Essays on Fiscal Policy in a Monetary Union

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Contents

Introduction **1**

1 Fiscal policy transmission in a non-Ricardian model of a monetary union **15**

1.1 Introduction 15

1.2 The Model 21

1.2.1 Households 21

1.2.2 The monetary and fiscal authorities 24

1.2.3 The current account 25

1.2.4 Technology and production 25

1.2.5 The initial steady state 26

1.2.6 The log-linearized model equations 26

1.3 Positive analysis 27

1.3.1 Balanced-budget changes in government spending 28

1.3.2 Deficit spending of the domestic government 38

1.3.3 A debt financed tax cut in the domestic country 41

1.4 Normative analysis 44

1.5 Conclusions 49

2 A Blanchard (1985)-Yaari (1965) OLG model for fiscal policy evaluation 55

2.1 Introduction 55

2.2 The Model 62

2.2.1 Households 63

2.2.2 Production sector 64

2.2.3 The monetary and fiscal authorities 67

2.2.4 Dynamic equilibria and calibration of the model 68

2.3 Fiscal stabilization policies 71

2.3.1 Government consumption 72

2.3.2 A lump-sum transfer to households 79

2.3.3 Public investment 85

2.4 Conclusions 88

3 Fiscal stabilization policies in a monetary union 93

3.1 Introduction 93

3.2 The Model 102

3.2.1 Households 102

3.2.2 Technology and production 105

3.2.3 The monetary and fiscal authorities 108

3.2.4 Dynamic equilibria and calibration of the model 109

3.3 Fiscal stabilization policies 113

3.3.1 Government consumption 114

3.3.2 A lump-sum transfer to households 124

3.3.3 Public investment 131

3.4 Conclusions 137

Bibliography **141**

List of Figures

1.1 A permanent balanced-budget increase of government spending. . . . 29

1.2 A temporary balanced-budget increase of government spending. . . . 30

1.3 Deficit-spending of the domestic government, no home bias. 38

1.4 A debt-financed tax cut by the domestic government. 41

1.5 Welfare. A permanent balanced budget increase in public spending. . 44

1.6 Welfare. A temporary balanced budget increase in public spending. . 45

1.7 Welfare. Deficit spending. 46

1.8 Welfare. A debt-financed tax cut. 47

2.1 A increase in public consumption financed by lump-sum taxation. . . 72

2.2 A increase in public consumption financed by spending cuts. 76

2.3 A lump-sum subsidy to households financed by future taxation. . . . 80

2.4 A lump-sum subsidy to households financed by spendings cuts. 82

2.5 A increase in public investment financed by future taxation. 84

2.6 A increase in public investment financed by spending cuts. 87

3.1 An increase in domestic public consumption financed by lump-sum taxation. 115

3.2 An increase in domestic public consumption financed by lump-sum taxation. 116

3.3 An increase in domestic public consumption financed by future spending cuts. 121

3.4 An increase in domestic public consumption financed by future spending cuts. 122

3.5 A lump-sum subsidy to domestic households financed by lump-sum taxation. 126

3.6 A lump-sum subsidy to domestic households financed by lump-sum taxation. 127

3.7 A lump-sum subsidy to domestic households financed by future spending cuts. 129

3.8 A lump-sum subsidy to domestic households financed by future spending cuts. 130

3.9 Domestic public investment financed by lump-sum taxation. 131

3.10 Domestic public investment financed by lump-sum taxation. 132

3.11 Domestic public investment financed by future spending cuts. 135

3.12 Domestic public investment financed by future spending cuts. 136

Introduction

There has been a steadily increasing academic interest in the effects of discretionary fiscal policy on key macroeconomic variables such as output, employment and household demand over the last decade.

The formation of the European Monetary Union (EMU) is one, but not the only reason for this development. Naturally, the establishment of the EMU has raised a number of topics related to fiscal policy and the effectiveness of fiscal instruments in an institutional framework in which one common central bank is facing several sovereign fiscal authorities.

The European Central Bank (ECB) decides on monetary policy on a supranational level, targeting an average of the inflation rates of the member countries. Thus, the ECB is obviously ill-equipped to respond to asymmetric inflation rate developments or structural differences among the member countries which imply differences in the propagation of common shocks as well as shocks to individual member countries.

The EMU features neither a common fiscal authority with the ability to enact fiscal law on its own nor a substantial union-budget.

It is well-known that the intertemporal budget constraint of the government requires that either monetary policy or the fiscal authorities have to sufficiently respond to the stock of public liabilities to guarantee the uniqueness and existence of equlibria, or in other words, to prevent Ponzi games.

According to Leeper (1991) this type of policy authority is characterized as being passive while the remaining declared as being active and free to pursue policy objec-

tives beyond the stabilization of the public debt stock. Awareness of this constraint has led to the introduction of the Stability and Growth Pact (SGP) which aims to limit the member country's annual new indebtedness and restrict the accumulated stock of government debt.

This institutional framework recognizes that in order to allow the ECB to fulfill its objective in terms of stabilizing the union-wide inflation rate, national fiscal authorities have to remain passive in the sense of Leeper (1991).

In any case, fiscal policy is the only flexible tool at the disposal of a member country's government to conduct short run stabilization policies on a national level.

The extent to which asymmetric shocks pose a problem for the currency union in the heart of Europe continues to remain a major concern of policymakers. These concerns are fueled by the conception that flexible exchange rates and national monetary policy serve as important instruments to stabilize national economies in the face of domestic shocks. Furthermore, flexible exchange rates are expected to shield off a country against spillovers and external effects that are originating from shocks elsewhere in the world economy.

Precisely such concerns, i.e. the costs of joining a currency union were popularized by the theory of optimal currency areas (OCA) which traces back to the seminal work of Mundell (1961). The OCA is based on the standard model of the 1960s, the classical Keynesian model. An excellent discussion regarding the implications of the original OCA for the cost of joining the EMU can be found in Buiter (2000). For a reconsideration of the OCA in modern micro-founded economic model, we suggest Corsetti (2008). The results of Corsetti (2008) suggest that the cost of joining a monetary union is of the same order of magnitude as that of fluctuations of the business cycle.

Directly related to such considerations is the idea that fiscal policy can serve as a substitute for national monetary policy and flexible exchange rates. This issue has been a topic of constant academic debates for the last fifty years. Thus, it comes

quite as a surprise that the European Commission (2008) based itself on strong stabilizing effects of fiscal policy when proposing the European Economic Recovery Plan (EERP) as a response to the economic crisis of 2007.

The European Commission (2008) presumed that certain fiscal instruments have effects on distinct macroeconomic variables, e.g. increased public consumption stimulates domestic output or tax cuts targeted at households increase domestic private demand. The OECD (2009) demonstrated at least the same degree of confidence in the effectiveness of fiscal policy. Here, similar fiscal measures were suggested to OECD members with the expectation that their implementation would not only hold but reverse an upcoming recession.

Furthermore, the European Commission (2008) strongly encouraged to implement expansive fiscal measures in all member countries at once in order to amplify the benefits of fiscal stabilization by mutual spillovers within the EMU. This indicates that the European Commission expected spillovers to an extent which would create incentives for free-riding behavior.

European policymakers obviously display great confidence in the stabilizing powers of fiscal policy. However, to develop a theoretical model which captures the key characteristics of fiscal policy, a summary of empirical findings is required in order to confront the demonstrated trust in individual measures with empirical evidence. Today, empirical evidence regarding the effectiveness of the SGP is scarce. The most important reason are limitations in available data, mainly due to the short time-series since the EMU is a relatively young currency area. Gali and Perotti (2003) address the question to which extent the SGP constraints fiscal policy. They reach the result that fiscal policy has become more counter-cyclical in the time periods that follow the SGP introduction. However, this is also true for member countries of the Organisation for Economic Co-operation and Development (OECD) outside the EMU.

A similar result and a comprehensive survey of related literature can be found in

von Hagen and Wyplosz (2008). But, although they extend the sample period as compared to the Gali and Perotti (2003) analysis, they do no contrast their findings to countries outside the EU. Therefore, it cannot be inferred whether the improved quality of fiscal policy is due to the SGP or not.

Regarding spillovers of fiscal expansions among EU member states, Beetsma et al. (2006) find that fiscal expansions boost economic activity in the implementing country and have positive spillover effects on its trading partners. In particular, this holds in cases where the implementing country is a large trading partner. Thus, one should expect substantial spillovers among the members of the EMU as they are highly integrated by both, the single European market and a common currency.

The national effects of fiscal policy on macroeconomic variables, such as consumption and output are a prospering area of empirical research. The work of Ramey and Shapiro (1998), Blanchard and Perotti (2002), Mountford and Uhlig (2005, 2009) are the seminal contributions in this field with numerous studies following up.

However, the latter literature is strongly focused on identifying fiscal shocks from data on the spending side of public budgets. With the exception of Ramey and Shapiro (1998), public consumption shocks are empirically defined by including government spending on goods and services as well as public investment.

A notable exception of this common practice is Mountford and Uhlig (2005, 2009) who identify fiscal shocks by looking at both the revenue and spending side of the government budget. Their approach allows them to distinguish between balanced budget changes in public spending, deficit spending and debt-financed tax cuts.

We should not a priory assume that the financing decision of the government has no effects on how fiscal shocks affect the economy. Thus, such an approach seems to be highly advisable. Mountford and Uhlig (2005, 2009) find that the responses of consumption and output depend on the type of the fiscal shock and the financing decision.

Finally, the empirical question remains how fiscal policy is conducted in practice.

More precisely, whether and how fiscal policy interacts with the state of the economy, e.g. if fiscal policy responds to the state of public finances represented by current budget deficits and the accumulated stock of public liabilities.

The standard approach to tackle these questions empirically is to estimate fiscal policy rules. Gali and Perotti (2003) find that public spending responds to the state of public finances. Regarding the instruments chosen to balance public budgets and to decrease the level of public liabilities, empirical literature identifies cuts in public budgets as the predominant approach throughout.

Alesina and Perotti (1996) and von Hagen et al. (2001) explore the issue and find no empirical support for short run fluctuations in tax rates. Instead they find that successful consolidations were mostly based on spending cuts. A similar result is obtained by Corsetti et al. (2009) who find that increases in public spending are followed by decreases below trend, so-called spending reversals.

Generally, the empirical literature suggests that the SGP did not substantially alter the conduct of fiscal policy in the member countries of the EMU if compared to countries outside the currency union. Moreover, empirical estimations of the effects of fiscal policy lead to the conclusion that these depend on the choice of instruments and the financing decision of the government. For the case of an increase in public consumption, the empirical literature converges to the conclusion that domestic output, consumption and employment rise. The spillovers of fiscal expansions are most likely positive, at least among countries which participate in highly integrated common markets.

Also, empirical literature suggests that fiscal policy works through a wide variety of measures which are affecting the spending and revenue side of the government budget. Fiscal policy is endogenous and responds to the state of public finances. Regarding the choice of instruments in practice as to respond to deteriorating public finances, the empirical literature finds little evidence for frequent changes in tax rates. Instead, respective literature obtains the result that cuts in public budgets

are at least as important as tax increases to keep public deficits and the stock of public liabilities in a sustainable state.

We summarize that the empirical literature lends some support to the idea of fiscal stabilization policies as advocated by the European Commission (2008).

A classical, but still influential theoretical approach to fiscal policy is the Keynesian model based on the highly regarded work of Keynes (1936), see e.g. Wohltmann (2005) for a detailed discussion. The Keynesian model is a closed economy approach explicitly designed for short run analysis. The model assumes that prices are fixed and households do not engage in intertemporal optimization but consume their current income. Aggregate demand in the Keynesian model consists of consumption and investment demand from the private sector and purely dissipative public consumption.

Though fiscal policy in the Keynesian model is restricted to public consumption, the model allows for a comparison of alternative financing decisions, namely the issuance of central bank money or public debt and taxation.

The Keynesian model predicts that increases in public spending always stimulates aggregate demand. However, it does not always trigger the famous Keynesian multiplier effect in terms of an increase of aggregate output by more than one-to-one. The Keynesian multiplier on public spending is above unity if the increase in public demand is financed by accumulating public debt or by money printing. However, for cases of tax-financed increases in government spending, the multiplier on output is smaller than one.

This leads us to the conclusion that the still influential Keynesian model provides for an explanation for the conception of a debt-financed increase in public spending in view of increasing the overall economic activity in times of distress. The second lesson from the Keynesian approach is that debt and taxation are no equivalent financing instruments.

The workhorse of modern macroeconomics is the dynamic general equilibrium

(DGE) model, e.g. the classical RBC model (e.g. Baxter and King (1993)) as well as standard new Keynesian models (e.g. Gali (2008)). These are based on the intertemporal optimizing behavior of infinitely-lived agents. Obviously, such agents are not so easily deceived by the issuance of public debt to prevent immediate tax increases in order to finance fiscal expansions. They anticipate increases in future tax bills implied by current debt-financed spending which is the Ricardian equivalence property of DGE models. This model implies that debt and lump-sum taxation are equivalent financing instruments.

Typically, fiscal policy enters the standard DGE model as an exogenous shock. An increase in public demand always decreases permanent income of the private sector. Households respond by adjusting their consumption plans downward and work more to offset their income loss. Thus, an increase in public spending stimulates aggregate demand but less than one-to-one as private demand is simultaneously decreased.

The characterizing properties of fiscal policy in standard models, which are the restriction to dissipative public consumption, fiscal policy enters as an exogenous process, the Ricardian equivalence property and, implied by that, a high variance of tax rates, are difficult to reconcile with empirical evidence.

In response to these shortcomings a lively theoretical literature has emerged that tries to move the predictions of DGE models closer to the empirical evidence. The main focus of this literature is on the failure of theoretical models to predict expansions of public consumption to crowd-in private demand and thus deliver Keynesian output multipliers.

Here, the predominant theoretical approach was popularized by Gali et al. (2007) who attempts to diminish the difference between the Keynesian model and its modern successors by distorting the intertemporal optimization behavior of households. In Gali et al. (2007) , a fraction of households cannot participate in intertemporal consumption-savings decisions as they have no access to capital markets. These so-called rule-of-thumb consumers are forced to consume their current income similar

to the households envisaged by the original Keynesian model. However, to obtain crowding-in effects models need to assume a large share of rule-of-thumb consumers which can hardly be confirmed by empirical evidence.

A priori it is not obvious that DGE models fail to predict crowding-in effects because of the intertemporal optimizing behavior of households. Among the model characteristics at odds with the empirical findings there are the assumptions that public spending is restricted to purely dissipative consumption of goods and that fiscal policy is exogenous.

Linnemann and Schabert (2006) show that the introduction of productive government spending in an otherwise standard new Keynesian model enables fiscal expansions to crowd-in private demand.

Corsetti et al. (2009) model an endogenous response of public consumption to the state of public finances. They find that increases in public consumption above trend potentially crowd-in household consumption if they are subsequently financed ,at least partially, by future decreases in public spending below trend, so-called spending reversals.

The theoretical work related to the formation of the EMU is focused on other issues such as the potential problems arising from the institutional framework which pits one common central bank versus seventeen sovereign fiscal authorities.

Prominent examples are Beetsma and Jensen (2005) and Gali and Monacelli (2008). Both study whether there are welfare gains from the co-ordination of fiscal policy or not. However, the results are inconclusive as Beetsma and Jensen (2005) find considerable gains from fiscal stabilization and the coordination of fiscal policy, while these are small in Gali and Monacelli (2008).

Finally, we are aware of only one paper attempting to estimate the impact of fiscal stabilization policies suggested by the EERP. Cwik and Wieland (2010) focus on the impact of an exogenous increase in public consumption which is financed by future taxation and find no support for the use of public consumption as an instrument to

boost aggregate demand in standard new Keynesian models.

However, according to the OECD (2009), in the majority of member countries tax cuts where preferred over increasing public spending.

We conclude that the theoretical literature related to the conduct of fiscal policy is focused on the effects of exogenous changes in public consumption. The main route taken to reconcile theory and empirical evidence is to extend standard DGE models to allow for failures of the Ricardian equivalence.

However, researchers typically need to assume deviations from the paradigm of intertemporally optimizing agents which cannot be confirmed empirically either. Thus, the predominant approach to move the predictions of standard DGE models closer to empirical findings contradicts another strand of empirical research.

Promising alternative extensions of theoretical models such as extending the set of fiscal policy instruments by introducing productive government spending or allowing for alternative financing decisions such as spending reversals are an exception.

Moreover, theoretical literature that features a more realistic approach to fiscal policy, compared to the standard DGE approach, in a model of a monetary union is scarce. Existing models are focused on institutional issues such as the coordination of monetary and fiscal policy.

This thesis consists of three chapters and aims to help closing this gap in the theoretical literature. Throughout, we employ standard new Keynesian models that are augmented by the introduction of overlapping generations (OLG) of the Blanchard (1985)-Yaari (1965) type.

Such a framework allows us to introduce uncertain lifetimes and thus failures of the Ricardian equivalence by a single parameter γ, which stands for the survival probability of households. A value of $\gamma < 1$ adds a wealth channel to the model that enables to use fiscal policy to affect household consumption by the intertemporal redistribution of income.

The first chapter presents an analytically tractable two-country model of a currency

union. We abstract from distortions other than sticky prices in the goods market and failures of the Ricardian equivalence. We assume that the government chooses a certain level of public spending and decides on how to finance it where the choice is between public debt and taxation.

Our main objective is to explore the transmission of various fiscal measures in a theoretical model of a monetary union.

We find that, depending on the financing decision of the government, fiscal policy measures can have very different effects on key macroeconomic variables such as consumption and output. The spillovers of national fiscal policy depend on the composition of government spending, the type of the fiscal measure and the cross-country substitutability between goods.

In chapter one, we also find that using debt as a policy instrument can be welfare improving and have stimulating effects on consumption as well as output at the same time.

In the second chapter we take a step backwards by restricting our attention to a closed economy model. We employ a new Keynesian model that features an overlapping generations structure of the Blanchard (1985)-Yaari (1965) type as well as sticky wages and prices. Moreover, we extend our model by allowing for public and private investment which requires us to solve the model numerically.

This approach permits to extend the analysis of fiscal shocks in two different dimensions: Firstly, the array of fiscal instruments is increased by public investment. Secondly, we assume a constant level of public spending which is financed by distortionary taxation in the model equilibrium.

The government is able to decide to either spending-side measures, i.e. cuts in public consumption, or to improve public revenues in order to finance a temporary fiscal expansion. Up to our best knowledge, we are the first comparing public consumption and investment as well as tax cuts assuming alternative financing schemes.

We then ask whether such an extension of the set of fiscal measures does allow us

to move the theoretical predictions closer to the empirical evidence.

We compare various fiscal instruments deployed in response to the recent economic downturn and focus on the response of output, consumption and hours worked. We find that both, the financing decision as well as possible failures of the Ricardian equivalence have a large impact on how fiscal measures affect key macroeconomic variables. Our results suggest that a single deviation from the standard model, e.g. failures of the Ricardian equivalence, is not sufficient to reconcile theory and empirical evidence.

Moreover, our result supports the policy advice of the OECD (2009) that also emphasizes the importance of the financing decision of the government.

The last chapter builds on the findings of chapter 2 and develops the issue further by extending the model to a two-country model of a currency union. The solution approach inherited from chapter two does not allow us to obtain quantitative predictions in terms of the impact of alternative fiscal policy measures, still, the model enables us to derive qualitative results in a framework that matches the respective empirical evidence.

We focus on fiscal measures that are frequently employed in practice by assessing the impact of central components of the EERP on the economy of the implementing country as well as the implied spillovers. We explore whether the fiscal policy measures suggested by the EERP have the effects envisaged by the European Commission in our theoretical model.

Up to our best knowledge, ours is the first approach which compares public consumption and investment as well as tax cuts by assuming alternative financing schemes in a full-fledged two-country model of a monetary union.

The European Commission expected specific fiscal measures to be effective instruments to stabilize important macroeconomic variables. The expectation that increased public consumption stimulates national output or that tax cuts are appropriate tools to strengthen household demand are examples for this kind of thinking.

Our model lends support to this view as we find that an increase in public consumption does always increase national output.

But, the expansionary effect depends on the financing strategy of the government as well as on the degree of deviations from Ricardian behavior. In general, financing temporary increases in public consumption by future spending cuts is more powerful in terms of its effect on output. However, to obtain Keynesian multiplier effects we need to assume deviations from Ricardian behavior to an extend which cannot be confirmed empirically.

We find that tax cuts targeted at households do, under certain conditions, have the potential to stabilize private consumption demand. The Ricardian equivalence prevents lump-sum subsidies which are financed by future increases in lump-sum taxation to have any effect on household consumption.

However, this measure does affect household consumption if we deviate from this assumption either by assuming finite lifespans or an alternative financing decision in terms of future spending cuts.

The European Commission expected increases in public investment to strengthen aggregate demand in the short run and to improve the aggregate supply by increased productivity. Our model confirms these expectations independently of the assumed financing strategy or failures the Ricardian equivalence.

Regarding the expected spillovers of fiscal policy, we find that these are always positive in the medium term. However, in a monetary union a common central bank is ill-equipped to respond to asymmetric shocks. Thus, in case of a fiscal policy shock in one country of the union, monetary policy at union level is too dovish for the implementing country and too restrictive for the remaining members, generally the degree of this divergence increases with the size of the country which implements the fiscal stimulus.

Finally, we briefly summarize the main results of all three chapters. In general, fiscal policy enters theoretical models in the form of exogenous changes in public

consumption. Extending otherwise standard new Keynesian models by a fraction of households that consume their income in a hand-to-mouth fashion, i.e. the introduction of failures of the Ricardian equivalence is the predominant approach to reconcile theory and empirical evidence in the literature. Such role-of-thumb consumers are close to the original setting of the classical Keynesian model.

Subsequently, the assumption of a sufficiently large fraction of non-Ricardian consumers enables an increase in private consumption in response to a rise in public consumption and thus, Keynesian multiplier effects.

By introducing an overlapping generations structure of the Blanchard (1985)-Yaari (1965), we followed a similar approach in each chapter. In addition, we extended the range of fiscal instruments both on the spending and revenue side of the public budget and assumed that fiscal policy is not exogenous, but rather responds to the state of public finances.

We find that failures of the Ricardian equivalence yield theoretical predictions that are close to empirical evidence. However, this comes at the price of deviating from the Ricardian equivalence in a way that cannot be confirmed empirically.

We find that the introduction of a more complex fiscal sector and the assumption that fiscal policy is endogenous allows us to move theoretical predictions closer to the empirical evidence without having to rely crucially on deviations from Ricardian behavior.

We conclude that focusing on distortions in intertemporal optimization and exogenous fiscal policy is a too narrow approach to tackle with research questions related to the conduct and effects of fiscal policy in theoretical models.

In each chapter, the chosen fiscal instrument as well as the financing decision of the government matter regarding the effects of fiscal policy on macroeconomic variables. In a monetary union, the national conduct of fiscal policy affects all member countries in various ways. We observe spillovers from fiscal policy together with effects on monetary policy which does not respond to national variables but targets union-

wide averages.

A natural next step would be the estimation of our model using European data. This follow-up work would lead to quantitative predictions regarding the national effects as well as the spillovers of fiscal policy. Extending the range of fiscal instruments further by including distortionary tax rates within the set of financing decisions, is another step forward.

The precise distinction between fiscal instruments and the related financing decision is crucial for the empirical validation of our results. In doing so, we suggest relying on the approach of Mountford and Uhlig (2005, 2009) which we consider being well suited to test the implications of our theoretical model.

Chapter 1

Fiscal policy transmission in a non-Ricardian model of a monetary union

1.1 Introduction

The formation of the European Monetary Union (EMU) has raised a notable debate on the role of fiscal policy within a currency union. The EMU membership comes at the cost of loosing monetary autonomy and flexible exchange rates between the member countries. It is the European Central Bank (ECB) that conducts monetary policy on the union level. Its overwhelming objective is to stabilize the unionwide price level.

However, there is no common fiscal authority in the EMU. The ECB is confronted with several national governments taking independent fiscal decisions. The Stability and Growth Pact (SGP) attempts to limit the member country's annual new indebtedness and the accumulated stock of government debt in the EMU. National fiscal policy is constrained but it has to sufficiently respond to the state of public finances to ensure the ECB's ability to fulfill its obligation. This implies in terms of design that monetary policy is *active* while fiscal policy is *passive* in the sense of

Leeper (1991).

Yet, fiscal policy is the only flexible tool at the disposal of a member country's government to conduct short run stabilization policies on the national level. The ECB is ill-equipped to respond to the needs of specific member countries. Moreover, national fiscal policies do not leave the remaining members of the monetary union unaffected as there are spillover effects of fiscal measures.

There is a scarcity of empirical evidence on fiscal spillovers and the effects of the SGP. Gali and Perotti (2003) try to answer the question to which extend the SGP constraints fiscal policy. They estimate fiscal rules for members of the EMU, members of the European Union that are not part of the EMU and other members of the OECD based on annual data. Gali and Perotti (2003) find that the SGP does not constrain the fiscal policy decisions of EMU members compared to the other countries in their sample.

Beetsma et al. (2006) estimate the spillovers from fiscal shocks via trade flows in Europe. They find that fiscal expansions boost economic activity in the implementing country and have positive spillover effects on its trading partners. Beetsma et al. (2006) conclude that spillovers from fiscal policy are important. In particular, in cases where the implementing country is a large trading partner.

The effects of fiscal policy on national variables such as consumption and output is a more active field of empirical research. Blanchard and Perotti (2002) estimate the effects of shocks to taxes and government spending on household consumption and output. They find that fiscal expansions have positive effects on output and consumption, and an increase in taxation has opposite effects.

Mountford and Uhlig (2005) identify three different fiscal policy shocks: Balanced budget changes in public spending, deficit spending and debt-financed tax cuts. They find that the responses of consumption and output depend on the type of the fiscal shock. In the aftermath of a balanced budget increase in public spending, output and consumption fall. The depressing effect of the tax increase dominates the

fiscal stimulus. Deficit spending stimulates output and consumption only weakly. A debt-financed tax cut has a significant positive effect on consumption and output. Mountford and Uhlig (2005) conclude the best fiscal stimulus is a debt-financed tax cut. Both of the above mentioned studies apply VAR estimation techniques to quarterly US data. Fiscal shocks are identified directly from the data.

An alternative strand of empirical literature, e.g. Ramey and Shapiro (1998) and Ramey (2009), apply the so-called narrative approach. They identify fiscal measures by studying contemporaneous press reports and focus on war expenses in so-called Ramey-Shapiro episodes. Using annual US data, Ramey (2009) finds that increases in public demand are partially offset by a negative response of consumption. Overall, they observe a small positive response of output.

This is not necessarily a contradiction to the empirical evidence from the VAR approach. Blanchard and Perotti (2002) and Mountford and Uhlig (2005) emphasize that it is the financing decision of the government that matters. The estimates of Ramey (2009) which are based on a small number of observations with different underlying financing decisions of the government support this notion. For a more extensive discussion see Perotti (2007).

Surveys of the empirical literature can be found in Gali et al. (2007) and von Hagen and Wyplosz (2008). We conclude that empirical evidence suggests that the response of consumption and output to fiscal expansions depends on the financing decisions of the government.

Beetsma and Jensen (2005), Gali and Monacelli (2008) and Ferrero (2009) are prominent examples for theoretical work on fiscal policy in a currency union. Beetsma and Jensen (2005) explore the interaction between fiscal and monetary policy in a two-country DSGE model of a monetary union. Gali and Monacelli (2008) study optimal monetary and fiscal policy in a DSGE model of a monetary union that consists of a continuum of infinitesimally small open economies. There is also Ferrero (2009)'s model which is similar to Beetsma and Jensen (2005). He studies the

optimal financing decision for a given level of public spending where the choice is between distortionary taxation and public debt.

Beetsma and Jensen (2005) find considerable gains from fiscal stabilization and the coordination of fiscal policy, while these are small in Gali and Monacelli (2008).

Both models feature infinitely-lived representative agents. Thus, the Ricardian equivalence holds which implies that debt and taxation are equivalent financing decisions of the government. Consequently, an increase of government spending financed by (lump-sum) taxes, increases the demand for output and decreases private consumption. The overall response of output is positive.

We conclude that the predominant modelling strategy is difficult to reconcile with empirical evidence. This suggests not only a wider variety of fiscal measures but also stipulates that the response of key macroeconomic variables depends on the precise assumptions to the type of fiscal measure and the government's financing decision.

Ferrero (2009) allows for distortionary taxation, i.e. failures of the Ricardian equivalence. However, he explores the optimal choice between debt and distortionary taxation to finance a given level of public spending. His result is that in case of public spending which has to be financed by distortionary taxation, constraining public debt is not optimal. Viewed against a welfare perspective, changes in the level of the public debt stock induce less disutility than variations in distortionary taxation.

Standard models contradict the empirical evidence as the financing decision does not affect the transmission of fiscal policy. However, debt-financed increases in public consumption and debt-financed tax cuts are among the measures frequently taken to stimulate the economy. In particular, these policy measures were included in the *European Economic Recovery Plan* suggested by the Commission of the European Communities in 2008 and suggested by the OECD (2009) to halt and even reverse the economic downturn in the wake of the financial crisis. Thus, practical policy decisions are difficult to reconcile with standard modelling choices.

Moreover, despite the SGP national governments in the EMU have substantial room for fiscal maneuver. In particular, as the constraints of the Pact are not binding in times of economic distress. In order to obtain meaningful theoretical predictions we need to model not only the national effects but also the spillovers of fiscal policy in accordance with the empirical evidence. Thus, we propose a two-country NOEM model of a currency union featuring overlapping generations (OLG) of the Blanchard (1985)-Yaari (1965) type. This enables us to study a wider range of fiscal measures including different ways of how to finance a given level of public spending. Our model features failures of the Ricardian equivalence. Debt and taxation are not equivalent policy instruments.

We assume that the government chooses a certain level of public spending and decides on how to finance it. Depending on the financing decision, we are interested in the effects of fiscal policy on national consumption and output as well as in the spillovers. We abstract from distortions other than failures of the Ricardian equivalence.

Our main objective is to explore the transmission of various fiscal measures in a two-country model of a monetary union. We show that using debt as a policy instrument can be welfare improving and consumption as well as output stimulating at the same time, even if alternative financing decisions are non-distortionary.

Moreover, Gali and Monacelli (2008) emphasize the empirical evidence for home bias in public spending. In fact, the assumption of complete home bias in public spending is common to all theoretical models mentioned above. We address the issue by allowing for government spending with and without home bias and explore the transmission of four different fiscal measures. These are temporary as well as permanent balanced budget changes in public spending, deficit spending and a debt-financed tax cut in the domestic country.

We find that the response of household consumption and output in the domestic country and the spillovers on the foreign country depend on the precise type of the

fiscal shock and the composition of government spending.

A balanced budget increase in public consumption always leads to a decrease in domestic consumption and an increase in home production in the short and long run. If the government spends exclusively on domestic goods, the spillover is negative for all time horizons. If there is no home bias in public spending, the spillover is reversed, and fiscal expansion enable higher consumption abroad.

Deficit spending has similar effects. However, these are weaker and depend on the assumptions we make regarding the financing decision of the implementing government. In particular, the intertemporal dispersion of the spending and financing decision determine the effects of deficit-spending on household consumption and utility. This is true for all debt-financed fiscal measures.

Finally, a debt-financed tax cut implies an increase in consumption at home and abroad in the short run. Output increases in both countries. In the long run, domestic households have to repay the accumulated public debt and suffer from a decrease in net foreign assets. Foreign households benefit from the increased real income while the opposite is true for the home country in the long run. Overall, our positive results are close to the estimates of Mountford and Uhlig (2005).

The welfare effects of fiscal policy can also be very different. While balanced budget changes in government spending always imply welfare losses which is not necessarily true for debt-financed fiscal expansions. Thus, we conclude that the proposed modelling strategy allows us to bring theoretical models closer to empirical evidence.

The other parts of the chapter are organized as follows. Section 1.2 sets out a two-country Blanchard (1985)-Yaari (1965) OLG of a currency union. In section 1.3 we analyze the positive aspects of various fiscal policy measures including policy transmission and spillover effects. We discuss the normative aspects of fiscal actions in section 1.4. Finally, section 1.5 presents the conclusions and possible extensions of the model.

1.2 The Model

We develop a dynamic, two-country, general equilibrium model of a monetary union with sticky prices and monopolistic competition in the goods market. Households are introduced in the form of overlapping generations following the discrete-time version of the Blanchard (1985)-Yaari (1965) OLG by Frenkel et al. (1996).

We identify one country as the domestic country H, while the other country is referred to as the foreign country F. In the domestic country, a cohort of $n \in [0,1]$ households is born in each period whereas $(1-n)$ agents are born abroad. All agents face a constant probability of death $(1-\gamma)$ in each period. Therefore, the population in the domestic country is $\sum_{a=0}^{\infty} \gamma^a n = \frac{n}{1-\gamma}$ and $\frac{1-n}{1-\gamma}$ is the population abroad. This implies a constant world population that is normalized to one.

Households have no bequest motive. Finite lifespans imply that an intertemporal redistribution of wealth potentially changes the expected permanent income in the remaining lifespan of an individual and thus, leads to failures of the Ricardian equivalence.

1.2.1 Households

Domestic households share identical preferences and maximize their utility over consumption C, real balances $\frac{M}{P}$ and leisure $(1-L)$. The certainty equivalent utility function of an individual domestic household reads

$$U_t = \sum_{s=t}^{\infty} (\gamma\beta)^{s-t} \left[\ln C_{a+s-t,s} + \chi \ln \left(\frac{M_{a+s-t,s}}{P_s} \right) + \psi \ln \left(1 - L_{a+s-t,s}\right) \right] \tag{1.1}$$

where $\beta, \chi, \psi > 0$ and $\gamma \in [0,1]$ is the probability to survive until the next period. Preferences are homothetic and additively separable over consumption, real balances and leisure. The household's endowment of time in each period is normalized to one, therefore $(1-L), L \in [0,1]$ denotes leisure. The parameter $\psi > 0$ measures the utility of time spent out of work.

The individual real flow budget constraint of a domestic household of age a reads

$$F_{a,t+1} + \frac{M_{a,t}}{P_t} + C_{a,t} = \frac{1}{\gamma} \left[\frac{M_{a-1,t-1}}{P_t} + (1+r_t) F_{a-1,t} \right] + \frac{W_{a,t}}{P_t} L_{a,t} + \frac{\Pi_t}{P_t} - T_t \tag{1.2}$$

where W is the nominal wage, F denotes the agents total asset holdings, T is a lump-sum tax and r_t the real interest rate known at $t-1$ and paid on bond holdings

between $t-1$ and t. Households owe a portfolio of bonds denominated in units of the composite consumption good and issued either by the national government or households abroad.
$\frac{\Pi_t}{P_t} = \pi_t(h)(1-\gamma)$ is the per-capita share of the profit of domestic producers received by an domestic individual. We assume that households receive an equal share of national profits independent of age[1].
Productivity and consumption preferences are assumed to be independent of age. This allows us to calculate per-capita variables by aggregating across ages and then dividing by population size. Individual and per-capita variables coincide in the model. Variables without age a index denote per-capita values. The domestic households optimizing behavior yields the consumption function

$$C_t = \frac{1-\gamma\beta}{1+\chi+\psi} TW_t \tag{1.3}$$

where the coefficient $\frac{1-\gamma\beta}{1+\chi+\psi}$ is the agent's marginal propensity to consume out of total wealth. Domestic per-capita demand for real balances is given by

$$\frac{M_t}{P_t} = \chi \frac{1+i_{t+1}}{i_{t+1}} C_t \tag{1.4}$$

where i denotes the nominal interest rate which is symmetric across countries and equal to the real interest rate plus expected inflation,

$$L_t = 1 - \kappa \frac{P_t}{W_t} C_t \tag{1.5}$$

is the labor-leisure trade-off equation and

$$C_{t+1} = \left(\frac{1-\gamma\beta}{1+\chi+\psi}\right)(1-\gamma)H_{t+1} + (1+r_{t+1})\gamma\beta C_t \tag{1.6}$$

the *Euler equation* for the optimal intertemporal allocation of consumption. We define

$$H_t = \sum_{s=t}^{\infty} \alpha_{s,t}\gamma^{s-t}\left[\frac{W_s}{P_s} + \frac{\Pi_s}{P_s} - \tau_s\right] \qquad \text{with} \qquad \alpha_{s,t} = \begin{cases} \alpha_{s,t} = 1 & \text{if} \quad s = t \\ \alpha_{s,t} = \frac{1}{(1+r_{t+1})\cdot\ldots\cdot(1+r_{t+s})} & \text{if} \quad s > t \end{cases} \tag{1.7}$$

where α is the present value factor as the human wealth and

$$TW_t = \frac{1}{\gamma}\left(\frac{1}{1+i_t}\frac{M_{t-1}}{P_{t-1}} + F_t\right)(1+r_t) + H_t \tag{1.8}$$

as the total wealth in per-capita terms. Human wealth is the present discounted value of gross earnings net of taxes over the expected lifespan of households. Total wealth is the sum of financial and human wealth. We assume that each country in the world economy specializes in the production of one type of good. For each type there

[1] A representative domestic producer earns $\pi_t(h)$. Aggregating across domestic producers we obtain $n\pi_t(h)$, dividing by the population size $\frac{n}{1-\gamma}$ yields $\pi_t(h)(1-\gamma)$ the share of domestic profits received by any domestic agent independent of age.

exists a continuum of brands. We describe the behavior of an individual domestic household with the notion that similar equations hold for foreign households. The consumption basket of an domestic individual of age a reads

$$C_{a,t} = \left[n^{\frac{1}{\theta}} C_{H,a,t}^{\frac{\theta-1}{\theta}} + (1-n)^{\frac{1}{\theta}} C_{F,a,t}^{\frac{\theta-1}{\theta}} \right]^{\frac{\theta}{\theta-1}} \tag{1.9}$$

where

$$C_{H,a,t} = \left(n^{-\frac{1}{\phi}} \int_0^n c_{a,t}(h)^{\frac{\phi-1}{\phi}} dh \right)^{\frac{\phi}{\phi-1}} \qquad C_{F,a,t} = \left((1-n)^{-\frac{1}{\phi}} \int_n^1 c_{a,t}(f)^{\frac{\phi-1}{\phi}} df \right)^{\frac{\phi}{\phi-1}} \tag{1.10}$$

Following Tille (2001) we refer to θ as the cross-country substitutability. $\phi > 1, \theta < \phi$ is the within-country substitutability which is assumed to be symmetric across countries.
The corresponding consumer price index is defined as the minimum expenditure to buy one unit of the composite consumption good which is given by

$$P_t = P_t^* = \left[n P_{H,t}^{1-\theta} + (1-n) P_{F,t}^{1-\theta} \right]^{\frac{1}{1-\theta}} \tag{1.11}$$

where

$$P_{H,t} \equiv \left(\frac{1}{n} \int_0^n p_t(h)^{1-\phi} dh \right)^{\frac{1}{1-\phi}} \qquad P_{F,t} \equiv \left(\frac{1}{1-n} \int_n^1 p_t(f)^{1-\phi} df \right)^{\frac{1}{1-\phi}} \tag{1.12}$$

We assume no impediments to trade. Hence, the law of one price $p(h) = p^*(h)$ holds for every single good. Home and foreign agents are assumed to have symmetric preferences which are invariant across ages. Throughout, we assume that $n = 0.5$. Thus, the law of one price, together with the consumption-based CPI implies that $P = P^*$ holds in every period as the two countries in the world economy share a common currency. An asterisk denotes a foreign country variable.
The terms of trade (TOT) are defined as the ratio of the price of a domestically produced consumption bundle and a bundle of goods produced abroad.

$$TOT = \frac{P_H}{P_F} \tag{1.13}$$

From the domestic household's point of view, an increase in the TOT is an improvement. A higher price of domestically produced goods enables a higher consumption of foreign brands.
Each individual domestic household maximizes his utility from consumption given his budget in any period of time. This optimizing behavior results in the following individual demand functions for brands h, f

$$c_{a,t}(h) = \left(\frac{p_t(h)}{P_{H,t}} \right)^{-\phi} \left(\frac{P_{H,t}}{P_t} \right)^{-\theta} C_{a,t} \qquad c_{a,t}(f) = \left(\frac{p_t(f)}{P_{F,t}} \right)^{-\phi} \left(\frac{P_{F,t}}{P_t} \right)^{-\theta} C_{a,t} \tag{1.14}$$

1.2.2 The monetary and fiscal authorities

We focus on fiscal policy. To facilitate the analysis, we assume that the common central bank is only obliged to keep the world money stock constant.
National governments act as individual entities. They decide on the level of public spending and how to finance it. Due to failures of the Ricardian equivalence in the model, debt and taxation are not equivalent instruments. Government spending on goods and debt services can be financed either by lump-sum taxation or by issuing new debt according to the period budget identity

$$G_t + (1 + r_t) D_t = T_t + D_{t+1} \tag{1.15}$$

and the usual no-Ponzi game condition. D denotes the real stock of public debt. We assume that the government's real consumption index takes the same form as that of households

$$G_t = \left[n^{\frac{1}{\theta}} G_{H,t}^{\frac{\theta-1}{\theta}} + (1-n)^{\frac{1}{\theta}} G_{F,t}^{\frac{\theta-1}{\theta}} \right]^{\frac{\theta}{\theta-1}} \tag{1.16}$$

where

$$G_{H,t} = \left(n^{-\frac{1}{\phi}} \int_0^n g_t(h)^{\frac{\phi-1}{\phi}} dh \right)^{\frac{\phi}{\phi-1}} \qquad G_{F,t} = \left((1-n)^{-\frac{1}{\phi}} \int_n^1 g_t(f)^{\frac{\phi-1}{\phi}} df \right)^{\frac{\phi}{\phi-1}} \tag{1.17}$$

The latter assumption implies that there is no home bias in government spending on goods.
However, Gali and Monacelli (2008) emphasizes that there is empirical evidence for home bias in public spending. In fact, the assumption of complete home bias in government consumption is predominant in the literature on fiscal policy in monetary unions. Beetsma and Jensen (2005), Gali and Monacelli (2008) and Ferrero (2009) are examples for this practice. This modelling decision mirrors the validity of the Ricardian equivalence. Fiscal policy becomes less powerful if it falls equally on all goods produced in the world economy. If there is no home bias in Ricardian models, there is no scope for fiscal policy interaction between the members of a monetary union.
Thus, to facilitate the comparison of our results with the existing literature, we modify our model to allow for complete home bias in government spending. All assumptions are maintained except the real consumption indices of the home and foreign governments which take the following form

$$G_{hb,H,t} = \left(n^{-\frac{1}{\phi}} \int_0^n g_{hb,t}(h)^{\frac{\phi-1}{\phi}} dh \right)^{\frac{\phi}{\phi-1}} \qquad G^*_{hb,F,t} = \left((1-n)^{-\frac{1}{\phi}} \int_n^1 g^*_{hb,t}(f)^{\frac{\phi-1}{\phi}} df \right)^{\frac{\phi}{\phi-1}} \tag{1.18}$$

consequently the domestic period budget identity becomes

$$\frac{P_{H,t}}{P_t} G_{hb,H,t} + (1 + r_t) D_t = T_t + D_{t+1} \tag{1.19}$$

1.2.3 The current account

The current account equation is derived from the government budget constraint together with the budget constraint of the private sector. The resulting current account equation in the basic model reads

$$V_{t+1} - V_t = \frac{\phi - 1}{\phi} \frac{p_t(h)}{P_t} L_t - C_t - G_t + \frac{\Pi_t}{P_t} + r_t V_t \tag{1.20}$$

where $V = F - D$ denotes the net foreign assets position in a given period. If we assume complete home bias in government consumption the domestic current account becomes

$$V_{t+1} - V_t = \frac{\phi - 1}{\phi} \frac{p_t(h)}{P_t} L_t - C_t - \frac{P_{H,t}}{P_t} G_{hb,H,t} + \frac{\Pi_t}{P_t} + r_t V_t \tag{1.21}$$

In the aggregate, we assume that $nV + (1-n)V^* = 0$ holds in any period and both cases.

1.2.4 Technology and production

There is a measure one of infinitely lived firms in the world economy of which $h \in [0, n]$ reside in the home country and $f \in (n, 1]$ abroad. A representative domestic producer h takes the demand for his production as given. We assume a linear production technology $Y_t(h) = L_t$. Firms operate under monopolistic competition at the goods market while there is perfect competition at the labor market. The demand curve facing each domestic producer is

$$y_t^d(h) = \left(\frac{p_t(h)}{P_{H,t}}\right)^{-\theta} \left(\frac{P_{H,t}}{P_t}\right)^{-\rho} [C_t^w + G_t^w] \tag{1.22}$$

where $C_t^w = nC_t + (1-n)C_t^*$ and $G_t^w = nG_t + (1-n)G_t^*$ are the global private and public demand for consumption goods. If the government spends only on national goods the demand curve facing the typical domestic producer becomes

$$y_t^d(h) = \left(\frac{p_t(h)}{P_{H,t}}\right)^{-\phi} \left[\left(\frac{P_{H,t}}{P_t}\right)^{-\theta} C_t^w + nG_{hb,H,t}\right] \tag{1.23}$$

A typical domestic producer sets its price $p_t(h)$ to maximize the stream of revenues at any t which yields the following mark-up pricing rule

$$p_t(h) = \frac{\theta}{\theta - 1} W_t \tag{1.24}$$

In a symmetric equilibrium all national producers choose the same price to maximize the stream of revenues at any t.

1.2.5 The initial steady state

The model has no closed-form solution. The solution technique is to log-linearize around an initial steady state and then solve the resulting system of equations in relative terms. For a detailed discussion of this approach see Obstfeld and Rogoff (1995, 1996).

We assume a fully symmetric initial steady state where the net foreign assets $V_0 = V_0^* = 0$, government spending $G_0 = G_0^* = 0$ and the stock of government debt $D_0 = D_0^* = 0$. Prices are set symmetric in each country and across borders $P_{H,0} = P_{F,0}$, supply equals demand on the world goods market.

Fiscal policy enters the model as an exogenous shock. The variety of fiscal measures includes changes in the level of government spending, debt and the levied lump-sum taxation.

We follow the timing assumptions of Obstfeld and Rogoff (1995, 1996). Prices are pre-set and fixed for one period. The model's response to an exogenous shock spans over three periods. In the initial steady state (period 0) no shock has occurred and prices are set for the subsequent period. In the model short run (period 1) prices are fixed and a shock hits the economy, whereby all other variables are allowed to adjust. From period 2 onwards, in the model's long run prices adjust and a new steady state is reached. The model will remain in equilibrium, provided no additional shocks occur.

1.2.6 The log-linearized model equations

The steady state of the model is fully characterized by the log linearized consumption-based CPI, the demand schedules for domestic/foreign products, the labor-leisure trade-off, Euler equations, human wealth, demand for real balances, government budget constraints and the current account equations for the home and foreign country which are presented below. Throughout lower case letters denote the log-linear approximation of a variable. $R_0 = 1 + r_0$ ist the real interest rate in the initial steady state.

$$p_t = p_t^* = np_{H,t} + (1-n)p_{F,t} \tag{1.25}$$

$$l_t = -\psi \frac{\phi}{\phi - 1} (c_t + p_t - p_{H,t}) \qquad l_t^* = -\psi \frac{\phi}{\phi - 1} (c_t^* + p_t - p_{F,t}) \tag{1.26}$$

$$\begin{aligned} c_{t+1} &= \frac{1-\gamma\beta}{1+\chi+\psi}(1-\gamma)(1+\psi)\left(\frac{R_0}{R_0-\gamma}\right) h_{t+1} + \gamma\beta R_0 c_t + \gamma\beta(R_0-1) r_{t+1} \\ c_{t+1}^* &= \frac{1-\gamma\beta}{1+\chi+\psi}(1-\gamma)(1+\psi)\left(\frac{R_0}{R_0-\gamma}\right) h_{t+1}^* + \gamma\beta R_0 c_t^* + \gamma\beta(R_0-1) r_{t+1} \end{aligned} \tag{1.27}$$

$$\begin{aligned} h_{t+1} &= -(p_{t+1} - p_{H,t+1}) + \frac{1}{\phi(1+\psi)} y_{t+1} - \frac{\gamma}{R_0-\gamma} R_{t+1} - \frac{1}{1+\psi} t_{t+1} \\ h_{t+1}^* &= -(p_{t+1} - p_{F,t+1}) + \frac{1}{\phi(1+\psi)} y_{t+1}^* - \frac{\gamma}{R_0-\gamma} R_{t+1} - \frac{1}{1+\psi} t_{t+1}^* \end{aligned} \tag{1.28}$$

$$m_t - p_t = c_t - \frac{r_{t+1}}{R_0} - \frac{p_{t+1} - p_t}{R_0 - 1} \qquad m_t^* - p_t^* = c_t^* - \frac{r_{t+1}}{R_0} - \frac{p_{t+1} - p_t}{R_0 - 1} \tag{1.29}$$

$$g_t = t_t + d_{t+1} - R_0 d_t \qquad g_t^* = t_t^* + d_{t+1}^* - R_0 d_t^* \tag{1.30}$$

$$y_t = \theta (p_t - p_{H,t}) + c_t^w + g_t^w \qquad y_t^* = \theta (p_t - p_{F,t}) + c_t^w + g_t^w \tag{1.31}$$

$$\begin{aligned} v_{t+1} - v_t &= (R_0 - 1) v_t - g_t + y_t + p_{H,t} - p_t - c_t \\ v_{t+1}^* - v_t^* &= (R_0 - 1) v_t^* - g_t^* + y_t^* + p_{H,t} - p_t - c_t^* \end{aligned} \tag{1.32}$$

where $nv + (1-n)v^* = 0$. To analyze the transmission of fiscal policy under complete home bias, here again we use the system (1.25)-(1.30). However, the log linearized demand schedules and the current account equations are altered by the assumption of complete home bias in government spending and presented below.

$$y_t = \theta (p_t - p_{H,t}) + c_t^w + n g_{hb,H,t} \qquad y_t^* = \theta (p_t - p_{F,t}) + c_t^w + (1-n) g_{hb,F,t}^* \tag{1.33}$$

$$\begin{aligned} v_{t+1} - v_t &= (R_0 - 1) v_t - g_{hb,H,t} + y_t + p_{H,t} - p_t - c_t \\ v_{t+1}^* - v_t^* &= (R_0 - 1) v_t^* - g_{hb,F,t}^* + y_t^* + p_{H,t} - p_t - c_t^* \end{aligned} \tag{1.34}$$

1.3 Positive analysis

Applying the timing assumptions x_0 denotes a variable in the initial steady state, the short run value of a variable carries no index and $\bar{x}$ refers to the long run value of a variable. The solution of the models provides for the endogenous variables as functions of exogenous variables in relative terms.

We can also solve for the levels of home and foreign variables by utilizing Aoki (1981)'s formula. The level of a home/foreign variable is given by

$$x = x^w + (1-n)(x - x^*) \qquad x^* = x^w - n(x - x^*) \tag{1.35}$$

Aoki (1981)'s formulas decompose the effect of a policy shock in the effect on the global variable and a relative effect whose weight depends on the size of the countries. This allows us to consider changes in the levels of endogenous variables as consumption or output without solving explicitly for the reduced forms. And thus, a discussion of the effects of national fiscal policy changes on the levels of domestic variables and the spill-over on foreign variables.
Finally, we can show that the long run world levels of consumption and output are not affected by the accumulated stocks of public debt

$$\bar{c}^w = -\frac{\phi - 1}{(\psi + 1)\phi - 1}\bar{g}^w \qquad \bar{y}^w = \frac{\psi\phi}{(\psi + 1)\phi - 1}\bar{g}^w \tag{1.36}$$

but are functions of public spending decisions in the home country and abroad. This is also true under the assumption of complete home bias in government spending

$$\bar{c}^w = -\frac{\phi - 1}{(\psi + 1)\phi - 1}\left(n^2\bar{g}_H + (1-n)^2\bar{g}_F^*\right) \qquad \bar{y}^w = \frac{\psi\phi}{(\psi + 1)\phi - 1}\left(n^2\bar{g}_H + (1-n)^2\bar{g}_F^*\right) \tag{1.37}$$

We explore the international transmission of fiscal policy shocks in a monetary union apart from balanced budget policies. We conduct a number of policy experiments involving different ways of financing a given level of government expenditures. Furthermore, we undertake a comparison of temporary or permanent changes in public spending. The monetary policy is delegated to a common monetary authority.
We analyze a debt-financed tax cut, deficit spending and a temporary or permanent balanced budget increase in domestic government spending. Moreover, we explore the spillover effects of fiscal measures within a monetary union.

1.3.1 Balanced-budget changes in government spending

Consider a permanent increase in domestic public consumption $g_0 < g = \bar{g}$ by one percent measured in terms of domestic output in the initial steady state. The fiscal expansion is financed by an equal increase in taxation $t = \bar{t} > t_0$. Following the literature for now, we assume complete home bias in government spending.
In response, domestic households decrease their demand for consumption goods. Private consumption demand (1.3) is a function of current and future total wealth. A permanent increase in taxation reduces the household's disposable income over all time horizons. We label this the *direct wealth effects* of fiscal policy.
In the short run the labor-leisure trade off does not bind and output is demand determined. Domestic households benefit from this effect by increased dividend payments and labor income. We refer to this as the *indirect wealth effect* of fiscal policy. Overall, the direct wealth effect dominates. Domestic households reduce

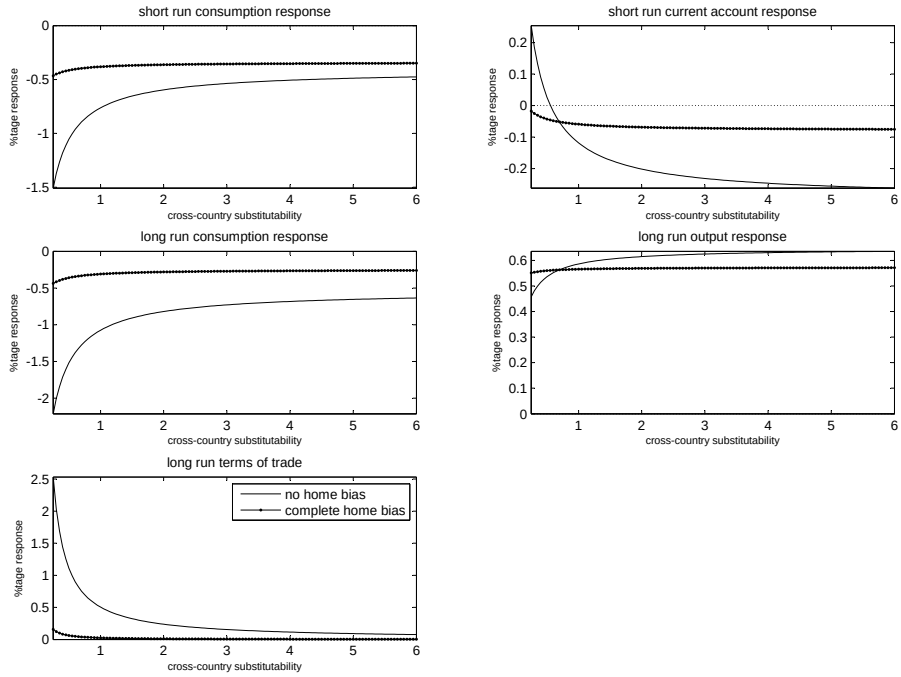

Figure 1.1: A permanent balanced-budget increase of government spending.

their demand for home and foreign goods.
Domestic output is increased one-to-one by public spending. Consumption demand by domestic households is decreased but less than the increase in taxation. This is partly explained by household consumption smoothing behavior and partly because the increase in taxation is offset by the indirect wealth effects in the short run.
The demand for foreign output is decreased compared to the initial steady state. Foreign households receive lower dividend payments and labor income and reduce their demand for consumption goods.
The relative solutions for consumption, output and the current account in the short run are given by

$$\begin{aligned} c - c^* = \frac{\gamma_{EU}}{\gamma\beta\omega + \gamma_{cc}}(\bar{d} - \bar{d}^*) - \frac{\gamma_{cc}}{\gamma\beta\omega - \gamma_{cc}}\left[(1-n)g_H - ng_F^*\right] \\ -\frac{\gamma_{cc}}{\gamma\beta R_0 + \gamma_{cc}(R_0 - 1)}\left[(1 - n\gamma_{gg})\,\bar{g}_{hb,H} - (1 - (1-n)\gamma_{gg})\,\bar{g}^*_{hb,F}\right] \end{aligned} \tag{1.38}$$

$$y - y^* = ng_{hb,H} - (1-n)g^*_{hb,F} \tag{1.39}$$

$$\bar{v} = -(1-n)\left[\begin{array}{c} \dfrac{\gamma_{EU}}{\gamma_{cc} + \gamma\beta\omega}(\bar{d} - \bar{d}^*) - \left[\dfrac{\gamma_{cc}}{\gamma\beta\omega + \gamma_{cc}} - 1\right]\left[(1-n)g_H - ng_F^*\right] \\ +\dfrac{\gamma_{cc}}{\gamma\beta R_0 + \gamma_{cc}(R_0 - 1)}\left[(1 - n\gamma_{gg})\bar{g}_H - (1 - (1-n)\gamma_{gg})\bar{g}_F^*\right] \end{array}\right] \tag{1.40}$$

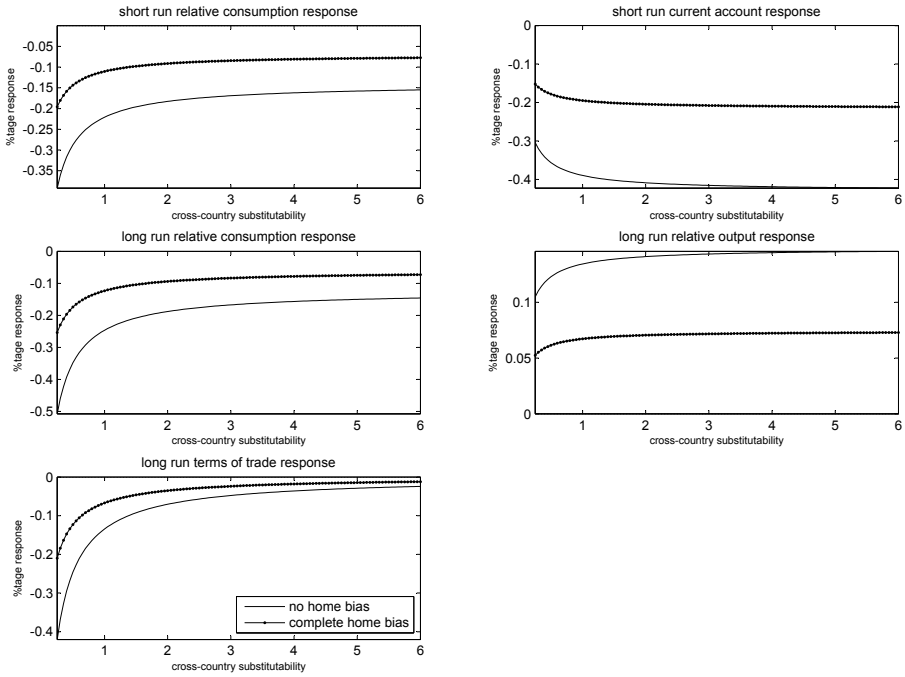

Figure 1.2: A temporary balanced-budget increase of government spending.

where $\gamma_{EU} = \frac{1-\gamma\beta}{1+\chi+\kappa}(1-\gamma)\frac{R_0}{R_0-1}$, $\omega = \frac{R_0}{R_0-1}$, $\gamma_{gg} = \left[\frac{1+\psi\Phi}{\theta+\psi\Phi} - \frac{\gamma_{EU}}{\gamma_{cc}}\left(\frac{\Psi}{\theta+\psi\Phi}+\frac{1}{\phi}\right)\right]$, $\gamma_{cc} = \frac{\rho+\kappa\frac{\theta}{\theta-1}\left(1-\gamma_{EU}\left(\kappa+1-\frac{\rho}{\theta}\right)\right)}{\rho\left(1+\kappa\frac{\theta}{\theta-1}\right)}$ and $\bar{d} = \frac{1}{R_0-1}\bar{t}$.

The marginal response of a relative variable to exogenous shocks is derived by taking the first order conditions and adding the partial effects. To provide some intuition, we illustrate our policy experiments with numerical examples[2]. Fig. 1.1 gives the marginal response of short run relative consumption, the current account as well as the relative consumption, output and the terms of trade in the long run to a permanent balanced-budget increase in public spending as functions of the cross-country substitutability.

If government spending is biased towards national products, a permanent balanced-budget increase induces two asymmetries. Firstly, the composition of public spending differs from that of household demand and determines the indirect wealth effects. Secondly, the direct wealth effects due to changes in taxation. The tax burden falls exclusively on domestic households. The response of relative consumption is negative in the short run.

[2]The numerical examples given in figure 1.1-1.4 are based on the following parametrization: $\beta = 0.99$, $\psi = 1$, $\chi = 0.1$, $\phi = 6$, $\gamma = 0.7$ and $n = 0.5$. We vary the cross-country substitutability $\theta \in [0.1, 6]$.

As public spending affects only domestic output, the response of relative output is strictly positive. The current account effect of fiscal policy depends on the household income in the long run. Households smooth consumption over time.
A well-known feature of two-country general equilibrium models is the so-called *expenditure switching*. It reflects the intratemporal optimizing behavior of households in demand for home and foreign output. Households maximize their consumption in each period of time. The allocation of demand between home and foreign products depends on their relative prices. Domestic households will substitute foreign for domestic goods if the TOT improve. However, in a MU under the given timing assumptions the TOT are fixed in the short run. Changes in the TOT are deferred to the long run.
Households anticipate the long run effects of fiscal measures and adjust their behavior. In the symmetric initial steady state, the weights of home and foreign products in the household's consumption basket correspond to the relative size of the countries. In the long run, depending on the degree of cross-country substitutability between goods and the change in the TOT, this is not necessarily true.
The response of relative consumption and the current account are functions of the survival probability γ and the cross-country substitutability. We follow Tille (2001) and assume $\theta < \phi$. The elasticity of substitution between home and foreign goods is smaller than within groups of national brands.
However, a wide range of assumptions with regard to the cross- and within-country elasticity of substitution can be found in the literature. Empirically, the estimates of the cross-country substitutability vary between $\theta \in [0.2, 6]$, for a recent discussion see Corsetti et al. (2008).
In a series of papers, Corsetti and Pesenti (2001, 2005) and Corsetti (2006) show that in a Ricardian two-country model with flexible exchange rates, the assumption of $\theta = 1 < \phi$ implies that all adjustment to exogenous shocks is determined by changes in the TOT. This finding is very robust. It holds under monetary and fiscal shocks. The assumption of home bias in private consumption demand and is also true in our model for $\gamma = 1$. Otherwise, the Corsetti-Pesenti result does not hold.
A permanent increase of domestic government spending implies that the domestic government absorbs a fraction of domestic output. The supply of domestic goods at the world market is decreased and the overall production in the home country as well as on the world level increased. The price of domestic output at the world market is increased in the long run and the TOT improve.
By exploiting the relative price improvement in the long run, domestic households have the opportunity to obtain more foreign output per unit of domestic production. However, the permanent direct wealth effect diminishes the level of real income of domestic households. They have to work more and consume less to pay the higher tax rate. In the long run, the labor-leisure trade off binds. Households maximize their consumption of goods and leisure. They substitute foreign for domestic goods as to enjoy more leisure.
The described mechanism implies that foreign goods are substitutes for domestic

output in the consumption basket of the domestic household. Thus, the cross-country substitutability determines the scope for expenditure switching. In general, households will exploit improvements in the TOT until they have reached the point where the utility loss induced by deviations from the initial steady state consumption basket equals the utility gains from the corresponding increase in leisure.
Following Tille (2001) we differentiate two cases. Home and foreign goods are poor substitutes ($\theta < 1$ if $\gamma = 1$) and home and foreign goods are close substitutes ($\theta > 1$ if $\gamma = 1$). For the Corsetti-Pesenti threshold, $\theta = 1, \gamma = 1$, the current account is balanced and all adjustment is done by changes in the TOT.
If home and foreign goods are poor substitutes, domestic households cannot exploit improvements of the TOT. The disutility induced by deviations from the preferred consumption basket exceeds the utility derived from additional leisure. Thus, fixed TOT imply that domestic households are wealthier in the short run than in the long run. As households adjust their behavior to the new steady state, the domestic country runs a current account surplus.
If home and foreign goods are close substitutes, households exploit the improved TOT in the long run. Prices are flexible and the labor-leisure trade off binds.
Expenditure switching in the long run implies a rising demand for foreign goods. The fact that prices are flexible diminishes the TOT changes in the long run. This mechanism leads to a goods market equilibrium in which the price of one unit of foreign output on the world market equals the marginal utility gain from additional leisure of domestic households. In such cases, fixed TOT in the short run imply that the income of domestic households is lower than in the new steady state. The overall result is that the home country runs a current account deficit.
We conclude that the response of relative consumption in the short run depends quantitatively, but not qualitatively on the value of the cross-country substitutability.
The domestic country runs a current account deficit if home and foreign goods are close substitutes, and a surplus if home and foreign output are poor substitutes. Magnitude and sign of the current account response are a function of the cross-country substitutability. The threshold for a balanced current account is a function of the probability to survive which governs the rate of time preference.
In the long run, domestic households always work more and consume less in order to finance the increased tax burden which has to be paid exclusively by them. Furthermore, they have to settle imbalances of the current account. We begin the discussion of the long run effects with the solutions for relative consumption, output and the TOT in the long run

$$\bar{c} - \bar{c}^* = \frac{\psi\Phi + \theta}{\theta(1+\psi\Phi)} \left[\frac{R_0 - 1}{1-n} \bar{v} + [[n\gamma_{cchb} - 1]\, \bar{g}_H - [(1-n)\gamma_{cchb} - 1]\, \bar{g}_F^*] \right] \tag{1.41}$$

$$\bar{y} - \bar{y}^* = -\frac{\psi\Phi}{\psi\Phi - 1} \left[\left(\frac{R_0 - 1}{1-n} \right) \bar{v} - (\bar{g}_H - \bar{g}_F^*) \right] \tag{1.42}$$

$$\bar{tot} = \frac{\psi\Phi}{\theta(1+\psi\Phi)}\left[\left(\frac{R_0-1}{1-n}\right)\bar{v} + \left(\left[1-n\gamma_{totlr}\right]\bar{g}_H - \left[1-(1-n)\gamma_{totlr}\right]\bar{g}_F^*\right)\right] \tag{1.43}$$

Because of the direct wealth effect, the response of relative consumption is negative and that of relative output positive. By the reasoning above, both are also functions of the cross-country substitutability and the short run current account response. However, the direct wealth effect dominates all other effects and determines the outcome of the model in the long run.

In the standard model with Ricardian consumers there is no strategic interaction of fiscal policy if there is not at least some home bias in government spending. This is no longer true if we assume failures of the Ricardian equivalence. Suppose a permanent balanced-budget increase in domestic government spending under the assumption that public demand aggregates in the same way as household demand does.

The government levies taxes to finance the permanent increase in public spending. The tax burden falls exclusively on domestic households and induces a permanent negative direct wealth effect.

A permanent fiscal expansion translates in an increased demand for home and foreign goods. In the short run, output is demand determined, thus world production increases. Home and foreign households benefit from a positive indirect wealth effect. Thus, domestic households are worse of than in the case of complete home bias in government spending. While the increased tax burden falls exclusively on them, they have to share the benefits with households abroad. The decrease in domestic household income over all time horizons is more pronounced.

The consumption demand of domestic households is lower compared to the initial steady state. Foreign household increase their demand for consumption goods and leisure because their disposable income increases in the short run.

Public and private demand aggregate in the same way. Thus, there is no response of relative output in the short run. The relative solutions for consumption, output and the current account in the short run are given by

$$c - c^* = \frac{\gamma_{EU}}{\gamma_{cc}+\gamma\beta\omega}\left(\bar{d}-\bar{d}^*\right) - \frac{\gamma_{cc}}{\gamma_{cc}(R_0-1)+\gamma\beta R_0}\left[\left(R_0-1\right)\left(g-g^*\right)+\left(\bar{g}-\bar{g}^*\right)\right] \tag{1.44}$$

$$y - y^* = 0 \tag{1.45}$$

$$\bar{v} = -(1-n)\left[\frac{\gamma_{EU}}{\gamma_{cc}+\gamma\beta\omega}(\bar{d}-\bar{d}^*) + \frac{\gamma\beta\omega}{\gamma_{cc}+\gamma\beta\omega}(g-g^*) - \frac{\gamma_{cc}}{\gamma_{cc}(R_0-1)+\gamma\beta R_0}(\bar{g}-\bar{g}^*)\right] \tag{1.46}$$

Again, we vary the cross-country substitutability. Fig. 1.1 gives the marginal response of short run relative consumption, the current account as well as the relative consumption, output and the TOT in the long run.

If government spending falls on domestic and foreign goods, a balanced-budget increase withdraws resources from domestic households as to spend them on home and foreign goods.
Domestic households share the benefits of this policy, i.e. increased wage and dividend payments for foreign households. The responses of relative consumption and the current account are of the same sign as under the assumption of complete home bias but more pronounced.
This is true in the short as well as in the long run. We conclude the discussion of a permanent balanced budget increase with the presentation of the relative solutions for consumption, output and the terms off trade in the long run

$$\bar{c} - \bar{c}^* = \frac{\psi\Phi + \theta}{\theta\,(1+\psi\Phi)} \left(\frac{R_0 - 1}{1-n}\right) \bar{v} - \frac{\psi\Phi + \theta}{\theta\,(1+\psi\Phi)} (\bar{g} - \bar{g}^*) \tag{1.47}$$

$$\bar{y} - \bar{y}^* = -\frac{\psi\Phi}{1+\psi\Phi} \left[\left(\frac{R_0 - 1}{1-n}\right) \bar{v} - (\bar{g} - \bar{g}^*)\right] \tag{1.48}$$

$$\bar{tot} = \frac{\psi\Phi}{\theta(1+\psi\Phi)} \left[\left(\frac{R_0 - 1}{1-n}\right) \bar{v} - (\bar{g} - \bar{g}^*)\right] \tag{1.49}$$

We are mainly concerned about fiscal shocks that have no effects in a Ricardian model, e.g. temporary deficit-financed fiscal policy measures.

As a reference point, we briefly discuss a temporary balanced budget increase in domestic government spending. The domestic government decides to expand its demand for goods for one period $g_0 = \bar{g} < g$. The fiscal expansion is financed by an equal temporary increase in taxation $t_0 = \bar{t} < t = g$.

Again, we start with the assumption of complete home bias in public consumption. Numerical examples are given in Fig. 1.2. There is a fundamental difference between temporary and permanent balanced-budget changes in public spending. Permanent changes in fiscal policy imply changes in household income in the long run. Namely, in the form of permanent direct wealth effects. If the fiscal measure is temporary, direct wealth effects are restricted to the short run.

Domestic consumption demand is a function of total income over the average life expectancy. A temporary tax increase to finance public spending implies a reduction of current income, while future total wealth is not directly affected.

We have shown that temporary fiscal measures do not alter the equilibrium world

output and consumption level, see (1.37). However, the distribution of consumption goods and labor effort between home and foreign households in the long run does not return to the initial steady state values but depends on the distribution of global wealth. Thus, the long run effect of a temporary change in fiscal policy depends on its current account effect which makes the crucial difference between temporary and permanent changes in government spending.

The increase in government spending induces certain asymmetries. The tax burden falls exclusively on domestic households and the government spends exclusively on home production. The cost and the benefits of the assumed policy measure occur exclusively to domestic households.

Households recognize the temporary nature of the fiscal measure. Because of the direct wealth effect, domestic income in the short run is below its long run level. Households use the international capital market to smooth consumption. For the assumed values of the cross-country substitutability, the domestic country runs a current account deficit in the short run. This has to be settled by domestic households in the long run. They work more and consume less. The TOT adjust and the labor-leisure trade-off binds.

The supply of domestic output on the world market increases compared to the initial steady state. Thus, the TOT of the home country worsen.

The response of foreign consumption demand clearly mirrors this phenomenon. There is a redistribution of world wealth in favor of foreign households in the long run. This enables foreign households to consume more and work less compared to the initial steady state. They benefit from improved TOT and their improved net foreign asset position.

In the long run, the level of world output and consumption corresponds to the initial steady state level. Because of the asymmetric distribution of world wealth, foreign households consume a larger fraction of world output and enjoy more leisure than in the initial equilibrium.

All long run responses depend in magnitude, but not in sign on the cross-country substitutability which determines the short run current account response.

To complete the discussion of balanced budget changes in domestic fiscal policy, we discuss a temporary balanced budget increase in public spending under the assumption that public demand aggregates in the same way as household demand. For a numerical example, see Fig. 1.2. The important difference to the case of complete home bias is again an asymmetric tax burden combined with symmetric indirect wealth effects.

Domestic household income is reduced more than under the assumption of complete home bias in public spending. Such a situation arises because the benefits of the domestic fiscal expansion, increased wage and dividend payments will now have to be shared with foreign households. As government demand falls on home and foreign goods, there is no short run response of relative output. The transmission mechanism is similar to the case of complete home bias. The only difference can be found in the magnitude of the response. If the domestic government spends on home as well as on foreign goods, the current account response and thus the long run effects are amplified.

We conclude the analysis of balanced-budget changes in domestic government spending with a brief discussion of the effects on the level of domestic consumption and output as well as the spillovers to the foreign country. For that we utilize the formulas of Aoki (1981).

A balanced-budget increase in domestic public spending increases domestic production in the short and long run, no matter if it is temporary or permanent and independently of the composition of domestic public demand. The domestic household's consumption of goods and leisure is decreased over all time horizons.

The effects on the levels of domestic variables are qualitatively independent of the assumed duration and the composition of public spending. But in general, the effects on domestic output are more pronounced if we assume complete home bias.

Intuitively this is clear as in cases of complete home bias where the government redistributes demand in favor of domestic producers and thus stimulates domestic production. This implies that the benefits of this policy exclusively occur to domestic households, whereby the decrease in consumption is relatively mild.

If we assume that government spending aggregates in the same way as private demand, the effect on output is much smaller while domestic consumption is decreased more severely. Again, this is intuitively evident as domestic households do not only have to bear the complete cost of this policy in form of increased taxation but also have to share the benefits with households abroad.

The spillover effects on output and consumption are much richer. In case of a permanent balanced-budget increase in domestic spending under the assumption of complete home bias, the spillover on output as well as on consumption for all time horizons is negative. The domestic government takes away resources from domestic consumers and spends these exclusively on domestic products. Thus, the demand as well as the wage and dividend payments for foreign households decrease over all time horizons. Output and consumption abroad are decreased.

If we assume that domestic spending aggregates in the same way as private demand, a permanent balanced-budget increase in domestic public spending enables a higher consumption abroad in the short as well as the long run. Foreign output is increased in the short run. In the long run, foreign households are enabled to consume more goods and leisure.

A temporary balanced-budget increase has similar short run effects. However, in the long run foreign households will always benefit from the possibility of expanded consumption and a reduced workload. Foreign output is always lower than domestic production. The reason for this is that temporary balanced-budget changes do not alter the world equilibrium output and consumption in the long run. The long run effects of a temporary fiscal measure are determined by the current account effects in the short run. As the domestic country runs a current account deficit in the short

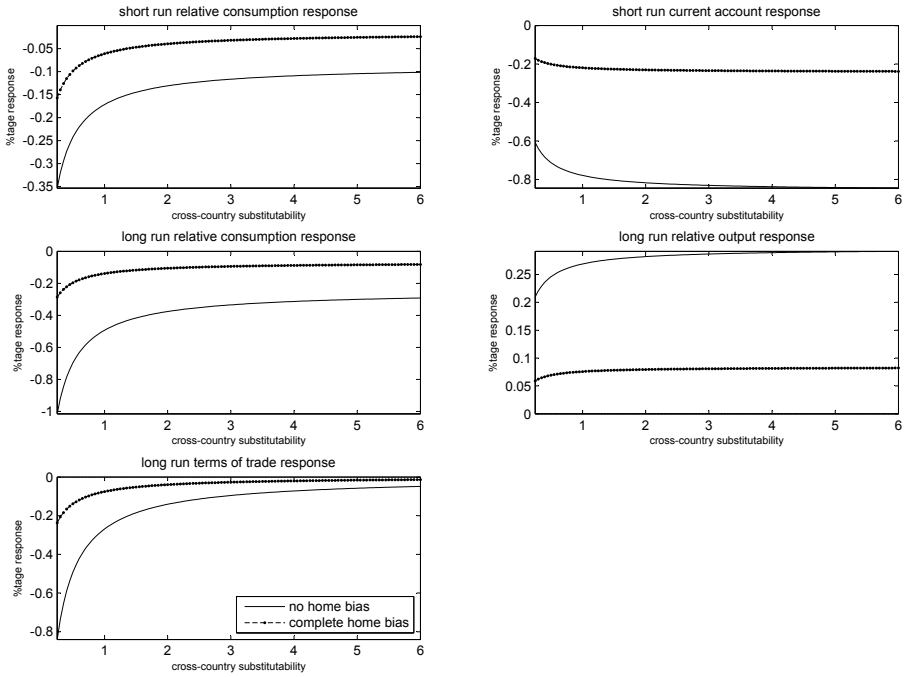

Figure 1.3: Deficit-spending of the domestic government, no home bias.

run for all cases to smooth consumption, a temporary balanced-budget increase in domestic public spending always implies a redistribution of world wealth in favor of foreign households.

We conclude that a balanced budget increase in domestic government spending always has an expansionary effect on domestic output. Like in the basic representative agent model, the response of domestic household consumption is always negative. The spillovers depend on the precise assumptions to the composition of public spending and the persistence of a fiscal shock.

1.3.2 Deficit spending of the domestic government

Suppose a temporary increase in government spending financed by debt. The domestic government issues bonds $d_0 < d = \bar{d}$ to finance a temporary increase of public spending on goods $g_0 = \bar{g} < g = d$. Taxes remain fixed in the short run $t = t_0$.

In the long run the domestic government levies taxes $\bar{t} = (R_0 - 1)\bar{d}$ to finance the interest payments on the accumulated stock of public liabilities.

A key characteristic of our model are failures of the Ricardian equivalence. In general, Ricardian equivalence describes models in which there are no real effects of the financing decision on aggregate demand. Thus, a temporary balanced-budget increase in government spending and deficit spending are equivalent.

We start the comparison of a deficit-spending and a temporary balanced-budget increase in government spending under the assumption of complete home bias in public spending. By the numerical examples in Figs. 1.2, 1.3 we see that the responses of the relative variables are qualitatively the same but quantitatively different.

Consider the consumption function of domestic households. Current consumption is a function of current and future wealth. Future wealth enters the consumption decision with a weight $\frac{\gamma}{R_0 - 1}$ which depends on the average life expectancy. Households base their consumption decision on the permanent income over the average life expectancy.

A debt-financed fiscal expansion differs from a temporary balanced-budget increase in domestic public spending by the intertemporal allocation of the cost and benefits of this policy measure. Balanced-budget changes in public spending imply that the costs and benefits of fiscal measures come into effect during the same period of time. Deficit-spending has a temporary effect in the short run and a permanent effect in the long run. The benefits of a positive indirect wealth effect occur in the short run while the increase in taxation to finance this policy is deferred to the long run.

The permanent income over the average life expectancy is increased compared to the case of a temporary balanced-budget change in public spending.

The transmission mechanism of the fiscal shock is unaffected by the financing decision. The intertemporal allocation of the financing decision alters the effect on the domestic household's consumption decision in the short run. This holds independently of the composition of public spending.

Domestic households reduce their consumption to a lesser account as compared to the balanced budget case. To enable this, households borrow abroad which in turn implies an increased current account deficit compared to the case of a temporary balanced budget increase in domestic public spending.

The long run responses of relative output, consumption and the TOT, all depend on the current account response. Thus, all responses are amplified. We conclude that by manipulating the intertemporal allocation of disposable income, the fiscal authorities have an additional policy instrument at hand. It allows the government to mitigate the effects of fiscal expansion on current consumption. However, in case of deficit spending it also implies that the tax burden to finance current government spending falls entirely on the shoulders of future generations.

The effects on the level of domestic consumption are negative, but smaller than in case of a temporary balanced-budget increase in domestic public spending. Domestic output is increased in the short as well as in the long run.

Again, the sign of the spillover effects depends on the precise assumption we make with regard to the composition of public spending. If the home government spends exclusively on national goods, foreign consumption and output are decreased in the short run. If domestic public spending aggregates in the same way as household demand does, the foreign consumption and output are increased in the short run.

However, the domestic country always runs a current account deficit. Domestic households borrow abroad to smooth consumption in the short run. The world distribution of wealth determines the long run responses at home and abroad. Thus, foreign households are enabled to consume more and work less in the long run.

We conclude that deficit-spending always stimulates domestic production and triggers a decline in domestic consumption of goods and leisure over all time horizons. Foreign households benefit from a redistribution of world wealth to their favor in the long run.

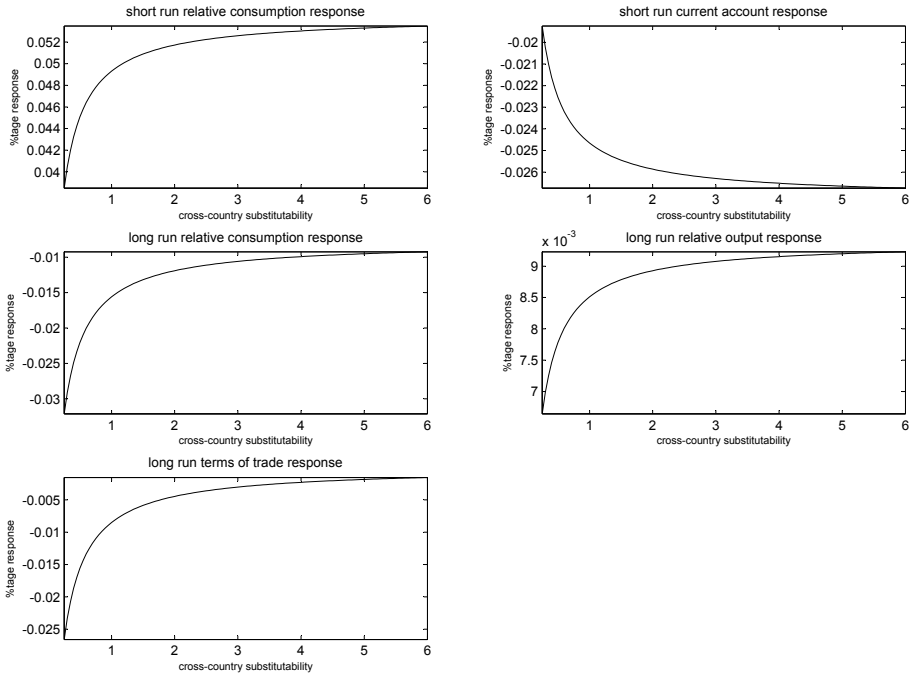

Figure 1.4: A debt-financed tax cut by the domestic government.

1.3.3 A debt financed tax cut in the domestic country

We conclude the evaluation of fiscal policy measures with a debt-financed tax cut in the domestic country. The home government issues bonds $d_0 < d = \bar{d}$ to finance a temporary tax cut $\bar{t} > t_0 > t$. In the long run, taxes are levied to finance the interest payments on the accumulated stock of public liabilities $\bar{t} = (R_0 - 1)\bar{d}$.

In a model featuring Ricardian agents, debt and taxation are equivalent financing decisions. Thus, Ricardian consumers do not respond to this policy measure at all. The key to the real effects of this policy is the finite horizon. Households in the Blanchard (1985)-Yaari (1965) OLG maximize utility over their average life expectancy. Individuals are aware that part of the stream of future taxation which is levied to finance the interest payments on debt issued in the short run falls in the periods of time after their death. They expect to repay only a fraction of the public liabilities, depending on their probability to survive $\gamma < 1$. Thus, part of the issued govern-

ment debt is perceived as net wealth. In the Blanchard (1985)-Yaari (1965) OLG a debt-financed tax cut is an intertemporal redistribution of real income in favor of the current generation.

The resources obtained by the government by issuing debt in the short run are completely redistributed to households. Public spending is fixed at the initial steady state level.

We illustrate this policy experiment with a numerical example in Fig. 1.4. Domestic households benefit from the direct wealth effect of a tax cut in the short run. In the long run, the direct wealth effect is reversed as taxes are levied to cover the interest payment on public debt. If γ is sufficiently small, the positive direct wealth effect in the short run prevails.

As a result, domestic households increase their demand for consumption goods. Output at home and abroad are increased compared to the initial steady state. This is explained by the fact that short run movements in output are determined by demand and not by the supply-side labor-leisure decisions. An increase in domestic consumption drives demand for world production up. However, as only part of government debt is perceived as net wealth, the effects on output and consumption are positive but small.

Households at home and abroad benefit from an indirect wealth effect. Labor and dividend income are increased in the home country and abroad. As private consumption demand falls on home and foreign goods there is no response of relative output in the short run.

Given this result, a change in relative consumption implies that domestic households consume a larger fraction of world production than in the initial steady state. To enable the households to do so, they have to borrow abroad.

Again, the magnitude of the relative consumption response as well the current account response depend on the assumed cross-country elasticity. If domestic households borrow abroad they have to settle the current account deficit in the future.

Thus, in the long run, domestic production has to be in excess to foreign output. The latter will only occur if the relative weights on home and foreign goods in the domestic and foreign consumption basket are different from the initial steady state. Or in other words, if home and foreign goods are poor substitutes there is only little scope for international lending. Foreign households do not gain from short run lending because the reimbursements do not increase their utility in the future. A low cross-country elasticity nearly shuts down the current account channel.

We conclude that the cross-country substitutability determines the international distribution of gains deriving from of a debt-financed tax cut. If home and foreign goods are poor substitutes, the benefits of a debt-financed tax cut are shared between home and foreign households in the short run. The response of relative consumption and the current account effects are only small.

In the long run, the model response is driven by the current account effect. A debt-financed tax cut alway worsens the domestic country's net foreign asset position. In addition, the long run tax burden has exclusively be carried by domestic households. Hence, the response of relative consumption in the long run is always negative. Domestic households have to work more to finance tax payments to the home government and interest payments to households abroad. The response of relative output in the long run is positive, whereas the TOT worsen.

The spillovers on foreign consumption are positive in the short as well as the long run. The levels of domestic and foreign output as well as consumption are always increased in the short run. In the long run, households abroad profit from a redistribution of world wealth in their favor.

We conclude that failures of the Ricardian equivalence allow for fiscal measures that increase short run consumption as well as output in the world economy by the intertemporal redistribution of income.

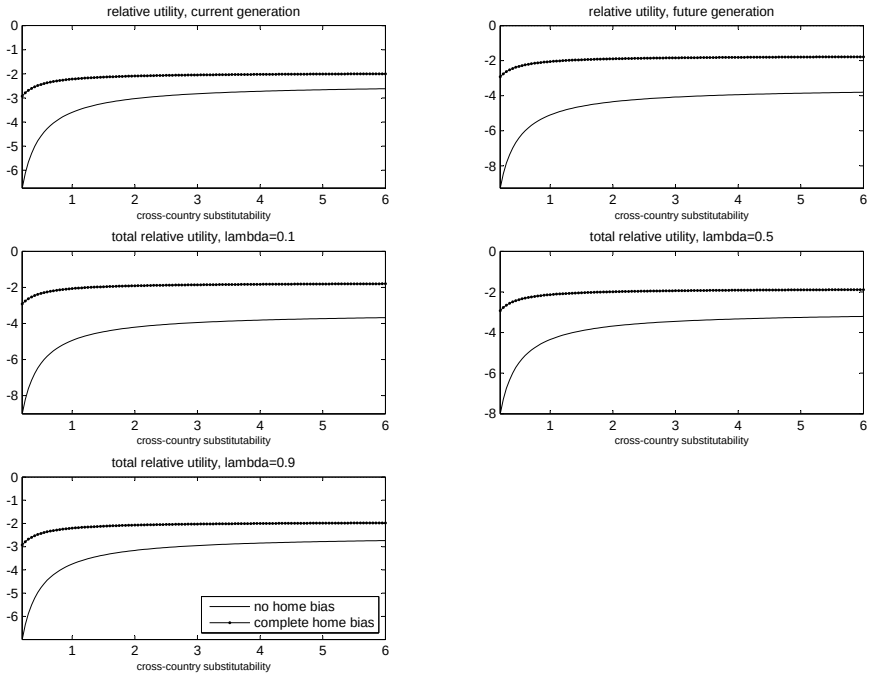

Figure 1.5: Welfare. A permanent balanced budget increase in public spending.

1.4 Normative analysis

The Blanchard (1985)-Yaari (1965) OLG poses a problem for normative policy analysis. Namely, the choice of an adequate welfare criterion. Blanchard and Fischer (1989) argue that an appropriate welfare criterion must be as such so that households agree to it, independently of the period of their birth. They suggest a weighted average of the welfare of current and future generations

$$(U-U^*)_{total} = \lambda\,(U-U^*)_{current} + (1-\lambda)\,(U-U^*)_{future} \tag{1.50}$$

where $0 < \lambda < 1$, $(U-U^*)_{current} = (c - c^*) - \frac{\phi-1}{\phi}(y - y^*) + \frac{\gamma\beta}{1-\gamma\beta}\left[(\bar{c}-\bar{c}^*) - \frac{\phi-1}{\phi}(\bar{y}-\bar{y}^*)\right]$ and $(U-U^*)_{future} = \frac{1}{1-\gamma\beta}\left[(\bar{c}-\bar{c}^*) - \frac{\phi-1}{\phi}(\bar{y}-\bar{y}^*)\right]$. The welfare criterion is derived by log-linearizing the utility function in per-capita terms. We measure utility in relative terms[3], where λ assigns weights to the utility of current and future generations. We abstract from utility that is derived from real balances.

[3]We follow Ganelli (2005) and measure utility in the two-country Blanchard (1985)-Yaari (1965) OLG in relative terms.

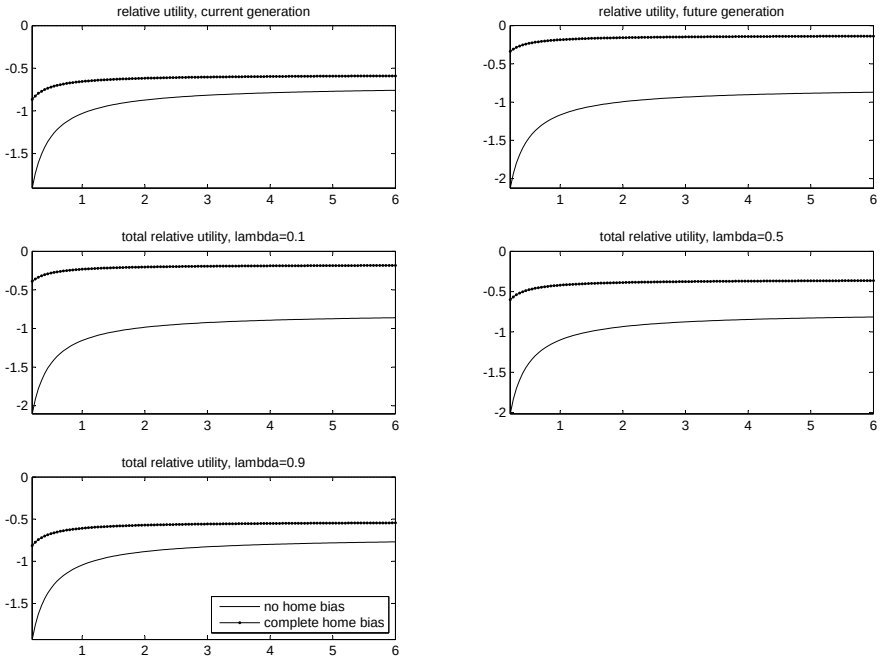

Figure 1.6: Welfare. A temporary balanced budget increase in public spending.

To illustrate the welfare effects of the various fiscal measures, we provide numerical examples[4]. Fig. 1.5 displays the welfare effects of a balanced budget increase in domestic public spending by one percent of the domestic output in the initial steady state. A permanent balanced budget rise in government spending decreases the real income of households over all time horizons. Domestic current and future generations suffer from a decrease in relative utility.

Nevertheless, the welfare effect on current and future generations is not identical. The current generation has to pay the higher tax rate and borrows abroad to smooth the transition in the path of consumption and leisure. Future generations have to carry the burden of increased taxation and to settle the current account imbalance which they have inherited from the current generation. Thus, the future

[4]The numerical examples given in figures 1.5-1.8 are based on the following parametrization: $\beta = 0.99$, $\psi = 1$, $\chi = 0.1$, $\phi = 6$, $\gamma = 0.7$ and $n = 0.5$. We vary the cross-country substitutability $\theta \in [0.1, 6]$ and calculate total welfare for different values of λ, $\lambda = 0.1, 0.5, 0.9$.

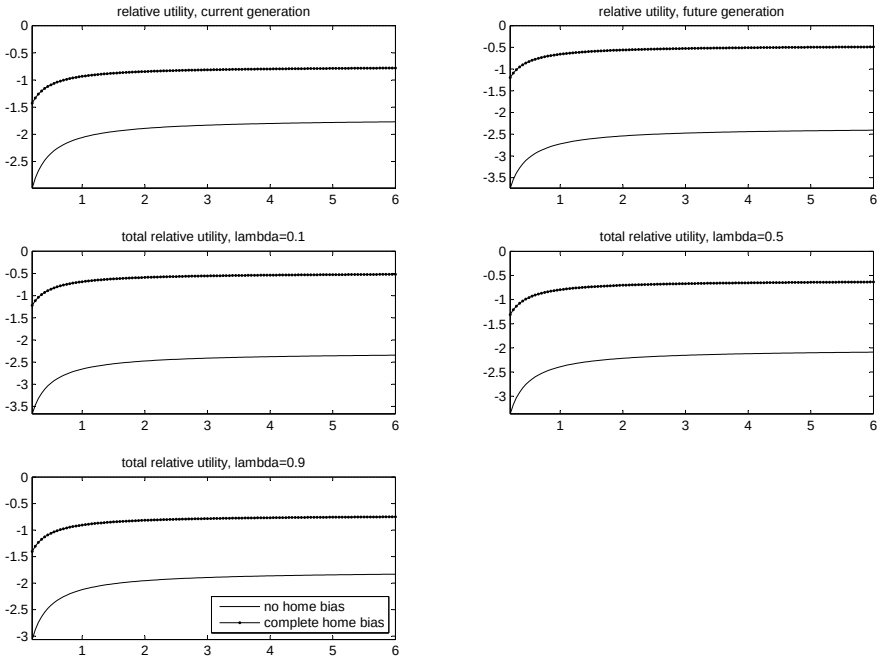

Figure 1.7: Welfare. Deficit spending.

generations suffer a welfare loss that is more severe than the loss of the current generation.

However, the difference in the welfare loss of current and future generations is small. The reason is that the change in taxation determines the welfare impact. Thus, the effect of changes in the weights on welfare of current and future generations on total welfare is small. The same is true for changes in the probability to survive. A change in the probability to survive affects the optimizing behavior of individual households. Again, as the tax increase dominates the welfare effect, changes in γ do not affect total welfare substantially.

The substitutability between home and foreign goods determines the expenditure switching effects and the scope for international lending. Thus, changes in the cross-country substitutability have considerable welfare effects.

An illustration of the welfare effects of a temporary balanced budget increase in

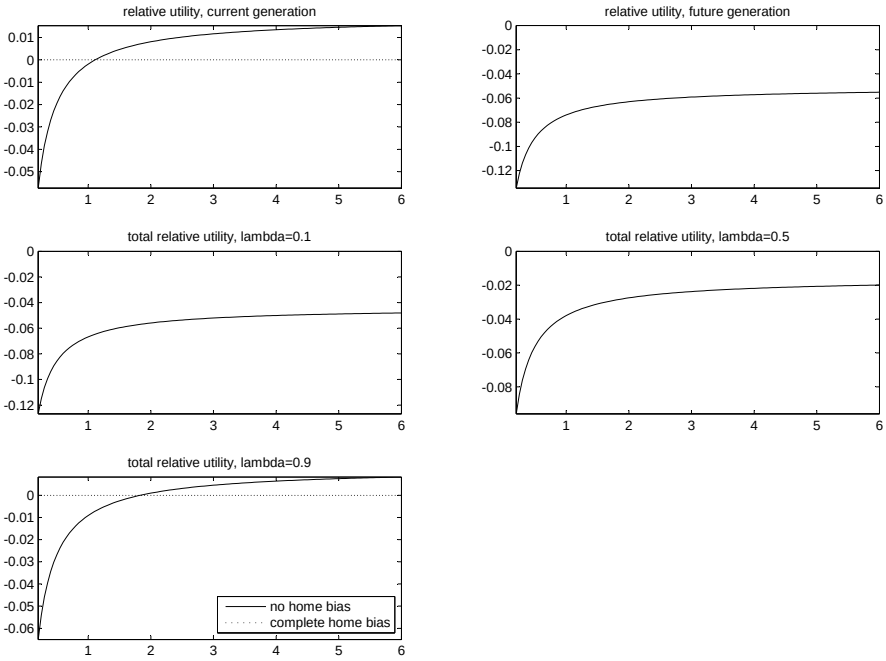

Figure 1.8: Welfare. A debt-financed tax cut.

government consumption is given in Fig. 1.6. In general, the welfare loss of current and future generations is lower than in the permanent case.

The reason is found in the temporary nature of the assumed policy. There are notable differences in the effects of a temporary balanced budget change in public consumption on current and future generations. The current generation has to finance the increase in government spending by an increased tax rate. To smooth the decrease in real income the current generation borrows abroad. In turn, this redistribution of world wealth determines the long run effects. Future generations have to settle the implied imbalance in world wealth but do not suffer from increased tax rates.

The effects of changes in the probability to survive and the cross-country substitutability are similar to the case of a permanent change in public spending. But now changes in the relative weight of the current and future generations have

considerable effects on total welfare. This is explained by circumstance that the long run effect of such a policy depends on its current account effects. The current generation internalizes the welfare loss of future generations for low values of λ.

We depict the welfare effects of deficit spending in Fig. 1.7. Deficit spending differs from a temporary balanced budget increase in government spending by the financing decision of the government. The temporary increase in public demand is financed by issuing public debt. Future generations have to finance the debt service by a permanent increase in taxation.

However, given our simple timing assumptions and the underlying assumption that the government only pays the interest rate on the accumulated debt stock, the welfare effects are similar to the case of a temporary balanced budget increase in public consumption. We want to emphasize that this is an outflow of the applied timing assumptions. This statement is not true if we allow the government to shift changes in taxation to finance the debt services further into the future.

The assumption to the composition of government spending does not alter the qualitative welfare effects of the fiscal measures discussed above. In general, the assumption of complete home bias decreases the welfare losses which are implied by an increase in government spending. This is because all benefits of the fiscal expansion, i.e. an increased demand for consumption goods occurs to domestic producers. Assuming complete home bias in the standard model potentially underestimates welfare losses that are implied by an increase in government spending, no matter how it is financed.

Fig. 1.8 illustrates the welfare impact of a debt financed tax cut. This fiscal measure differs from the above mentioned in two dimensions. Firstly, it implies an intertemporal reallocation of real income in favor of the current generation and secondly, does not involve changes in the level of public consumption.

The current generation profits from this phenomenon in terms of an increase in real income. It enables an increased consumption of the current generation which

implies welfare gains. In the long run, future generations have to cover the cost of such a policy measure by higher taxation in order to cover the interest payments on the accumulated stock of government debt.

Thus, a debt-financed tax cut increases the welfare of the current generation and implies welfare losses for future generations. As a consequence, the probability to survive and the weight on the welfare of the current and future generations are important elements to determine the total welfare effects of such a fiscal measure.

If γ is close to one, households expect to survive long enough to repay a relatively large fraction of the issued debt. Thus, the utility of the current generation decreases. Small values of λ imply that the current generation cares for their descendants. Total welfare decreases with the weight on the utility of the current generation and increasing life expectancy which mirrors the famous result of Barro (1974).

Changes in the cross-country substitutability affect the welfare of households in the same way as discussed above.

We conclude that in the two-country Blanchard (1985)-Yaari (1965) OLG, fiscal measures have the potential to increase short run output and private consumption demand at the same time. Moreover, a fiscal stimulus does not necessarily diminish total household welfare in the implementing country. It is evident that the positive as well as the normative effects of fiscal policy depend on the precise type of the assumed policy measure.

1.5 Conclusions

We present a two-country model of a currency union featuring failures of the Ricardian equivalence. The model allows us to study the transmission and welfare effects of fiscal measures in a monetary union apart from balanced budget policies. Furthermore, we explore the role of the cross-country substitutability and look at

the composition of public spending in view of the transmission of fiscal shocks.

The underlying model is complex. Our simplifying assumptions of one period price stickiness and abstracting from the use of capital in production allow us to solve it in relative terms. The solution yields some intuitive insights into the mechanisms that are underlying the transmission of fiscal policy in a currency union.

Firstly, a permanent balanced budget increase in domestic public spending decreases consumption but stimulates output in the home country. The real income loss due to increased taxation determines the overall effects of this policy measure. This implies welfare losses for the domestic households in the short as well as the long run.

The spillover effects on the foreign country depend on the precise assumptions regarding the composition of public spending. Under complete home bias in domestic public spending, real income abroad is decreased over all time horizons. The spillover effects are unambiguously negative and lead to welfare losses abroad.

However, if we assume that public spending aggregates in the same way as household consumption does then the spillover switches sign. In that case, a permanent balanced budget increase in domestic government spending rises real income and welfare abroad.

Secondly, in case of temporary balanced budget increases in the domestic country have similar effects on the levels of variables. However, the transmission mechanism is very different. While in the case of permanent changes, the tax effects determine the short as well as the long run model response, which is not true for cases of temporary fiscal measures.

Moreover, we have shown that world output and consumption return to their steady state level in the long run, given that a fiscal measure does not alter the permanent level of public spending. The long run effects of temporary fiscal measures depend on how they affect the distribution of world wealth. Thus, a temporary balanced budget increase in government spending does not affect the level of world output

and consumption in the long run, but it has an impact on the distribution of the world workload and globally available consumption goods.

The magnitude of changes in the distribution of world wealth and expenditure switching effects in the long run, in turn, depend on the cross-country substitutability which determines the scope for international lending and borrowing.

Thirdly, deficit spending is not equivalent to a temporary balanced budget increase in public spending. However, under our simple timing assumptions the transmission and welfare effects are identical as in case of a temporary balanced budget increase in domestic public spending but quantitatively smaller.

This is because although deficit spending implies an intertemporal dispersion of the cost and benefits of public spending this is just a shift by one period in our setting. Technically, deficit spending is a combination of a long run change in taxation and a temporary change in government spending which is not equivalent to a temporary balanced budget change in government spending.

Fourthly, a debt financed tax cut has no effects in Ricardian models. In our model, it affects the consumption decision of private households and domestic output. The reason for this is a redistribution of real income from the future to the current generations. Domestic households increase their demand for consumption goods. Production home and abroad increases in the short run. Depending on the assumptions we make on the expected lifetime of domestic households and their selfishness, a debt-financed tax cut can be welfare improving.

The spillovers are positive, foreign households benefit from an increased real income over all time horizons and thus lead to improved welfare.

Overall, our results are close to the empirical findings of Mountford and Uhlig (2005) as far as the domestic consumption and output response to fiscal measures are concerned. Under the assumption of no home bias in public spending, our results are close to empirical evidence provided by Beetsma et al. (2006) on spillovers of fiscal policy measures in Europe.

We conclude that the precise type and the financing decision matters for the transmission and spillover effects of fiscal policy in a monetary union. The predictions of Ricardian models can be misleading as this modelling choice restricts fiscal policy to balanced budget measures.

The *European Economic Recovery Plan* as well as the OECD (2009) rely on increases in public consumption, tax cuts targeted to households and public investment to stimulate the economy during the recent economic downturn. As we do not model investment, we focus on the national effects and spillovers of the first two measures, only. Moreover, we restrict our attention to the short run effects of fiscal policy.

In our model, a temporary debt-financed increase in public spending stimulates output and at the same time decreases consumption in the home country. The spillovers depend on the precise assumptions to the composition of public demand. If the government spends exclusively on national goods, the spillovers on foreign output and consumption are negative. However, although the spillovers on foreign consumption are still negative the assumption that the home government spends on home and foreign goods changes the sign of the spillover on foreign production. The latter is in accordance with the empirical evidence provided by Beetsma and Jensen (2005). Finally, we can state that the welfare effects of debt-financed increases are always negative and this in both countries.

A debt-financed tax cut stimulates domestic output and consumption and has positive spillover effects on both variables abroad. Moreover, in our model the before mentioned measure is the only policy capable of stimulating private consumption. The welfare effect of a debt-financed tax cut depends on the survival probability of households and how much they care for future generations. The result can be either positive or negative.

In the long run, both policies lead to increased taxation and welfare losses for future generations. We conclude that from our simple model's point of view the choice of policy measures employed to stimulate the economy depends on the macroeconomic

variable the government wants to target. If the government intends to stimulate private consumption, tax cuts are the only instrument at hand. Moreover, from a welfare perspective a debt-financed tax cut can be implemented in such a way so that it does not decrease the welfare of current generations.

However, one has to bear in mind that some of our results are driven by our simplifying assumptions. Therefore, we discuss some extensions and their potential effects on the results. Because of the solution technique we cannot evaluate fiscal measures such as deficit spending or tax cuts that are financed by decreases in government spending in the future. Such intertemporal balanced budget operations potentially improve welfare of the current as well as the future generation.

As we abstract from capital holdings, we cannot explore the effects of fiscal measures on private investment. Hence, an extension of the model to allow for capital and richer timing assumptions is the natural next step.

Chapter 2

A Blanchard (1985)-Yaari (1965) OLG model for fiscal policy evaluation

2.1 Introduction

How does fiscal policy affect private activity over the business cycle? More precisely, which fiscal instruments, if any, are appropriate to conduct stabilization policies? The recent economic downturn accompanied by massive and mostly debt-financed stimulus packages have forcefully increased public awareness in these questions. The European Commission (2008) suggests discretionary increases in public spending and investment combined with decreases in household taxation to halt the economic downturn.

The OECD (2009) which surveyed the discretionary fiscal measures taken in the wake of the recent economic downturn found that debt-financed expansions of government consumption, public investment in infrastructure and tax reliefs targeted at private households where implemented in virtually all member countries.

According to the OECD (2009), government consumption is expected to be the most effective discretionary measure in terms of output stabilization. When it comes to

policy advice, the OECD identifies fiscal measures which are expected to boost aggregate demand in the short run and strengthen aggregate supply in the long run at the same time. The OECD (2009) claims that public investment as well as decreases in household taxation yield such double-dividends.

Cwik and Wieland (2010) and Cogan et al. (2010) try to assess the impact of the stimulus packages released both in Europe and the US in 2009 by using quantitative macroeconomic models. They focus on the standard experiment in macroeconomic literature, i.e. an exogenous increase in public consumption which is financed by future taxation.

Cwik and Wieland (2010) and Cogan et al. (2010) ask whether public consumption is indeed capable of stimulating output by more than one-to-one, i.e. if there are Keynesian multiplier effects of public consumption. They find that increases in public consumption crowd out private consumption and investment which in turn mitigates positive effects on output. Thus, they find no support for the use of public consumption as an effective instrument to boost aggregate demand, that is there is no Keynesian multiplier effect of public consumption.

Although public consumption is expected to be the most powerful fiscal tool to stabilize aggregate demand in the short run, the assumed policies of Cwik and Wieland (2010) and Cogan et al. (2010) are, for various reasons, no realistic description of fiscal measures that are implemented in response to the recent economic downturn. Firstly, their results are based on the assumption that increases in public spending are financed by taxation.

Empirical evidence, e.g. the findings of Alesina and Perotti (1996) and von Hagen et al. (2001) do not support short run fluctuations in taxation. They find that in developed countries successful consolidations have predominantly been based on spending cuts. This view is confirmed by Corsetti et al. (2009) who also find that increases in public spending are financed by increased taxation and spending cuts in the medium and long run. In particular, the results of Corsetti et al. (2009) suggest

that the financing decision of the government has a strong impact on the behavior of households.

Secondly, the stimulus packages released in OECD member countries were rarely focused on government consumption. In fact, according to the OECD (2009), in the majority of member countries tax cuts where preferred over increasing public spending. Thus, restricting the attention to public consumption is likely to exclude important dimensions of the implemented policies to fight the recent economic downturn.

Moreover, a focus on standard models is questionable when it comes to the evaluation of fiscal measures. Consider an increase in government spending on goods in either the classical RBC model, e.g. Baxter and King (1993), or the standard new Keynesian model, e.g. Gali (2008) and you will find that increased government spending withdraws resources from the private sector. To offset the negative wealth effects, households increase their labor supply and demand less consumption goods which then leads to a decrease in real wages and an increase in output. These predictions of widely used standard models contradict a large body of empirical evidence. The issue of how fiscal policy affects key macroeconomic variables such as consumption and output is an active field of empirical research. Since the seminal contributions of Ramey and Shapiro (1998), Blanchard and Perotti (2002) and Mountford and Uhlig (2009), numerous empirical studies estimated the effects of fiscal policy shocks. The empirical work on fiscal policy is based on structural vector autoregressive (SVAR) methods. Fiscal policy is characterized by time lags in the decision process and sluggish implementation.

In view of the wide variety of fiscal instruments and possible financing schemes, the identification of exogenous fiscal policy shocks is the central issue in this literature. Blanchard and Perotti (2002) assume that because of the time-consuming process of fiscal decision making there is no discretionary interaction between fiscal policy and contemporaneous macroeconomic developments in high frequency data. In

quarterly data, the only contemporaneous interaction is due to automatic stabilizers. They model these interactions by institutional information, i.e. Blanchard and Perotti (2002) estimate the elasticities of automatic fiscal responses with respect to the macroeconomic variables included in their SVAR.

The SVAR approach suggested by Mountford and Uhlig (2009) does fully rely on the identification of fiscal policy shocks from the data. More precisely, they identify a fiscal shock from a two dimensional vector space which is spanned by a spending and a revenue shock by sign restrictions, e.g. a positive spending shock and a revenue shock of the same sign constitute a balanced-budget expansion of public spending. In doing so, Mountford and Uhlig (2009) implicitly rely on economic theory, i.e. an underlying model that delivers the imposed restrictions. Thus, their approach is an excellent test to compare the performance of competing theories. At the same instance, this is the major criticism of the method as there is no generally agreed theoretical model for fiscal policy transmission.

Another strand of research relies on the narrative approach suggested by Ramey and Shapiro (1998) who identify fiscal policy shocks in US data. They study contemporary newspapers in view of identifying several military build-ups as exogenous fiscal shocks. These are labeled as Ramey-Shapiro episodes in the subsequent literature.

There is a vast number of empirical studies that assess the effects of fiscal policy following the above mentioned three approaches. Surveys of the empirical literature can be found in Gali et al. (2007) and von Hagen and Wyplosz (2008). The empirical evidence suggests that the response of consumption and output to fiscal expansions depends on the financing decisions of the government.

Moreover, empirical estimates of the effects of fiscal spending expansions suggest that output and consumption increase in response to an increase in public consumption. They suggest an increase in employment and the results for the response of the real wage rate are inconclusive. In particular, there is no empirical evidence for the pronounced decrease in real wage rates as predicted by standard models.

The definition of public consumption in empirical literature is not homogeneous. In general, studies which are applying the approach of Blanchard and Perotti (2002) or Mountford and Uhlig (2009) define government spending as the sum of public consumption and investment. Studies that utilize the approach of Ramey and Shapiro (1998) are necessarily based on increases in public defense spending.

From these definitions only the latter corresponds to the assumption of purely dissipative government spending in standard models. The fact that the empirical evidence is difficult to reconcile with standard theoretical models is widely accepted. A number of researchers suggests theoretical models to overcome this contradiction. Cogan et al. (2010) address this issue by extending their quantitative model by so-called rule-of-consumers who have no access to financial markets. In doing so, they follow Gali et al. (2007). However, to obtain qualitative changes in the response of consumption to increases in public spending, Cogan et al. (2010) need to assume a very large share of credit-constraint consumers. In fact, the share of rule-of-thumb consumers estimated by Cogan et al. (2010) using US data does not change their results substantially.

We suggest a new Keynesian model that features finite lifespans modeled as an overlapping generations structure of the Blanchard (1985)-Yaari (1965) type. The model features nominal and real rigidities as well as private and public investment. The characteristic distortion of the Blanchard (1985)-Yaari (1965) OLG model is the introduction of uncertain lifetimes by a single parameter γ, the survival probability of households. If $\gamma < 1$ the model features failures of the Ricardian equivalence. A value of $\gamma < 1$ adds a wealth channel to the model that enables fiscal policy to affect household consumption by the intertemporal redistribution of income. In particular, if fiscal policy measures are financed by taxation, depending on the precise value of γ only a fraction of the tax burden falls on current generations.

We extend the analysis of fiscal shocks in two dimensions. Firstly, we allow for a wider array of fiscal instruments to stimulate the economy, both, on the spending-

and revenue side of the public budget. We allow for public consumption, tax cuts targeted directly to households and public investment in infrastructure.

Secondly, we assume a positive and constant level of public spending which is financed by distortionary taxation in the model equilibrium. Thus, the government is also able to decide on how to finance temporary fiscal measures. It may either decide to choose spending-side measures, i.e. cuts in public consumption, or decide to improve public revenues by increasing taxation.

Thus, our model allows for the evaluation of fiscal measures that are typically used in practice to halt and even reverse a recession. We ask whether we can confirm the effectiveness of such policies in a theoretical model.

We find that a temporary increase in public consumption always stimulates aggregate demand, increases hours worked and leads to a drop in the real wage rate. However, its effects on household consumption and private investment depend on the assumed financing strategy as well as failures of the Ricardian equivalence. If the increase in public consumption is financed by taxation, private investment is always crowded out. Consumption is decreased, if the Ricardian equivalence holds and is stimulated otherwise.

Financing of a temporary increase in public consumption by future spending cuts stimulates household consumption, no matter whether the Ricardian equivalence holds or not.

However, failures of the Ricardian equivalence affect the response of private investment which is increased in the standard model and crowded out otherwise.

Lump-sum subsidies that are financed by future taxation have no effect in a Ricardian model. Failures of the Ricardian equivalence allow this fiscal policy pattern to increase output and household consumption. Private investment as well as the real wage rate are decreased and we observe an increase in hours worked.

In cases where a lump-sum transfer to households is financed by future spending cuts output as well as private consumption and investment in a Ricardian model are

stimulated. However, failures of the Ricardian equivalence affect the impact of this fiscal choice on private investment, whereby the sign is reversed.

Finally, public investment has similar effects as a positive productivity shock in standard models. Output, consumption, private investment and hours worked are always increased while the real wage rate declines. These effects are only altered qualitatively when we assume that public investment is financed by spending cuts or when we allow for failures of the Ricardian equivalence.

In summary we find that the choice of the fiscal instrument as well as the financing decision have an impact on the effects of fiscal policy on key macroeconomic variables. The effect of the financing decision is at least as important as non-Ricardian behavior.

We conclude from that the policy advice of the OECD, which emphasizes the importance of the fiscal exit strategy is confirmed by our results. Moreover, the preferred choice of the majority of OECD countries not to focus their fiscal stimulus packages solely on public consumption, seems a reasonable choice from our model's point of view.

Finally, our results suggest that in order to estimate the effects of fiscal measures, it is crucial to identify the precise type of fiscal shock as well as the financing decision from the data.

This chapter is organized as follows: Section 2.2 sets out the closed economy Blanchard (1985)-Yaari (1965) OLG. In section 2.3, we analyze the positive aspects of fiscal policy measures which were implemented by a typical OECD member country in response to the recent economic turmoil. Finally, section 2.4 presents the conclusions and possible extensions of the model.

2.2 The Model

We suggest a discrete-time new Keynesian closed-economy model featuring capital accumulation as well as nominal and real frictions in goods and labor markets. We follow Erceg et al. (2000) and assume staggered wage and price setting of the Calvo (1983) type.

Households are introduced in the form of overlapping generations following the discrete-time version of the Blanchard (1985)-Yaari (1965) OLG by Frenkel et al. (1996). Individuals face a symmetric constant probability of death $0 < 1 - \gamma < 1$, share the same preferences and have no bequest motive. For analytical convenience, we assume that birth and death rates are equal. The total population is normalized to one.

A new cohort of $(1 - \gamma) \in [0, 1]$ of households is born in each period. The size of a generation born at time a in period $s \geq a$ is $(1 - \gamma)\gamma^{a-s}$, the expected lifetime of an individual household is $\frac{1}{1-\gamma}$. Failures of the Ricardian equivalence[1] are a well known property of this model setup. Households perceive issued government debt as net wealth if $\gamma < 1$. If the survival probability tends to unity households expect to live forever and the non-Ricardian features of the model vanish.

Following Blanchard (1985) and Yaari (1965), we assume the existence of a perfectly competitive life insurance market that solves the problem of unintended bequests. Insurance companies receive the financial wealth of deceased households and distribute it to the surviving members of the society.

[1] We refer to Ricardian equivalence to describe theories or/and models in which there are ***no real effects*** of the *financing decision* of a given amount of government spending on aggregate demand.

2.2.1 Households

A individual household $h \in [0,1]$ born in period a maximizes his utility over consumption C and leisure $(1-L)$ according to the certainty equivalent utility function

$$E_t U_t(h) = \sum_{s=t}^{\infty} (\gamma\beta)^{s-t} \left[\ln C_{a+s-t,s}(h) + \frac{\chi_0}{1-\chi} \left(1 - L_{a+s-t,s}(h)\right)^{1-\chi} \right]$$

where $\beta, \chi_0, \chi > 0$ and $\gamma \in [0,1]$. Preferences are homothetic and additively separable over consumption and leisure. The household's endowment of time in each period is normalized to one, therefore $(1-L), L \in [0,1]$ denotes leisure. The nominal individual flow budget constraint of a household of age a reads

$$\frac{\gamma D_{a,t}(h)}{1+i_t} - (1+\tau_t^c) P_t C_{a,t}(h) \leq D_{a-1,t-1}(h) +$$
$$(1-\tau_t^w) W_{a,t}(h) L_{a,t}(h) + P_t T_{a,t}(h) + (1-\tau_t^k) \int_0^1 \Pi_t(i) di + \Pi_t^k$$

where D denotes the individual holdings of government debt, τ^c, τ^k, τ^w are distortionary tax rates on consumption, capital and labor, T is a lump-sum transfer and i_t the nominal interest rate paid on bond holdings between t and $t+1$. Individual households receive equal shares of profits of intermediate goods producers $\int_0^1 \Pi_t(i) di$ and capital rental firms Π_t^k independently of age.
The assumption that productivity and consumption preferences are independently of age allows us to calculate per-capita variables by aggregating across ages and then dividing them by population size. Individual and per-capita variables coincide in the model. Variables without age a index denote per-capita values. The households optimizing behavior yields the per-capita consumption function

$$P_t C_t(h) = \frac{1-\gamma\beta}{1+\tau_t^c} \left[H_t(h) + \Omega_{a,t}(h) + D_{a-1,t-1}(h) \right] \tag{2.1}$$

where $\frac{1-\gamma\beta}{1+\tau_t^c}$ is the marginal propensity to consume out of total wealth

$$\Omega_t = \sum_{s=t}^{\infty} \psi_{t,s} \gamma^{s-t} (1-\tau_s^k) \left[\int_0^1 \Pi_s(i) di + \Pi_s^k \right]$$

the household financial wealth and

$$H_t = \sum_{s-t}^{\infty} \psi_{t,s} \gamma^{s-t} \left[(1-\tau^w) W_t L_t + P_t T_t \right]$$

the human wealth in per-capita terms. The present value factor is defined as

$$\psi_{t,s} = \begin{cases} \psi_{t,s} = 1 & \text{if} \quad s = t \\ \psi_{t,s} = \frac{1}{(1+i_t)\cdot\ldots\cdot(1+i_{t+s})} & \text{if} \quad s > t \end{cases}$$

The optimizing behavior of households implies the *Euler equation* for the optimal intertemporal allocation of consumption

$$(1+\tau_t^c) P_{t+1} C_{t+1} + \frac{1-\gamma}{\gamma} \frac{1-\gamma\beta}{1+\tau^c} D_t = (1+i_t)\beta(1+\tau_t^c) P_t C_t \tag{2.2}$$

We assume that each individual household h, independently of age, faces a downward-sloping demand curve for his individual skill

$$L_t(h) = \left(\frac{W_t(h)}{W_t}\right)^{-\phi} L_t$$

where $\phi > 1$ is the elasticity of substitution between differentiated labor inputs in production, L_t, W_t are the aggregate labor demand and wage rate and $W_t(h)$ is the per-capita wage rate. Individual workers have monopolistic power on the labor market as they supply a unique skill.
We follow Calvo (1983) and assume that in any period, a fraction of workers can reset their wages with probability $0 < (1 - \xi_w) < 1$. If a worker is not allowed to reset his wage rate, it is updated according to the rule

$$W_{t+j} = \pi^j W_{a,t}(h)$$

where π is the inflation target of the monetary authority. The optimal wage choice of an individual household that resets his individual wage rate in period t in per-capita terms reads

$$w_t(h) = \left(\chi_0 \frac{\phi}{1-\phi}\right) \frac{E_t \sum_{s=t}^{\infty} (\gamma\beta\xi_w)^{s-t} (1 - L_s(h))^{-\chi} (1 + \tau_s^c) C_s(h)}{E_t \sum_{s=t}^{\infty} (\gamma\beta\xi_w)^{s-t} (1 + \tau_s^k) w_s} E_t \sum_{s=t}^{\infty} (\gamma\beta\xi_w)^{s-t} \prod_{k=1}^{s-t} \Delta w_{t+k} \quad (2.3)$$

where $w_t = \frac{W_t}{P_t}$, $\Delta w_t^{-1} = \frac{\pi W_{t-1}}{W_t}$ and $w_t(h) = \frac{W_t(h)}{W_t}$ and the law of motion for the aggregate wage level reads

$$W_t = \xi_w \pi W_{t-1} + (1 - \xi_w) W_t(h)$$

2.2.2 Production sector

The production sector provides a homogeneous final good Y_t which can be either used for investment or consumption and consists of three sectors: capital rental firms, intermediate goods producers and a representative final goods producer. Capital rental firms demand the final goods and transform them into production capital that is used in the production of intermediate goods.

There is a continuum of intermediate goods producers. They demand capital and labor as productive inputs and combine them into differentiated intermediate goods which are supplied to a representative final goods producer. In the final production stage intermediate goods are transformed costlessly into the homogeneous final good.

The capital rental firm

A representative capital rental firm transforms the homogeneous consumption good into a capital good K which is used by intermediate goods producers as a productive input. We assume that each household holds an identical share of the representative capital rental firm. The capital rental firm maximizes the discounted value of its real profits

$$\frac{\Pi_t^k}{P_t} = \sum_{s=0}^{\infty} \left(\frac{1}{1+r_t}\right)^s \left[(1-\tau^k) r_{k,t+s} K_{t+s} - I_{t+s} - \frac{\kappa_k}{2} K_{t+s} \left(\frac{I_{t+s}}{K_{t+s}} - \delta\right)^2\right]$$

where $r_{k,t}$ is the real rental cost for capital, I_t real investment and K_t the capital stock. We assume quadratic capital adjustment cost which is a standard approach, common in the literature; see Adda and Cooper (2003) for a throughout discussion of the functional form and the related empirical literature. The parameter $\kappa_k > 0$ scales the capital adjustment costs, when used in production capital depreciates at rate $\delta > 0$. The law of motion for the capital stock is given by

$$K_{t+1} = (1-\delta) K_t + I_t \tag{2.4}$$

The first order conditions for capital and investment are given by

$$q_t = 1 + \kappa_k \left(\frac{I_t}{K_t} - \delta\right) \tag{2.5}$$

$$q_t = \frac{\frac{P_{t+1}}{P_t}}{1+i_t} \left[(1-\tau_{t+1}^k) r_{k,t+1} + q_{t+1}(1-\delta) - \frac{\kappa_k}{2} \left(\frac{I_{t+1}}{K_{t+1}} - \delta\right)^2 + \kappa_k \left(\frac{I_{t+1}}{K_{t+1}} - \delta\right) \frac{I_{t+1}}{K_{t+1}}\right] \tag{2.6}$$

where q_t is the Lagrangian multiplier of the firm's optimization problem which can be interpreted as Tobin's q.

Intermediate goods producer

A continuum of intermediate goods producers $i \in [0,1]$ combines capital and labor into a variety $y_t(i)$ of the intermediate good. In doing so, intermediate producers operate in three different markets: the market for intermediate goods, the labor market and the market for physical capital. Intermediate producers have no market power at labor and capital markets on which they act as price takers.
Intermediate producers supply a unique variety of the intermediate good. They have some monopolistic power in setting the price for their production. Intermediate producers maximize their profits given a constant returns to scale Cobb-Douglas production technology

$$y_t(i) = K_t(i)^{\alpha} L_t(i)^{1-\alpha-\theta_p} K_{p,t}^{\theta_p} \tag{2.7}$$

where $0 < \alpha + \theta_p < 1$. We allow for government investment in infrastructure $K_{p,t}$. The optimal combination of capital and labor for a given stock of public capital is obtained from cost minimization by intermediate producers

$$mc_t = \frac{r_{k,t}}{\alpha \frac{y_t(i)}{K_t(i)}} \tag{2.8}$$

$$mc_t = \frac{w_t}{(1-\alpha-\theta_p)\frac{y_t(i)}{L_t(i)}} \tag{2.9}$$

where w_t is the real aggregate wage rate and mc_t the real marginal cost which is symmetric across intermediate firms.
We assume staggered price setting on the intermediate goods market following Calvo (1983). An intermediate producer i can renew its price in any period of time with probability $1-\xi_p$. The probability that an intermediate producer i cannot reset its price in any period between t and $t+j$ is ξ_p^j. If an intermediate producer cannot update its pricing calculations, prices adjust according to the rule

$$P_{t+j}(i) = \pi^s P_t$$

The optimal pricing decision in period t is given by

$$P_t(i) = \frac{\theta}{\theta - 1} \frac{E_t \sum_{j=0}^{\infty} \psi_{t,j} \xi_p^s \left(\prod_{k=1}^{j} i_{t+k} mc_{t+j} Y_{t+j} \right)}{E_t \sum_{j=0}^{\infty} \psi_{t,j} \xi_p^s Y_{t+j}} \tag{2.10}$$

and the law of motion for the aggregate price level reads

$$P_t = \xi_p \pi P_{t-1} + (1-\xi_p) P_t(i)$$

The final good producer

A representative final goods producer transforms intermediate goods into a homogeneous final consumption good

$$Y_t = \left(\int_0^1 y_t(i)^{\frac{\theta-1}{\theta}} di \right)^{\frac{\theta}{\theta-1}}$$

using a CES technology. The final goods producer chooses its inputs $i \in [0,1]$ to maximize profits. The implied demand schedule facing the intermediate goods producer of variety i is given by

$$y_t(i) = \left(\frac{P_t(i)}{P_t} \right)^{-\theta} Y_t$$

Under the assumption of perfect competition on the final goods market, the final goods producer sets its price to ensure zero profits. Thus, the final goods pricing rule is given by

$$P_t = \left(\int_0^1 P_t(i)^{1-\theta} di \right)^{\frac{1}{1-\theta}}$$

2.2.3 The monetary and fiscal authorities

We focus on the effects of fiscal policy shocks. To facilitate the analysis monetary and fiscal policy are assumed to follow simple feedback rules. The monetary authority sets its instrument, the nominal interest rate i_t, according to the Taylor rule

$$i_t = \frac{1}{\beta} - 1 + \phi_\pi(\pi_t - \pi) \tag{2.11}$$

where $\pi = 0$ is the inflation target and $\phi_\pi > 1$ the Taylor coefficient on inflation stabilization. The central bank chooses a value for its policy parameter ϕ_π. For a given monetary policy the fiscal authorities decide on the level of taxation and public spending

$$G_t = G_{c,t} + I_{p,t} \tag{2.12}$$

where $G_{c,t}$ is the level of purely dissipative government consumption of goods and $I_{p,t}$ the level of public investment in infrastructure. Following the literature, public capital enters the production function of the intermediate goods sector. The law of motion for public capital $K_{p,t}$ is given by

$$K_{p,t+1} = (1 - \delta)K_{p,t} + I_{p,t} \tag{2.13}$$

where the capital depreciation rate is the same as in the private sector. For an extensive discussion of the modeling decision, see Romp and de Haan (2007).
Government revenues stem from distortionary taxes on consumption τ_t^c, wages τ_t^w, capital income τ_t^k, the level of a non-distortionary lump-sum tax/transfer T_t and issuing public debt. The real government flow budget is given by

$$\frac{d_{t-1}}{1+\pi_t} + G_t = T_t + \tau_t^w \frac{W_t}{P_t} L_t + \tau_t^c C_t + \tau_t^k r_{k,t} K_t + \tau^k \int_0^1 \frac{\Pi_t(i)}{P_t} di + \frac{d_t}{1+r_t} \tag{2.14}$$

where $d_t = \frac{D_t}{P_t}$ is real public debt. The model setup allows for a wide variety of possible fiscal policy measures. The government can decide on the level of public consumption, investment and a lump-sum tax or subsidy T_t or changes in distortionary taxation. There are different ways to finance a given level of public spending. Moreover, the financing decision itself affects the level of economic activity and thus overall tax revenues.
According to the OECD (2009), during the recent downturn, debt financed increases in public spending on goods and investment as well as debt financed tax cuts where among the most popular responses of OECD members. Further evidence for debt-financed tax subsidies to private households in the US which are intended to stimulate private consumption is provided by Sahm et al. (2010). In the short run, debt is the predominant financing choice in OECD countries.
In the long run, there are several instruments to decrease the level of public debt, e.g.

the government initiated spending cuts or changes in taxation. However, Alesina and Perotti (1996) and von Hagen et al. (2001) find that successful consolidations of public budgets have always been based on spending cuts. This view is confirmed by Corsetti et al. (2009) who also find that public spending responds to the state of public finances in a systematic way.
We assume that fiscal expansions are always pre-financed by debt for two reasons: Firstly, the fiscal shock is intended to stimulate the economy, whereby fiscal authorities postpone the financing decision to avoid a weakening of the desired effects by increased taxation. Secondly, debt finance allows the government to response to increased spending requirements rapidly by avoiding time consuming changes in taxation laws.
Fiscal policy enters the model as an exogenous change in the level of taxation, public investment or consumption. Fiscal shocks, e.g. a shock to government consumption

$$G_{c,t} = \rho G_{c,t-1} + \epsilon_t \tag{2.15}$$

evolve according to a AR(1) process where $0 < \rho < 1$ measures the persistence of the shock. We restrict our attention to the following set of expansionary fiscal shocks: A lump-sum subsidy to private households, increases in public spending on goods and public investment.
After one fiscal year, the government decides on the measures which it finds appropriate to return the level of the public debt stock to the assumed target by employing a simple feedback rule

$$Tax_t = \tau_t d_{t-1} + \tau^d (d_t - d) \tag{2.16}$$

with $\tau_t, \tau^b > 0$ which may imply changes in each of the tax rates or the level of public spending on goods and investment. If, for example, the government decides to use lump-sum taxation as its policy instrument, the above rule implies that $Tax_t = T_t$ for given target level of the public debt stock $d = 0$. Changes in public consumption or investment and distortionary taxation complete the set of possible fiscal instruments.

2.2.4 Dynamic equilibria and calibration of the model

The Euler equation for the optimal intertemporal allocation of consumption (2.2), the optimal wage choice of households(2.3), the law of motion for the capital stock (2.4), the first order conditions for capital and investment (2.5), (2.6) from the capital rental sector, the optimal pricing decision for intermediate goods (2.10), the optimal combination of capital and labor for a given stock of public capital (2.8),

(2.9) in the intermediate goods sector, the resource constraint of the economy

$$Y_t = C_t + I_t + G_t \tag{2.17}$$

coupled with the Fisher equation

$$1 + i_t = (1 + r_t) E_t \frac{P_{t+1}}{P_t} \tag{2.18}$$

and the government budget constraint (2.14) characterize the dynamic equilibria of the model in per-capita terms. The model is closed by the assumed feedback rules for monetary and fiscal policy.

We assume that the government provides a constant level of public investment as to maintain the public capital stock and consumes a constant amount of goods in equilibrium. Public spending and investment are constant in real terms. The precise level is determined by the choice of parameters; more precisely, the values for distortionary taxation in steady state. Thus, the public capital stock is constant in a zero inflation steady state.

It is well known that the model has a determinate equilibrium if $\gamma = 1$ and the government relies only on non-distortionary taxation, provided that the monetary policy follows the Taylor principle $\phi_\pi > 1$. Under these assumption the Ricardian equivalence holds and the policy problems of the monetary and fiscal authorities are separable.

According to Leeper (1991) and Woodford (1996), monetary policy is then active and fiscal policy passive, i.e. taxes or public spending respond sufficiently to the level of public debt and ensure that the intertemporal budget constraint of the government holds.

Leith and von Thadden (2008) show that this logic needs to be modified if $\gamma < 1$. The level of public debt does not only affect the intertemporal government budget constraint but enters all equilibrium conditions via the household Euler equation and therefore becomes a relevant state variable.

Leith and von Thadden (2008) show that the Blanchard (1985)-Yaari (1965) OLG with capital accumulation has determinate equilibria given that monetary and fiscal

policy follow simple rules as given by (2.11), (2.16) under certain conditions. More precisely, if the monetary policy is active and the policy instruments of the government are chosen such that $\tau \geq r, \tau^d \geq 0$, there exist locally determinate equilibria characterized by the assumed target level for public debt.

The model has no closed-form solution and is solved numerically by using DYNARE. The applied approach is a first order Taylor approximation around the steady state following the approach of Schmitt-Grohe and Uribe (2004).

The model is calibrated on a quarterly basis. A summary of the parameter values is given in Table 2.1. Regarding the parameters in the utility function we set the discount factor $\beta = 0.99$ and the Frisch elasticity of labor supply to $\frac{2}{\chi} = 0.5$. For the latter choice see the discussion in Domeij and Floden (2006). We assume that, in equilibrium, workers spend one third of their time endowment working.

In the production sector we assume a capital depreciation rate of $\delta = 0.025$ and set $\frac{1}{\kappa_k} = 0.04$ which is a conventional value for quadratic capital adjustment costs according to Adda and Cooper (2003).

In the Cobb-Douglas function, the elasticity of output with respect to private and public capital is set to $\alpha = 0.3$ and $\theta_p = 0.1$ respectively. The latter value is in the range of empirical estimates reported in the survey of Romp and de Haan (2007).

Our model features monopolistic competition in the goods and labor markets. We choose conventional markups of 10%. In the goods market, the average price duration is set to 4 quarters which corresponds to $\xi_p = 0.75$ and is in accordance with the empirical evidence, see Alvarez et al. (2006). Wage contracts last longer than price spells, we set $\xi_w = 0.83$ which implies one and a half year being the average duration of wage contracts. The assumption that wages are more sticky than prices is common in the literature, see Christoffel et al. (2009) or Corsetti et al. (2009) and the references therein.

For the Taylor rule describing the behavior of the common central bank, we assume a standard value of $\phi_\pi = 1.5$ for the Taylor coefficient. The distortionary

β	$2/\chi$	$2/\kappa_k$	δ	α	θ_p	ξ_p	ξ_w	τ^c	τ^w	τ^k	ρ	τ^d	ϕ_π
0.99	0.5	0.04	0.025	0.3	0.1	0.75	0.83	0.1	0.279	0.279	0.9	0.05	1.5

Table 2.1: Calibration of the model parameters

tax rates are set according to Andres and Domenech (2006) who estimate rates of $\tau^c = 0.1, \tau^w = 0.279, \tau^k = 0.279$ using European data.

For the persistence of public spending shocks, we assume $\rho = 0.9$. Again, this is a common choice in a quarterly calibration, see e.g. Corsetti et al. (2009). The fiscal authorities pre-finance spending measures by issuing public liabilities. The level of public debt is returned to the target level according to the rule (2.16) where we assume $\tau_t = r_t, \tau^b = 0.05$.

The first choice implies that the government finances interest payments fully by increased taxation or spending cuts. The second assumption implies that in each quarter, the government repays five percent of the above-target stock of public debt. This assumption is more ambitious than the proposals of the European Council for the Euro Plus Pact of 24/25 March 2011.

We are not aware of any existing empirical consensus for the survival probability γ. We assume three alternative values which are $0.95, 0.975$ and 1. These values imply expected per-capita planning horizons of 20 and 40 as well as an infinite number of quarters. Such an approach allows us to explore the effect of failures of the Ricardian equivalence on the decision making behavior of households.

2.3 Fiscal stabilization policies

We explore the effects of discretionary fiscal measures on output, consumption, labor, investment and the real wage rate as a function of the financing scheme chosen by the fiscal authorities. In doing so, we compare the effects of typical fiscal measures taken in the wake of the recent economic crisis, these are increased public consumption, investment and lump-sum transfers to households. Moreover, we evaluate two

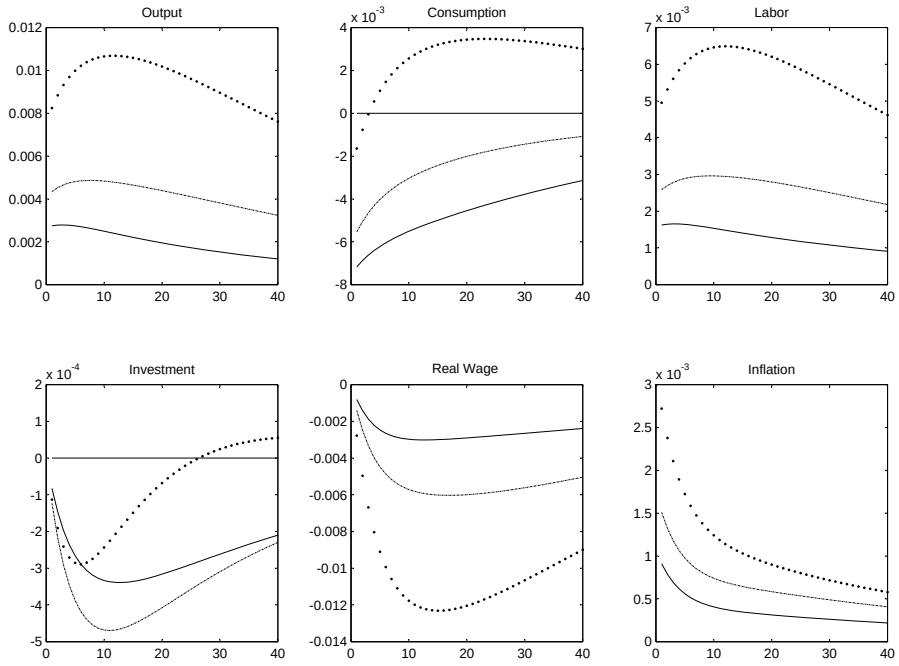

Figure 2.1: A increase in public consumption financed by lump-sum taxation.

alternative financing schemes, which are lump-sum taxation and spending cuts.

We investigate the effect of the characteristic distortion of the Blanchard (1985)-Yaari (1965) OLG, changes in the survival probability of individuals γ. Our interpretation of this parameter is that of a measure for myopia. We suggest $\gamma = 0.95, 0.975, 1$ implying planning horizons of either 20 and 40 or an infinite number of periods.

Up to our best knowledge there is no throughout evaluation as yet of how the macroeconomic impact of fiscal measures is influenced by the exit strategy of the government.

2.3.1 Government consumption

Changes in the level of government consumption are a central issue in the empirical literature on fiscal policy. Moreover, an exogenous increase in dissipative govern-

ment spending modeled as an exogenous AR(1) process is the standard experiment in the theoretical literature. According to the OECD (2009), it is also one of the policy patterns implemented by a typical member country during the recent downturn.

It should be emphasized that such a policy experiment is not necessarily equivalent to the definition of a government spending shock in the empirical literature where the corresponding shock is usually including public investment and wage spending. However, one exception from this practice is the approach of Ramey and Shapiro (1998). The so-called Ramey-Shapiro episodes are characterized by exogenous increases in public defense spending which corresponds to dissipative spending in theoretical standard models.

The government finances its increased spending on goods in advance by issuing public debt. We assume that, for legislative issues, the government decides on how to return the level of public liabilities to the target levels within four quarters. We start our discussion by assuming that the fiscal authority decides to use lump-sum taxation as the financing instrument. The numerical results are given in Fig. 2.1. As in all illustrations, the horizontal axes indicate the timepath of variables after the fiscal shocks measured in quarters. Variables are measured in deviations from steady state where solid lines refer to the Ricardian case , $\gamma = 1$, dashed lines and dotted lines refer to the alternative values of $\gamma = 0.975$ and $\gamma = 0.95$ respectively.

Under the assumption of Ricardian households $\gamma = 1$ the model reproduces the results of the standard new Keynesian model. A temporary increase in government consumption which is financed by an increase in future taxation implies a negative wealth effect. Households respond by adjusting their consumption plans downwards. The government finances its spending expansions in advance by issuing debt which implies an increase in the real interest rate, while private investment is crowded out. An increase in government consumption affects major components of aggregate demand. Public investment remains constant by assumption while public consumption

is increased. Ricardian households suffer from a decrease in future income as they have to carry the burden of future taxation in order to return the level of public debt to the target level.

We observe a persistent increase in output and labor demand. Labor income is the largest part of household income in the model. Households set their wages above the marginal disutility of labor in advance and are willing to supply their individual skills at this rate. Thus, households meet the increased demand for their individual skills for given wages and we observe an increase in hours worked. We assume staggered wage setting, thus households cannot adjust their wage calculations immediately.

In particular, the increased demand for final goods allows intermediate goods producers to demand higher prices. Prices adjust more frequently than wages with the effect that the real wage rate declines.

As a consequence, private consumption, the real wage rate as well as private investment decline. In the long run, as the government fully returns the level of public liabilities to the steady state level all, variables return to their initial values.

The assumption of uncertain lifetime $\gamma < 1$ alters the transmission of fiscal shocks. The modified Euler equation (2.2) implies that changes in the level of government debt affect all macroeconomic variables of the model as B_t enters the model as an additional state variable. The characteristic distortion of the Blanchard (1985)-Yaari (1965) OLG adds additional wealth channels to the model.

Household consumption demand (2.1) is a function of current and future total wealth where the weight of each component depends on the survival probability. Given the assumed exogenous increase in government consumption, the related increase in debt to pre-finance the increased spending as well as the increase in lump-sum taxation imply changes in per-capita total wealth.

Labor income is the largest fraction of total wealth. In the period of time during which the spending shock hits the economy total wealth is reduced as the decrease

in the real wage rate is not fully offset by increased labor demand. However, the increased level of public debt adds to total wealth.

One year after the fiscal shock, we witness taxes rising with the aim of reducing the level of public debt. As a fraction of households resets their wage in each period, labor income increases.

Depending on the assumed degree of myopia, the effects on total per-capita wealth of households can either be positive or negative and vary over time. However, even for the very brave assumption that households have a planning horizon of only five years, the initial impact on household consumption is negative.

The assumption of finite planning horizons mitigates the negative wealth effects of a tax-financed increase in public consumption. This is explained by the fact that a fraction of the increased tax burden falls on the shoulders of future generations. The stimulus of aggregate demand is more pronounced as compared to the baseline case which is featuring Ricardian households. However, to enable an initial increase in household consumption, i.e. a Keynesian multiplier effect of public consumption, we need to assume extremely myopic households.

This finding confirms the results of Gali et al. (2007) who assume that some households have no access to financial markets and spend their income in a hand-to-mouth fashion. However, to obtain a positive response of private consumption to a tax-financed increase in dissipative government spending, the share of such rule-of-thumb consumers in the economy has to be very large. A finding that is also confirmed by Cwik and Wieland (2010).

One major result of our policy experiment is that myopia of households mitigates negative response of private consumption and investment compared to the case of Ricardian agents.

We explicitly assume that government spending in steady state is positive and financed by constant distortionary tax rates. Thus, we observe that depending on its effects on macroeconomic variables, the tax-financed increase in public consumption

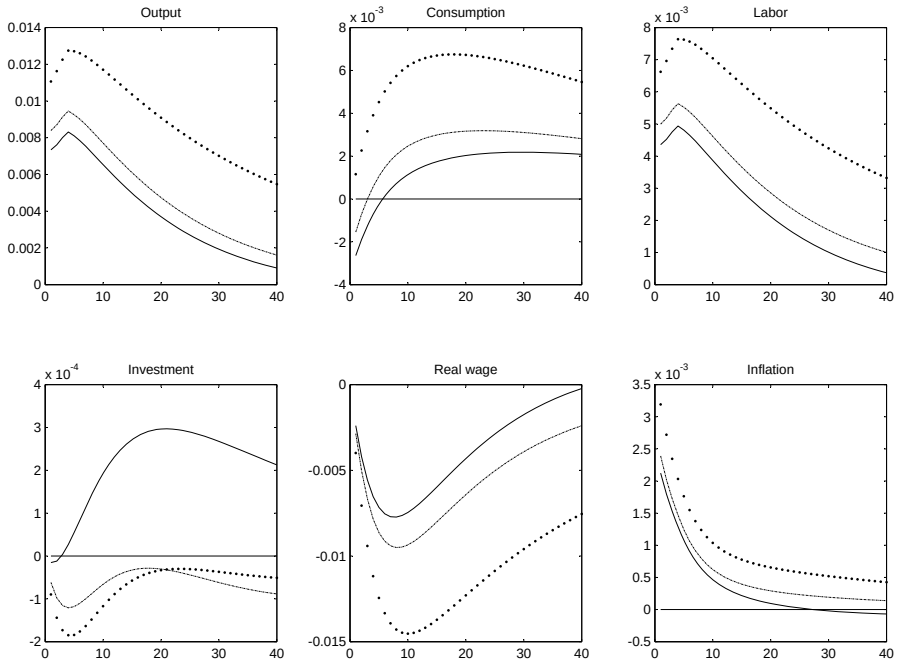

Figure 2.2: A increase in public consumption financed by spending cuts.

is self-financing to some degree.

The reason is that changes in household consumption, investment and labor income directly affect government revenues from distortionary taxation. Additional revenues from distortionary taxes are used to finance debt services. Thus, the increase in lump-sum taxation required as to finance the expansion of public consumption is decreased compared to a model that has zero government spending in steady state. Moreover, this property of the model is convenient as it allows to assess as to which extend fiscal expansions are self-financing. The argument that by expansionary fiscal policies can be financed by the implied increase in consumption and output, i.e. an increased tax base, is frequently used in the political discussion.

If a fiscal measure is taken with the prospective as to increase economic activity, the exit strategy might influence the expansionary effects. Again, the government decides to return the level of accumulated debt to target according to the simple

feedback rule (2.16). However, instead of lump-sum taxes the government implements spending cuts as its policy instrument. The numerical results are given in Fig. 2.2.

If the government decides to finance additional current spending by decreasing future spending on goods, the effects of fiscal policy on aggregate demand substantially change over time. In the period of time during which the public spending shock hits the economy, the public demand for goods is increased above the steady state level. Public debt is increased and the government starts to use part of the current budget to cover debt services.

The latter measure weakens the expansionary effect of increased public consumption on aggregate demand. Moreover, the increase in government consumption decreases over time depending on the persistence of the underlying AR(1) process. With a lag of four quarters, the government starts to repay the accumulated public debt. Depending on the choice of the fiscal policy parameter τ^d government consumption is reduced over time.

The direct effect of government consumption on aggregate demand is expansive on impact and becomes negative over time, depending on the persistence of the spending shock and parameter choice in the fiscal feedback rule.

Again, we start the discussion of the effects of fiscal policy with the Ricardian case. The increase in public consumption boosts aggregate demand as discussed above. However, the responses of private consumption and investment substantially differ as compared to the case of a tax-financed increase in government consumption.

We observe an immediate decline in household consumption. With a time lag of six quarters, the response of private consumption turns positive. The same is true for private investment. However, private investment is decreased for one quarter of time and persistently increased from the second quarter onwards.

Financing public consumption by a reduction of spending in the future, does substantially alter the wealth effects of the assumed policy measure. As the level of

public debt is decreased by spending cuts while increased revenues from distortionary taxation are used for the same purpose, Ricardian households benefit from positive wealth effects.

However in the initial quarters, the effect on household income is negative as the implied decrease in the real wage rate is not fully compensated by increased labor demand. Labor income is decreased. As soon as households are allowed to adjust their wage-setting decision, this effect vanishes.

In the medium and long run, households benefit from increased labor income and interest payments on government bonds which are in their portfolios. Thus, consumption and investment increase. Households use their increased income to consume and save more. In the long run, all variables return to the initial steady state.

Household myopia has strong effects on this transmission mechanism. Finitely-lived households are exposed to different wealth effects as their expected total wealth is calculated over a finite number of future time periods. Moreover, non-Ricardian households perceive government debt as net wealth and do not necessarily survive until the government has returned the level of public liabilities to the initial level.

Non-Ricardian households suffer more by the losses in labor income and benefit less from interest payments implied by the assumed financing strategy. However, their total wealth is increased which allows them to adjust their consumption plans upwardly. They consume more but do not necessarily increase their saving by the same amount as Ricardian households do. Moreover, the real interest rate is increased by the public demand for capital to finance the increase in public spending. Thus, private investment is crowded out. The output stimulus is larger than in the case of Ricardian households and the same is true for the increase in hours worked. Moreover, the decrease in the real wage rate is more pronounced, too.

As a consequence, the fiscal expansion does stimulate aggregate output substantially. The fiscal stimulus is self-financing to a larger degree than under the alternative financing scheme of levying taxes. In particular, the response of private investment

allows us to identify the appropriate modelling assumption, that is either Ricardian or non-Ricardian households in empirical data.

In summary, we find that assuming finite horizons alters the impact of fiscal policy on macroeconomic variables in cases where policy measures imply changes in the intertemporal distribution of household income. In general, financing additional public demand for goods by taxation is effective, if the government intends to increase output. However, if the government tries to stimulate household consumption, choosing future spending cuts is the superior choice.

In any case, to enable the model to predict Keynesian multiplier effects of public consumption we need to assume a very low value for the survival probability γ, or in other words, take it that households are very short-sighted.

We conclude that it can be very misleading to ignore the financing decision of the government when evaluating the effects of fiscal stimulus packages in theoretical models. A result that is confirmed by the work of Corsetti et al. (2009). However, as discussed above, stimulus packages implemented in practice are rarely restricted to changes in public consumption.

2.3.2 A lump-sum transfer to households

According to the OECD (2009) direct transfers to consumers were frequently part of the stimulus packages implemented in response to the recent economic downturn. Moreover, Sahm et al. (2010) report two lump-sum subsidies to US consumers over the last decade.

Hence, we are interested in the predictions of our model. We assume an exogenous increase in lump-sum transfers. The government finances the subsidy in advance by public debt. With a time lag of four quarters, the level of public liabilities is returned to the target level according to the fiscal feedback rule (2.16). Again, we compare two different financing instruments, these are lump-sum taxation and spending cuts in public consumption.

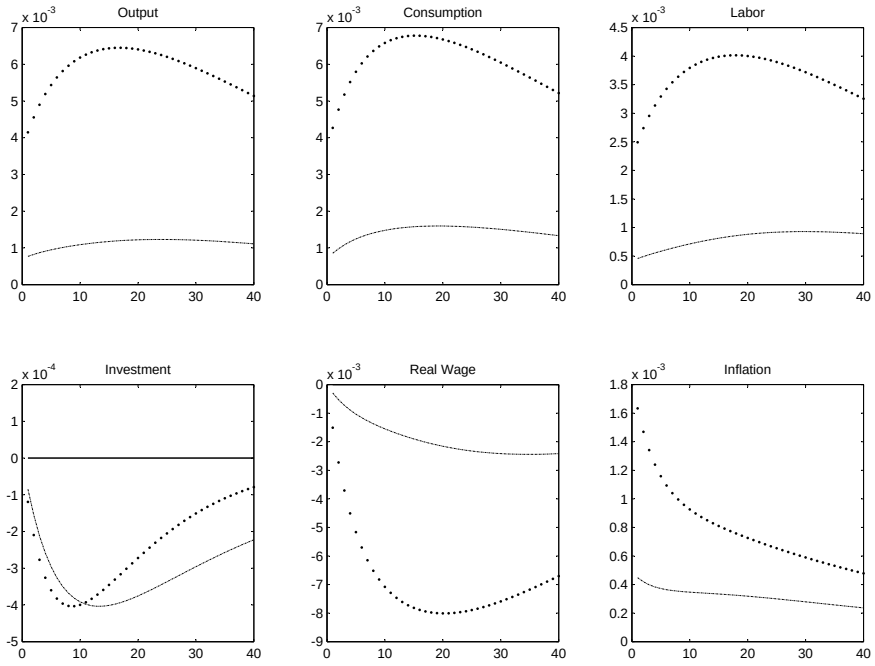

Figure 2.3: A lump-sum subsidy to households financed by future taxation.

For the time being, we assume that public liabilities are returned to the target level by using lump-sum taxation as the policy instrument. The numerical results are given in Fig. 2.3. Lump-sum subsidies financed by future lump-sum taxation are an intertemporal redistribution of income. Current generations receive a subsidy which is financed by future taxation. The expansive effects depend entirely on the consumption-savings decisions of households.

If $\gamma = 1$, the Ricardian equivalence holds. We observe no effects on macroeconomic variables except for changes in public liabilities and lump-sum tax rates.

If households face uncertain planing horizons, public debt enters the model's equilibrium conditions through the modified Euler equation (2.2) and becomes a relevant state variable. Non-Ricardian households perceive public debt as net wealth.

In the initial equilibrium, the level of public spending equals its revenues from distortionary taxation. From the time period onwards at which the fiscal shock hits

the economy we observe two effects on the level of lump-sum taxes: Firstly, the temporary subsidy which follows an AR(1) process and diminishes over time. Secondly, the government starts to finance the subsidy by issuing debt and levying lump-sum taxes to pay the debt service.

With a time lag of four quarters, the government starts to return the level of public debt to the target level which implies a further increase in lump-sum taxation.

Thus, the effect of a lump-sum subsidy on total wealth is positive in the beginning and turns negative as soon as the taxes levied to return the level of public liabilities exceed the subsidy. The lower the probability to survive, i.e. the more pronounced the assumed myopia of households, the stronger is the positive effect on total wealth. Wealth effects entirely depend on γ. Non-Ricardian households take the opportunity and use the additional income to increase their consumption.

Apart from these effects on total wealth the fiscal shock affects the economy also via a second channel, its effects on the real interest rate. The increase in public liabilities drives real interest rates up which crowds-out private investment. Overall, aggregate demand is increased.

Firms increase their production and demand more labor. Moreover, producers take the opportunity to adjust their prices upwards. As labor is demand driven we observe an increase in hours worked. Because the adjustment of wages is more sluggish than price adjustment, the real wage rate declines.

In the long run, the level of public debt is returned to the target level and the model returns to the initial steady state.

We conclude that a lump-sum subsidy financed by lump-sum taxation is only effective if we assume failures of the Ricardian equivalence. If households behave in a non-Ricardian manner it boosts aggregate demand by stimulating private consumption.

We evaluate the impact of the financing decision by assuming the temporary lump-sum subsidy which is financed by future spending cuts, see Fig. 2.4.

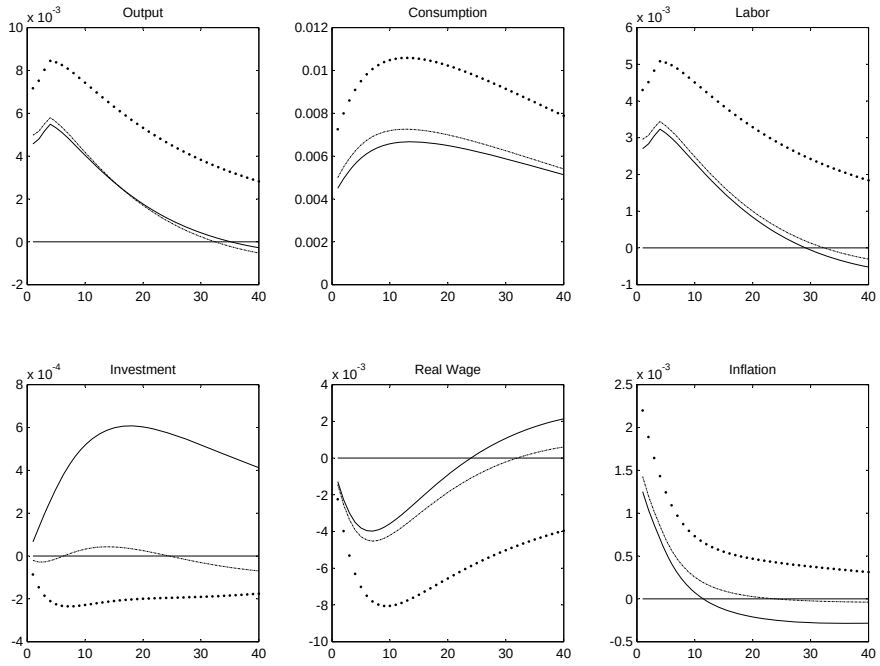

Figure 2.4: A lump-sum subsidy to households financed by spendings cuts.

If the government decides to finance additional current spending by decreasing future spending on goods, the overall effects of fiscal policy on aggregate demand as well as the wealth effects on private agents are substantially altered.

The financing of current subsidies by future spending cuts changes the impact on the economy in two dimensions: Firstly, the fiscal measure corresponds to a temporary balanced-budget tax cut. The measure is pre-financed by debt and the spending cut postponed to the future. Secondly, financing tax cuts by future cuts in government demand implies a decrease in future public demand and therefore aggregate demand for final goods in the future.

We start the discussion with the assumption of Ricardian households. These recognize that the assumed policy implies an increased income. Thus, they adjust their consumption plans upwards. Moreover, the increased demand for goods drives production and therefore labor demand upwards.

Households supply labor at given rates. Thus, hours worked increase. As wages are adjusted less frequently than prices, we observe a decrease in the real wage rate. Overall, Ricardian agents use their additional income to consume and save more in the short run. Aggregate demand is increased.

However, as the government finances the lump-sum subsidy by spending cuts we observe a decrease in aggregate demand with a time lag of more than 30 quarters. The same is true for hours worked. As soon as the government has returned public liabilities to the target level all variables return to their steady state values.

For non-Ricardian households the overall effects are similar. However, the transmission mechanism is not the same as public debt enters the equilibrium conditions of the models via the per-capita Euler equation. Thus, the positive wealth effects on current generations are more pronounced. We observe a stronger boost of aggregate output and labor demand in the short and medium term.

The key difference between Ricardian and non-Ricardian households is the response of private investment. We observe that household spending on investment goods is decreased compared to Ricardian households.

The response of private investment even becomes negative for low values of γ. The reason for this development is, that the finite life expectancy of non-Ricardian households do not expect to survive until the level of public liabilities is returned to the initial level. Thus, they do not expect to experience future periods in which public spending is cut and aggregate demand and therefore labor income falls below the equilibrium level. Consequently, finitely-lived households save less to smooth future consumption.

In summary, a tax-financed lump-sum subsidy to households is only effective in terms of boosting aggregate demand if households behave in a non-Ricardian manner. However, if the Ricardian equivalence holds, the government still can stimulate private consumption and therefore aggregate demand. This implies that the government decides to finance these measures in times of economic distress by future

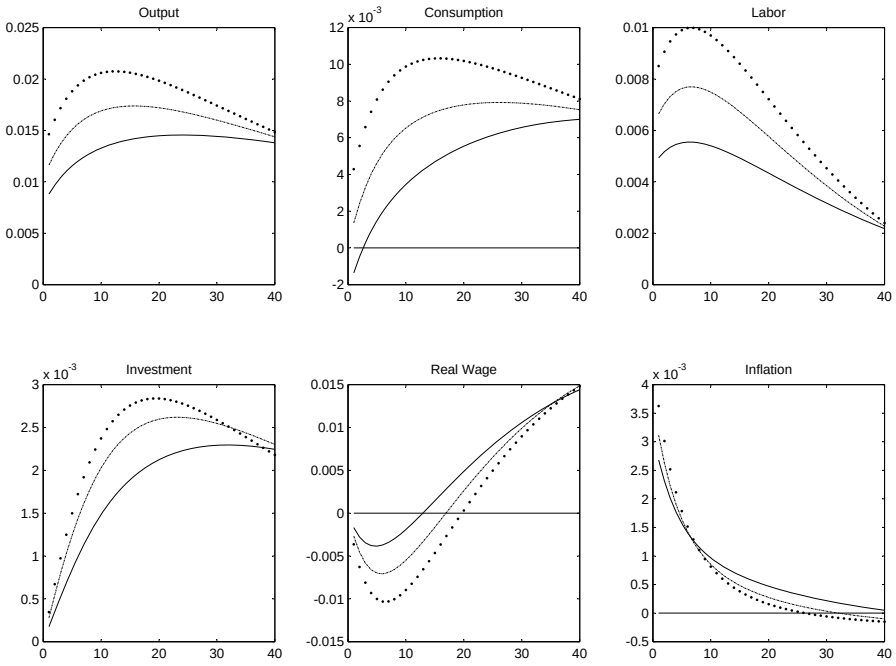

Figure 2.5: A increase in public investment financed by future taxation.

spending cuts.

Thus, the exit strategy as well as the intertemporal optimizing behavior of household matters for the effect of debt-financed tax cuts. Moreover, this result carries over to the case of distortionary taxation, e.g. a temporary cut in labor income tax financed by future spending cuts.

In particular, a tax cut is more effective in stabilizing private consumption while in terms of stabilizing employment government consumption and tax cuts perform well. However, in both cases the myopicness of households as well as the financing decision of the government have a large impact on the stabilizing properties of fiscal policy.

2.3.3 Public investment

Public investment in infrastructure was part of virtually all stimulus packages released as response to the current economic crisis. We assume an exogenous shock to public investment accordingly and compare two alternative exit strategies which are taxation and spending cuts.

Up to our best knowledge, the impact of spending cuts as a potential financing decision on public investment is evaluated for the first time. We wish to emphasize that, with the exception of the Ramey-Shapiro approach, public investment is part of the empirical definition of government consumption.

However, there are other theoretical models allowing for the assessment of public investment. Our approach to public investment is similar to that of Linnemann and Schabert (2006). In their model households are Ricardian and public investment enters as a flow into the production function of the private sector. However, Linnemann and Schabert (2006) abstract from private investment and the possibility of spending cuts as to finance public investment. We start our discussion assuming that the fiscal authorities decides to use lump-sum taxation as the preferred financing instrument, see Fig. 2.5.

Under the assumption of Ricardian households, the results are similar to the effect of a positive productivity shock in the standard RBC/new Keynesian model. Public investment increases productivity in the intermediate goods sector. For each combination of the productive private inputs, capital and labor, the firm sector produces more of the final good.

Households use their increased income to consume and save more. The reason is that they anticipate increased future taxation as to finance that policy measure. While public consumption remains constant, we observe a pronounced increase of aggregate demand.

The latter, once again, implies an increased demand for labor and, by less frequent adjustments of wages, a decrease in the real wage rate. However, the increase in

consumption demand of Ricardian households comes along with a time lag. The reason for such a phenomenon is that households suffer labor-income losses by the decrease in real wages. They adjust their consumption plans as soon as they have an opportunity to adjust their wage calculations.

Similar to the prediction of the standard RBC/New Keynesian model for a temporary productivity shock, we observe that output, consumption, investment and labor all rise above their equilibrium values.

By the same mechanism as outlined above, the assumption of uncertain lifetime $\gamma < 1$ alters the transmission of fiscal shocks. Consumption demand is a function of current and future total wealth. Given the assumed exogenous increase in public investment, the related increase in debt as to pre-finance the increased spending and the increase in lump-sum taxation imply changes in per-capita total wealth after four quarters of time.

The crucial difference is, once again, that finite lifetimes imply that households do not expect to survive long enough to pay the full amount of taxation required as to return the level of public debt to its target level. Thus, all effects described above are more pronounced and, they increase as a function of decreasing life expectancy or myopia.

If the government decides to choose cuts in the budget for public consumption in order to finance a temporary increase in public investment, we observe similar effects, see Fig. 2.6.

A temporary increase in public investment does increase the production possibilities in our model economy. Assuming that the government finances this measure by decreasing future public consumption, the negative wealth effects of this policy choice diminishes.

Although a decrease in future public demand reduces aggregate demand for final goods in the future, the implied income loss is smaller than in case of increased taxation to finance the same policy pattern. As a consequence, Ricardian households

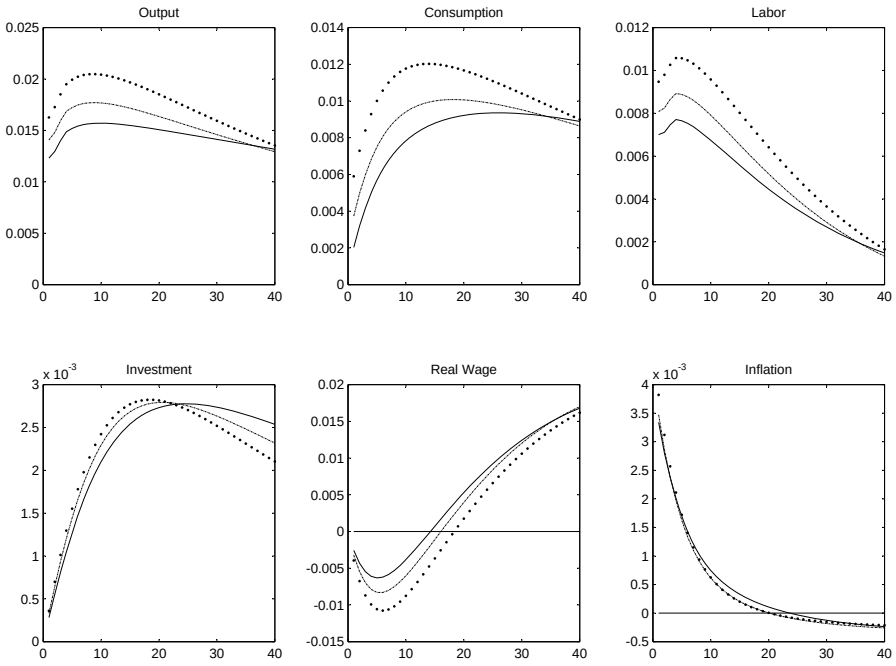

Figure 2.6: A increase in public investment financed by spending cuts.

increase their demand for consumption and investment purposes.

Again, if we assume uncertain planning horizon of households the response of macroeconomic variables to a boost in public investment is more pronounced.

Again, we observe that output, consumption, investment and labor all rise above their equilibrium values. The real wage rage is decreased because wages adjust less frequently than prices. However, after a period of three to five years, depending on the assumed value of the survival probability, real wages rise above the equilibrium level.

In summary, public investment is a powerful instrument to stimulate aggregate demand and, in particular, household consumption. If the government decides to finance public investment by decreasing future government consumption, the stimulus is amplified.

Contrary to the case of public consumption we find that public investment does

yield Keynesian multiplier effects. In particular, we find that these effects are robust under different assumptions regarding the financing decision of the government. We also found that these effects do not crucially depend on the assumed degree of household myopia. However, if public investment is financed by future cuts in public consumption, the Keynesian multiplier on output is more pronounced.

We find that the exit strategy together with the intertemporal optimizing behavior of households influence the effects of public investment. Failures of the Ricardian equivalence have only small quantitative effects, unless these are very pronounced.

2.4 Conclusions

In this paper we study the effects of fiscal policy on macroeconomic variables. We focus on the response of output, consumption, hours worked, private investment and the real wage rate to fiscal shocks as a function of the financing decision of the government.

We compare various fiscal instruments that are deployed in response to the recent economic downturn: government spending on goods, tax cuts targeted at households and public investment. Moreover, we explore how failures of the Ricardian equivalence alter the transmission of fiscal policy shocks in a closed economy model which is featuring sticky wages and prices.

We find that government spending shocks always stimulate output. We observe a decrease in the real wage rate and an increase in hours worked. However, the effect of decreased real wages dominates and households suffer from an income loss as labor income is the major fraction of private income.

Important components of aggregate demand such as household consumption and private investment are sensitive to the assumed financing strategy as well as to the assumed value of the survival probability.

If we assume that public consumption is financed by increased taxation households

adjust their consumption plans downwards and private investment is crowded out unless we assume that households are very short-sighted.

An increase in public consumption that is financed by future spending cuts does always stimulate output and household consumption. Private investment is crowded in unless we assume large deviations from Ricardian behavior.

More importantly, under the assumption of a tax-financed increase of public consumption, we require a degree of household myopia that cannot be confirmed in the data to enable public consumption to stimulate private consumption. The alternative financing decision of future spending cuts enables the government to stimulate output and private consumption at the same time, no matter if households behave in a Ricardian manner or not. However, for both cases we observe Keynesian multiplier effects only if we assume unrealistically short-sighted household behavior.

The effect of a lump-sum subsidy to households is highly sensitive to both, the assumed value of the survival probability γ as well as to the financing decision of the government. A lump-sum subsidy financed by lump-sum taxation has no effect on the behavior of Ricardian households. Only if we assume failures of the Ricardian equivalence, such a measure affects the consumption-savings decision of households. In general, lump-sum subsidies to households stimulate private consumption if $\gamma < 1$. This effect is independently of the exit strategy. However, if such subsidies are tax-financed the positive effect on consumption is mitigated by the negative wealth effects of increased taxation. In case of financing direct transfers by future cuts in public spending the response of private consumption is always positive.

Finally, public investment does have similar effects as a positive productivity shock in standard RBC and new Keynesian models. Generally, public investment increases productivity. Households use their increased income to consume and save more and we observe a Keynesian multiplier effect.

This is the case for all possible values of the survival probability γ and independent of the financing decision. The effect is more pronounced, if public investment is

financed by future spending cuts.

In summary, we find that assuming finite horizons alters the impact of fiscal policy on macroeconomic variables in cases where policy measures imply changes in the intertemporal distribution of household income.

However, in cases where we cannot observe Keynesian multiplier effects in the Ricardian baseline scenario, we need to assume unrealistically short-sighted household behavior to enable fiscal measures to increase output by more than one-to-one. On the other hand, Keynesian multiplier effects can be observed by deviating from the standard policy experiment of a tax-financed increase in public consumption. An extension of the model to allow for public investment, does allow for Keynesian multipliers even in the Ricardian case. Moreover, extending the set of fiscal instruments shows that these are more pronounced if public investment is financed by future cuts in public consumption.

In general, financing additional public demand for goods by taxation is effective, if the government intends to increase output. However, if the government tries to stimulate household consumption, choosing future spending cuts is the superior choice. We conclude that it can be very misleading to ignore the financing decision of the government when evaluating the effects of fiscal stimulus packages in theoretical models.

Thus, our results support the policy advice of the OECD (2009), which also emphasizes the importance of the financing decision of the government. We find that measures such as increases in public investment and tax cuts which are targeted at households have indeed the potential to yield double-dividends. In particular, this is the case when these measures are financed by future spending cuts.

Our results suggest that a single deviation from the standard model, e.g. failures of the Ricardian equivalence, is not sufficient to reconcile theory and empirical evidence.

Regarding empirical work, we conclude that an identification scheme for fiscal shocks

that abstracts from the financing decisions of the government, may lead to misleading empirical results. In particular, in cases where fiscal expansions are financed by a combination of spending cuts and increased taxation this might lead to inconclusive empirical results. The approach of Mountford and Uhlig (2009) seems well suited to put the sign restrictions implied by our model to an empirical test.

Chapter 3

Fiscal stabilization policies in a monetary union

3.1 Introduction

In response to the economic turmoil caused by the financial crisis of 2007, on November 26, 2008, the European Commission initiated a co-ordinated fiscal policy response of the European Union, the European Economic Recovery Plan (EERP) to halt the economic downturn. This fiscal stimulus package had a volume of approximately 200 billion euros which corresponds to 1.5% of the union-wide GDP.

The major objectives of the Commission were to stabilize employment, strengthen the purchasing power of European consumers and to invest in Europe's future in the form of public investment programs. The Commission emphasized the importance of a co-ordinated approach in which, depending on their fiscal position, all member states were encouraged to launch national fiscal stimulus packages simultaneously.

The approach of the Commission reflects central institutional characteristics of the EU. The EU member states are highly integrated by the single European market. Moreover, seventeen EU member states form the European monetary union (EMU) and share a common currency.

Despite this deep integration, there is no substantial union budget which would al-

low for the launch of a union-wide fiscal stimulus package. Instead, the Commission had to rely on the member states' willingness to implement fiscal policy measures at national level. The European Commission expected substantial spillovers from national fiscal stimulus packages. The co-ordination of fiscal policy was expected to amplify the expansionary effects of fiscal policy and to avoid free riding problems at the same time.

Regarding the composition of individual national stimulus packages, the Commission suggested a combination of public spending increases and tax cuts targeted at households. In fact, increasing public investment was the most favored fiscal measure with an emphasis on improving Europe's infrastructure in view of strengthening economic growth in the long run.

The effects of fiscal policy on key macroeconomic variables such as consumption, employment and output are a lively field of empirical research. The predominant approaches trace back to the seminal work of Blanchard and Perotti (2002) and Mountford and Uhlig (2005, 2009) which all are based on structural vector autoregressive (SVAR) methods in order to identify fiscal shocks directly in high frequency data.

The alternative narrative approach suggested by Ramey and Shapiro (1998) identifies fiscal policy shocks in the US by the study of contemporary newspapers. They find several exogenous fiscal shocks in the form of military build-ups.

The empirical work on fiscal policy shocks is strongly focused on shocks to government consumption. In general, with the exception of Ramey and Shapiro (1998), spending shocks always include public consumption and investment.

Following these seminal contributions, numerous researchers contributed to this empirical literature over the last decade. Excellent surveys of the empirical results and the related methodological issues are provided by Perotti (2007), Gali et al. (2007) and von Hagen and Wyplosz (2008).

The main results are that the effects of fiscal policy depend on the choice of instru-

ments, e.g. public consumption or investment and the related financing decision. Regarding an increase of public consumption, the empirical literature reached the conclusion that output, consumption and employment rise. We conclude that the empirical literature renders some support to the idea of fiscal stabilization policies advocated by the European Commission in the EERP.

The EERP includes a wide set of fiscal instruments which are affecting the spending side as well as the revenue side of the public budget. Furthermore, the EERP implicitly assumes that a specific fiscal instrument is appropriate to stabilize a particular macroeconomic variable. The expectation that public consumption increases national output or that tax cuts increase household demand are examples for this approach.

The major objective of the EERP according to European Commission (2008) was the stabilization of output. Fiscal measures targeted to stabilize employment and private demand where suggested to further strengthen the expansive effects of public consumption and investment on output.

Thus, the impact of fiscal measures on national output is a key criterion for the evaluation of fiscal policy. Implicitly, the EERP assumes that the costs of fiscal policy in terms of debt and ultimately increased future taxation or spending cuts are smaller than the benefits in terms of increased output.

The idea that fiscal policy has the power to increase aggregate demand more than one-to-one is known as Keynesian multiplier effect. In Keynesian models, aggregate demand consists of private demand for consumption and investment, net exports and public consumption. Private demand is a function of current after-tax income. Thus, a debt financed increase in public spending increases aggregate demand more than one-to-one as private demand is crowded in.

Modern economic standard models are based on the optimizing behavior of agents. The classical RBC models (e.g. Baxter and King (1993)) as well as standard new Keynesian models (e.g. Gali (2008)) predict that an increase in public spending

does stimulate aggregate demand but the effect is mitigated by decreases in private consumption.

The key to this prediction is the validity of the Ricardian equivalence. It implies that debt and lump-sum taxation are equivalent financing instruments. Fiscal policy enters standard models typically as an exogenous shock where debt and taxation are the only financing instruments of the government. Thus, an increase in public demand always implies a decrease in permanent income. Households respond by adjusting their consumption plans downward and work more to offset the income loss.

These assumptions potentially ignore important dimensions of fiscal policy measures that were implemented during the recent downturn. This does also apply to a large part of the empirical evidence. Fiscal policy measures which aimed to mitigate the recent economic turmoil were not restricted to the spending side of the public budget but included increased public spending as well as temporary tax cuts targeted at households. In particular, spending increases and tax cuts were regularly implemented simultaneously and financed by public debt. Interestingly, a debt-financed tax cut, among the measures expected to halt and even reverse an economic downturn will have no effect at all in standard models of fiscal policy.

Moreover, quite contrary to the standard modelling choice of an exogenous spending process, the empirical evidence suggests that public spending responds to the state of the economy in a systematic way. Estimating fiscal policy rules Gali and Perotti (2003) find that public spending does respond to the state of public finances, in particular, the accumulated stock of public liabilities. A finding which is confirmed by the earlier work of Alesina and Perotti (1996) and von Hagen et al. (2001) who find no empirical support for the assumption of short run fluctuations in tax rates as to balance the government budget. They find that successful consolidations are predominantly based on spending cuts.

Corsetti et al. (2009) find that increases in public spending are financed by increased

taxation and spending cuts. According to them, fiscal expansions are followed by decreases in public spending below the trend. A phenomenon labeled as spending reversals by Corsetti et al. (2009).

The effects of fiscal policy are not restricted to the implementing country but have implications also for their trading partners. Beetsma et al. (2006) estimate the spillovers from fiscal shocks via trade flows in Europe. They find that fiscal expansions boost economic activity in the implementing country and have substantial positive spillover effects on its trading partners.

A number of researchers aim to reconcile the predictions of theoretical models with empirical evidence. The predominant approach follows the suggestion of Gali et al. (2007) who allow for failures of the Ricardian equivalence by assuming that a fraction of households cannot participate in credit markets.

These so-called rule-of-thumb consumers spend their disposable income in each period of time. However, their approach depends crucially on the choice of parameters, i.e. the share of credit constraint consumers. The main objective of Gali et al. (2007) is to enable a fiscal expansion to crowd in private demand. To obtain such a result, they need to assume a large share of credit-constrained consumers. An assumption that, according to Coenen and Straub (2005) and Cwik and Wieland (2010), cannot be confirmed in the data.

Another route is taken by Linnemann and Schabert (2006) who show that productive government spending in an otherwise standard new Keynesian model generates effects that are similar to the empirical evidence. In particular, they demonstrate a positive response of employment and household consumption to a fiscal shock.

Corsetti et al. (2009) extend an otherwise standard new Keynesian open economy model by a fiscal feedback rule which enables a systematic response of public spending to the level of public liabilities. In their model, the spending process is not exogenous. Corsetti et al. (2009) show that the financing decision, taxation or spending cuts, of the government has strong effects on the behavior of private households.

Government consumption has the power to crowd in private demand, if it is, at least to some degree, financed by future spending cuts. In subsequent work Corsetti et al. (2010) and Corsetti et al. (2011) find that the national effects of fiscal policy and the spillovers depend on the financing decision of the government, the size of the implementing country relative to the world economy as well as the trade elasticity. Among these factors, the assumed financing strategy has by far the strongest impact. However, the authors focus on public consumption while ignoring fiscal measures such as tax cuts or public investment.

In previous work, we found that the fiscal instrument employed, public consumption or tax cuts targeted at households, and the assumed financing strategy, taxation or future spending cuts, have a large impact on the way fiscal policy affects the economy. In a two-country New Open Economy Macroeconomics model of a currency union featuring an overlapping generations structure of the Blanchard (1985)-Yaari (1965) type chapter 1 shows that, depending on the financing decision of the government, fiscal policy measures can have very different effects on consumption and output. The spillovers of national fiscal policy depend on the composition of government spending, the type of the fiscal measure and the cross-country substitutability between goods.

In chapter 2 we suggest a closed economy model of the Blanchard (1985)-Yaari (1965) type and look at the impact of additional distortions such as staggered wage setting and distortionary taxation to evaluate the effects of fiscal policy further. We compared public consumption, investment and tax cuts targeted at households and explored how failures of the Ricardian equivalence as well as alternative financing decisions alter the transmission of fiscal policy shocks. We found that both, the financing decision and possible failures of the Ricardian equivalence have a large impact on how fiscal measures affect the economy.

We conclude that standard models potentially miss important dimensions of fiscal decision making. Removing the restriction of fiscal instruments to exogenous spend-

ing shocks and considering taxation being the only instruments of the government as well as allowing for failures of the Ricardian equivalence moves theoretical predictions closer to the empirical consensus.

The EU gave an example of swift decision making. Mid-December 2008, the European Council approved the EERP as proposed by the European Commission, which was implemented by member states immediately. We focus on Germany.

On January 12, 2009, the German government decided on the corresponding national stimulus package which was labeled Konjunkturpaket II. It passed the Deutsche Bundestag on February 13 2009, followed by the approval of the Bundesrat on February 20 2009. The law entered into force on March 6, 2009. The Konjunkturpaket II had a total volume of 50 billion euros and was focused on public consumption and infrastructure spending as well as tax cuts and subsidies which were targeted at households.

The OECD (2009) estimated that, together with an earlier stimulus package, the fiscal packages released in Germany had a size of around 3.5% of the German GDP in the years 2009 to 2010.

The high expectations of the European Commission and national governments in the power of fiscal policy to halt and even reverse an economic downturn by expansionary fiscal policy as well as the empirical consensus outlined above is difficult to reconcile with economic standard models.

We extend the model evaluated in 2 and propose a two-country New Open Economy Macroeconomics model of a currency union which is featuring an overlapping generations structure of the Blanchard (1985)-Yaari (1965) type as well as monopolistic frictions and staggered adjustment in the goods and labor market. We allow for public investment and distortionary taxation. This enables us to study a wide range of fiscal measures including different ways of financing a given level of public spending.

We want to assess the impact of the most important components of the EERP on

the economy of the implementing country, together with the spillovers on the other members of the EMU. The EERP suggests increased public spending on goods, public investment and tax cuts targeted at households as adequate fiscal measures to halt the recent economic downturn. We compare the impact of alternative financing schemes, taxation or future spending cuts. The phenomenon of spending reversals and instruments of fiscal policy are apart from public consumption rarely evaluated in the theoretical literature.

Our contribution to the literature is twofold. Firstly, up to our best knowledge, we are the first comparing public consumption and investment as well as tax cuts by assuming alternative financing schemes. Secondly, we explore fiscal policy in a full-fledged model of a monetary union with an emphasis on the impact of the financing decision and the possibility of failures of the Ricardian equivalence.

We than further ask whether the fiscal policy measures suggested by the EERP have the effects as envisioned by the European Commission when adopted to a full-fledged two-country model that qualitatively captures the empirical evidence.

We find that expansions in public consumption always increase national output and employment. The response of private consumption is sensitive to the financing choice of the government.

If financed by future taxation, public consumption decreases wealth and consumption demand of Ricardian consumers persistently. The alternative financing choice of future spending cuts mitigates the negative wealth effect. The consumption demand of Ricardian households is decreased on impact but quickly returns to its pre-shock level, but moves to a higher level as compared to the pre-shock level before the financing decision comes fully into effect. However, in any case the multiplier effect on national output is smaller than one.

The introduction of finite lifetimes yields a level of household consumption that is always higher as compared to the case of Ricardian consumers in response to a tax-financed increase in public consumption. To enable the model to predict an increase

in household consumption and therefore a Keynesian multiplier effect on domestic output, we need to assume a very high degree of household myopia.

However, if public consumption is financed by future spending cuts, non-Ricardian households always respond by increasing their demand for consumption goods and we obtain Keynesian multipliers on national output.

A lump-sum subsidy to households which is financed by lump-sum taxes in the future has no effect at all in a Ricardian model. Non-Ricardian households respond by a persistent increase in consumption. Driven by household demand, domestic output and employment increase.

Financing a temporary subsidy to consumers by future spending cuts, alters the model prediction substantially. Output, employment and household consumption increase on impact whether, we allow for failures of the Ricardian equivalence or not. But, in both cases we find no Keynesian multipliers on output.

We find that increases in public investment have effects similar to a positive productivity shock in the home country. No matter how the government decides to finance these measures and independently of possible failures of the Ricardian equivalence, public investment increases domestic output, employment and household consumption. The Keynesian multiplier on national output is always larger than one. However, we find no double dividends of public investment.

Moreover, the European Commission expected substantial positive spillovers and thus free riding problems. In our model spillovers are driven by household consumption and can be even negative on impact. In the medium term, the spillovers of fiscal policy shocks are always positive. Output, consumption and employment abroad increase.

The remainder of this chapter is organized as follows. Section 3.2 sets out a two-country Blanchard (1985)-Yaari (1965) OLG of a currency union. In section 3.3, we analyze the positive aspects of various fiscal policy measures including policy transmission and spillover effects. Finally, section 3.4 presents the conclusions and

possible extensions of the model.

3.2 The Model

We develop a dynamic, two-country, general equilibrium model of a monetary union which is featuring monopolistic competition and staggered adjustment in the goods and the labor market. We follow Erceg et al. (2000) and assume staggered wage and price setting of the Calvo (1983) type. Households are introduced in the form of overlapping generations following the discrete-time version of the Blanchard (1985)-Yaari (1965) OLG by Frenkel et al. (1996).

We identify one country as the home country H while the other country is referred to as the foreign country F. In the domestic country, a cohort of $n \in [0, 1]$ households is born in each period of time whereas $(1 - n)$ agents are born abroad. Therefore, the population in the domestic country is $\sum_{a=0}^{\infty} \gamma^a n = \frac{n}{1-\gamma}$ and $\frac{1-n}{1-\gamma}$ is the population abroad. This implies a constant world population that is normalized to one as we assume that a fraction of $1 - \gamma$ of the population is dying in each period of time.

The characteristic distortion of the Blanchard (1985)-Yaari (1965) OLG model is the introduction of uncertain lifespans by a single parameter γ, the survival probability of individual households. Households have no bequest motive. Finite lifespans imply that an intertemporal redistribution of wealth alters the expected permanent income in the remaining lifespan of an individual and thus lead to failures of the Ricardian equivalence.

3.2.1 Households

We discuss the behavior of an individual domestic household with the notion that similar equations hold for foreign households. Domestic households $h \in [0, n]$ share identical preferences and maximize their utility over consumption C and leisure $(1 - L), L \in [0, 1]$. The certainty equivalent utility function of an individual domes-

tic household reads

$$E_t U_t(h) = \sum_{s=t}^{\infty} (\gamma\beta)^{s-t} \left[\ln C_{a+s-t,s}(h) + \frac{\chi_0}{1-\chi} \left(1 - L_{a+s-t,s}(h)\right)^{1-\chi} \right] \tag{3.1}$$

where $\beta, \chi_0, \chi > 0$ and $\gamma \in [0,1]$ is the probability to survive until the next period of time. The parameter $\chi > 0$ measures the utility of time spend out of work.
The individual real period t budget constraint of a domestic household of age a reads

$$F_{a,t}(h) + (1+\tau_t^c) C_{a,t}(h) = \frac{1}{\gamma} F_{a-1,t-1}(h)(1+r_{t-1}) + \tag{3.2}$$

$$(1-\tau_t^w) w_{a,t}(h) L_{a,t}(h) - T_t + (1-\tau_t^k) \int_0^n \Pi_t(i) di + \Pi_t^k \tag{3.3}$$

where τ^c, τ^k, τ^w are distortionary tax rates on consumption, capital and labor. w is the real wage rate and $F = D + B$ denotes the agents total asset holdings denominated in units of the composite consumption good. D are national government bonds and B bonds which are issued by private households home or abroad.
T is a lump-sum tax and r_{t-1} the real interest rate paid on bond holdings between $t-1$ and t. We assume that households receive an equal share of national profits independent of age. $\int_0^n \Pi_t(i) di, \Pi_t^k$ are the real individual shares of profits of national final goods producers and capital rental firms respectively received by a domestic individual.
Productivity and consumption preferences are assumed to be independently of age. Thus, we are able to calculate per-capita variables by aggregating across ages and then dividing by population size.
Individual and per-capita variables coincide in the model. Variables, without individual h and age a index denote per-capita values. The domestic households optimizing behavior yields the consumption function

$$C_t = \frac{1-\gamma\beta}{1+\tau_t^c} \left[(1+r_{t-1}) F_{t-1} + H_t + \Omega_t \right] \tag{3.4}$$

where $(1-\gamma\beta)$ is the marginal propensity to consume out of total wealth

$$\Omega_t = \sum_{s=t}^{\infty} \psi_{t,s} \gamma^{s-t} \left[(1-\tau_s^k) \Pi_s + \Pi_s^k \right]$$

the household financial wealth and

$$H_t = \sum_{s-t}^{\infty} \psi_{t,s} \gamma^{s-t} \left[(1-\tau_s^w) w_t L_t - T_t \right]$$

the human wealth in per-capita terms. The present value factor is defined as

$$\psi_{t,s} = \begin{cases} \psi_{t,s} = 1 & \text{if} \quad s = t \\ \psi_{t,s} = \frac{1}{(1+r_t)\cdot\ldots\cdot(1+r_{t+s})} & \text{if} \quad s > t \end{cases}$$

The optimizing behavior of households implies the following per-capita *Euler equation* for the optimal intertemporal allocation of consumption

$$(1+\tau_{t+1}^c) C_{t+1} + \frac{1-\gamma}{\gamma} (1-\gamma\beta) F_t = (1+\tau_t^c)(1+r_t)\beta C_t \tag{3.5}$$

We assume that each individual domestic household h, independently of age, faces a downward-sloping demand curve for his individual skill

$$L_t(h) = \left(\frac{W_t(h)}{W_t}\right)^{-\phi_l} L_t$$

where ϕ_l is the elasticity of substitution between differentiated labor inputs in production, W_t is the aggregate labor demand and W_t the aggregate nominal wage. Individual workers have monopolistic power on the labor market which allows them to set their individual nominal wage rate $W_t(h)$.
We follow Calvo (1983) and assume that in any period, only a fraction of workers can reset its wage with probability $0 < (1 - \xi_w) < 1$. If a worker is not allowed to reset his wage rate for $j \geq 1$ periods, it is updated according to the rule

$$W_{t+j} = \pi_{MU}^{j} W_t(h)$$

where π_{MU} is the inflation target of the common monetary authority in the monetary union. The optimal wage choice of an individual household that resets his individual wage rate in period t in per-capita terms reads

$$w_t(h) = \left(\chi_0 \frac{\phi_l}{1-\phi_l}\right) \frac{E_t \sum_{s=t}^{\infty} (\gamma\beta\xi_w)^{s-t} (1 - L_s(h))^{-\chi} (1+\tau_s^c) C_s(h)}{E_t \sum_{s=t}^{\infty} (\gamma\beta\xi_w)^{s-t} (1-\tau_s^w) w_s} E_t \sum_{s=t}^{\infty} (\gamma\beta\xi_w)^{s-t} \prod_{k=1}^{s-t} \Delta w_{t+k} \quad (3.6)$$

where $\Delta w_t^{-1} = \frac{\pi W_{t-1}}{W_t}$ and $w_t(h) = \frac{W_t(h)}{W_t}$. The law of motion for the aggregate wage level reads

$$W_t = \xi_w \pi W_{t-1} + (1 - \xi_w) W_t(h)$$

We assume that each country in the world economy specializes in the production of a homogeneous national consumption good. The per-capita consumption basket of domestic households is given by

$$C_t = \left[(1-(1-n)\varphi)^{\frac{1}{\theta}} C_{H,t}^{\frac{\theta-1}{\theta}} + ((1-n)\varphi)^{\frac{1}{\theta}} C_{F,t}^{\frac{\theta-1}{\theta}}\right]^{\frac{\theta}{\theta-1}} \quad (3.7)$$

Following Tille (2001) we refer to θ as the cross-country substitutability or trade elasticity. The assumed functional form of the consumption basket follows Sutherland (2005) and Corsetti et al. (2009). The parameter $\varphi \in [0, 1]$ measures the relative weight of national goods in the household's consumption basket. A value of $\varphi < 1$ implies that the fraction of domestically produced goods in the household consumption basket exceeds the share of domestic production in the world economy, i.e. home bias in private consumption.
The corresponding consumer price index is defined as the minimum expenditure to buy one unit of the composite consumption good and given by

$$P_t = \left((1-(1-n)\varphi) P_{H,t}^{1-\theta} + ((1-n)\varphi) P_{F,t}^{1-\theta}\right)^{\frac{1}{1-\theta}} \quad (3.8)$$

We assume no impediments to trade. Hence, the law of one price $P_H = P_H^*$ holds where an asterisk denotes a foreign country variable. Home and foreign agents are assumed to have symmetric preferences which are invariant across ages.

A monetary union implies a nominal exchange rate of one, whereby both countries share a common currency. However, a value of $\varphi < 1$, i.e. home bias in private consumption, implies deviations from the purchasing power parity. $Q_t = \frac{P_t^*}{P_t}$ defines the real exchange rate.
The terms of trade (tot) are defined as the ratio of the price of a domestically produced consumption bundle and a bundle of goods produced abroad.

$$TOT = \frac{P_H}{P_F} \tag{3.9}$$

Thus, from the domestic household's point of view, an increase in the tot is considered to be an improvement. Domestic households maximize their utility from consumption, given their budget in any period of time. We obtain

$$C_{H,t} = (1 - (1 - n)\varphi) \left(\frac{P_{H,t}}{P_t} \right)^{-\theta} C_t \qquad C_{F,t} = ((1 - n)\varphi) \left(\frac{P_{F,t}}{P_t} \right)^{-\theta} C_t \tag{3.10}$$

as the domestic private demand functions for home and foreign final consumption goods.

3.2.2 Technology and production

We describe the productive sector in the home country with the notion that a set of similar equations characterizes the foreign country.

In each country there are firms producing intermediate goods by combining national capital with national labor services. The production technology in the intermediate goods sector is Cobb-Douglas and we assume that intermediate firms set their prices on the basis of Calvo (1983).

The final good sector consists of a single final good produced in each country and sold both in the domestic and the foreign market for private consumption purposes. However, demand for the final goods for public consumption and investment is restricted to the national government and capital rental firms, respectively.

The final good sector operates under perfect competition and buys the bundle of domestically produced intermediate goods. These inputs are combined by a Constant Elasticity of Substitution (CES) production function.

Finally, a national capital rental firm demands the national final consumption good and transforms it into production capital. We allow for variable capital utilization

with quadratic adjustment costs.

The capital rental firm

The domestic representative capital rental firm transforms the homogeneous consumption good into a capital good K which is used by the producers of intermediate goods producers as productive input. We assume that each domestic household holds an identical share of the representative national capital rental firm. The capital rental firm maximizes the discounted value of its real profits

$$\frac{\Pi_t^k}{P_t} = \sum_{s=0}^{\infty} \left(\frac{1}{1+r_t}\right)^s \left[(1-\tau^k) r_{k,t+s} K_{t+s} - I_{t+s} - \frac{\kappa_k}{2} K_{t+s} \left(\frac{I_{t+s}}{K_{t+s}} - \delta\right)^2\right]$$

where $r_{k,t}$ is the real rental cost for capital, I_t real investment and K_t the capital stock. The formulation of the capital rental sector follows Adda and Cooper (2003). The parameter $\kappa_k > 0$ scales the capital adjustment costs, when used in production capital depreciates at rate $\delta > 0$. The law of motion for the capital stock is given by

$$K_{t+1} = (1-\delta) K_t + I_t \tag{3.11}$$

and the first order conditions for capital and investment are

$$q_t = 1 + \kappa_k \left(\frac{I_t}{K_t} - \delta\right) \tag{3.12}$$

$$q_t = \frac{\frac{P_{t+1}}{P_t}}{1+i_t} \left[(1-\tau_{t+1}^k) r_{k,t+1} + q_{t+1}(1-\delta) - \frac{\kappa_k}{2} \left(\frac{I_{t+1}}{K_{t+1}} - \delta\right)^2 + \kappa_k \left(\frac{I_{t+1}}{K_{t+1}} - \delta\right) \frac{I_{t+1}}{K_{t+1}}\right] \tag{3.13}$$

where q_t is the Lagrangian multiplier of the firm's optimization problem which can be interpreted as Tobin's q.

Intermediate goods producer

We assume a continuum of domestic intermediate goods producers $i \in [0, n]$. Each intermediate producer demands capital and labor for the production of its unique variety $y_t(i)$ of the domestic intermediate good.
Because of their monopolistic power, individual domestic intermediate goods firms have the market power to set prices. Intermediate producers maximize their profits given a constant returns to scale Cobb-Douglas production technology

$$y_t(i) = K_t(i)^{\alpha} L_t(i)^{1-\alpha-\theta_p} K_{p,t}^{\theta_p} \tag{3.14}$$

where $0 < \alpha + \theta_G < 1$. We allow for government investment in infrastructure $K_{p,t}$, for an extensive discussion of the modelling decision see Romp and de Haan (2007).

The optimal combination of capital and labor for a given stock of public capital is obtained from the cost minimization of intermediate producers

$$mc_t = \frac{r_{k,t}}{\alpha \frac{y_t(i)}{K_t(i)}} \tag{3.15}$$

$$mc_t = \frac{w_t}{(1-\alpha-\theta_p)\frac{y_t(i)}{L_t(i)}} \tag{3.16}$$

where mc_t is the real marginal cost which is symmetric across intermediate firms. Following Calvo (1983) an intermediate producer i is allowed to renew his price in any period of time with probability $1-\xi_p$. Thus, the probability that an intermediate goods firm cannot reset its price in any of the periods between t and $t+j$ is ξ_p^j. If an intermediate producer cannot update his pricing calculations, prices adjust according to the rule

$$P_{H,t+j}(i) = \pi_{MU}^j P_{H,t}$$

The optimal pricing decision in period t is given by

$$p_{H,t}(i) = \frac{\phi_g}{\phi_g - 1} \frac{E_t \sum_{j=0}^{\infty} (\gamma\beta\xi_p)^j mc_{t+j} \left(\prod_{k=1}^{j} \pi_{MU,t+k}\right) Y_{t+j}}{E_t \sum_{j=0}^{\infty} (\gamma\beta\xi_p)^j Y_{t+j}} \tag{3.17}$$

and the law of motion for the aggregate price level reads

$$P_{H,t} = \xi_p \pi_{MU} P_{H,t-1} + (1-\xi_p) P_{H,t}(i)$$

The final good producer

The representative domestic final goods firm transforms intermediate goods into the homogeneous domestic final good. The final goods producer applies a CES technology

$$Y_t = \left(\int_0^1 y_t(i)^{\frac{\phi_g - 1}{\phi_g}} dh \right)^{\frac{\phi_g}{\phi_g - 1}} \tag{3.18}$$

where $\phi_g > 0$ is the substitutability between intermediate inputs. The final goods producer chooses his inputs $i \in [0, n]$ to maximize real profits which implies

$$y_t(i) = \left(\frac{P_{H,t}(i)}{P_{H,t}} \right)^{-\phi_g} Y_t \tag{3.19}$$

as the demand schedule for variety i facing each individual domestic intermediate goods producer. Under the assumption of perfect competition on the final good market, the final goods producer sets his price to ensure zero profits. Thus, the final goods pricing rule is given by

$$P_{H,t} = \left(\int_0^1 P_{H,t}(i)^{1-\phi_g} di \right)^{\frac{1}{1-\phi_g}} \tag{3.20}$$

3.2.3 The monetary and fiscal authorities

We focus on the effects of fiscal policy. To facilitate the analysis and to compare it with the literature, we use a standard monetary policy rule. The common monetary authority sets its instrument, the nominal interest rate i_t, according to the Taylor rule

$$i_t = \frac{1}{\beta} - 1 + \phi_\pi(\pi_{MU,t} - \pi_{MU}) \tag{3.21}$$

where $\pi_{MU} = 0$ is the inflation target. We assume that the central bank targets a union wide inflation rate which is defined as a weighted averages of national variables, i.e. $\pi_{MU,t} = n\pi_t + (1-n)\pi_t^*$ is the relevant union-wide inflation rate where $0 < n < 1$ is the relative size of the domestic country. The common central bank follows the Taylor principle and chooses $\phi_\pi > 1$ as the Taylor coefficient on union-wide inflation stabilization.
For the given monetary policy, the domestic government decides on the level of taxation and public spending. Government spending is given by

$$G_t = G_{c,t} + I_{p,t} \tag{3.22}$$

where $G_{c,t}$ is the level of purely dissipative government consumption of goods and $I_{p,t}$ the level of public investment in infrastructure. The law of motion for public capital $K_{p,t}$ is given by

$$K_{p,t+1} = (1-\delta)K_{p,t} + I_{p,t} \tag{3.23}$$

where the capital depreciation rate is the same as in the private sector. Government revenues stem from distortionary taxes on consumption τ_t^c, wages τ_t^w, capital income τ_t^k, the level of a non-distortionary lump-sum tax/transfer T_t and issuing public debt D_t. The real government flow budget is given by

$$\frac{D_{t-1}}{1+\pi_t} + G_t = T_t + \tau^w w_t L_t + \tau^c C_t + \tau^k r_{k,t} K_t + \tau^k \int_0^1 \Pi_t(i)di + \frac{D_t}{1+r_t} \tag{3.24}$$

The model setup allows for a wide variety of possible fiscal policy measures such as dissipative public spending on goods, public investment or cuts in distortionary as well as lump-sum taxation. There are several instruments on the spending and revenue side of the public budget which allow the government to balance its budget or to decrease the level of public debt.
As is standard in the literature, fiscal policy enters the model as an exogenous change in the level of taxation, public investment or consumption. Fiscal shocks, e.g. a shock to government consumption

$$G_{c,t} = \rho G_{c,t-1} + \epsilon_t \tag{3.25}$$

evolve according to a AR(1) process where $0 < \rho < 1$ measures the persistence of the shock. We assume that, for legislative issues, fiscal expansions are always pre-financed by debt.

After a period of one year, the government decides on the measures which it considers to be appropriate to return the level of the public debt stock to the assumed target by employing a simple feedback rule

$$Tax_t = \tau D_{t-1} + \tau^d (D_{t-1} - D) \tag{3.26}$$

which may imply changes in each of the tax rates or the level of public spending on goods and investment. If, for example, the government decides to use lump-sum taxation as its policy instrument, the above rule implies that $Tax_t = T_t$ for a given target level of the public debt stock $D = 0$. Changes in public consumption or investment and distortionary taxation complete the set of possible financing instruments.

3.2.4 Dynamic equilibria and calibration of the model

The per-capita law of motion for consumption (3.5), the optimal wage choice of households (3.6), the definition of the household consumption basket (3.7), the aggregate demand for home and foreign goods (3.10), and the definition of the consumption-based price index (3.8) in the domestic country as well as their foreign counterparts describe the demand side of the model.
The supply side is characterized by the aggregate production function of the intermediate goods sector (3.14), the law of motion for the capital stock (3.11), the first order conditions for capital and investment (3.13), (3.12) from the capital rental sector, the optimal pricing decision for intermediate goods (3.17), the optimal combination of capital and labor (3.16), (3.15) for a given stock of public capital in the intermediate goods sector. This set of equations, together with the resource constraints

$$Y_t = C_t + I_t + G_t \qquad Y_t^* = C_t^* + I_t^* + G_t^* \tag{3.27}$$

the Fisher equations

$$1 + i_t = (1 + r_t) E_t \frac{P_{t+1}}{P_t} \qquad 1 + i_t = (1 + r_t^*) E_t \frac{P_{t+1}^*}{P_t^*} \tag{3.28}$$

the government budget constraint (3.24) in the home and foreign country and the current account equation

$$B_t = (1 + r_{t-1}) B_{t-1} + Y_t - C_t - I_t - G_t \tag{3.29}$$

where $B = F - D$ denotes the net foreign assets position in a given period, fully characterizes the dynamic equilibria of the model in per-capita terms. In the aggregate, we assume that $nB + (1 - n) B^* = 0$ holds in any period of time.

The model is closed by the feedback rules for monetary policy (3.21) and fiscal policy (3.26). We assume that national governments provide a constant level of public investment to maintain the public capital stock and consume a constant amount of national goods in equilibrium. The precise levels of permanent public consumption and investment are determined by the choice of parameters; more precisely, the real government revenues from distortionary taxation in steady state.

Following Leeper (1991), we categorize fiscal and monetary policy as being *active* respectively being *passive*, depending on their stance to the state of public finances. A policy authority that does not respond to the level of national public debt is active. Thus, a systematic response of fiscal policy to the level of national liabilities as such so that public debt is stabilized around a target level, is characterized as passive fiscal policy.

Within the institutional framework of the EMU, the Stability and Growth Pact limits the member country's annual new indebtedness as well as the accumulated stock of government debt. We assume that national fiscal policy is constrained and sufficiently responds to the state of public finances.

Leith and von Thadden (2008) show that the Blanchard (1985)-Yaari (1965) OLG with capital accumulation has determinate equilibria when monetary policy is active and fiscal policy passive. In particular, in cases in which monetary and fiscal policies are characterized by simple feedback rules such as (3.21), (3.26) and the policy instruments are chosen as such that $\phi_\pi, \tau \geq r, \tau^d \geq 0$, there exist locally determinate equilibria which are characterized by the steady state level of public debt.

The model has no closed-form solution and is solved numerically by using DYNARE. The applied approach is a first order Taylor approximation around the steady state following the approach of Schmitt-Grohe and Uribe (2004).

We calibrate the model parameters as such so that one period of time corresponds with one quarter. For a summary of our set of parameter chosen, see table 3.1. Except for the country-size, all selected parameters are symmetrical for the home

and foreign country.

The calculation of the relative size of the domestic country $n = 0.27$ is based on ECB data of 2008 (www.ecb.int/stats/html/index.en.html). The domestic country matches Germany in terms of its share of the EMU's gross domestic product.

We suggest four alternative values for the survival probability which are $\gamma = 0.95, 0.975, 0.99$ and 1. These imply average individual planing horizons of 5, 10, 25 and an infinite number of years. Such a setup allows us to explore the impact of failures of the Ricardian equivalence on the effects of fiscal policy. We are not aware of any empirical consensus for γ. In the literature a value of $\gamma = 0.99$ is frequently suggested, see e.g. Smets and Wouters (2002).

For the trade elasticity and the home bias in private consumption we set $\theta = 2/3$ and $\varphi = 0.185$, respectively. These values are taken from Corsetti et al. (2009).

However, a broad variety of values for the trade elasticity can be found in the empirical literature. For a broader discussion see, Corsetti et al. (2008). A higher elasticity of substitution between home and foreign goods, in our model, affects the size of spillovers. In fact, spillovers increase along side the degree of substitutability between home and foreign production.

We set the discount factor in the utility function to $\beta = 0.99$ and the Frisch elasticity of labor supply to $\frac{2}{\chi} = 0.5$. For a discussion of the latter choice, see Domeij and Floden (2006). We assume that, in equilibrium, workers spend one third of their time endowment working.

As for the capital depreciation rate we assume a value of $\delta = 0.025$ and set $\frac{1}{\kappa_k} = 0.04$ which is a conventional value for quadratic capital adjustment costs according to Adda and Cooper (2003).

In the Cobb-Douglas function, the elasticity of output with respect to private and public capital is set to $\alpha = 0.3$ and $\theta_p = 0.1$ respectively. The latter value finds itself within the range of empirical estimates reported in the survey of Romp and de Haan (2007).

β	$2/\chi$	$1/\kappa_k$	δ	α	θ_p	ξ_p	ξ_w	τ^c	τ^w	τ^k	ρ	τ^d	ϕ_π	n	φ	θ
0.99	0.5	0.04	0.025	0.3	0.1	0.75	0.83	0.1	0.279	0.279	0.9	0.05	1.5	0.27	0.185	2/3

Table 3.1: Calibration of the model parameters

Our model features monopolistic competition in the goods and labor markets. We choose conventional markups of 10%. In the goods market, the average price duration is set to 4 quarters which corresponds to $\xi_p = 0.75$ and is in accordance with the empirical evidence, see Alvarez et al. (2006). Wage contracts last longer than price spells, we set $\xi_w = 0.83$ which implies one and a half years being the average duration of wage contracts. The assumption that wages are more sticky than prices is common in the literature, see Christoffel et al. (2009) or Corsetti et al. (2009) and the references therein.

For the Taylor rule describing the behavior of the common central bank, we assume a standard value of $\phi_\pi = 1.5$ for the Taylor coefficient. The distortionary tax rates are set in accordance with Andres and Domenech (2006) who estimate rates of $\tau^c = 0.1, \tau^w = 0.279, \tau^k = 0.279$ on the basis of European data.

For the persistence of public spending shocks, we assume $\rho = 0.9$ where we follow the example of Corsetti et al. (2009). The fiscal authorities pre-finance spending measures by issuing public liabilities. The level of public debt is returned to the target level according to the rule (3.26) where we assume $\tau_t = r_t, \tau^b = 0.05$.

The first choice implies that the government finances interest payments fully by either increased taxation or spending cuts. The second assumption implies that in each quarter, the government repays five percent of the above-target stock of public debt. However, such an assumption is more ambitious than the proposals of the European Council for the the Euro Plus Pact of 24/25 March 2011.

3.3 Fiscal stabilization policies

We assess the impact of fiscal instruments as suggested by the EERP which aimed at holding and even reversing the economic downturn in the wake of the financial crisis in an open economy model of a monetary union. The EERP suggested a temporary increase in public consumption to stabilize output.

Discretionary increases in public investment were expected to strengthen aggregate demand in the short run and contribute to the prosperity of the EU in the long run, by improving aggregate supply. Both measures were expected to stabilize employment and therefore labor income of European consumers.

Tax cuts targeted to households were suggested as to strengthen the purchasing power of households and with that to stabilize private demand and thus to contribute to the stabilization of aggregate demand. The stabilization of output, employment and private consumption were the predominant motives of the EERP.

A major concern of the European Commission (2008) was to increase the stabilizing effect of fiscal measures by a co-ordinated approach. All member states of the EU, depending on their room for fiscal manoeuvre, were encouraged to act simultaneously. The European Commission relied on the mutual occurrence of positive spillovers of national fiscal expansions among the member states of the EU.

Our approach aims at providing results helpful for policy-making in practice. We abstract from welfare considerations and rank alternative policy measures by their effects on the macroeconomic variables as targeted by the European Commission.

The model is calibrated to mirror the relation between Germany, as the major economy in the EMU, and the remaining members of the monetary union. Our focus is on discretionary fiscal measures, included in the German Konjunkturpaket II.

We evaluate an increase in public consumption and investment as well as a lump-sum subsidy to households. We investigate how failures of the Ricardian equivalence influence the stabilizing power of fiscal policy. Furthermore, we analyze how alternative financing decisions influence national effects and the spillovers on other members

of the currency union.

Up to our best knowledge, there is no throughout evaluation as yet of how the macroeconomic impact of fiscal measures is influenced by the exit strategy of the government. We are not aware of any other study that compares fiscal measures which are frequently used in practice in order to conduct short run stabilization policies under alternative assumptions to the financing decision of the government in a full-fledged two-country model of a currency union.

3.3.1 Government consumption

According to the inquiries of the OECD (2009), discretionary increases in public consumption were implemented in all major member countries of the EMU. In particular, the measures taken were expected to stabilize national output by strengthening aggregate demand.

We assume an exogenous increase in public consumption according to the AR(1) process (3.25). The domestic government finances the increased spending on goods in advance by issuing public debt. With a time lag of one year, the fiscal authorities decide on how to return the level of public liabilities to the initial level. For now, we assume that the increase in public consumption is financed by lump-sum taxation according to the simple feedback rule (3.26). The numerical results of this policy are reported in Figs. 3.1, 3.2.

Here, as in all subsequent illustrations, the horizontal axes indicate the timepath of variables in the periods of time in the aftermath of a fiscal policy shock. One period of time corresponds to one quarter. Variables are expressed in deviations from their steady state values where solid lines refer to the Ricardian case where $\gamma = 1$, dotted, dashed and dash-dotted lines refer to our alternative values of the survival probability, $\gamma = 0.99$, $\gamma = 0.975$ and $\gamma = 0.95$, respectively.

In the case of Ricardian households, $\gamma = 1$, the model reproduces the results of standard new Keynesian open economy models. A shock to public consumption

which is pre-financed by debt and paid by domestic households via taxation in the long run, implies a negative wealth effect.

The government exclusively purchases national goods. A discretionary increase in domestic public spending augments the demand for home goods one-to-one. Increases in demand for domestic goods allow producers to raise prices. They increase their demand for the productive inputs capital and labor, with the effect that marginal costs and domestic inflation rise. We observe a persistent increase in domestic output and labor demand.

Whenever workers have a chance to reoptimize their wages, they set them with

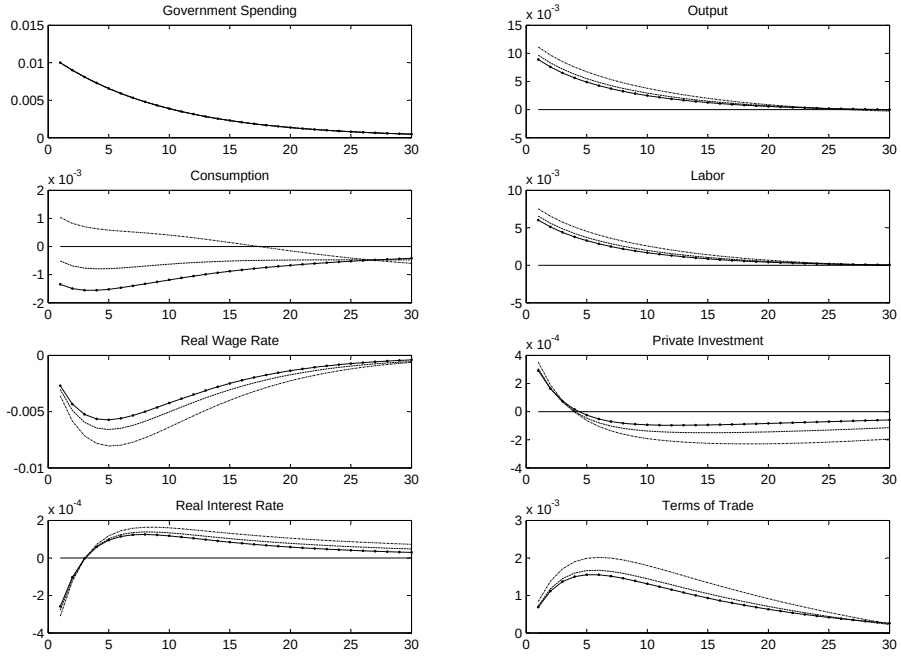

Figure 3.1: An increase in domestic public consumption financed by lump-sum taxation.

a constant markup above the marginal disutility of labor. At that rate, domestic households meet the increased demand for their individual skills. We observe an increase in hours worked, while nominal labor income is rising and the domestic real wage rate declining. The decrease in the real wage rate does not allow households

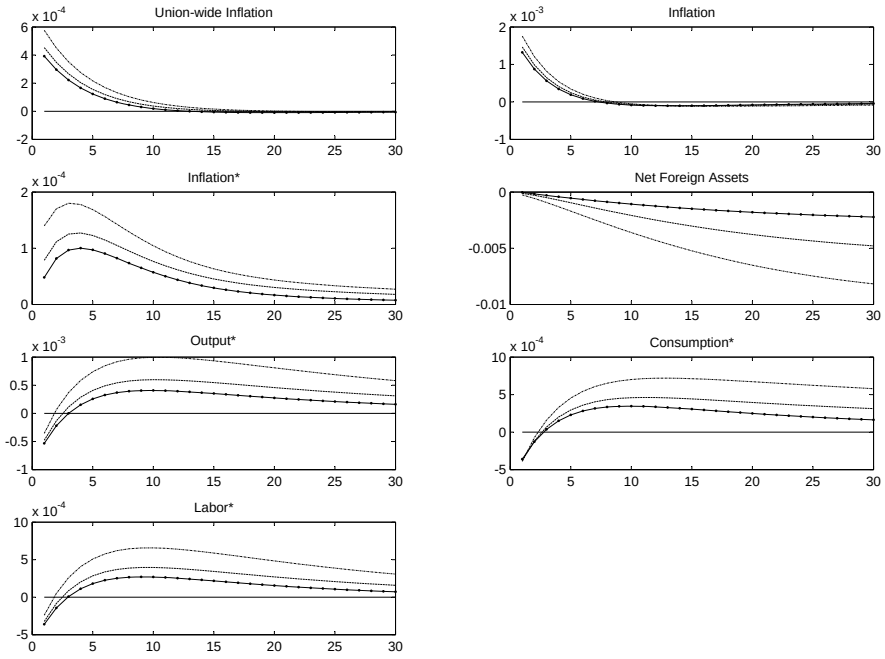

Figure 3.2: An increase in domestic public consumption financed by lump-sum taxation.

to fully offset the resulting income loss. As a consequence, households adjust their consumption plans downwards. However, the decrease in private demand for domestic final goods is more than offset by the increases in public demand.

The union-wide monetary authority targets a weighted average of the inflation rates of the member countries of the currency union according to the Taylor rule (3.21). It responds to the fiscal spending shock by increasing the nominal interest rate to keep the union-wide inflation at bay. Moreover, the domestic government finances public spending in advance by issuing public debt. These mechanisms put an upward pressure on the domestic real interest rate.

The domestic inflation rate is higher than the union-wide average which is targeted by the common central bank. Thus, the increase in the union-wide nominal interest rate is too mild compared to the case of a national central bank following a similar rule in the home country. According to the Fisher equation, a strong rise in do-

mestic inflation implies a decrease in the domestic real interest rate. However, the domestic inflation quickly returns to its pre-shock level which allows the domestic real interest rate to rise above its steady state level.

We observe an immediate increase in domestic private investment which is followed by a persistent period of crowding out. However, it should be recalled that the nominal interest rate is determined at union level. Thus, these effects are small and the response of private investment is negligible.

In summary, a temporary increase in public consumption financed by taxation affects the domestic components of aggregate demand in different ways. Public demand increases, while private demand for consumption and investment purposes decreases. Domestic output is increased when compared to the pre-shock level.

Government spending falls exclusively on domestic final goods. Potential spillovers are driven by domestic private demand. Because of the inflation differential, the home country's terms of trade improve.

The composition of public demand differs from household consumption. Households consume home and foreign final goods according to the consumption basket (3.7). The demand for each type of good depends on the substitutability between home and foreign goods, the size on the national economy as well as the assumed degree of home bias in consumption.

Households have the opportunity to substitute foreign goods for domestic goods in their consumption basket. The latter behavior is a well known feature of two-country models and labeled as expenditure switching and explains why the domestic country's net foreign asset position worsens persistently.

We observe an initial drop in foreign output which is then followed by a persistent increase. In our baseline parametrization of the consumption basket, we assume a value of $\theta = 0.66$ at the lower bound of the empirical estimates for the elasticity between home and foreign goods. Domestic and foreign output are poor substitutes. The household's consumption choice has an inter- as well as an intratemporal di-

mension. The first choice is governed by the decrease in permanent income which is implied by the assumed policy choice, i.e. the consumption-savings decision. The second choice depends on the trade elasticity.

We observe a pronounced decrease in domestic consumption demand which slowly returns to its initial level. Expenditure switching does not increase the demand for foreign final goods, at least not during the first quarters after the fiscal shock. As domestic consumption returns to its initial level, expenditure switching pushes domestic household demand for foreign output above its steady state level.

Foreign output and employment rise. The foreign real wage rate is decreased by the mechanism described above. Foreign households benefit from an improvement of their net foreign asset position and consume more.

We observe positive spillovers on output, consumption and employment abroad. But these spillovers are weak and sensitive to changes in the value of the trade elasticity, e.g. a value of $\theta = 4$ at the upper bound of the empirical estimates lets negative spillovers on foreign output disappear.

The assumption of uncertain lifetime affects the consumption-saving decision of households. If $\gamma < 1$, then taxation and public debt are no equivalent financing instruments.

Household demand (3.4) is a function of current and future total wealth where the weight of each component depends on the survival probability. Changes in the level of public debt, in lump-sum taxation and in labor income imply changes in total wealth and affect household consumption.

In the period of time during which a fiscal shock hits the economy, household income is reduced by a drop in the real wage rate. This decrease in disposable income cannot be fully offset by the increase in hours worked. The financing decision in terms of increased taxation comes into effect with a lag of four quarters and decreases future income. Between the timespan during which the increase in public consumption occurs and the subsequent financing decision, households benefit from the positive

wealth effects of increased public debt.

Finite lifespans mitigate the negative effects of a tax-financed increase in public consumption on private demand and even reverse them for low values of γ. The shorter the planing horizon, the more pronounced the positive wealth effects are.

We observe a more pronounced increase in domestic output and hours worked. Again, the response of private investment is negligible, the real wage rate is decreased and households profit from improved terms of trade and substitute foreign for domestic goods. The stimulus of aggregate demand is more pronounced as compared to the assumption of Ricardian households and the same is true for the positive spillovers on the foreign country.

Our results confirm previous findings in the literature, e.g. Gali et al. (2007), Coenen and Straub (2005) or Cwik and Wieland (2010). However, these authors explore the impact of failures of the Ricardian equivalence on household behavior by a different route. They model a fraction of households as rule-of-thumb consumers. Similar to our result, this literature typically finds that in order to enable a tax-financed increase in public consumption to stimulate private demand, one has to assume a fraction of borrowing constraint or myopic households a situation which cannot be confirmed by empirical evidence.

For a value of $\gamma = 0.99$ proposed in other studies, e.g. Smets and Wouters (2002) and imply an individual planning horizon of 25 years, failures of the Ricardian equivalence do not affect the model predictions substantially. In particular, to obtain model predictions such as an increase in household consumption in response to a tax-financed public spending shock, we have to assume a very short individual planing horizon.

Modelling discretionary fiscal policy as an exogenous process and financed by taxes is the standard approach in theoretical literature. For a recent discussion see Corsetti et al. (2009). Our model allows for alternative financing choices by the government. We revisit the case of a shock to public consumption by assuming that the increase

in spending is not financed by fiscal measures which would affect the revenue-side of the public budget but by spending cuts.

To carve out the impact of the financing decision on the effects of fiscal shocks, we discuss the extreme case in which the assumed increase in public consumption is completely financed by future spending cuts. The numerical results are given in Figs. 3.3, 3.4.

If the government decides to finance additional current spending by reducing future spending on goods, the effects of fiscal policy on aggregate demand change substantially over time. In the period of time during which the public spending shock hits the economy, public demand for goods is increased above the steady state level.

The government starts immediately to use a part of the current budget to service its debt. With a time lag of one year, the government begins to return the level of public liabilities to the target level. During this process which is depending on the choice of the fiscal policy parameter τ^d, government consumption decreases below the initial level. This is precisely what Corsetti et al. (2009) label a spending reversal.

We start the discussion with the Ricardian case. An increase of public consumption which is financed by future spending cuts affects the permanent income of households. In the long run, public consumption is decreased as the cut in future spending exceeds any temporary stimulus because of interest payments on public debt.

We assume complete home bias in public spending. Public consumption stimulates the demand for domestic goods one-to-one. The domestic price level rises and we observe an increase in demand for domestic productive inputs.

Employment in the home country increases and the real wage rate is persistently decreased. The income loss from the drop in the real wage rate cannot be fully offset by the increase in employment. Moreover, the increase in public debt absorbs a fraction of domestic household income.

Domestic household demand is decreased for more than eight quarters following the

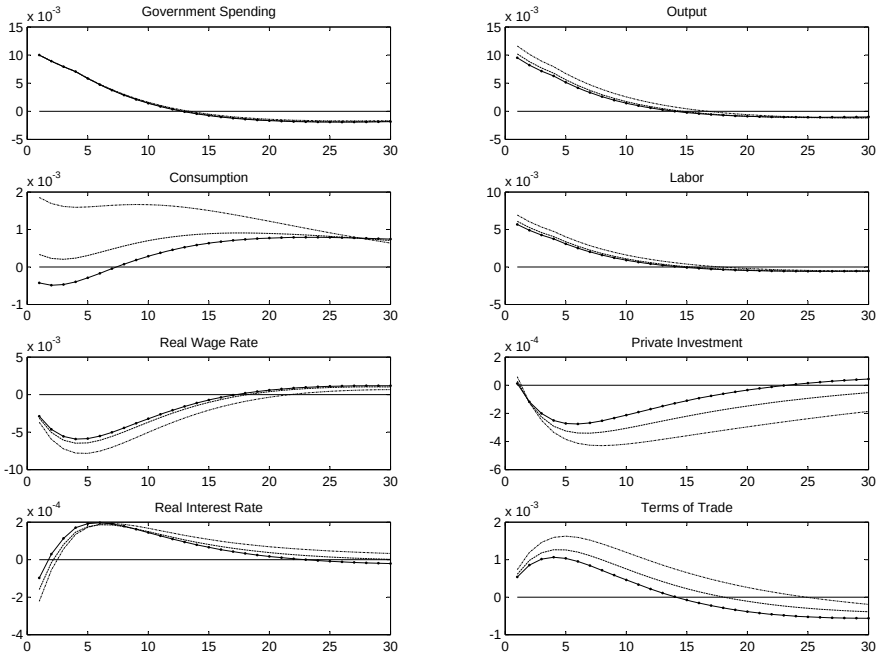

Figure 3.3: An increase in domestic public consumption financed by future spending cuts.

fiscal shock. However, the decrease in private demand for domestic final goods is more than offset by the increase in public demand. We observe a persistent increase in domestic production in the periods of time that follow the fiscal shock.

The common central bank responds to the increase in its monetary target by increasing the union-wide interest rate. As before, this response is too mild from the domestic country's point of view and too restrictive for the other countries of the monetary union. The domestic real interest rate is decreased. However, this effect as well as the response of domestic investment is small.

In contrast to the case of a tax-financed increase in domestic public consumption this variable does not only return to the initial level, but decreases below the equilibrium level. The effect on aggregate demand for home goods is reversed.

A decrease in demand for domestic goods puts a downward pressure on the domestic inflation rate and pushes it beneath the equilibrium value. The nominal wage

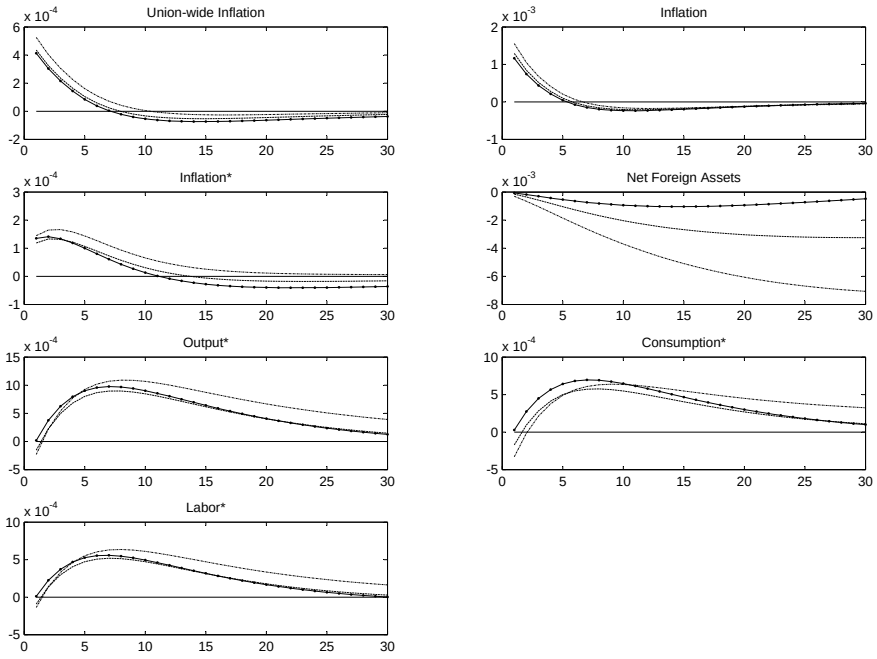

Figure 3.4: An increase in domestic public consumption financed by future spending cuts.

rate adjusts upwards in a staggered fashion. These two effects imply an increase in the real wage rate above its equilibrium level over time. In addition, domestic households benefit from interest payments by the domestic government. Thus, the effects of the assumed policy on domestic permanent income are reversed, too.

Forward-looking households recognize the implications of such a policy and expect increases in their future income. Domestic consumption increases above the steady state level well before the spending reversal occurs.

The increase in private demand cannot offset the decrease in aggregate demand, which is implied by the spending reversal in public consumption, in the medium term. Domestic output decreases below its initial level five years after the initial fiscal shock.

With reference to the previous case of a tax-financed increase in public spending, the spillovers of this policy depend on the response of household consumption as

well as on the parameter choice for the trade elasticity. We observe an improvement in the domestic terms of trade and a persistent decrease in the home country's net foreign asset position.

Domestic households substitute foreign for domestic goods. Consequently, the initial response of foreign output and consumption is negative followed by persistent increases in these variables which mirrors the response of domestic private demand. Moreover, we observe a positive spillover on foreign employment.

Again, part of the initial negative spillover is due to the parametrization of the model. If we switch from our baseline scenario $\theta = 0.66$ to a value of $\theta = 4$ at the upper bound of the empirical estimates, the negative spillover on foreign output vanishes.

We observe an initial decrease in domestic private demand which slowly returns to its initial level. Moreover, home consumption demand increases above its equilibrium level. Foreign output and employment rise, while the foreign real wage rate is decreased.

Foreign households benefit from an improvement of their net foreign asset position and the persistently increased demand for foreign products. They respond to the improvement of their permanent income by adjusting their consumption plans upward. Again, the spillovers of a domestic expansion of public consumption are positive and more pronounced than in the baseline calibration. The magnitude of the spillover effects increases with the chosen value for the elasticity between home and foreign goods by the same mechanism as discussed above.

Uncertain lifetimes $\gamma < 1$ work through their impact on the consumption-savings decision of households. Household demand (3.4) is a function of current and future total wealth were the weights of each component depends on the survival probability of individuals.

An increase in public debt is perceived as an increase in total wealth. Moreover, real labor income and future taxation that enter total wealth affect the consumption

decision of finitely-lived households. In the period of time during which the fiscal shock hits the economy household income is decreased by the drop in the real wage rate. The accumulation of public debt that is required to finance such a fiscal policy, has a positive effect on per-capita wealth.

Finite lifetimes imply that households may die before the fiscal measure is completed. They may not live long enough to witness the spending reversal or the period in which the level of public debt has returned to its initial level. Thus, finite planning horizons mitigate the negative effects of fiscal policy on household income. We observe a less pronounced drop in private demand in the time periods that follow directly after the fiscal shocks. Overall, the level of private demand increases in relation to the planing horizons of individuals, e.g. the higher the demand increases, the shorter the planning horizons become.

The expansionary effects of fiscal policy and the spillovers are more pronounced. Most noticeable, given the alternative financing decision of a future cut in public consumption, private demand is increased up to values of the survival probability which are common in the theoretical literature.

We conclude that both, failures of the Ricardian equivalence as well as the financing decision of the government, have a strong impact on the model predictions.

3.3.2 A lump-sum transfer to households

The German Konjukturpaket II included direct transfers and debt-financed tax cuts which were targeted at households. We explore the effects of such policies by assuming a lump-sum subsidy to domestic consumers that is either financed by future taxation or decreases in public consumption.

To explain these alternative assumptions in relation to the financing decision, we refer to the fiscal policies implemented in Germany since 2007. The Konjunkturpaket II included measures such as lump-sum subsidies to households. However, since then, there were no increases in tax rates. On the contrary, in 2011 the gov-

ernment suggested tax cuts, see Bannas (06.11.2011). Although these suggestions are currently debated at government and parliament level, they cast doubts on the assumption that taxation being the only financing instrument of the government in standard models.

We assume constant distortionary tax rates and a constant permanent level of public spending. Thus, an overall increase in economic activity implies an increase in tax revenues. We implicitly assume that in all cases in which public revenues exceed the level of planned public spending budget surpluses are automatically redistributed to households.

However, our model points to an obvious extension for future research. If a fiscal stimulus leads to an increase in economic activity, then the stimulus is self-financing, at least to some degree. For now, we focus on wealth effects and the impact of failures of the Ricardian equivalence.

We assume a lump-sum transfer which is financed beforehand by issuing public debt. After a time period of one year the government decides on the fiscal instrument in order to return the level of public debt to the target level.

We start the discussion by assuming that the fiscal measure is financed by taxation. The numerical results are given in Figs. 3.5, 3.6. A lump-sum subsidy financed by future lump-sum taxation is a intertemporal redistribution of income. Current generations receive a subsidy which is financed by future generations. The overall tax burden of households is the sum of the transfer shock and the increase in taxation which is required to finance this transfer.

The expansive effects depend entirely on the consumption-savings decisions of households. Thus, if the Ricardian equivalence holds, we observe, apart from changes in public liabilities and lump-sum tax rates, no effect at all.

If households face uncertain planning horizons, public debt enters the model's equilibrium conditions and becomes a relevant state variable. Non-Ricardian households perceive public debt as net wealth. From the time period onwards at which the

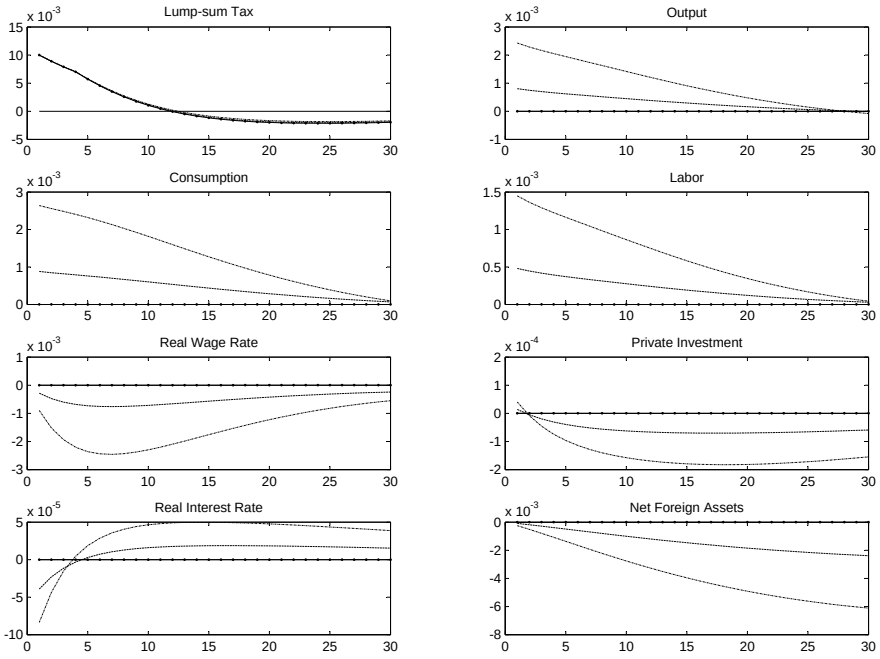

Figure 3.5: A lump-sum subsidy to domestic households financed by lump-sum taxation.

transfer shock hits the economy the income of domestic households rises. The government pre-finances the subsidy by issuing debt. Domestic households benefit from a positive wealth effect.

With a time lag of one year, steadily increasing lump-sum taxes are levied to finance the temporary subsidy, i.e. to pay debt services on public liabilities and to return the stock of public debt to the target level.

Depending on the persistence of the transfer shock and the fiscal policy parameters τ, τ^d, the net effect on household income turns negative. Moreover, the sum of taxation levied to return the level of public debt to the target level exceeds the temporary subsidy in the long run, because there are interest payments on public debt.

Thus, the effect of a lump-sum subsidy together with the related increase in public debt on total wealth is positive on impact but turns negative as soon as the taxes

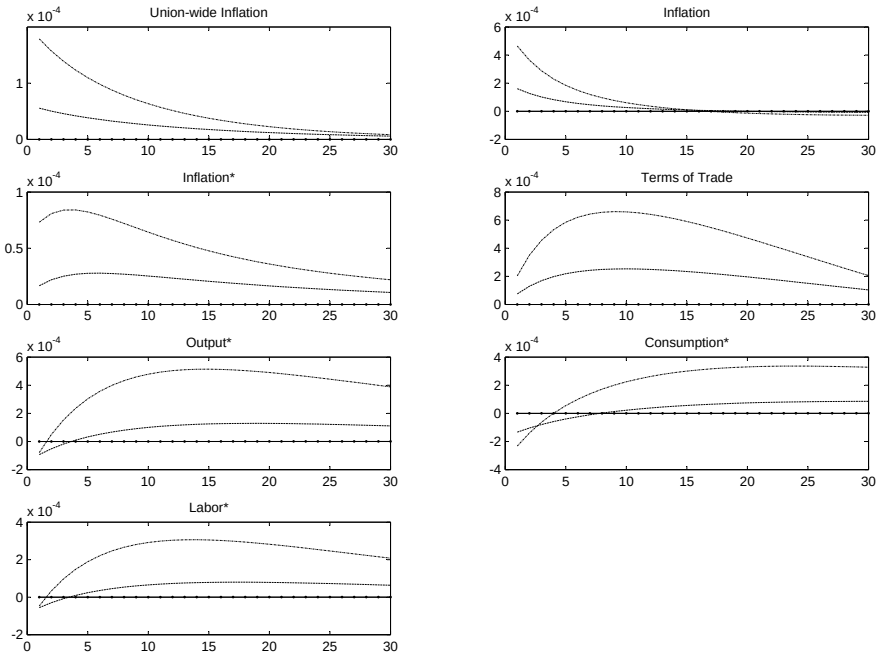

Figure 3.6: A lump-sum subsidy to domestic households financed by lump-sum taxation.

levied with regard to returning the level of public liabilities exceed the volume of the subsidy. The positive wealth effect of public liabilities vanishes as soon as the level of public debt is returned to the target level.

Wealth effects entirely depend on γ. The lower the probability to survive, which is reflected in an increasing myopia of households, the stronger is the positive effect on total wealth. Non-Ricardian households take the opportunity and use the additional income to increase their consumption.

In the domestic country, the hike in demand for final consumption goods enables producers to increase their prices. They demand more labor and capital in order to increase their production.

As a consequence, the domestic inflation rate is higher than abroad and the response of monetary policy is too dovish for the domestic country and too hawkish for the remaining members of the monetary union. Similarly as before, the response of do-

mestic investment is small and driven by the real interest rates in the home country.

In summary: Under the assumption of non-Ricardian behavior, a redistribution of household income from future generations in favor of the current generations increases current household demand. Households increase their consumption, with the effect that domestic output and employment go up. We observe a persistent decline in domestic real wage rates.

In contrast to public spending, households spend on home and foreign goods. The inflation differential between the home and foreign country leads to an improvement of the domestic country's terms of trade. We observe positive spillovers.

Foreign output and employment improve persistently. Foreign households profit from an improved net foreign asset position and increased labor income due to the increased demand for foreign output in the medium term.

However, foreign real wage rates decrease and the foreign country's terms of trade worsen on impact. Foreign consumption is increased persistently after experiencing a small decrease in the first quarter after the domestic transfer shock. We contrast the tax-financed lump-sum transfer to the case where a subsidy to current generations is financed by decreases in future public consumption, see Figs. 3.7, 3.8. The assumption that a subsidy to current generations is financed by future spending cuts, changes the impact of the assumed fiscal measure on aggregate demand.

In terms of the standard model, this policy corresponds to a temporary balanced-budget decrease in domestic tax rates. Ricardian households benefit from a positive wealth effect. We observe a persistent increase in private demand. Domestic output and employment as well as domestic inflation increase on impact. The real wage rate in the home country decreases.

However, as the financing decision of cuts in public consumption comes into effect, the response of these domestic variables is reversed. Public demand falls exclusively on domestic goods. The increase in private demand cannot offset the drop in aggregate demand for domestic goods which is implied by the financing decision.

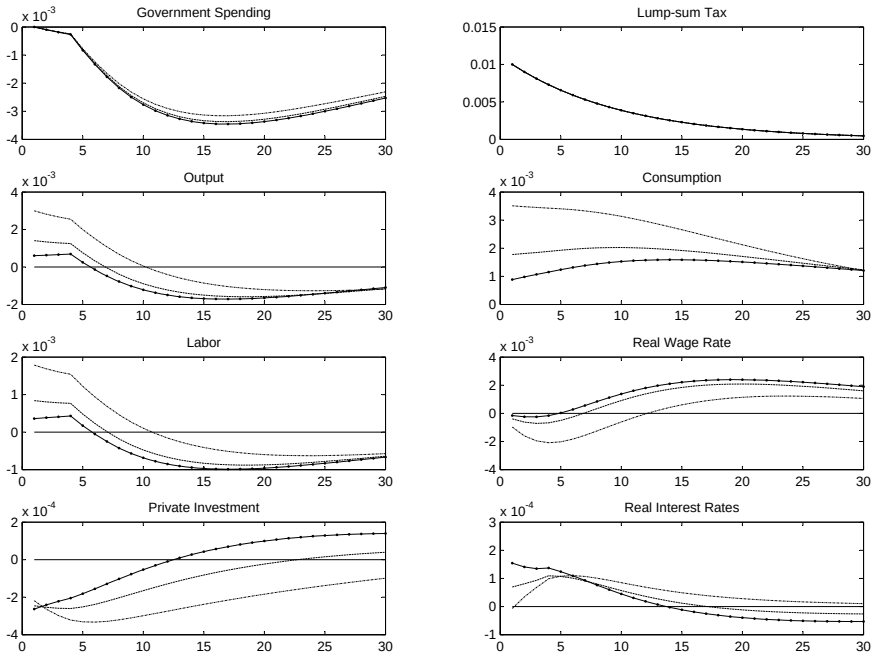

Figure 3.7: A lump-sum subsidy to domestic households financed by future spending cuts.

Domestic households do not spend their additional income completely on domestic goods but derive utility from home and foreign products. Thus, a fraction of the additional income is spend on foreign goods.

In the medium term, the demand for domestic goods is decreased and foreign producers benefit from improved demand by domestic households. Thus, the inflation rate in the domestic country is lower than the inflation rate abroad. By construction of the central bank's inflation target, the response of monetary policy to mild for the home country and too restrictive abroad. The terms of trade of the home country worsen considerable.

The spillovers of this policy depend its impact on private demand. Domestic households demand more consumption goods both from home and foreign producers. However, home bias in consumption and worsened terms of trade mitigate this effect on demand for foreign goods.

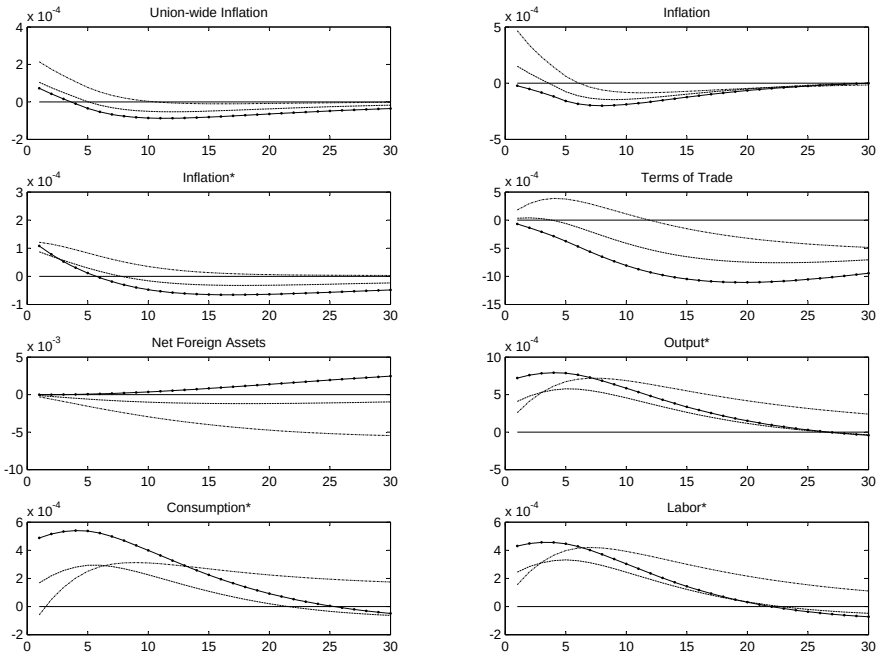

Figure 3.8: A lump-sum subsidy to domestic households financed by future spending cuts.

Foreign producers benefit from increased demand for their production. We observe positive spillovers, foreign output, consumption and employment increase.

Allowing for failures of the Ricardian equivalence does not change the effects of a temporary decrease in taxation which is financed by future decreases in public consumption substantially. Failures of the Ricardian equivalence work by the additional wealth channel since public debt is perceived as net wealth. The increase in private demand is more pronounced and offsets the decrease in public demand for domestic goods which is implied by the financing decision for several quarters more if compared to the Ricardian case. The increase in household consumption is amplified, the same is true for output, employment and the real wage rate.

The terms of trade effects are reversed. The terms of trade improve on impact and worsen over time as private demand returns to its pre-shock level. The assumption of finite lifetime leads to an increase in the spillovers as an overall increase in private

demand add to the demand for foreign goods.

3.3.3 Public investment

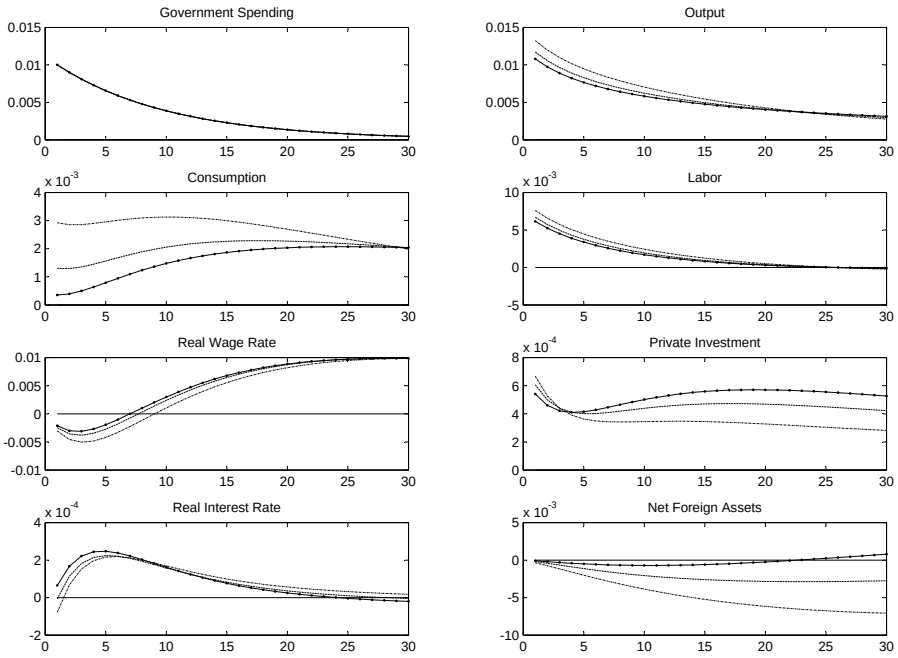

Figure 3.9: Domestic public investment financed by lump-sum taxation.

The European Commission (2008) strongly advocates increases in public investment to strengthen aggregate demand in the short run and to secure Europe's prosperity in the long run. In practice, policymakers rely on the occurrence of such double-dividends of public investment. Thus, public investment in infrastructure was an important part of the German Konjunkturpaket II.

We evaluate a temporary increase in public investment which was intended to stimulate the domestic economy. Technically, a shock to public investment enters according to the AR(1) process (3.25). As before, fiscal policy is pre-financed by the issuance of public debt. With a time lag of one year, the government decides on the fiscal instruments employed to finance debt-services and to return the level of

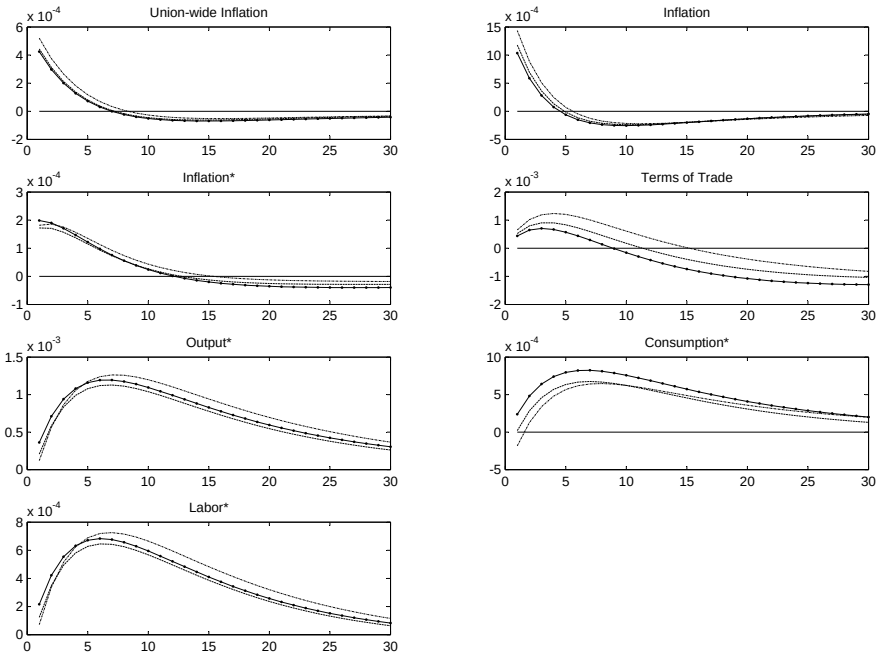

Figure 3.10: Domestic public investment financed by lump-sum taxation.

public liabilities to the target level. The choice is between an increase of lump-sum tax rates and a future cut in public consumption.

Up to our best knowledge, the impact of spending cuts as a potential financing decision on public investment is evaluated for the first time in a full-fledged two-country model of a monetary union.

We start our discussion with the Ricardian case by assuming that the fiscal authorities decide to use lump-sum taxation as their preferred financing instrument. For the numerical results see Figs. 3.9, 3.10.

The effects of a temporary increase in public investment on the economy are similar to a positive productivity shock in the home country. For any combination of the productive inputs capital and labor the domestic output is increased.

Moreover, the domestic government does exclusively use home final goods to increase the public capital stock. Thus, apart from its effects on domestic productivity, pub-

lic investment increases the demand for domestic goods.

Domestic households anticipate these positive wealth effects in terms of increased income as well as the negative wealth effects which are implied by the governments financing decision. However, the positive effects on permanent income prevail and the income of households increased.

Households have to decide if they wish to consume the whole amount of additional income today or to save it. According to the Euler equation (3.5), domestic households base their consumption-savings decision on their expected lifetime income. Moreover, households prefer to smooth consumption over time.

They decide to consume some of their higher income and save the rest to enable increased consumption of goods and leisure as well as to finance future rises of tax rates. We observe a persistent increase in consumption and private investment.

Domestic producers set their prices in a forward-looking manner. However, price-setting is staggered and the fiscal policy shock has two opposing effects on price-setting. Firstly, the domestic government demands more goods to bolster the domestic stock of public capital. Secondly, households in the home country increase their demand for domestic goods and with that increase their overall consumption and to save. Both effects imply an increase in aggregate demand for home production and, in principle, allow domestic producers to demand higher prices. But domestic producers are also more productive which puts a downward pressure on the prices of domestic goods.

We observe an increase in domestic prices on impact. The level of domestic public investment decreases over time. After approximately one year, the second effect prevails and prices fall below the pre-shock level.

This phenomenon is mirrored in the response of domestic employment which is increased on impact but falls below the pre-shock level over time.

According to the Taylor rule (3.21) monetary policy responds to the average inflation rate in the monetary union. The increase in public investment is restricted to

the domestic country. Thus, the home inflation rate is increased and higher than the inflation rate of the foreign country. The response of monetary policy is too loose for the home country and too restrictive for the rest of the currency union. As soon as the effects of enhanced domestic productivity prevail, the situation is reversed.
The inflation rate differential is mirrored in the terms of trade response. The terms of trade of the domestic country improve on impact and worsen over time as the domestic price level declines below the pre-shock level.
The spillovers are driven by private demand. Domestic households demand more home and foreign goods as they have become more wealthy because of increased domestic productivity. Moreover, while domestic terms of trade are improved because of the strong effects of this policy on the demand for domestic goods foreign production is comparatively cheap. However, the response of the domestic net foreign assets as well as the spillover on the demand for foreign goods are weak. Nevertheless foreign output, consumption and employment are increased.
If we allow for failures of the Ricardian equivalence, the effects of a tax-financed increase in public investment are not altered substantially. Finite lifetimes work through their effect on the income profile of households. Depending on the assumed degree of household myopia a fraction of the implied increase in future tax rates occurs in time periods beyond their planning horizon.
Thus, failures of the Ricardian equivalence imply a more pronounced response of household consumption. As a consequence, the responses of domestic macroeconomic variables, e.g. domestic output and employment, are more pronounced. In particular, as domestic consumption falls on home and foreign goods, the spillovers on the foreign country are amplified.
However, an exogenous and temporary increase in domestic public consumption works as an increase in domestic productivity the effects of failures of the Ricardian equivalence are small.
The alternative financing decision which would imply future cuts in the budget for

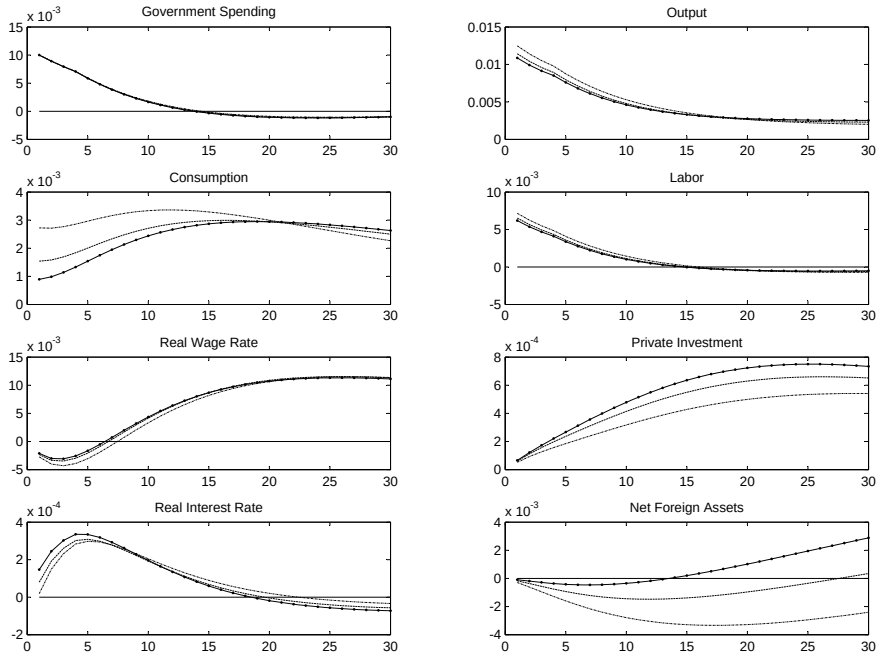

Figure 3.11: Domestic public investment financed by future spending cuts.

public consumption in order to finance a temporary increase in public investment, does not change the effects of public investment shocks substantially either. Again, financing public investment by reduction in future government spending alters the policy impact on household wealth. We observe similar, but more pronounced effects, see Figs. 3.11, 3.12. The changes in the response of variables are driven by household behavior.

The government levies a constant level of taxation which is defined by the steady state rates of distortionary tax rates. In particular, additional tax revenues are not spend but redistributed to households or used to cover debt services. An increase in domestic investment financed by cuts in public consumption redistributes existing tax revenues from unproductive consumption to the enhancement of national productivity.

A temporary hike in public investment increases the production possibilities in our

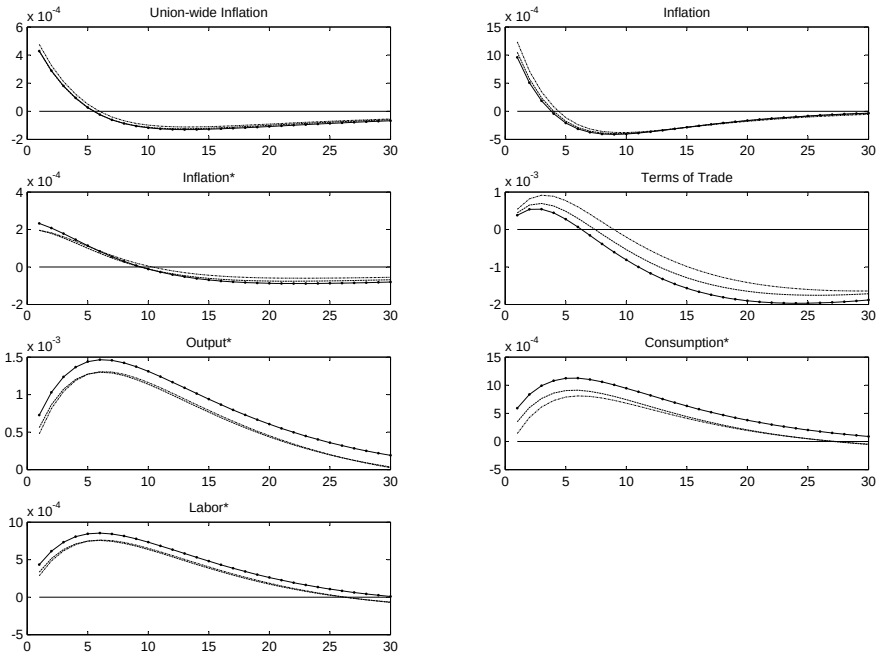

Figure 3.12: Domestic public investment financed by future spending cuts.

model economy. By assuming that the government finances this measure by decreasing future public consumption, the negative wealth effects of such a policy choice in terms of increasing tax rates vanishes.

The alternative financing decision of future spending cuts does increase the positive wealth effects on households. The increase in private consumption is more pronounced as compared to a tax-financed increase in public investment. In turn, the response of household consumption amplifies the increase in domestic output and employment. Thus, the observed inflation rate differential between the home and foreign country as well as the spillovers increase.

Allowing for failures of the Ricardian equivalence has only small effects on the model predictions. Again, the response of the home and foreign variables is driven by the productivity enhancement in the domestic country. In contrast to other fiscal instruments, e.g. an increase in public consumption, failures of the Ricardian equivalence

do not have the power to change the model's prediction qualitatively and the quantitative changes are small.

3.4 Conclusions

In this paper we elaborate an extended new open economy macroeconomics model of a monetary union with the aim of exploring the effects of fiscal policy measures. We focus on fiscal instruments that are frequently used in practice. Our model allows for public investment and failures of the Ricardian equivalence.

The major targets of fiscal stabilization policies that were suggested by the European Commission (2008) were output, household demand and employment. We compare the impact of the fiscal instruments suggested by the EERP depending on the financing decision of the implementing government.

We find that an increase in public consumption increases national output and employment independent of the financing decision. The response of household consumption is sensitive to the financing choice of the government. If public consumption is financed by future taxation, Ricardian households suffer from negative wealth effects and adjust their consumption plans downwards. Private demand remains persistently below the pre-shock level which mitigates the expansive effects of public consumption, both on national production and employment.

When assuming that the government decides to finance increases in current spending on goods by future decreases in public consumption, the negative wealth effects of this policy choice are moderate. The consumption demand of Ricardian households is decreased on impact but quickly returns to its pre-shock level. It even rises to a higher level as compared to the pre-shock level, even before the financing decision comes into effect. For both financing strategies, the multiplier effect on national output is smaller than one.

The introduction of finite lifetimes implies failures of the Ricardian equivalence.

Households perceive public debt as net wealth. A fraction of the negative effects on household wealth, such as increases in taxation come into effect in time periods beyond the expected lifetime of households. The level of household consumption is always higher as compared to the case of Ricardian consumers.

But we need to assume a very high degree of household myopia, to enable the model to predict an increase in private consumption in response to a tax-financed increase in public consumption, i.e. a Keynesian multiplier effect on domestic output being above one. If public consumption is financed by future spending cuts, non-Ricardian households always respond by increasing their demand for consumption goods. We observe a Keynesian multiplier.

The effects of a lump-sum subsidy to households crucially depend on the financing decision of the government as well as on the assumption regarding the validity of the Ricardian equivalence. If a lump-sum subsidy to Ricardian households is financed by future increases in taxation, the result is that there are, apart from changes in the level of public debt and taxation, no effects at all.

Non-Ricardian households respond to a lump-sum subsidy which is financed by future increases in taxation by a persistent increase in consumption. Household demand drives domestic output and employment, both variables increase. Thus, the response of all variables mentioned before increases with the degree of household myopia.

The alternative financing decision in the form of cuts in future public consumption to finance contemporary subsidies to households, alters the model predictions substantially. National output, employment and household consumption increase on impact and they do so independently of failures of the Ricardian equivalence. Future cuts in public consumption influence the spending side of the public budget and thus future demand by the government for domestic production. Output and employment are increased, but drop below the pre-shock level when the financing decision comes into effect.

The European Commission (2008) expected double dividends of a short run increase in aggregate demand and a long run improvement of aggregate supply from increases in public investment. We find that increases in public investment have effects similar to a positive productivity shock in the home country. No matter how the government decides to finance these measures and independently of possible failures of the Ricardian equivalence, public investment increases domestic output, employment and household consumption.

However, the financing decision has effects on household wealth, i.e. the magnitude of the positive response of private consumption. If public investment is financed by future taxation, its expansive effects are mitigated by the negative wealth effects of the financing decision. The Keynesian multiplier on national output is always positive and larger than one.

In our model, a temporary increase in public investment boosts economic activity only for a limited timespan. The assumed permanent level of public investment is only sufficient to maintain the steady state level of public capital. We find no double dividends of public investment.

A major concern of the European Commission was that substantial positive spillovers of national fiscal shocks would lead to free riding problems. In our model, spillovers are driven by household consumption. Thus, these spillover can be negative on impact in case of fiscal shocks that have strong negative effects on household wealth, e.g. increases in dissipative public spending. In the medium term, the spillovers of fiscal policy shocks are always positive. Output, consumption and employment abroad are increased. Our results correspond to a large extend with the empirical findings of Beetsma et al. (2006).

However, there is more than one reason to advise a co-ordinated approach to fiscal policy in a currency union. National fiscal policy shocks induce asymmetries in national inflation rates. The common central bank is ill-equipped to respond to asymmetric shocks as its inflation target is a union-wide average. Thus, in case of

a national fiscal shock, monetary policy will always be too dovish for some and too restrictive for other union members.

In general, a domestic fiscal shock increases the demand for national goods by more than that for foreign goods. Thus, domestic inflation rates rise above the union-wide average. As soon as the financing decision comes into effect, the situation reverses. Thus, in case of a union-wide downturn, member countries that do not have the room for fiscal maneuvre to implement a fiscal stimulus package, suffer from a too restrictive monetary policy for several quarters of time.

Regarding the applied approach to solve the model, there might be concerns whether a first order Taylor approximation around the steady state is suitable to evaluate fiscal policy during a severe economical crisis. We run into technical limitations regarding the evaluation of large shocks.

We are well aware that our model cannot provide precise numerical estimations of fiscal multipliers in case of large shocks. However, the model matches the empirical evidence qualitatively and allows to infer some lessons regarding the set of standard assumptions that are frequently used for the evaluation of fiscal policy. The standard approach to fiscal policy in theoretical models restricts its attention to exogenous changes in public consumption which are financed by changes in lump-sum taxation. The assumption of distortions of the intertemporal optimizing behavior of households, e.g. by the introduction of rule-of-thumb consumers, is the predominant approach in the theoretical literature to reconcile theory and evidence in the assessment of fiscal shocks. Indeed, we find that this route enables theoretical predictions close to the empirical findings. But in order to obtain model predictions such as an increase in private demand in response to a public consumption shock, i.e. Keynesian multiplier effects, we need to assume an extremely high degree of household myopia.

With reference to the measures that were suggested by the EERP and extending an otherwise standard model by allowing for failures of the Ricardian equivalence,

and at the same time increasing the array of fiscal instruments on the spending and revenue side of the public budget, we have shown that the latter is a promising way to reconcile predictions of modern macroeconomic models with empirical evidence. Modeling fiscal policy beyond exogenous shocks to public consumption and taxation as the single instrument of fiscal policy to finance stabilizing policies, alters the predictions of standard model substantially.

We conclude that a more realistic approach to the choice of instruments on the spending and revenue side of public budgets opens promising perspectives for future research.

The financing strategy of the government has strong effects on the impact of fiscal policy. We draw the conclusion that a fiscal stimulus is more effective, if it is financed by future spending cuts as compared to increases in taxation. This result mirrors the empirical results that suggest cuts in public budgets being a prerequisite for a successful consolidation of public budgets.

Moreover, our results suggests that if a fiscal package is intended to stimulate the economy during a recession, a credible commitment to abstain from tax increases is required. Instead stimulus measures should be financed by future spending cuts as such a move would amplify the intended effects. Thus, our results lend support for the SGP and the Euro Plus Pact suggested by the European Council. However, respective policy measures have to be implemented in a credible way.

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