulus in structural models. IMF Working Papers 10/73, International Monetary Fund, March 2010.

John F. Cogan, Tobias Cwik, John B. Taylor, and Volker Wieland. New keynesian versus old keynesian government spending multipliers. *Journal of Economic Dynamics and Control*, 34(3):281–295, March 2010.

Jason G. Cummins, Kevin A. Hassett, and R. Glenn Hubbard. A reconsideration of investment behavior using tax reforms as natural experiments. *Brookings Papers on Economic Activity*, 25(2):1–74, 1994.

Thomas Dalsgaard, Christophe André, and Pete Richardson. Standard shocks in the oecd interlink model. OECD Economics Department Working Papers 306, OECD Publishing, September 2001.

Troy Davig and Eric M. Leeper. Monetary-fiscal policy interactions and fiscal stimulus. *European Economic Review*, 55(2):211–227, February 2011.

Michael B. Devereux, Allen C. Head, and Beverly J. Lapham. Monopolistic competition, increasing returns, and the effects of government spending. *Journal of Money, Credit and Banking*, 28(2):233–54, May 1996.

Thorsten Drautzburg and Harald Uhlig. Fiscal stimulus and distortionary taxation. ZEW Discussion Papers 11-037, ZEW - Zentrum für Europäische Wirtschaftsforschung/ Center for European Economic Research, 2011.

Wendy Edelberg, Martin Eichenbaum, and Jonas D.M. Fisher. Understanding the effects of a shock to government purchases. *Review of Economic Dynamics*, 2(1):166–206, January 1999.

Gauti B. Eggertsson. What fiscal policy is effective at zero interest rates? In *NBER Macroconomics Annual 2010, Volume 25*, NBER Chapters. National Bureau of Economic Research, Inc, October 2010.

Gauti B. Eggertsson. Was the new deal contractionary? *American Economic Review*, 102(1):524–55, February 2012.

Gauti B. Eggertsson and Michael Woodford. Optimal monetary and fiscal policy in a liquidity trap. In *NBER International Seminar on Macroeconomics 2004*, NBER Chapters, pages 75–144. National Bureau of Economic Research, Inc, November 2006.

Martin Eichenbaum. Some thoughts on practical stabilization policy. *American Economic Review*, 87(2):236–39, May 1997.

Doug Elmendorf and Jason Furman. If, when, how: A primer on fiscal stimulus. *Working Paper, Brookings Institution*, January, 2008.

Christopher J. Erceg and Jesper Linde. Is there a fiscal free lunch in a liquidity trap? International Finance Discussion Papers 1003, Board of Governors of the Federal Reserve System (U.S.), 2010.

Michael K. Evans. Reconstruction and estimation of the balanced budget multiplier. *The Review of Economics and Statistics*, 51(1):14–25, 1969.

Martin Feldstein. Rethinking the role of fiscal policy. *American Economic Review*, 99(2): 556–59, May 2009.

Jesús Fernández-Villaverde. Fiscal policy in a model with financial frictions. *American Economic Review*, 100(2):35–40, May 2010.

James Feyrer and Bruce Sacerdote. Did the stimulus stimulate? real time estimates of the effects of the american recovery and reinvestment act. Working Paper 16759, National Bureau of Economic Research, February 2011.

Mary G. Finn. Cyclical effects of government's employment and goods purchases. *International Economic Review*, 39(3):635–57, August 1998.

Milton Friedman. *Essays in Positive Economics*, chapter The Effects of a Full-Employment Policy on Economic Stability: A Formal Analysis, pages 117–132. Chicago: University of Chicago Press, 1953.

Milton Friedman. *A Theory of the Consumption Function*. Number 57-1 in NBER Books. National Bureau of Economic Research, Inc, May 1957.

Jordi Galí, J. David López-Salido, and Javier Vallés. Understanding the effects of government spending on consumption. *Journal of the European Economic Association*, 5 (1):227–270, 03 2007.

Francesco Giavazzi and Marco Pagano. Can severe fiscal contractions be expansionary? tales of two small european countries. In *NBER Macroeconomics Annual 1990, Volume 5*, NBER Chapters, pages 75–122. National Bureau of Economic Research, Inc, 1990.

Francesco Giavazzi, Tullio Jappelli, and Marco Pagano. Searching for non-linear effects of fiscal policy: Evidence from industrial and developing countries. *European Economic Review*, 44(7):1259–1289, June 2000.

Simon Gilchrist and Charles Himmelberg. Investment: Fundamentals and finance. In *NBER Macroeconomics Annual 1998, volume 13*, NBER Chapters, pages 223–274. National Bureau of Economic Research, Inc, June 1999.

Simon Gilchrist and Egon Zakrajsek. Investment and the cost of capital: New evidence from the corporate bond market. NBER Working Papers 13174, National Bureau of Economic Research, Inc, June 2007.

Robert J. Gordon and Robert Krenn. The end of the great depression 1939-41: Policy contributions and fiscal multipliers. NBER Working Papers 16380, National Bureau of Economic Research, Inc, September 2010.

Robert E. Hall. Stochastic implications of the life cycle-permanent income hypothesis: Theory and evidence. *Journal of Political Economy*, 86(6):971–87, December 1978.

Robert E. Hall. By how much does gdp rise if the government buys more output? *Brookings Papers on Economic Activity*, 2:183–250, 2009.

Robert E. Hall. The long slump. *American Economic Review*, 101(2):431–69, April 2011.

Kevin A. Hassett and R. Glenn Hubbard. Tax policy and business investment. In A. J. Auerbach and M. Feldstein, editors, *Handbook of Public Economics*, volume 3 of *Handbook of Public Economics*, chapter 20, pages 1293–1343. Elsevier, 00 2002.

Fumio Hayashi. Tests for liquidity constraints: A critical survey. NBER Working Papers 1720, National Bureau of Economic Research, Inc, October 1985.

Shafik Hebous. The effects of discretionary fiscal policy on macroeconomic aggregates: A reappraisal. *Journal of Economic Surveys*, 25(4):674–707, September 2011.

Christopher L. House and Matthew D. Shapiro. Temporary investment tax incentives: Theory with evidence from bonus depreciation. *American Economic Review*, 98(3): 737–68, June 2008.

Ethan Ilzetzki, Enrique G. Mendoza, and Carlos A. Végh. How big (small?) are fiscal multipliers? IMF Working Papers 11/52, International Monetary Fund, March 2011.

David S. Johnson, Jonathan A. Parker, and Nicholas S. Souleles. Household expenditure and the income tax rebates of 2001. *American Economic Review*, 96(5):1589–1610, December 2006.

John Maynard Keynes. *The General Theory of Employment, Interest and Money*. Harcourt, Brace and Company, 1936.

Paul R. Krugman. It's baaack: Japan's slump and the return of the liquidity trap. *Brookings Papers on Economic Activity*, 29(1998-2):137–206, 1998.

Daniel Leigh, Andrea Pescatori, and Jaime Guajardo. Expansionary austerity new international evidence. IMF Working Papers 11/158, International Monetary Fund, July 2011.

Ludger Linnemann. The effect of government spending on private consumption: A puzzle? *Journal of Money, Credit and Banking*, 38(7):1715–1735, October 2006.

Ludger Linnemann and Andreas Schabert. Fiscal policy in the new neoclassical synthesis. *Journal of Money, Credit and Banking*, 35(6):911–29, December 2003.

Jr. Lucas, Robert. Econometric policy evaluation: A critique. *Carnegie-Rochester Conference Series on Public Policy*, 1(1):19–46, January 1976.

Sydney Ludvigson. The macroeconomic effects of government debt in a stochastic growth model. *Journal of Monetary Economics*, 38(1):25–45, August 1996.

Franco Modigliani and Richard Brumberg. *Post Keynesian Economics*, chapter Utility Analysis and the Consumption Function: An Interpretation of Cross-Section Data, pages 388–436. New Brunswick: Rutgers University Press, 1954.

Franco Modigliani and Richard Brumberg. Utility analysis and the consumption function: An attempt at integration. In Andrew Abel, editor, *The Collected Papers of Franco Modigliani: The Life Cycle Hypothesis of Saving*, volume 2, pages 128–97. Cambridge and London: Cambridge University Press, 1980.

Tommaso Monacelli and Roberto Perotti. Fiscal policy, wealth effects, and markups. NBER Working Papers 14584, National Bureau of Economic Research, Inc, December 2008.

Andrew Mountford and Harald Uhlig. What are the effects of fiscal policy shocks? *Journal of Applied Econometrics*, 24(6):960–992, 2009.

Emi Nakamura and Jón Steinsson. Fiscal stimulus in a monetary union: Evidence from u.s. regions. NBER Working Papers 17391, National Bureau of Economic Research, Inc, September 2011.

OECD. The effectiveness and scope of fiscal stimulus. *Economic Outlook Interim Report*, Chapter 3:Organisation for Economic Co–operation and Development, 2009.

Arthur M. Okun. The personal tax surcharge and consumer demand. *Brookings Papers on Economic Activity*, 2(1971-1):167–212, 1971.

Jonathan A. Parker. The reaction of household consumption to predictable changes in social security taxes. *The American Economic Review*, 89:959–973, 1999.

Jonathan A. Parker. On measuring the effects of fiscal policy in recessions. *Journal of Economic Literature*, 49(3):703–18, September 2011.

Jonathan A. Parker, Nicholas S. Souleles, David S. Johnson, and Robert McClelland. Consumer spending and the economic stimulus payments of 2008. NBER Working Papers 16684, National Bureau of Economic Research, Inc, January 2011.

Roberto Perotti. Estimating the effects of fiscal policy in oecd countries. *Proceedings*, 2005.

James M. Poterba. Are consumers forward looking? evidence from fiscal experiments. *American Economic Review*, 78(2):413–18, May 1988.

Valerie A. Ramey. Identifying government spending shocks: It's all in the timing. *The Quarterly Journal of Economics*, 126(1):1–50, 2011a.

Valerie A. Ramey. Can government purchases stimulate the economy? *Journal of Economic Literature*, 49(3):673–85, September 2011b.

Valerie A. Ramey and Matthew D. Shapiro. Costly capital reallocation and the effects of government spending. *Carnegie-Rochester Conference Series on Public Policy*, 48(1): 145–194, June 1998.

Morten Ravn, Stephanie Schmitt-Grohe, and Martin Uribe. Deep habits. *Review of Economic Studies*, 73(1):195–218, 01 2006.

Ricardo Reis. Comment on "in search of the transmission mechanism of fiscal policy". In *NBER Macroeconomics Annual 2007, Volume 22*, NBER Chapters, pages 227–236. National Bureau of Economic Research, Inc, Summer 2008.

Christina D. Romer and David H. Romer. The macroeconomic effects of tax changes: Estimates based on a new measure of fiscal shocks. *American Economic Review*, 100 (3):763–801, June 2010.

Julio J. Rotemberg and Michael Woodford. Oligopolistic pricing and the effects of aggregate demand on economic activity. *Journal of Political Economy*, 100(6):1153–1207, December 1992.

Glenn D. Rudebusch. The fed's monetary policy response to the current crisis. *FRBSF Economic Letter*, (May), 2009.

Juan Carlos Suárez Serrato and Philippe Wingender. Estimating local fiscal multipliers. Technical report, Working Paper, University of California at Berkeley, 2011.

Matthew D. Shapiro and Joel Slemrod. Consumer response to tax rebates. *American Economic Review*, 93(1):381–396, March 2003a.

Matthew D. Shapiro and Joel Slemrod. Did the 2001 tax rebate stimulate spending? evidence from taxpayer surveys. In *Tax Policy and the Economy, Volume 17*, NBER Chapters, pages 83–110. National Bureau of Economic Research, Inc, 2003b.

Daniel Shoag. The impact of government spending shocks evidence on the multiplier from state pension plan returns. Technical report, Working Paper, Harvard University, 2011.

Christopher A. Sims. Macroeconomics and reality. *Econometrica*, 48(1):1–48, January 1980.

Frank Smets and Rafael Wouters. Shocks and frictions in us business cycles: A bayesian dsge approach. *American Economic Review*, 97(3):586–606, June 2007.

Robert M. Solow. Imf talk. Presentation at the imf conference "macro and growth policies in the wake of the crisis", International Monetary Fund, 2011.

Nicholas S. Souleles. The response of household consumption to income tax refunds. *American Economic Review*, 89(4):947–958, September 1999.

Antonio Spilimbergo, Steve Symansky, and Martin Schindler. Fiscal multipliers. Staff Position Note, 09/11, May, International Monetary Fund, 2009.

Lawrence Summers. The state of the us economy. Technical report, Presentation at Brookings Institution forum on December 19, 2007, 2007.

Alan Sutherland. Fiscal crises and aggregate demand: can high public debt reverse the effects of fiscal policy? *Journal of Public Economics*, 65(2):147–162, August 1997.

John B. Taylor. Reassessing discretionary fiscal policy. *Journal of Economic Perspectives*, 14(3):21–36, Summer 2000.

John B. Taylor. The lack of an empirical rationale for a revival of discretionary fiscal policy. *American Economic Review*, 99(2):550–55, May 2009.

Merih Uctum and Michael Wickens. Debt and deficit ceilings, and sustainability of fiscal policies: An intertemporal analysis. *Oxford Bulletin of Economics and Statistics*, 62 (2):197–222, May 2000.

Harald Uhlig. Some fiscal calculus. *American Economic Review*, 100(2):30–34, May 2010.

Michael Woodford. Simple analytics of the government expenditure multiplier. *American Economic Journal: Macroeconomics*, 3(1):1–35, January 2011.