

FISCAL EXPANSIONS UNDER FLEXIBLE EXCHANGE
RATES AND IN A MONETARY UNION:

THE INTERPLAY OF BIASED PREFERENCES AND
PRICING-TO-MARKET

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Ingo Pitterle

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Dekan:	Prof. Dr. Jörg Baten
Erstkorrektor:	Prof. Dr. Uwe Walz
Zweitkorrektorin:	Prof. Dr. Claudia Buch
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Chapter 1

Introduction

In this thesis we address the issue of fiscal policy under alternative exchange rate regimes. Our analysis is located in the realm of New Open Economy Macroeconomics (NOEM) - a new literature strand that has emerged from the so called *Redux* model by Obstfeld and Rogoff (1995a). The NOEM approach has by and large replaced the Mundell-Fleming-Dornbusch (MFD) framework as the standard workhorse of international economic policy analysis in the academic sphere.

Why do we focus on fiscal policy? The stabilization of economic activity over the business cycle is an ever recurrent issue in the international policy debate. In principle, governments and central banks can implement monetary or fiscal policies in order to smooth out economic fluctuations. However, in recent times of low nominal interest rates in the major industrialized countries there is only limited room left for monetary policy as a potential stabilization tool due to the zero bound of nominal interest rates. Under these circumstances, fiscal policy appears to be the only alternative left. Lately, Feldstein (2003) has commentated on this issue:

Economic conditions in the US and Europe require a rethinking of the roles of monetary and fiscal policy in reversing economic downturns. We must

recognize that fiscal policy can stimulate demand by changing incentives as well as by increasing disposable income ... [T]he current relatively low rates of inflation and correspondingly low nominal interest rates restrict the ability of central banks to stimulate the economy by reducing nominal and therefore real interest rates. In this situation, monetary policy must be supplemented by fiscal policy.

While very low nominal interest rates are a rather recent phenomenon in the U.S. and Europe, Japan has experienced almost a decade of nominal interest rates at the zero-bound. Hence, it is of no surprise that expansive fiscal policies are currently high on the agenda of the international policy debate. Policymakers across member states of the European Monetary Union face the additional problem that monetary sovereignty has been conferred on the European Central Bank, such that output cannot be stabilized by monetary policy on the individual country level. Even though the European Growth and Stability Pact theoretically imposes restrictions on the use of expansive fiscal policies, there is de facto still discretionary room for the national fiscal authorities as demonstrated by the recent violations of the pact on part of major member countries. Therefore, active fiscal policy making is an important subject of economic analysis, even if one does not share the view that active fiscal policy should be pursued.

In the context of the ongoing policy debate, it is not only essential to assess the national effectiveness of fiscal policy but also the associated international spillover effects. In the analysis of the transmission of fiscal policies, the prevailing exchange rate regime is of particular relevance. Intuitively, the absence of the exchange rate as a potential shock absorbing instrument in a monetary union leads to adjustment

processes to macroeconomic disturbances that differ substantially from those under a flexible exchange rate regime. In order to prepare the ground for sound economic policies, a thorough analysis of the interdependent effects of fiscal policy is indispensable. To this end, one can make use of theoretical models of open economies that help to clarify potential costs and benefits of the policy at issue.

What is the appropriate framework for the analysis of fiscal policy? Since the 1960s, the field of open economy macroeconomics has been largely dominated by the Mundell-Fleming model and its later perfect-foresight extension of Dornbusch (1976). When dealing with classical issues of international macroeconomics, including for instance the international transmission of monetary and fiscal policy, the evaluation of exchange-rate regimes, and the analysis of costs and benefits of international policy coordination, both academic researchers and policymakers relied heavily on the Keynesian type model framework that emerged from the seminal works of Fleming (1962) and Mundell (1963, 1964). Specifically, the incorporation of nominal rigidities into open economy macroeconomic analysis proved to be a crucial step in the process of building a bridge between the real and the monetary side of the economy. The assumption of temporarily sticky prices opened up a much larger role for monetary policy to affect real variables compared to standard flexible price models. Besides, the high tractability of the Mundell-Fleming-Dornbusch (MFD) framework as well as its broad field of application contributed to its enormous popularity.

Yet, it has long been recognized that the classical MFD approach to open-economy macroeconomics has several serious methodological drawbacks. Certainly the most fundamental of them is the model's entire lack of microfoundations. Instead of basing

the economic analysis on an explicitly optimizing behavior of economic agents, MFD-type models mainly rely on ad-hoc relationships between macroeconomic aggregates. Due to their lack of a choice-theoretic foundation of the relevant macroeconomic relationships these models cannot provide any well-defined welfare criteria to assess the effects of alternative macroeconomic policies. In addition, the absence of private and public intertemporal budget constraints impedes a thorough analysis of current account and exchange rate dynamics, see for instance Obstfeld and Rogoff (1999).

In the last decade, a tremendous amount of research has been undertaken to overcome the major drawbacks of the MFD approach and to develop a new workhorse for the analysis of international macroeconomic issues. Eventually, these attempts resulted in the emergence of a new paradigm in international macroeconomics, labelled “New Open Economy Macroeconomics”. The most prominent contribution to this new literature strand is Obstfeld and Rogoff’s (1995a) *Redux* model, which is generally regarded as the starting point of the NOEM paradigm. The unifying feature of this literature is the combination of monopolistic behavior of economic agents with nominal rigidities in the context of explicitly microfounded dynamic general equilibrium models. Thereby, the NOEM literature builds on the MFD approach by accounting for nominal rigidities, but substitutes the assumptions of ad-hoc relationships between macroeconomic aggregates by a choice-theoretic framework. The integration of explicit utility and profit maximizing problems in an intertemporal general equilibrium model not only provides a more stringent and rigorous fundament of the aggregate macroeconomic relationships but also allows for a strictly welfare based analysis of alternative macroeconomic policies. By introducing a monopolistic supply sector - either on the goods markets or on the labor markets -, where prices

are set above marginal costs, the NOEM approach is capable of reconciling the basic Keynesian assumption that output is temporarily demand-determined when prices are sticky with a strictly rational behavior of economic agents. Moreover, the assumption of monopoly power on the supply side implies that equilibrium output is inefficiently low, which translates into welfare losses of private households. Hence, in the NOEM model setup there is room for possible welfare improving government policies despite the fact that the model framework precludes long run growth effects of economic policies. All in all, the NOEM approach provides a suitable framework to address the questions raised by the international fiscal policy debate that have been outlined above.

What are the specific features of the model framework that we use to address fiscal policy issues? Basically, our analysis in the main chapters of the thesis builds on the baseline model of Obstfeld and Rogoff (1995a). We follow Obstfeld and Rogoff and consider the policy experiment of an unanticipated fiscal expansion in one of the countries. However, we account for several stylized facts by extending the model in various directions.¹ First, we introduce money via cash-in-advance constraints on households and on governments instead of modelling real balances as a direct argument of the households' utility function, the latter of which being the standard practice in the NOEM literature. We thereby modify the scale variable of money demand in that not only private consumption but also public spending trigger money demand. While the competing approaches lead to similar results in the light of monetary policy, the effects of fiscal policy hinge crucially on the exact specification of the scale variable of money demand. Second, we depart from the assumption of

¹A detailed empirical motivation of the respective features as well as an overview of the theoretical background is provided in chapter 3.

identical preferences across countries and consider the possibility of a home bias in consumption. Thereby we construct a model that replicates the empirical finding of a significant home bias in trade. Third, we drop the assumption that the law of one price holds for all goods at any time. Instead we follow Betts and Devereux (2000) and allow for a special form of pricing-to-market behavior where some producers can discriminate between markets and set prices in the currency of the consumer. Finally, we consider not only flexible exchange rates but also a monetary union. Via a direct comparison of the two alternative exchange rate regimes we identify the differences of the output, consumption and welfare effects of fiscal policy.

The outline of the thesis is as follows. In the following chapter 2, we give a brief description of the fiscal policy experiment carried out by Obstfeld and Rogoff (1995a) in the *Redux* model. We also shortly summarize the major fiscal policy related results of the NOEM literature that have been achieved so far. Chapter 3 presents the empirical and theoretical background of our major extensions of the baseline model. We thereby rationalize the assumptions of an absorption based scale variable of money demand, a home bias in consumption, and pricing-to-market behavior on part of the firms. In chapters 4 and 5 we address the national and international effects of expansive fiscal policy under a flexible exchange rate regime and in a monetary union, respectively. In chapter 6, we carry out an explicit comparison of the alternative exchange rate regimes. Finally, chapter 7 summarizes the major results of our analysis, addresses some caveats, and points to possible extensions of the underlying model framework.

Chapter 2

Fiscal Policy in New Open Economy Macroeconomics

As in the majority of the subsequent extensions of the basic model, Obstfeld and Rogoff's (1995a) analysis had its major impact on the discussion of the international transmission of monetary shocks, even though they also considered fiscal policy issues. This section presents the key assumptions and features of the *Redux* model and describes the major results of their fiscal policy experiment. Thereby, we offer both an introduction to the basic NOEM analysis framework and a benchmark for the analyses carried out in chapters 4 and 5. After the description of the *Redux* model, we give a short overview of some of the most important extensions of the basic model in the context of fiscal policy. For more extensive surveys on fiscal policy analyses in the realm of NOEM the reader is referred to Ganelli and Lane (2002) and Coutinho (2003).

2.1 The Redux Model

In the *Redux* model, Obstfeld and Rogoff (1995a, 1999) consider a two-country general equilibrium setup. Each country is populated by a continuum of monopolistic yeoman

households that all produce a single differentiated tradable good. Additionally, there is a government in each country that is responsible for fiscal and monetary policy. Money is directly introduced in the model via the individual's utility function, that is to say, Obstfeld and Rogoff follow the money-in-the-utility approach which implies that private consumption is the scale variable of money demand.¹ Accordingly, each individual derives utility not only from consumption and leisure, but also from the holdings of real balances.

As for our later analysis, it is important to stress that preferences of domestic and foreign individuals do not display a home bias in consumption in the baseline model. The consumption baskets of the respective households thus aggregate symmetrically across the differentiated varieties of the consumption good produced in the two countries. Hence, in the *Redux* model, the elasticity of substitution between domestic and foreign goods equals the degree of monopolistic competition. Importantly, Obstfeld and Rogoff also rule out trade impediments of any kind such that the law of one price holds for all goods at any time. From the assumption of identical preferences across countries it follows that purchasing power parity (PPP) always holds in their model. Furthermore, financial markets are assumed to be incomplete as Arrow-Debreu securities do not exist and the only internationally traded asset is a riskless consumption indexed real bond.² Each individual thus faces a dynamic budget constraint that comprises current and future money and bond holdings, income from the sales of goods, consumption expenditures and lump-sum taxes.

¹This issue will be discussed in more detail in the next chapter.

²In fact, assuming complete asset markets - that is, a complete set of Arrow-Debreu securities - in an environment where the law of one price always holds, leads to complete risk sharing across countries. As a consequence, the current account does not serve as an important transmission channel of macroeconomic disturbances.

For the analysis of fiscal policy, it is assumed that the government consumes a basket of goods that is identical to the one of private agents. To simplify matters, Obstfeld and Rogoff regard government spending as being purely dissipative. Moreover, they assume that the government budget is balanced in each period. Public consumption expenditures are therefore entirely financed via lump-sum taxes as seignorage revenues only arise from monetary policy.

In every period, agents choose the optimal level of consumption, labor supply, and asset holdings and set the optimal output price. One of the central assumptions in the *Redux* model is that prices are fixed for one period (short run), but that they can be fully adjusted in the next period (long run). As pointed out by Obstfeld and Rogoff (1999), the assumption of price stickiness can best be motivated by a menu cost argument, see for instance Mankiw (1985). In the presence of price adjustment costs, producers might find it optimal to leave prices unchanged in response to sufficiently small demand shocks. The absence of staggered price setting behavior in turn implies that the economy reaches its new steady state directly one period after the shock. The applied solution method thus explicitly distinguishes between the short run impact of a fiscal shock, where prices remain fixed on their pre-shock level, and the long run steady state effect after prices have been fully adjusted. As the model does not yield closed-form solutions for the analysis of exogenous shocks, a log-linear approximation is taken around an initial flexible-price steady state. The analysis of fiscal policy therefore has to be restricted to small shocks. Combining sticky prices with a monopolistic structure of goods markets implies that output is entirely demand determined in the short run. Since each household enjoys some monopoly power on the production side, prices are set above marginal costs. If demand then rises in

response to an unanticipated fiscal expansion and prices can not be changed, it is optimal for the yeoman households to satisfy the additional demand. As a consequence, the labor-leisure trade off equations do not bind in the short run.

In order to analyze the effects of fiscal policy in this model framework, Obstfeld and Rogoff (1995a, 1999) carry out the policy experiments of unanticipated temporary and permanent expansions of government spending in one of the two countries. The immediate consequence of a balanced-budget increase in domestic government expenditures is a higher tax burden of domestic individuals. However, the associated crowding out of domestic private consumption is only limited as world demand and hence world output are stimulated. Since relative domestic consumption decreases, money market equilibrium requires a depreciation of the exchange rate.³ Domestic goods then become cheaper relative to foreign goods, resulting in an increase in the demand for domestic goods and a decrease in the demand for foreign goods (expenditure switching effect). As a consequence, short run domestic output is always higher than in the initial steady state, whereas the response of foreign output depends on the persistence of the shock. In the case of a permanent fiscal expansion in the domestic economy, the negative effect on short run foreign output that stems from the depreciation of the exchange rate dominates the positive effect from an increase in world demand. Hence, permanent expansions yield a negative spillover effect on foreign output in the short run. In contrast, if the fiscal expansion is only temporary, the net effect on foreign output in the short run is positive. Likewise, the response of the short run current account is qualitatively different under temporary and permanent shocks. Temporary shocks result in a current account deficit of the domestic country, while

³As noted above, the money-in-the utility approach implies that private consumption is the scale variable of money demand.

permanent shocks lead to a current account surplus. Intuitively, permanent shocks imply a stronger depreciation of the short run exchange rate such that disposable income rises. Additionally, the re-increase in consumption is lower with permanent expansions.

Evaluating the results of the fiscal policy experiment in terms of welfare, Obstfeld and Rogoff (1995a) find that fiscal expansions are always a prosperity-neighbor and a beggar-thyself instrument. The latter result comes at no surprise as government expenditures are assumed to be purely dissipative, implying that a higher tax burden unambiguously leads to welfare losses of domestic households. Intuitively, foreign households benefit from the domestic fiscal expansion via the increase in world demand that partially offsets the initial monopolistic distortion.

2.2 Major Extensions of the Redux Model

As noted above, the publication of the seminal *Redux* model has stirred great interest among macroeconomic researchers due to its potential to offer an alternative framework for analyzing the international transmission of macroeconomic disturbances. Although fiscal policy has received far less attention than monetary policy, several studies contributed significantly to our understanding of potential spillover effects of fiscal policy. Building on Obstfeld and Rogoff's (1995a) approach, the fiscal policy analysis has been extended in various directions. In the context of this thesis, the most relevant extensions of the basic model are related to alternative exchange rate regimes, biased preferences, utility enhancing government expenditures, and alternative pricing behaviors.

Maintaining Obstfeld and Rogoff's (1995a) basic setup, Caselli (2001) develops a

fixed-exchange rate version of the model. The author readdresses the issue of fiscal consolidations in Europe using the insights of the NOEM literature. Her analysis yields the interesting result that fiscal consolidations are less harmful under a unilateral exchange rate peg where the foreign country pursues price stability than in a bilateral exchange rate arrangement where the involved countries fix the world money supply. Essentially, Caselli's (2001) welfare results hinge simply on the fact that fiscal policy is accompanied by a world monetary expansion under the unilateral peg, which leads to a stimulation of world demand. Nevertheless, Caselli (2001) was the first author to address fiscal policy under fixed exchange rates in a NOEM framework. In chapter 5, we develop a monetary union model where the two countries give up monetary sovereignty rather than pegging their exchange rate.

Corsetti and Pesenti (2001) primarily deviate from the *Redux* model by allowing the degree of monopolistic competition to differ from the elasticity of substitution between domestic and foreign goods. They assume an overall consumption index that aggregates in a unitary-elasticity, i.e. Cobb-Douglas form over domestic and foreign goods, while the elasticity of substitution between the individual country-specific varieties is bigger than one. Under these assumptions, the terms of trade provide complete risk-sharing such that current account imbalances are entirely precluded. In this aspect, Corsetti and Pesenti's (2001) results resemble those of Betts and Devereux (1999), who introduce complete asset markets in the *Redux* model. By shutting down the current account, Corsetti and Pesenti's (2001) model does not capture one of the essential mechanisms of fiscal policy transmission which has been highlighted by Obstfeld and Rogoff (1995b). However, the model has the advantage that it provides closed form solutions without resorting to a log-linear approximation.

This in turn implies that the analysis is not restricted to small shocks. The high degree of tractability mainly explains why Corsetti and Pesenti's (2001) setup serves as the basic model in the policy coordination strand of the NOEM literature, see for instance Canzoneri, Cumby, and Diba (2002). A second major difference to the *Redux* model is that Corsetti and Pesenti assume a complete home bias in government expenditures. The authors demonstrate that in this case - unlike in the basic *Redux* model - a permanent fiscal expansion in the domestic country is likely to decrease welfare in the foreign country. The intuition behind this beggar-thy-neighbor property of fiscal expansions is the following: In the short run, the increase in demand for domestically produced goods, that is associated with a domestic fiscal expansion, leads to a one-for-one increase of domestic output, while the remaining variables and thus foreign welfare are unaffected. In the long run, the permanent fiscal expansion leads to higher relative domestic prices and hence to a long run deterioration of the foreign terms of trade that translates into foreign welfare losses.

Ganelli (2003) analyzes the effects of expansive fiscal policy in a variant of Obstfeld and Rogoff's (1995a) basic model where he assumes that government expenditures increase private utility in a non-separable way. He demonstrates that the direct crowding out effect of public expenditures on private consumption is stronger than in the case of purely dissipative government spending. Not surprisingly, Ganelli (2003) obtains the result that the introduction of utility enhancing government expenditures mitigates the beggar-thyself property of fiscal expansions. For certain parameter values, the beggar-thyself result of the *Redux* model may even be reversed. As the additional insights of non-separable government spending in the utility function are limited and complicate the analysis, we opt for the simpler additive formulation in

our later analysis.

Finally, Carré and Collard (2003) provide an explicit comparison of a flexible exchange rate regime and a monetary union in a calibrated NOEM model. The authors allow for capital accumulation and consider price adjustment costs such that the model converges to its post-shock steady state rather than directly jumping into the new equilibrium like in standard NOEM models. Similar to our analysis, government expenditures trigger money demand in Carré and Collard's (2003) model. While the authors opt for a cash-in-advance constraint that includes not only consumption expenditures but also tax payments, we directly impose cash-in-advance constraints on households and on the government. Carré and Collard find that a country that experiences fiscal expansions generally favors a monetary union regime because their model setup implies an appreciation of the nominal exchange rate in the flexible regime. Though the applied model framework is quite appealing as it covers several important features that are relevant for the analysis of fiscal policy in an international context, analytical solutions cannot be achieved. This hampers the understanding of the underlying economic mechanisms substantially. In the two models presented in chapters 4 and 5, we build on Carré and Collard's (2003) work in so far as we elaborate on the role of alternative pricing behaviors for the transmission of fiscal disturbances. Moreover, we directly address the effects of biased preferences, a subject which is not analyzed by the authors. Most importantly, our analytical approach has the advantage that the economic mechanisms at work can be exactly identified, which facilitates a comprehensive positive and normative analysis of fiscal expansions.

Chapter 3

Major Building Blocks

Before turning to the theoretical analysis of the questions related to fiscal policy, which have been raised in the introduction, we give a short description of the major non-standard building blocks of the NOEM models that we deploy in the sequel. We believe that any study of fiscal policy should be aware of the qualitative and quantitative consequences of, first, the scale variable of money demand, second, biased preferences, and third, the pricing behavior of firms. In this section, we provide empirical evidence and a brief summary of the theoretical work that has been done so far on either subject. Note that an extensive survey on the three building blocks is beyond the scope of this thesis, given the great amount of differing approaches to the respective issues in the literature. However, we will try to cover the most prominent contributions in the related fields that touch upon the research goals of our subsequent theoretical analysis of fiscal policy in a NOEM setup. In the main part of the thesis, i.e. in chapters 4 and 5, the implications of our specific model setup will become evident when being compared with the standard *Redux* assumptions.

3.1 The Scale Variable of Money Demand

Almost without exception, the NOEM literature follows the baseline *Redux* model by introducing money into the general equilibrium framework via a money-in-the-utility (MIU) formulation, which dates back to Sidrauski (1967). Under this specification, real balances yield direct utility for private households which is generally motivated by the fact that money facilitates transactions, see for instance Obstfeld and Rogoff (1999). The popularity of the MIU approach is due to its high tractability and well behaved money demand functions in the case of monetary policy: Money demand displays a negative interest rate elasticity and a positive elasticity of the transaction variable “consumption” - properties that are broadly in line with economic intuition and empirical evidence.

However, many economists feel uneasy about writing real balances directly into the utility function. Even more serious drawbacks arise when the issue at stake is fiscal policy as private consumption does then no longer coincide with total absorption in the economy. In that case, not only the private sector but also the government carries out transactions. Unlike monetary policy, fiscal policy thus leads to a transaction volume which only partially translates into money demand in a MIU setting. The intrinsic asymmetry in the transaction needs of households and governments is not consistent with economic intuition as all economic agents are at least to some extent in the need of money as a means of transaction. In fact, in MIU models, tax-financed public spending changes the composition of absorption - i.e. more government spending and less private consumption - and directly leads to lower country-wide money demand.

At first sight, the detailed account of the model predictions on money demand

may look like a subtlety. However, the implications of neglecting the public component of money demand become very important when one considers a two-country model with a flexible exchange rate regime - which is the very case in the NOEM literature. Intuitively, the nominal exchange rate can be interpreted as the relative price of two monies and exchange rate movements mainly reflect the evolution of relative money demand. Therefore, asymmetric expansive fiscal policies generally lead to depreciations of the nominal exchange rate in standard NOEM models even though relative domestic absorption rises and only relative consumption declines. If the scale variable of money demand was total absorption, in contrast, one would expect an appreciation of the exchange rate. With money supply in both countries unchanged, money market equilibrium requires an appreciation of the exchange rate, when domestic absorption relative to foreign absorption increases. The issue of fiscal policy under alternative money demand specifications has also received substantial interest in the Mundell-Fleming-Dornbusch policy framework. A detailed discussion of the topic is provided by Chang and Lai (1997). The authors demonstrate that the equilibrium response of the nominal exchange rate is very sensitive to the choice of the scale variable of money demand - a result that is also obtained in NOEM models as will become clear throughout our analysis.

Tracing back to Mankiw and Summers (1986), there is also some empirical evidence that the constituents of money demand are not limited to private consumption - albeit being the most important source -, but also comprise money demand that stems from transactions of the fiscal authorities. Using US data of the year 1980, Mankiw and Summers (1986) attribute around ten per cent of overall M1 holdings to the government component. Given much larger public sectors in most European

countries, the government component is likely to play an even bigger role for money demand in Europe. In order to account for the private and public sources of money demand we introduce money via cash-in-advance (CIA) constraints in the theoretical models developed in chapters 4 and 5. Specifically, we follow Sargent (1987) and Schmitt-Grohé and Uribe (2000) among others and impose a CIA constraint not only on private households but also on the fiscal authorities. For tractability reasons, we opt for a rigid CIA constraint along the lines of Carlstrom and Fuerst (2001), that implies a zero interest elasticity of money demand. Low or zero interest elasticities of money demand are a common prediction of CIA models, see Sriram (2001). While this feature is often under criticism, it may be justified in times of low nominal interest rates as the interest elasticity of money demand then tends to be very low, see Mulligan and Sala-i-Martin (1997).

All in all, our cash-in-advance approach opens up the possibility to analyze the effects of fiscal policy when the scale variable of money demand is total absorption. We thereby overcome a major drawback of NOEM models with money-in-the-utility in the light of fiscal policy analysis.

3.2 A Home Bias in Consumption

International macroeconomics is a field that is currently confronted with several major puzzles.¹ One of the most prominent puzzles refers to the empirical finding that international goods markets are far more segmented than macroeconomic theory suggests. In fact, consumers tend to strongly favor domestically produced goods over

¹The term “puzzle” describes a situation where results of empirical studies cannot be reconciled with the respective predictions of well-established theoretical models. An overview of six major macroeconomic puzzles as well as a seminal attempt to explain them is provided by Obstfeld and Rogoff (2000b).

goods that are produced abroad. This demand pattern results in a considerable home bias in trade which has been confirmed by a large number of empirical studies in the international trade literature that we now briefly survey. For a recent discussion of the home bias in trade, see Obstfeld and Rogoff (2000b).

In his paper on “the case of the missing trade”, Trefler (1995) demonstrates that a model which allows for a home bias in consumption and international technology differences performs much better empirically than the classical Heckscher-Ohlin-Vanek (HOV) theorem does.² The HOV theorem predicts that countries will export goods that are mainly produced with factors in relatively great supply. For instance, a capital-abundant country should export capital services. Trefler investigates the relationship between a country’s relative factor endowments and the factor content of trade, that is the amounts of labor, capital, land etc. which are embodied in the exports and imports of a country. He documents that factor service trade is far too small compared to the theoretical prediction of the HOV theorem and labels this misprediction as “the case of the missing trade”. He then introduces a preference bias towards domestically produced goods that helps to explain part of the missing trade under the standard HOV assumptions.

In a closely related field, but with a quite different focus, McCallum (1995) finds a so called “border effect” in international trade when analyzing Canadian and U.S. trade flows. On the basis of a gravity model that controls for distance and trading partner sizes, he shows for a sample of the year 1988 that trade between two Canadian provinces has been more than 20 times larger than trade between individual Canadian

²The HOV theorem is the multi-good, multi-factor extension of the classical Heckscher-Ohlin theorem which states that a capital-abundant country tends to export capital-intensive goods, see Heckscher (1919), Ohlin (1933), and Vanek (1968).

provinces and individual U.S. states. Extending the sample to cover the period 1988 - 1994 and performing various robustness checks, Helliwell (1996) endorses McCallum's result of a highly biased trade structure, even though he finds a significantly lower home bias factor of 12.³ Wei (1996) and Evans (1999) conduct similar analyses for a large number of OECD countries and longer time periods. While Wei (1996) finds a relatively low home bias factor of 2.5 for the period 1982 - 1994, Evans (1999) reports magnitudes between Wei's and Helliwell's estimates. All in all, empirical studies suggest that a large degree of home bias in trade is still prevailing despite the opening up of industrial countries in the last decades.

In principal, a home bias in trade can be explained by two major factors that are qualitatively very different, see Evans (2001). First, the process of importing goods is often subject to various obstacles, which simply makes it easier and often cheaper to buy domestically produced goods instead of foreign ones. Such impediments to trade include higher international transport costs, tariffs and non-tariff barriers, and higher administrative costs when dealing with foreign distribution networks. Second, consumers might have an inherent preference for domestically produced goods. This preference phenomenon can be classified as a "pure" home bias in consumption. A question that arises immediately is why individuals should prefer goods only because of their origin of production. In general, it is hard to rationalize this second factor of a home bias in trade because the intrinsic reasons for this behavior are somehow vague. One possible explanation for preferring domestically produced goods is that households are more familiar with these goods than they are with goods produced

³Note that in the empirical trade literature, the home bias factor refers to the ratio between the inner-country and the cross-border trade volume. In our later model based analysis, in contrast, the home bias parameter captures the share of domestically produced goods in the households' consumption baskets, as it is standard in the NOEM literature.

abroad.⁴ As Meade (1951) puts it:

The fact ... that purchasers in each country have a greater familiarity with ... their own country's products will cause purchasers ... to have some natural preference for the purchase of home products.

So far, surprisingly little work has been done to obtain robust estimates of the relevance of the two competing factors. Evans (2001) examines the home bias in trade in various OECD countries with respect to imports from the United States. To this end, she decomposes the overall home bias in trade into two parts: "Location effects" refer to costs incurred when crossing the border as for instance transport costs or tariffs. These costs are often avoided by producing directly in the foreign market instead of exporting the good. By contrast, "nationality effects" are merely related to the nationality of the producer and also apply when production takes place in the foreign market. While finding a significant overall home bias, Evans attributes the major part of it to location effects and finds only weak evidence of nationality effects. As a consequence, local production would allow a firm to avoid a large portion of adverse home bias effects. However, Evans does not provide a sound theoretical explanation, why firms do not engage more strongly in foreign direct investment, if transport costs are the main obstacle for successful export activities.

Obstfeld and Rogoff (2000b) argue in the same spirit as Evans, remarking that the observed home bias in trade is more likely to stem from trade costs and other frictions than from a per se home bias in consumers' preferences. However, they point to the fact that a model that allows for a home bias in preferences has very similar

⁴One reason for the greater familiarity of purchasers with domestically produced goods may be the fact that local producers are better informed about local preferences and therefore tailor their goods to the domestic market.

implications for the international trade pattern when compared with the simple trade cost model the authors propose. As the main interest of this dissertation does not lie in the microeconomic foundations of biased trade but rather in the macroeconomic effects of an asymmetric demand structure on the international transmission of fiscal policies, the introduction of a home bias in consumer preferences instead of the adoption of a transaction cost model seems to be a valid approach. Moreover, the biased preference variant is also quite appealing when one considers European economies. The European Single Market has reduced trade barriers - and hence transaction costs - substantially, while the home bias in trade has proved to be surprisingly persistent, see among others Head and Mayer (2000).

While biased preferences are well recognized in the theoretical literature on international macroeconomics, there is not yet a consensus on their quantitative importance. This is especially true in the context of New Open Economy Macroeconomics as the new theoretical insights of this literature have not yet been subject to rigorous empirical tests. In a recent attempt to advance the NOEM literature in an empirical direction, Bergin (2004) estimates and tests a two-country model fitted to U.S. and G-7 data. Accounting for the prevalence of a home bias in the production technology of the underlying model, the parameter measuring the share of domestically produced goods in the final goods aggregate is set to 0.8 in the empirical analysis - a value which is in line with the lower estimates of the border effect literature. In a calibrated NOEM model, Carré and Collard (2003) allow for a home bias, this time in the consumption baskets, and opt for a value that roughly matches the French import share of 22.5 %.

In general, allowing for a home bias in consumption or production tends to improve the qualitative and quantitative predictions of macroeconomic models in many aspects. For instance, it increases the volatility of nominal exchange rates and generates short-run and long-run deviations from consumption-based purchasing power parity which imply real exchange rate movements. These results are broadly consistent with empirical findings in the real business cycle literature, see Backus, Kehoe, and Kydland (1992) among others. Bergin and Feenstra (2001) replicate the main stylized facts of real exchange rates. In a sample covering the period 1973 - 1997, all G7-ex-U.S. countries exhibit volatile and highly autocorrelated bilateral real exchange rates with the U.S. dollar. Moreover, various time series papers find that real exchange rates are not even mean reverting, see for example Engel (2000). As a consequence, calibrated NOEM models, that aim at the best possible empirical fit of nominal and real exchange rate movements, generally account for a home bias either in preferences or in the production technology. Take Chari, Kehoe, and McGrattan (2000) for an innovative study on real exchange rate movements. In contrast, most analytical NOEM treatments do not account for biased preferences and follow Obstfeld and Rogoff's (1995a) assumption of identical consumption baskets in the two countries. The main reason for not doing so lies in the fact that the incorporation of asymmetric consumer preferences significantly hampers the analytical tractability of the respective models. Especially long run deviations from purchasing power parity complicate the analytical solution process substantially.

Nevertheless, a few authors have studied the macroeconomic effects of a home bias in consumption in the context of New Open Economy Macroeconomics. The majority of these papers has focussed on the analysis of monetary policy issues. Warnock (2003)

investigates the international spillovers and exchange rate dynamics of monetary policy in a standard money-in-the-utility model. In contrast to the basic *Redux* model, where identical consumer preferences are assumed, nominal exchange rate overshooting of the Dornbusch (1976) type can occur if households display a home bias in consumption. Moreover, Warnock points out that biased preferences can give rise to “beggar-thy-neighbor effects” of asymmetric monetary expansions, as combined expenditure switching and terms-of-trade effects are adverse to foreign households’ welfare.⁵ This result reconciles the *Redux* approach, where the baseline model predicts that asymmetric monetary expansions benefit domestic and foreign households symmetrically, with traditional models which stress the beggar-thy-neighbor property of monetary expansions.

Michaelis (2004) extends the basic framework of the *Redux* model in two directions in order to analyze the effects of monetary policy. He allows for a home bias in preferences and assumes that the cross-country substitutability of goods can differ from the within-country substitutability of goods. His major result of a likely “prosper-thy-neighbor” and “beggar-thyself” property of monetary expansions is directly related to the second assumption, while a home bias in preferences tends to work in favor of the country where the expansion originates.

Up to our knowledge, the only paper which addresses the role of biased consumer preferences for the international transmission of fiscal policy is Warnock (1999). However, he focusses exclusively on the positive analysis and does not provide a comprehensive welfare analysis of fiscal expansions. Since he relies on a money-in-the-utility specification, an asymmetric fiscal expansion results in a depreciation of the short run

⁵Surprisingly, Warnock does not distinguish explicitly between the two competing effects and thereby misses an important aspect of the issue.

exchange rate. Warnock demonstrates that, for reasonable parameter values, a strong home bias in preferences results in a current account surplus of the country where the expansion takes place. Short run domestic production is stimulated by expenditure switching and by higher relative demand for domestically produced goods. All in all, Warnock's (1999) model remains fairly close to the *Redux* model, as he sticks to a money-in-the-utility formulation and - even more importantly - does not address the impact of possible pricing-to-market behavior of firms.

Finally, some authors like Corsetti and Pesenti (2001) opt for a complete home bias in government expenditures, while private households are assumed to have symmetric preferences. This kind of preferences tends to reinforce possible beggar-thy-neighbor effects of fiscal expansions as primarily domestic production is stimulated. From empirical grounds, the assumption of a stronger home bias in government expenditures than in private consumption is certainly appealing. However, while the assumption of public spending that falls exclusively on domestically produced goods is very illustrative for the analysis of demand composition effects and their impact on international spillovers of fiscal policy, it is obviously exaggerated from an empirical perspective and remains only a theoretical limiting case.

To sum up, there is broad empirical evidence that consumers strongly favor domestically produced goods over goods produced abroad. The general formulation of a home bias in consumption that is deployed in the theoretical models of the following chapters allows for a comprehensive analysis of the macroeconomic effects of biased preferences in the light of fiscal disturbances.

3.3 Pricing-to-Market Behavior of Firms

Starting with the seminal contributions of Betts and Devereux (1996, 2000), Devereux and Engel (2000) and Obstfeld and Rogoff (2000a), the New Open Economy Macroeconomics literature has shed light on the relevance of the pricing behavior of firms for the international transmission of macroeconomic disturbances. In fact, the question to what extent exchange rate movements translate into changes of import prices, i.e. the degree of the exchange rate pass-through has stimulated a very fruitful debate among researchers in the last years. The debate is centered around the empirical evidence on alternative pricing behaviors, its microeconomic foundations, and their macroeconomic implications, the latter of which are at the center of this thesis. The literature on these subjects is growing at a fast pace. The objective of this subsection is to provide an introduction into the issue of international pricing behavior and to highlight some of the most important results of the literature without claiming to be an exhaustive treatment. At the same time, this section serves as a rationale for our modelling of alternative pricing behaviors in the theoretical models of the subsequent chapters.

One of the fundamental properties of the basic *Redux* model of Obstfeld and Rogoff (1995a) is that the law of one price (LOP) holds for all goods at any time. The law of one price says that in competitive markets, which are free of transportation costs and barriers to trade, homogeneous goods must sell for the same price in all locations, when prices are converted to a common currency. Under these assumptions, any existing price differences would induce an arbitrage process. As preferences are assumed to be identical across countries in the *Redux* model, the law of one price implies that consumption based purchasing power parity always holds. Furthermore,

Obstfeld and Rogoff assume that exporting firms set prices in their own currencies - an assumption generally known as producer currency pricing (PCP). In the light of temporary price rigidities, the price of a specific good is then only fixed in the country where the good is produced (and in the currency of this country), whereas in the foreign country the price varies one-for-one with the nominal exchange rate. In other words, there is a complete pass-through of exchange rate movements to prices of imported goods. The assumption that the law of one price - and consequently purchasing power parity - always holds, simplifies the analysis of monetary and fiscal policy in an international context substantially. However, they appear to be at odds with empirical observations. In fact, there is overwhelming empirical evidence that deviations from the law of one price are large and persistent, see for example Engel (1993) and Jenkins and Rogers (1995). Engel (1999) finds that in the case of the U.S. almost all of the variation in the real exchange rate stems from failures of the law of one price for tradeable goods, while the relative price of non-traded to traded goods plays only a minor role.

In general, the law of one price may fail as international markets are highly segmented due to trade impediments such as transport costs and tariffs. Price differences then cannot be entirely eliminated by arbitrage activities. In principal, there are two basic lines of argumentation that lead to different prices of the same good in different markets, see for example Bergin (2003).

First, monopolistic firms might directly set different prices because of different market conditions. This is particularly relevant in the case of pronounced movements of the exchange rate. Consider the case of a German firm that has some market power and exports cars to the United States. In the face of a strong appreciation of the

euro against the U.S. dollar, the firm might find it profitable to raise the U.S. dollar price by less than the exchange rate change. If the firm faces local production costs denominated in euro, its price markup factor would then decrease. The motivation for the firm to accept a lower per-unit profit in euro, could lie, for instance, in the goal to maintain its U.S. market share. In this example, the appreciation of the exchange rate would be absorbed partially by a higher U.S. dollar price and a smaller profit margin of the exporting firm. The pass-through of exchange rate movements to consumer prices would be less than one. Krugman (1987) coined the name *pricing-to-market* (PTM) for this phenomenon of incomplete pass-through and presented some early partial equilibrium models on the issue. In related work, Froot and Klemperer (1989) show that the magnitude of the pass-through effect depends crucially on whether exchange rate variations are expected to be only temporary or permanent.

Second, the assumption of strongly segmented markets can be supplemented by the assumption that the monopolistic producers set prices in the currency of the local consumer, a behavior often referred to as local currency pricing (LCP). This approach has been pioneered by Betts and Devereux (1996, 2000) and Devereux and Engel (1998, 2000). Consider the case where a German firm that exports to the U.S. initially sets its price in U.S. dollar. Nominal price rigidities then result in temporarily fixed prices in U.S. dollar terms and exchange rate movements result in significant price differences between German and U.S. markets when prices are expressed in the same currency. In the short run, when prices are rigid, the entire movement of the exchange rate would be absorbed by a change in the profit margin of the exporting firm while the degree of exchange rate pass-through into U.S. consumer prices would be zero. Under these conditions, exchange rate changes lead to proportional short run

deviations from the law of one price because consumer prices are temporarily not responsive to changes in the nominal exchange rate. As this phenomenon results from both an assumption about market structures and export invoicing practices, some authors refer to it as PTM cum LCP, see for example Obstfeld and Rogoff (2000a). In the theoretical models of the following chapters, we deploy this second approach to generate deviations from the law of one price. For the sake of lean exposition, we follow the majority of the literature and refer to the assumed pricing behavior simply by the term “pricing-to-market” (PTM).⁶ However, it is important to keep in mind that this approach combines the assumption of monopolistic firms that act on segmented markets with the assumption that prices are fixed in the buyers’ currency. As a consequence, our model neither generates deviations from the law of one price in the context of a monetary union, where a common central bank issues the single currency, nor in the long run, when prices are completely flexible.⁷ In a recent paper, Bergin (2003) develops a monetary union model where deviations from the law of one price are endogenously generated via pricing-to-market, that results from the assumption of translog preferences. He thereby offers an alternative explanation for the divergence in national inflation levels typically observed in monetary unions, the most prominent one being the European Monetary Union. Most importantly, the author overcomes the theoretical fiction of “one money, one price” without relying on a Balassa-Samuelson style productivity differential argument and stresses the importance of pricing-to-market for union-wide price differentials.

⁶In the related literature, there is still no broad consensus on the adequate labelling of this kind of pricing behavior.

⁷Note that the monetary union model of chapter 5 does yield long run deviations from purchasing power parity despite the validity of the law of one price because we allow for biased preferences.

From a macroeconomic perspective, the magnitude of the pass-through of exchange rate changes into import prices is of vital importance for the way monetary and fiscal shocks are internationally transmitted. Under the standard assumption that the law of one price holds for all goods, the complete pass-through of exchange rate movements to consumer prices leads to strong expenditure switching by consumers when prices are rigid. Consider the case of an unexpected depreciation of the euro against the U.S. dollar. Goods produced in Germany then become cheaper compared with goods produced in the U.S. inducing both German and U.S. consumers to increase relative demand for goods produced in Germany. Hence, if the law of one price holds, unexpected exchange rate movements exert a strong impact on the international structure of demand. The PTM approach, in contrast, restrains or even eliminates the expenditure switching role of exchange rates. Under local currency pricing, consumer prices in all countries remain entirely unaffected by unexpected exchange rate changes. Hence, while the markups and profit margins of firms respond to the unexpected exchange rate movement, the international demand structure does not change at all. As Obstfeld and Rogoff (2000a) put it, the incorporation of the PTM approach in open economy models implies “a radical rethinking of the traditional expenditure switching role of exchange rates”. In fact, the assumption of PTM behavior might help to rationalize why even large exchange rate movements appear to have only a small short-run impact on the economy. Of course, in the intermediate case, where only a fraction of goods is subject to the law of one price, the exchange rate pass-through is incomplete and the expenditure switching role of exchange rate movements is present but limited. In the theoretical models of chapters 4 and 5, we employ a general formulation of pricing-to-market that is flexible enough to capture

alternative degrees of PTM.

A second major macroeconomic implication of PTM behavior is related to the terms of trade response in the light of an unexpected exchange rate movement. Contrary to the result in traditional models, where the law of one price holds, pricing-to-market models predict that unexpected currency depreciations are associated with an *improvement* of the respective country's terms of trade. To understand the main intuition behind this result, consider the above example of a depreciation of the euro against the U.S. dollar. With consumer prices set in the local currency and short run nominal price rigidities, the euro price paid in Germany for U.S. imports remains unchanged, while the price of German goods exported to the U.S. rises when expressed in euros. Hence, Germany experiences an improvement of its terms of trade in the short run. As will be discussed below, this implication of pricing-to-market is a very controversially debated issue.

The incorporation of the PTM approach in the New Open Economy Macroeconomics literature has stirred renewed interest in the empirical relevance of PTM and has opened a debate on the explanatory power of this approach. Broadly speaking, the empirically oriented literature can be divided into two main strands. On the one hand, a significant number of recent econometric studies has directly estimated the degree of pricing-to-market in different industries and for different countries. In closely related work, several authors documented empirical estimates of the degree of exchange rate pass-through into import prices. On the other hand, in a more indirect approach to test the relevance of pricing-to-market, various quantitative studies examined the ability of pricing-to-market models to explain stylized macroeconomic facts.

We now present a brief summary of the most important results of the two approaches. In seminal empirical studies on the pricing behavior of firms, Knetter (1989, 1993) measured the degree of price discrimination across export destinations that is associated with exchange rate movements. His sample comprises U.S., U.K., German, and Japanese seven digit industry-level data for the period 1973 - 1987. The author applies a fixed-effects model in order to examine changes in the markup of prices over marginal costs. Specifically, he isolates destination-specific changes from changes in marginal costs and in markups that are common to all destinations. In general, Knetter finds substantial industry-level evidence that in response to exchange rate changes U.K., German and Japanese exporters often adjust destination-specific markups in order to stabilize local-currency prices of exports. Consistent with earlier studies, this behavior is most pronounced in the case of Japan. While in the aggregate pricing-to-market is non-existent in the U.S., Knetter (1993) attributes this finding to a different pattern of industry specialization in the U.S. rather than to behavioral differences by firms in the same industry. Overall, variations in PTM across industries appear to be more important than variations across source and destination countries. Gil-Pareja (2002) uses the same empirical framework as Knetter to study pricing-to-market behavior in several European Union member states over the period 1988 - 1996. By and large, he confirms the major findings of Knetter, indicating both the overall relevance of PTM and the high degree of variation across different products. While PTM appears to be particularly widespread in Germany, Gil-Pareja cannot find any significant evidence of PTM in the case of U.K. firms. In many product classes, British exporters seem to behave in a distinctive manner. Unfortunately, Gil-Pareja does not offer an explanation for this phenomenon.

In a recent study, Warmedinger (2004) investigates pricing-to-market behavior in the Euro area from the importing country's perspective for the period 1980 - 1999. His methodological approach differs from Knetter (1989, 1993) and Gil-Pareja (2002) in that he estimates a structural macro-econometric model addressing both short and long run PTM effects on import price indexes.⁸ The author finds evidence of significant PTM behavior in Germany, France, Italy, and Spain, but not in the Netherlands. Surprisingly, the short and long term effects are of equal size for both Germany and France. In contrast, for Italy and Spain one obtains the expected picture that short run PTM effects are much stronger than long run effects.

All in all, there is persuasive empirical evidence of pricing-to-market behavior in a large number of industries and for several countries, including Japan, Germany and most of the other large EU countries.⁹ In general, the pass-through of exchange rate movements into import prices is limited and thus industrialized countries appear to be best characterized as economies, where firms follow a combination of local-currency pricing and producer-currency pricing. As pointed out earlier, the models of our later theoretical analysis are constructed in a way that the share of firms pursuing PTM can be varied.

Finally, we briefly turn to the literature that addresses the potential of the PTM approach to replicate some important business-cycle facts. Several authors have shown that the incorporation of PTM behavior can contribute significantly to the understanding of empirically observed phenomena. To provide a quantitative illustration of their basic analytical PTM model, Betts and Devereux (2000) recur to

⁸Note that in the theoretical models of the subsequent chapters long run PTM effects cannot arise as all prices are completely flexible, such that the law of one price holds in the long run.

⁹The fact that PTM behavior appears to be almost irrelevant in some countries is still largely unexplained.

a simple simulation exercise. This attempt is carried out more thoroughly in the capital-including version of the model in Betts and Devereux (1999). The authors demonstrate that the PTM model outperforms the standard purchasing-power-parity based *Redux* model in several respects, all of which are well documented in the empirical macroeconomic literature. Firstly, the PTM model generates high international output correlations relative to consumption correlations in the light of monetary and fiscal policy shocks. Secondly, PTM creates the possibility of persistent real exchange rate movements following macroeconomic shocks. Thirdly, the PTM model captures international nominal and real interest rate differentials. Hence, Betts and Devereux (1999) conclude that “the empirical international monetary transmission mechanism seems to be in accord with the economy where pricing-to-market is predominant”.

Prominent calibrated dynamic general equilibrium models include Chari, Kehoe, and McGrattan (2000) and Kollmann (2001a), which combine the assumptions of monopolistic competition and sticky prices with pricing-to-market behavior. These models are superior to standard flexible price models in that they generate significantly more volatile real exchange rates. However, they are not capable of replicating the empirical finding of a very high degree of persistency in real exchange rates, even with staggered price setting. Despite this weakness, the integration of pricing-to-market behavior into the general equilibrium analysis turned out to be an important step towards a better empirical fit of international macroeconomic models.

However, the increasing incorporation of the PTM approach in the NOEM and international business cycle literature has also been criticized by several authors. Most notably, Obstfeld and Rogoff (2000b) question the plausibility and the usefulness of

the PTM approach for a number of reasons. The authors point out that both direct evidence on currency invoicing practices and indirect international evidence on markups suggest a predominance of price setting in exporters' home currencies. Furthermore, they regard the implications of pricing-to-market for expenditure switching and the terms of trade response as widely implausible. To illustrate this point, Obstfeld and Rogoff (2000b) investigate the correlations between changes in nominal exchange rates and changes in the terms of trade. The authors document almost exclusively correlations between the two variables that indicate a deterioration of a country's terms of trade when its nominal exchange rate depreciates. While this observation is contrary to the prediction of models that assume a high degree of PTM, empirical research in this area is still ongoing. For instance, Mihailov (2003) finds correlation coefficients that differ substantially from Obstfeld and Rogoff (2000b) and stresses the time-varying and country dependent nature of the results.

To sum up, empirical evidence both from a microeconomic and a macroeconomic perspective generally suggests that pricing-to-market and local currency pricing behavior are important real world phenomena and that accounting for this kind of pricing behavior advances the profession significantly. However, a consensus on the quantitative relevance of pricing-to-market has not yet been reached. As a consequence, the respective views of researchers on the degree of expenditure switching and on the response of the terms of trade following an exchange rate movement still differ substantially. The theoretical models of the subsequent chapters take account of the competing views by allowing the degree of PTM to vary. We thereby provide a comprehensive analysis of the effects of pricing-to-market on the international transmission of fiscal disturbances.

Chapter 4

Fiscal Policy under Flexible Exchange Rates

4.1 Introduction

In this chapter, we analyze fiscal policy in a *Redux* style two-country general equilibrium model under a flexible exchange rate regime with nominal rigidities on the goods markets. Specifically, we focus on the welfare effects that result from the introduction of pricing-to-market behavior and of a home bias in consumption in a cash-in-advance economy, where not only private consumption but also government expenditures trigger money demand. As outlined in section 3.1, empirical research suggests that beside private consumption also government purchases are relevant for money demand. Our model captures this stylized fact as we assume that both households and governments need cash in order to carry out transactions. Consequently, money demand is absorption based rather than consumption based, which is the case in standard money-in-the-utility NOEM models. This model feature leads to very different findings when analyzing the implications of fiscal policy in an international context against the backdrop of pricing-to-market and biased preferences. In this context, it is necessary to remind the reader that in this dissertation we exclusively

analyze unanticipated asymmetric fiscal shocks - a standard policy experiment in the NOEM literature. Recently, the NOEM model framework has also increasingly been used to study optimal monetary and fiscal rules that aim at macroeconomic stabilization (see for example Dixit and Lambertini (2003) and Beetsma and Jensen (2002)).

The underlying model of our analysis is perhaps closest to Carré and Collard (2003) who analyze fiscal and technology shocks in a calibrated cash-in-advance economy under alternative exchange rate regimes. However, our approach differs methodologically, since we provide closed form solutions. We achieve this as we leave out capital accumulation and consider exogenous price rigidities.¹ The analytical solution identifies the main economic mechanisms at work and provides a deeper understanding of fiscal policy interdependencies. Moreover, we carry out a detailed analysis of the interplay of pricing-to-market and a home bias in consumption, which is absent in the work of Carré and Collard (2003).

This chapter is organized as follows. Section 4.2 gives a description of the underlying model of our analysis. Section 4.3 provides long run and short run solutions of the linearized model with a special focus on the exchange rate movement and current account imbalances. In section 4.4 we carry out an assessment of fiscal expansions in terms of output stimulation and address their impact on the international consumption pattern. Section 4.5 explores the welfare implications of fiscal policy, which is facilitated by the strict micro-foundations of the analysis framework. Finally, section 4.6 provides a summary of the major results of the analysis.

¹The inclusion of capital accumulation and endogenous price rigidities prevents that the model economy reaches a new steady state quickly after unanticipated shocks. Therefore, an analytical solution cannot be derived.

4.2 Model Setup

The considered model consists of two countries, home and foreign, which have equal size. This feature is mandatory because households and governments display a home bias in consumption. Different population sizes would lead to a structure of world demand such that an analytical solution for the steady state is precluded, see Warnock (1999). We normalize the population size in each country to one. Households interact on international goods and bond markets, whereas the production factor labor is immobile between countries. Producers in both countries are split into two groups. A fraction s of producers are capable of segmenting markets as we rule out consumer arbitrage for their goods. These producers set prices for home and foreign markets in the respective buyer's currency, i.e. they pursue local currency pricing. Following Betts and Devereux (2000), we call this kind of pricing behavior “pricing-to-market”. To be more precise, the pricing behavior we label PTM, comprises segmented markets *and* local currency pricing, see our discussion of pricing-to-market in section 3.3. The remaining $(1 - s)$ producers price their goods in the currency of the seller. There is no restriction on trade in these goods. Hence, markets cannot be segmented, and only one price may be set by producers. This producer-currency-pricing behavior is consistent with the law of one price. Finally, fiscal policy in both countries is implemented by the respective governments, while monetary policy decisions are conducted by independent central banks.

4.2.1 Households

The description of the model will be carried out in detail for the home country. As for the foreign country, most of the equations are defined analogously. All foreign

variables are denoted with an asterisk.

Households derive utility from consumption, leisure and government purchases. In that respect, we deviate from most standard NOEM models that follow Obstfeld and Rogoff's (1995a) *Redux* model by assuming that government expenditures are purely dissipative. By including government expenditures additively in the utility function of the household, we follow Tille (2001), Corsetti and Pesenti (2001) and Beetsma and Jensen (2002). The basic advantage of this approach lies in the fact that the welfare analysis of fiscal policy is not blurred by an immediate welfare loss that is associated with a fiscal expansion. Ganelli (2003) investigates the implications of welfare enhancing government spending under the assumption of non-separability. In that case, government spending has a direct impact on the marginal utility of private consumption, which reinforces the crowding out of private consumption against the background of fiscal expansions.

As we are interested in obtaining a manageable closed form solution of the model, we use a special case of the general isoelastic utility function: The elasticity of intertemporal substitution is set to one and equal weight is attached to consumption and leisure.² Thus, an infinitely long-living representative household maximizes discounted life-time utility, which is given by:

$$U = \sum_{t=0}^{\infty} \beta^t [\log c_t + \log(1 - h_t) + V(g_t)]. \quad (4.2.1)$$

The discount factor $\beta \in [0, 1]$ captures the household's time preference. Private consumption in t is denoted by c_t and $(1 - h_t)$ represents leisure enjoyed by the household.

²Attaching different weights to consumption and leisure would complicate the analysis substantially without changing the qualitative results of the model. In Betts and Devereux (2000), the more general utility specification does not yield important additional insights.

Government expenditures g_t enter private utility additively via the function $V(g_t)$, which we will specify in the course of the subsequent welfare analysis. While we generally assume that at the margin government expenditures yield the same utility as private consumption, the model also captures the *Redux* case, where government spending is purely dissipative, i.e. $V(g_t) = 0 \forall g_t \geq 0$. Private consumption is defined as a constant elasticity of substitution (CES) real consumption index. The latter consists of a basket of differentiated goods produced in the domestic economy, c_t^h , and a basket of goods produced in the foreign country, c_t^f :

$$c_t = \left[\omega^{\frac{1}{\theta}} c_t^h^{\frac{\theta-1}{\theta}} + (1-\omega)^{\frac{1}{\theta}} c_t^f^{\frac{\theta-1}{\theta}} \right]^{\frac{\theta}{\theta-1}}. \quad (4.2.2)$$

The consumption basket can be interpreted as a sub-utility function of the household. By determining the weight of the domestically produced goods in the consumption index, $\omega \in [0.5, 1)$ serves as a measure of a possible home bias in consumption.³ If $\omega > 0.5$, domestically produced goods yield higher utility than goods that are produced in the foreign country. We rule out a complete home bias, i.e. $\omega = 1$, as goods and bond markets would be disconnected in that case.

The parameter $\theta > 1$ denotes the elasticity of substitution between the two consumption baskets. To keep the preference structure simple, we follow Obstfeld and Rogoff (1995a) and assume the same cross-country and within-country substitutability of goods.⁴ The consumption baskets of domestic and foreign goods are defined as

³Warnock (2003) models a home bias in consumption using a similar specification of consumption preferences.

⁴Tille (2001) investigates the effects of differing substitutabilities on the welfare implications of monetary shocks. In the working paper version, Tille (1999) also explores unanticipated fiscal shocks within the modified model setup.

$$c_t^h = \left(\int_0^s c_t^m(h)^{\frac{\theta-1}{\theta}} dh + \int_s^1 c_t^a(h)^{\frac{\theta-1}{\theta}} dh \right)^{\frac{\theta}{\theta-1}} \quad (4.2.3)$$

and

$$c_t^f = \left(\int_0^s c_t^m(f)^{\frac{\theta-1}{\theta}} df + \int_s^1 c_t^a(f)^{\frac{\theta-1}{\theta}} df \right)^{\frac{\theta}{\theta-1}}, \quad (4.2.4)$$

where c_t^h aggregates over the consumption of individual PTM goods, $c_t^m(h)$, and PCP goods, $c_t^a(h)$, that are all produced in the domestic economy. The consumption basket, c_t^f , aggregates over the consumption of individual PTM goods, $c_t^m(f)$, and PCP goods, $c_t^a(f)$, that are produced in the foreign economy. Note that a lower within-country substitutability of goods implies a higher degree of monopoly power in the two economies.

The consumption-based price indexes corresponding to the consumption baskets (4.2.2) - (4.2.4) are obtained by minimizing the expenditure for one unit of the respective consumption index.⁵ They read:

$$p_t = \left(\omega p_t^h{}^{1-\theta} + (1-\omega) p_t^f{}^{1-\theta} \right)^{\frac{1}{1-\theta}} \quad (4.2.5)$$

$$p_t^h = \left(\int_0^s p_t^m(h)^{1-\theta} dh + \int_s^1 p_t^a(h)^{1-\theta} dh \right)^{\frac{1}{1-\theta}} \quad (4.2.6)$$

$$p_t^f = \left(\int_0^s p_t^m(f)^{1-\theta} df + \int_s^1 (e_t p_t^{a*}(f))^{1-\theta} df \right)^{\frac{1}{1-\theta}}. \quad (4.2.7)$$

The aggregate price level (4.2.5) is a home biased function of import prices (p_t^f) and of prices of domestic goods (p_t^h). The price index for domestic goods (4.2.6) and the

⁵For the derivation of the price index in the two-good constant elasticity of substitution case, see Obstfeld and Rogoff (1999). The case of a continuum of goods is a straightforward extension of the two-good case.

import price index (4.2.7) aggregate over the prices of s individual goods that are priced to market and $(1 - s)$ PCP goods. Prices denoted with an asterisk are given in the foreign currency and are multiplied by the exchange rate, e_t , as we use price notation of the exchange rate.

In order to analyze the distribution of gains in international trade it is convenient to define the terms of trade, which describe the relation between domestic export and import price indexes in domestic currency:

$$\tau_t = \frac{e_t p_t^{h*}}{p_t^f}, \quad (4.2.8)$$

where the domestic import price index p_t^f is given by equation (4.2.7). The domestic export price index denominated in foreign currency may be stated as

$$p_t^{h*} = \left(\int_0^s p_t^{m*}(h)^{1-\theta} dh + \int_s^1 \left(\frac{p_t^a(h)}{e_t} \right)^{1-\theta} dh \right)^{\frac{1}{1-\theta}}. \quad (4.2.9)$$

A rise in the domestic terms of trade implies that the domestic country benefits *ceteris paribus* more from the international trade of goods. With $\tau_t > 1$, the domestic country receives more than one unit of imported goods in exchange for one unit of exported goods. It will turn out in the subsequent analysis of fiscal shocks, that the degree of pricing-to-market governs the direction of the terms of trade response in the light of rigid prices and exchange rate fluctuations.

Standard consumption maximization yields the domestic households' demand functions for the respective individual goods:⁶

⁶See Obstfeld and Rogoff (1999) for details on the derivation of the demand functions.

$$c_t^a(h) = \left(\frac{p_t^a(h)}{p_t} \right)^{-\theta} \omega c_t \quad (4.2.10)$$

$$c_t^m(h) = \left(\frac{p_t^m(h)}{p_t} \right)^{-\theta} \omega c_t \quad (4.2.11)$$

$$c_t^a(f) = \left(\frac{e_t p_t^{a*}(f)}{p_t} \right)^{-\theta} (1 - \omega) c_t \quad (4.2.12)$$

$$c_t^m(f) = \left(\frac{p_t^m(f)}{p_t} \right)^{-\theta} (1 - \omega) c_t. \quad (4.2.13)$$

The demand functions are specified for goods produced at home (h) and abroad (f). A further distinction has to be made for goods of PCP producers, indicated by a , and goods offered by PTM producers, indicated by m . The difference between pricing-to-market and producer-currency-pricing shows up most clearly in the demand functions (4.2.12) and (4.2.13) for foreign goods. While foreign PCP producers set a foreign currency price that has to be multiplied by the exchange rate, e_t , to yield domestic currency prices, foreign PTM producers segment markets and set the price directly in the currency of the domestic consumer. Hence, in times of fixed prices and exchange rate movements it is only the consumer prices of PCP goods that may change. The possibility of pricing-to-market thereby tends to limit the exchange rate pass-through into import prices. Equations (4.2.10) - (4.2.13) also show that households have biased demand for goods that are produced in their own country as long as $\omega > 0.5$. For any given relative price, domestic households then demand relatively more domestic goods than foreigners do.

As opposed to the majority of NOEM models, we introduce money into the model

economy via a cash-in-advance constraint that captures the role of money as a transaction medium. Importantly, we consider a non-standard CIA constraint, where households can decide upon their money holdings in the beginning of each period after having observed possible fiscal shocks. The representative household's optimization problem is then restricted by the budget constraint

$$m_t^{priv} + R_t f_{t+1} = f_t + w_t h_t + \Pi_t - p_t T_t \quad (4.2.14)$$

and the cash-in-advance constraint

$$m_t^{priv} \geq p_t c_t. \quad (4.2.15)$$

The budget constraint (4.2.14) says that nominal expenditure on cash holdings and bond purchases equals income after taxes, which is derived from maturing bonds, f_t , from the remuneration of labor effort, i.e. hours worked, h_t , multiplied by the nominal wage, w_t , and from profits, Π_t , of domestic firms.⁷ In order to smooth consumption, households may purchase nominal one-period bonds, f_{t+1} , that are denominated in domestic currency units. The bond price, R_t , is inversely related to the nominal interest rate.⁸ Our timing convention is the following: Bonds denoted with $t + 1$ are acquired at the beginning of period t and mature at the beginning of period $t + 1$.

The absence of real bonds implies that real interest rates may differ internationally. As opposed to Obstfeld and Rogoff (1995a), real bond payoffs depend on the

⁷As it is standard in NOEM models, we rule out cross-country ownership of firms. This assumption can be motivated by the strong portfolio home bias present in the real world.

⁸Accordingly, we obtain $R_t = \frac{1}{1+i_{t+1}} = \frac{p_t}{p_{t+1}} \frac{1}{1+r_{t+1}}$, where i_{t+1} and r_{t+1} denote the nominal and real interest rate, respectively.

rate of inflation, which may not be the same in the two countries, and on possible exchange rate overshooting, which is relevant for the foreign real interest rate. The specification of the budget constraint is a short cut to Helpman (1981) as money holdings are not carried over from the previous period, though it is theoretically possible to do so. As Helpman points out, households will not find it reasonable to hold money between periods if interest yielding bonds are available. Money thereby reduces to "money to spend". Another important aspect of the budget constraint is the timing of payments. Households receive nominal labor income, $w_t h_t$, and profits, Π_t , instantaneously. In that respect, we follow Carré and Collard (2003). We thereby avoid an additional source of distortion that is usually associated with standard cash-in-advance models.⁹ Coutinho (2002), who analyzes the effects of different monetary policy rules in a NOEM model, points out that introducing a lag between the receipt of labor income and the possibility to acquire cash on the money market, does not alter the main qualitative implications of her model. This is also true for our approach.

Additionally, households face a cash-in-advance constraint (4.2.15) à la Helpman (1981) and Lucas (1982), which is binding in the light of positive nominal interest rates. Households need money in order to carry out purchases of consumption goods. Our specification rules out possible distortions of the consumption decision by unexpected inflation as households decide on money demand *after* the occurrence of shocks. This special form of the cash-in-advance constraint can also be found in the literature on real indeterminacy, see for example Carlstrom and Fuerst (2001). As the

⁹The analysis of fiscal policy against the background of nominal rigidities and monopolistic competition becomes clearer without an inflation tax on consumption or production. For explicit monetary research goals, however, a more sophisticated CIA constraint is appropriate.

cash-in-advance constraint determines the household's demand for money, this specification leads to a zero interest elasticity of money demand. Consequently, Carlstrom and Fuerst (2001) refer to this approach as a rigid cash-in-advance constraint.

Households maximize their intertemporal utility described by (4.2.1), subject to their budget constraint (4.2.14) and their cash-in-advance constraint (4.2.15). The first-order condition with respect to bond holdings decision yields a standard Euler equation of the form:

$$\beta p_t c_t = R_t p_{t+1} c_{t+1}. \quad (4.2.16)$$

Marginal utility of consumption today equals marginal utility of future consumption, adjusted by the time preference β and multiplied by one plus the real interest rate ($1 + r_{t+1} = \frac{1}{R_t} \frac{p_t}{p_{t+1}}$). The optimal labor supply decision leads to the labor leisure trade-off:

$$\frac{1}{1 - h_t} = \frac{w_t}{p_t c_t}. \quad (4.2.17)$$

At the margin, an additional unit of leisure yields the same utility as the extra consumption possibilities derived from an additional unit of work that is remunerated with the current real wage.

Finally, the cash-in-advance constraint (4.2.15) defines the money demand function of the household:

$$m_t^{priv} = p_t c_t. \quad (4.2.18)$$

The CIA constraint implies a consumption elasticity of money demand equal to one and a zero interest elasticity, which can be attributed to its rigid form as outlined above. Sriram (2001) points out that cash-in-advance constraints in general imply a low sensitivity of money demand to interest rate changes as they impose a strict upper ceiling on consumption purchases via the direct modelling of the economic agents' money demand for transactions. While the rigid CIA constraint is certainly a special case, the resulting money demand functions are nevertheless close to the standard CIA literature.

4.2.2 Central Banks and Governments

As we concentrate on the analysis of fiscal policy issues, we assume that the two independent central banks leave the money supply unchanged. The domestic money supply, m^s , thus evolves according to

$$m_t^s = m_{t-1}^s = \bar{m}^s, \quad (4.2.19)$$

where \bar{m}^s denotes the initial steady state money supply. An analogous equation holds for the foreign money supply rule. This monetary stance can be motivated by a monetary entity that focuses exclusively on price stability. More specifically, price developments that result from optimal adjustments to fundamental disturbances are not accommodated by expansive or restrictive monetary policies.

The government decides in every period on purchases of public goods, g_t . As discussed above, government spending is assumed to enhance private utility in an additive way. The public consumption indexes are defined analogously to the real consumption indexes of the representative household. Let g_t^h denote the basket of

differentiated PTM and PCP goods produced in the domestic economy and g_t^f the basket of PTM and PCP goods produced in the foreign economy:

$$g_t = \left(\omega^{\frac{1}{\theta}} g_t^h{}^{\frac{\theta-1}{\theta}} + (1 - \omega)^{\frac{1}{\theta}} g_t^f{}^{\frac{\theta-1}{\theta}} \right)^{\frac{\theta}{\theta-1}} \quad (4.2.20)$$

$$g_t^h = \left(\int_0^s g_t^m(h)^{\frac{\theta-1}{\theta}} dh + \int_s^1 g_t^a(h)^{\frac{\theta-1}{\theta}} dh \right)^{\frac{\theta}{\theta-1}} \quad (4.2.21)$$

$$g_t^f = \left(\int_0^s g_t^m(f)^{\frac{\theta-1}{\theta}} df + \int_s^1 g_t^a(f)^{\frac{\theta-1}{\theta}} df \right)^{\frac{\theta}{\theta-1}} . \quad (4.2.22)$$

For $\omega > 0.5$, government expenditures are also biased towards domestically produced goods. The resulting public demand functions for individual goods are analogous to the demand functions of the households (4.2.10) - (4.2.13). Some studies in the realm of New Open Economy Macroeconomics, for instance Tille (1999) and Corsetti and Pesenti (2001), consider a complete home bias in government expenditures whereas consumers are indifferent to the goods' country of origin when making their consumption decisions. However, we prefer to avoid this asymmetry between public and private preferences as the polar assumption of a complete home bias in government expenditures may lead to an overestimation of the potential beggar-thy-neighbor property of fiscal expansions.

Due to the specification of the central bank's policy, the government cannot rely on seignorage as a financing source for public expenditures. Therefore, the government finances its expenditures solely via lump sum taxes, T_t .¹⁰ The government budget

¹⁰Introducing distortionary taxes such as income or consumption taxes along the lines of Auerbach and Obstfeld (2004, 2005) may be a fruitful extension of the model.

constraint then reduces to:

$$g_t = T_t. \tag{4.2.23}$$

We follow Sargent (1987), chapter V, and Schmitt-Grohé and Uribe (2000) in that the government also faces a cash-in-advance constraint for its purchases:

$$m_t^{gov} \geq p_t g_t. \tag{4.2.24}$$

This assumption can be motivated by empirical findings that suggest a substantial role of government expenditures for overall money demand, see the discussion in section 3.1. An alternative way to account for the public component of money demand is to include tax payments in the household's cash-in-advance constraint as investigated by Pitterle and Steffen (2004a). Then, public expenditures affect money demand rather indirectly via the cash requirements of the associated tax payments.

4.2.3 Firms

In both countries, there are two types of firms. As mentioned above, a fraction s of firms pursues pricing-to-market (PTM) while the remaining firms follow standard producer-currency-pricing (PCP). Each firm produces a single differentiated good. Producers therefore enjoy some monopoly power and derive positive profits from their productive activities. These profits are equally distributed to the respective national households as they are the sole owners of the firms. We assume that labor is the only production factor. As we abstract from technology shocks, we define the production

functions for domestic PTM producers $h \in [0, s]$ and PCP producers $h \in (s, 1]$ in its simplest form:

$$y_t^a(h) = h_t^a(h) \quad (4.2.25)$$

$$y_t^m(h) + y_t^{m*}(h) = h_t^m(h). \quad (4.2.26)$$

For producers that pursue PTM, total output is divided between output sold at home, $y_t^m(h)$, and output sold abroad, $y_t^{m*}(h)$, while this separation is not required for PCP producers.

PCP producers maximize profits subject to overall demand for their products, which stems from domestic and foreign households and governments:

$$\max_{p_t^a(h)} \Pi_t^a(h) = p_t^a(h)y_t^a(h) - w_t h_t^a(h), \quad (4.2.27)$$

subject to

$$y_t^a(h) = \left(\frac{p_t^a(h)}{p_t} \right)^{-\theta} \omega (c_t + g_t) + \left(\frac{p_t^a(h)}{e_t p_t^*} \right)^{-\theta} (1 - \omega)(c_t^* + g_t^*). \quad (4.2.28)$$

Recall that due to arbitrage possibilities of consumers, PCP producers set the same domestic currency price in both markets.

PTM producers, in contrast, maximize profits by setting optimal prices for the domestic and the foreign market in the respective consumers' currency:

$$\max_{p_t^m(h), p_t^{m*}(h)} \Pi_t^m(h) = p_t^m(h)y_t^m(h) + e_t p_t^{m*}(h)y_t^{m*}(h) - w_t h_t^m(h) \quad (4.2.29)$$

subject to

$$y_t^m(h) = \left(\frac{p_t^m(h)}{p_t} \right)^{-\theta} \omega(c_t + g_t) \quad (4.2.30)$$

$$y_t^{m^*}(h) = \left(\frac{p_t^{m^*}(h)}{p_t^*} \right)^{-\theta} (1 - \omega)(c_t^* + g_t^*). \quad (4.2.31)$$

Though PTM producers are free to pursue price discrimination, they will set the same domestic currency price for home and foreign consumers when prices are completely flexible. To show this, we derive the optimal price setting rule of any home producer h by solving the respective maximization problems. It turns out that the optimal price is always given as a markup on nominal marginal production costs:

$$p_t^h = p_t^a(h) = p_t^m(h) = e_t p_t^{m^*}(h) = \frac{\theta}{\theta - 1} w_t. \quad (4.2.32)$$

A higher value of θ implies a lower markup factor. Hence, the degree of monopolistic distortion decreases with the degree of substitutability between goods. As a result of the assumption of constant elasticity of substitution (CES) consumption baskets, the level of overall demand does not influence the optimal price. Therefore, PTM producers will not charge different prices across countries, even if the demand levels differ. Furthermore, both types of producers face the same marginal production costs, and will therefore set the same price. Hence, we can conclude that the differentiation between PCP and PTM price setting behavior does not matter when prices are flexible. However, if consumer prices are rigid and the nominal exchange rate changes,

domestic currency prices of PTM goods sold at home differ from those of PTM goods sold abroad. In this case, domestic currency revenues derived from the sale of PTM goods fluctuate. An appreciation of the nominal exchange rate reduces the domestic currency value of sales abroad, while a depreciation increases the value.

4.3 Short Run and Long Run Equilibrium

With the setup of the model at hand, we now turn to the policy experiment of an unanticipated asymmetric fiscal shock. We investigate the effects of a temporary and a permanent increase of tax-financed government expenditures under a flexible exchange rate regime. This section presents the derivation of the short and long run equilibrium. In the following section, we take a closer look at the consumption and output responses that follow an asymmetric fiscal expansion.

We assume that prices are temporarily sticky and cannot be changed by the producers directly after the occurrence of the fiscal shock. In the long run prices are fully flexible and producers set the optimal price according to equation (4.2.32). Therefore, the economy reaches its new steady state right after the shock period. Models that endogenize price rigidities via explicit price adjustment costs like Hairault and Portier (1993) or use Calvo (1983) style price determination as in Kollmann (2001a, 2001b) yield more dynamic optimization problems of the firms. Though these approaches are richer in structure as the economies gradually approach the new steady state they hamper the finding of analytical solutions.¹¹ Furthermore, while these models generally aim at replicating specific empirical features, our focus is to provide a

¹¹This kind of models relies on calibration techniques and usually yields higher persistence and better dynamics of price and exchange rate movements in the light of monetary and fiscal shocks. However, the major economic mechanisms at work are less transparent in calibrated models than in models that provide analytical solutions.

comprehensive welfare analysis of asymmetric fiscal disturbances.

Given this special structure of price rigidities, we may split the algebraic problem into two parts that can be treated (almost) independently. First, we solve for the long run values of the international consumption differential and the exchange rate under the assumption of flexible prices. It turns out that both depend on exogenous variables and on endogenous bond holdings that are determined in the short run. Second, we solve for the short run equilibrium with rigid prices given the long run values of the variables. The combination of the short run (period t) and the long run (period $t + 1$) solutions finally allows us to determine the exchange rate response. The exchange rate response will then be used to derive the equilibrium levels of consumption, output and prices. The essential link between the short and long run system is provided by bond holdings that are acquired in the shock period as a result of the households' desire to smooth consumption.

As the model is non-linear, we have to recur to a linearization technique. We follow the NOEM literature and opt for log-linearization. This implies that we may not consider large shocks to the dynamic system as the approximation error would grow too much once you leave the steady state. In a major contribution to the analysis of monetary and fiscal policy in a NOEM setup, Corsetti and Pesenti (2001) present a model that does not rely on log-linearization. However, as outlined above, the postulated Cobb-Douglas specification of the consumption baskets rules out any current account imbalances. This stands in contrast to the achievements of the intertemporal approach to the current account, summarized by Obstfeld and Rogoff (1995b), which stresses the importance of the current account as a main channel of international transmission of macroeconomic shocks.

As we evaluate the dynamic system around a stationary equilibrium, we first derive the initial steady state of the model. This exercise also yields the flexible price version of the model, which serves as a starting point for the following shock analysis in the presence of price rigidities.

4.3.1 Steady State

To achieve a convenient closed form solution of the steady state we assume that initial nominal bond holdings and government expenditure equal zero. In the sequel, steady state values of the variables are denoted with a bar.

One of the most important features of NOEM models is the incorporation of monopolistic competition into the general equilibrium analysis. This gives way to demand driven welfare improvements, because production is inefficiently low in the initial steady state. We may derive the steady state output and employment levels from the labor markets equilibria in both countries, which result from the labor-leisure trade-off of households (4.2.17) and the optimal pricing rule of firms (4.2.32):¹²

$$\bar{h} = \bar{h}^* = \bar{y} = \bar{y}^* = \frac{\frac{\theta-1}{\theta}}{1 + \frac{\theta-1}{\theta}}. \quad (4.3.1)$$

The socially optimal output level would be $\frac{1}{2}$ which follows from a social planner's optimization calculus. The inverse markup $\frac{\theta-1}{\theta}$ that defines the market power of firms, enters the labor market equilibria via the (distorted) real wage that workers receive for an hour worked, see the pricing equation (4.2.32).

¹²Since prices are flexible in the initial steady state, there is no need to differentiate between pricing-to-market and producer-currency-pricing behavior.

Steady state consumption may be derived from barred versions of the current account and are given as:

$$\bar{c} = \frac{\bar{p}^h}{\bar{p}} \bar{y} = \frac{\bar{p}^h}{\bar{p}} \bar{h} = \bar{h}. \quad (4.3.2)$$

With zero steady state government expenditures and zero bond holdings, which imply a balanced current account, domestic real production always equals domestic real consumption in the initial steady state. This follows from the identity of individual goods prices and the overall price index. Obviously, an inefficiently low level of hours worked translates into inefficiently low production and thereby lower consumption levels.

Barred versions of the Euler equation (4.2.16) link the steady state real interest rate to the time preference factor β :

$$\bar{r} = \frac{1 - \beta}{\beta}. \quad (4.3.3)$$

Finally, money market clearing reveals that the steady state nominal exchange rate hinges on relative money supply and on the international consumption ratio. As purchasing power parity holds in the steady state, we can easily make use of the steady state versions of the domestic money demand function (4.2.18) and of its foreign counterpart to obtain the following expression for the steady state nominal exchange rate:

$$\bar{e} = \frac{\bar{m} c^*}{\bar{m}^* c}. \quad (4.3.4)$$

Intuitively, an expansionary monetary policy precipitates a depreciation of the exchange rate from the perspective of the domestic country while a higher relative consumption level leads to an appreciation. The latter relation arises from higher relative money demand that governs the relative price of the domestic currency.

4.3.2 Long Run Equilibrium

We now address the question how asymmetric fiscal expansions affect the steady state economies. As outlined above, we first analyze the long run (period $t+1$) implications of a fiscal shock that occurs at the beginning of period t . The long run equilibrium in the two countries is defined by a system of equations that includes market clearing and optimality conditions.

MONEY MARKETS

To begin with, we derive the money market clearing conditions in the two countries. Overall money demand directly results from the aggregation of private and public money demand and has to match the respective money supply in the two countries. The money market clearing equations thus read:

$$m_{t+1}^s = m_{t+1}^{priv} + m_{t+1}^{gov} = p_{t+1}(c_{t+1} + g_{t+1}) \quad (4.3.5)$$

$$m_{t+1}^{s*} = m_{t+1}^{priv*} + m_{t+1}^{gov*} = p_{t+1}^*(c_{t+1}^* + g_{t+1}^*). \quad (4.3.6)$$

Note that the imposition of cash-in-advance constraints on *both* private households *and* governments implies that the scale variable of money demand amounts to total absorption. As discussed in section 3.1, the issue of the scale variable of money

demand against the background of fiscal policy has not been addressed in detail in the NOEM literature. Most of the models rely on money-in-the-utility specifications, where the scale variable of money demand is private consumption. The neglect of the public component of money demand leads to very different implications for the exchange rate response and the resulting welfare effects of fiscal policy. In the sequel, this issue will be addressed in more detail.

CURRENT ACCOUNTS

The national budget constraints, i.e. the respective current account equations, can analytically be derived by integrating the households' budget constraints over time and by imposing a standard transversality condition.¹³ They state that nominal expenditures on private and government consumption and on home-currency denominated bonds (left-hand side) must equal nominal income from goods sales plus pay-offs derived from maturing bonds that have been acquired in the previous period (right-hand side):

$$p_{t+1}(c_{t+1} + g_{t+1}) + R_{t+1}f_{t+2} = p_{t+1}^h y_{t+1} + f_{t+1} \quad (4.3.7)$$

$$p_{t+1}^*(c_{t+1}^* + g_{t+1}^*) + \frac{R_{t+1}}{e_{t+1}} f_{t+2}^* = p_{t+1}^{f*} y_{t+1}^* + \frac{f_{t+1}^*}{e_{t+1}}. \quad (4.3.8)$$

GOODS MARKETS

The goods market clearing conditions in both countries can be obtained by equating the supply of each good with the total (private and public) domestic and foreign demand for each good. They read:

¹³See Obstfeld and Rogoff (1999) for the technical details in the baseline *Redux* model.

$$y_{t+1} = \left(\frac{p_{t+1}^h}{p_{t+1}} \right)^{-\theta} \omega (c_{t+1} + g_{t+1}) + \left(\frac{p_{t+1}^h}{e_{t+1} p_{t+1}^*} \right)^{-\theta} (1 - \omega) (c_{t+1}^* + g_{t+1}^*) \quad (4.3.9)$$

$$y_{t+1}^* = \left(\frac{p_{t+1}^{f*}}{p_{t+1}^*} \right)^{-\theta} \omega (c_{t+1}^* + g_{t+1}^*) + \left(\frac{p_{t+1}^{f*} e_{t+1}}{p_{t+1}} \right)^{-\theta} (1 - \omega) (c_{t+1} + g_{t+1}). \quad (4.3.10)$$

As prices are flexible in the long run and all producers face the same marginal production costs, we do not have to distinguish between PCP and PTM producers when stating the long run goods markets.

EULER EQUATIONS

The Euler equations describe the optimal consumption paths in both countries and are directly taken from the household's optimization problem:

$$\beta p_{t+1} c_{t+1} = R_{t+1} p_{t+2} c_{t+2} \quad (4.3.11)$$

$$\beta p_{t+1}^* c_{t+1}^* = R_{t+1} \frac{e_{t+2}}{e_{t+1}} p_{t+2}^* c_{t+2}^*. \quad (4.3.12)$$

LABOR MARKETS

Finally, we combine the households' optimal labor supply decision (4.2.17) and the firms' pricing rule (4.2.32). Eliminating the nominal wage, w , we obtain the labor market clearing conditions in the two countries:

$$\frac{1}{1 - h_{t+1}} = \frac{\theta - 1}{\theta} \frac{p_{t+1}^h}{p_{t+1} c_{t+1}} \quad (4.3.13)$$

$$\frac{1}{1 - h_{t+1}^*} = \frac{\theta - 1}{\theta} \frac{p_{t+1}^{f*}}{p_{t+1}^* c_{t+1}^*}. \quad (4.3.14)$$

Before proceeding, we log-linearize the model around the steady state as it is standard in the NOEM literature. From now on, let the percentage deviation of a variable x from its steady state value \bar{x} be defined as $\tilde{x} = \frac{dx}{\bar{x}}$.¹⁴ As we assume zero bond holdings and no government expenditure in the initial steady state, the respective deviations of these variables will be related to steady state domestic consumption \bar{c} . The complete log-linearized long run equilibrium is stated in Appendix A.1.

An important feature of our model are the long run implications of fiscal shocks for the price levels. Due to the home bias in private and public consumption, possible marginal production cost differentials across countries may lead to long run deviations from purchasing power parity. To derive this effect, we linearize the domestic price indices (4.2.5) - (4.2.7) and their foreign counterparts around the symmetric steady state.¹⁵ The linearized versions of the domestic and foreign price indexes are stated in Table 4.1.

In the long run, producers are free to set their prices and PTM producers may segment markets. Nevertheless, the law of one price will hold for all types of goods in our specific model setup because the optimal price across producers is derived as a markup on marginal production costs. Therefore, PTM producers will set prices for the foreign market in the same way as PCP producers do. That is, they calculate the optimal price in their own currency and then multiply (divide) it by the exchange rate.

¹⁴For the sake of lean exposition, we will always refer to the deviation when speaking of a variable, if not otherwise stated.

¹⁵We briefly illustrate the linearization procedure for the domestic aggregate price index p_{t+1} : In a first step, we calculate the absolute deviation from the steady state, dp_{t+1} . We then divide the resulting expression by the initial steady state value, \bar{p} , and simplify the result, making use of the underlying symmetry properties.

Table 4.1: Linearized long run price indexes

$$\begin{aligned}
\tilde{p}_{t+1} &= \omega \tilde{p}_{t+1}^h + (1 - \omega) \tilde{p}_{t+1}^f & \tilde{p}_{t+1}^* &= \omega \tilde{p}_{t+1}^{f*} + (1 - \omega) \tilde{p}_{t+1}^{h*} \\
\tilde{p}_{t+1}^h &= s \tilde{p}_{t+1}^m(h) + (1 - s) \tilde{p}_{t+1}^a(h) & \tilde{p}_{t+1}^{f*} &= s \tilde{p}_{t+1}^{m*}(f) + (1 - s) \tilde{p}_{t+1}^{a*}(f) \\
\tilde{p}_{t+1}^f &= s \tilde{p}_{t+1}^m(f) + (1 - s) (\tilde{p}_{t+1}^{a*}(f) + \tilde{e}_{t+1}) & \tilde{p}_{t+1}^{h*} &= s \tilde{p}_{t+1}^{m*}(h) + (1 - s) (\tilde{p}_{t+1}^a(h) - \tilde{e}_{t+1})
\end{aligned}$$

However, the validity of the law of one price for all goods does not imply purchasing power parity, as marginal production costs across countries may differ and domestic and foreign consumption baskets are not identical. For example, if the real wage at home is lower than abroad, domestic producers - PTM and PCP types alike - will set a lower price than their foreign competitors. Then, it is not only the exchange rate, but also the mix of (relatively cheap) domestic and (relatively expensive) foreign goods in the consumption bundles that governs the international price level differential. Making use of the law of one price, the aggregate international price level differential can be written as:

$$\tilde{p}_{t+1} - \tilde{p}_{t+1}^* = \tilde{e}_{t+1} + (2\omega - 1)(\tilde{p}_{t+1}^h - \tilde{p}_{t+1}^f). \quad (4.3.15)$$

Obviously, in a world of symmetric preferences, i.e. $\omega = 0.5$, equation (4.3.15) reduces to the familiar log-linear form of purchasing power parity, $\tilde{p}_{t+1} - \tilde{p}_{t+1}^* = \tilde{e}_{t+1}$.

Following Obstfeld and Rogoff (1995a) and Aoki (1981) we now solve for the country-differences of the linearized variables before analyzing the individual variables in the subsequent sections. As insinuated above, the different pricing behaviors of

firms do not matter for the long run solution of the model.¹⁶ Combining the difference of the linearized long run money markets, (4.3.5) and (4.3.6), and remembering that both central banks leave the money supply unchanged, we can derive the following expression for the long run exchange rate:

$$\tilde{e}_{t+1} = -(\tilde{c}_{t+1} - \tilde{c}_{t+1}^*) - \frac{dg_{t+1} - dg_{t+1}^*}{\bar{c}} - (2\omega - 1)(\tilde{p}_{t+1}^h - \tilde{p}_{t+1}^f). \quad (4.3.16)$$

Equation (4.3.16) reveals that the endogenous price differential of home and foreign goods only enters the exchange rate equation if there is a home bias in consumption. As already mentioned, the reason for this lies in the lack of purchasing power parity in the long run. Once we set $\omega = 0.5$, we arrive immediately at an exchange rate equation that only depends on the exogenous government spending differential and on the endogenous long run consumption differential. In this case, the long run exchange rate equation that stems from the money market equilibrium depends only on relative absorption, which is the scale variable of relative money demand. A rise in relative absorption yields an appreciation of the long run exchange rate, while lower relative absorption leads to a depreciation.

Using linearized versions of equations (4.3.7) - (4.3.14) we may derive the long run consumption differential following deviations from the steady state in the short run:¹⁷

$$\tilde{c}_{t+1} - \tilde{c}_{t+1}^* = \frac{\theta}{2\theta - 1} \frac{2(1 - \beta)df_{t+1}}{\bar{p}\bar{c}} + \left(\frac{2\omega - 1}{2\omega(\theta - 1) + 1} - \frac{\theta}{2\theta - 1} \right) \frac{dg_{t+1} - dg_{t+1}^*}{\bar{c}}. \quad (4.3.17)$$

¹⁶The only way in which the parameter s , which determines the share of PTM firms, enters the long run solution is via bond holdings that are determined in the short run.

¹⁷See Appendix A.2 for details.

The evolution of the long run consumption differential is governed by nominal bond holdings and by the long run government expenditure differential if the fiscal shock is permanent, i.e. $\frac{dg_{t+1}-dg_{t+1}^*}{\bar{c}} > 0$. Domestic bond holdings will be determined by the short run solution of the model. Assume that domestic households acquire debt in the short run as a response to a domestic fiscal expansion. Negative domestic bond holdings then reduce the consumption differential as home residents face permanent interest payments that allow for a higher relative consumption path of foreign residents. A positive long run government spending differential yields a further reduction of the consumption differential.¹⁸ This is mainly due to the permanent reduction of disposable income in the home country as government expenditures are tax-financed. Once we abstract from home bias concerns ($\omega = 0.5$), the coefficient that determines the impact of government spending on consumption reduces to $-\frac{\theta}{\theta+(\theta-1)}$. The absolute value of this term is always less than one since θ is bigger than one. Hence, a certain positive government expenditure differential does not fully translate into a consumption differential as households react to the increased tax burden by supplying more labor and thereby generate more income.¹⁹ Thus, an asymmetric domestic fiscal expansion raises overall relative domestic absorption.

Finally, we may take a look at the effects of a home bias in private consumption and government spending on the long run consumption differential. While the coefficient of bond holdings remains unaffected, the coefficient of the public spending differential depends on the size of ω . With $\frac{dg_{t+1}-dg_{t+1}^*}{\bar{c}} > 0$, the partial derivative of the consumption differential with respect to ω is positive, $\frac{\partial(\tilde{c}_{t+1}-\tilde{c}_{t+1}^*)}{\partial\omega} > 0$. Therefore,

¹⁸In order to obtain the sign of the government spending differential, we may rewrite the preceding term as $-\left(\frac{\theta-1}{2\theta-1} + \frac{2(1-\omega)\theta}{(2(\theta-1)\omega+1)(2\theta-1)}\right)$.

¹⁹This behavior is reinforced by the way we model government spending in the utility function of the households, where the marginal utility of private consumption remains unaffected.

a rising home bias mitigates the negative effect of an asymmetric domestic fiscal expansion on the consumption differential. The explanation for this dampening effect is straightforward, once you consider the goods markets. Domestic demand increases relative to foreign demand because of the limited crowding out effect of the fiscal expansion. As both public and private demand are ruled by a home bias, the overall increase in world demand falls primarily on home goods, thereby increasing domestic relative income compared with a situation of symmetric preferences. The home bias driven rise in relative domestic income can either come through a direct increase in domestic production or via improved long run terms of trade if domestic households demand higher wages. In the sequel, we refer to this kind of phenomenon as an overall demand effect which comprises a possible stimulation of world demand and its possibly asymmetric composition.

4.3.3 Short Run Equilibrium

We can now proceed to the analysis of the short run (period t) equilibrium, which is characterized by sticky prices. Before the fiscal shock occurs, producers set their prices above marginal costs and they cannot change them but in the next period. In the light of a small unanticipated increase in demand, it is profitable for a producer to raise output. Consequently, production becomes entirely demand determined in the short run.²⁰ The combination of fixed prices and adjusting nominal wages to meet the required labor supply implies that the labor market conditions do not bind. Hence, they are not relevant for the characterization of the short run equilibrium system, which can be described by the following equations:

²⁰We have to rule out situations where marginal costs exceed marginal revenues so as to guarantee the full adjustment of production to demand changes.

MONEY MARKETS

$$m_t^s = m_t^{priv} + m_t^{gov} = p_t (c_t + g_t) \quad (4.3.18)$$

$$m_t^{s*} = m_t^{priv*} + m_t^{gov*} = p_t^* (c_t^* + g_t^*) \quad (4.3.19)$$

CURRENT ACCOUNTS

$$p_t(c_t + g_t) + R_t f_{t+1} = (1-s)p_t^a(h)y_t^a(h) + s(p_t^m(h)y_t^m(h) + e_t p_t^{m*}(h)y_t^{m*}(h)) \quad (4.3.20)$$

$$p_t^*(c_t^* + g_t^*) + \frac{R_t}{e_t} f_{t+1}^* = (1-s)p_t^{a*}(f)y_t^a(f) + s\left(p_t^{m*}(f)y_t^{m*}(f) + \frac{p_t^m(f)}{e_t}y_t^m(f)\right) \quad (4.3.21)$$

GOODS MARKETS

$$y_t^a(h) = \left(\frac{p_t^a(h)}{p_t}\right)^{-\theta} \omega (c_t + g_t) + \left(\frac{p_t^a(h)}{e_t p_t^*}\right)^{-\theta} (1-\omega)(c_t^* + g_t^*) \quad (4.3.22)$$

$$y_t^a(f) = \left(\frac{p_t^{a*}(f)}{p_t^*}\right)^{-\theta} \omega (c_t^* + g_t^*) + \left(\frac{p_t^{a*}(f)e_t}{p_t}\right)^{-\theta} (1-\omega)(c_t + g_t) \quad (4.3.23)$$

$$y_t^m(h) = \left(\frac{p_t^m(h)}{p_t}\right)^{-\theta} \omega (c_t + g_t) \quad (4.3.24)$$

$$y_t^{m*}(h) = \left(\frac{p_t^{m*}(h)}{p_t^*}\right)^{-\theta} (1-\omega)(c_t^* + g_t^*) \quad (4.3.25)$$

$$y_t^m(f) = \left(\frac{p_t^m(f)}{p_t}\right)^{-\theta} (1-\omega)(c_t + g_t) \quad (4.3.26)$$

$$y_t^{m*}(f) = \left(\frac{p_t^{m*}(f)}{p_t^*}\right)^{-\theta} \omega (c_t^* + g_t^*) \quad (4.3.27)$$

EULER EQUATIONS

$$\beta p_t c_t = R_t p_{t+1} c_{t+1} \quad (4.3.28)$$

$$\beta p_t^* c_t^* = R_t \frac{e_{t+1}}{e_t} p_{t+1}^* c_{t+1}^*. \quad (4.3.29)$$

Besides the labor markets, the short run equilibrium system differs from the long run system only in one major aspect. As the pricing regime now becomes relevant, we distinguish explicitly between PCP and PTM goods in the current account and goods markets equations. With respect to the current accounts, total revenues from sales of PTM goods comprise revenues from sales in the domestic and in the foreign country. Demand from the foreign country is denoted by an asterisk, while h and f define the country of production. Analogous to the current accounts, we differentiate on the goods markets explicitly between demand that stems from the respective domestic markets and demand faced in the foreign markets. The linearized version of the short run equilibrium is stated in Appendix A.3.

In order to derive the positive effects of fiscal policy we rely on a solution process where the short run nominal exchange rate response serves as a vehicle. We may express all other variables of interest in a semi-reduced form only depending on the exchange rate response and on international fiscal developments. This approach has two major advantages: a concise exposition of the positive results and a more direct comparability of fiscal shocks that display different persistence properties.

Using short term versions of the linearized price indexes stated in Table 4.1 and remembering that prices are sticky in the short run, it becomes clear that a change in the overall national price indexes can only be brought about through a variation of the exchange rate:

$$\tilde{p}_t = (1 - \omega)(1 - s)\tilde{e}_t \tag{4.3.30}$$

$$\tilde{p}_t^* = -(1 - \omega)(1 - s)\tilde{e}_t. \tag{4.3.31}$$

The overall price indexes do not respond to an exchange rate movement if there is either full pricing to market ($s = 1$) or an almost complete home bias ($\omega \rightarrow 1$). While pricing-to-market limits the pass-through of exchange rate movements to consumer prices from the supply side, a home bias in consumption works in a similar way from the demand side.

Short Run Exchange Rate Response

Taking linearized differences of the money market equations (4.3.18) and (4.3.19), substituting for the price levels and keeping in mind that money supplies do not vary, we obtain the following expression for the short run exchange rate:

$$2(1 - \omega)(1 - s)\tilde{e}_t = -(\tilde{c}_t - \tilde{c}_t^*) - \frac{dg_t - dg_t^*}{\bar{c}}. \quad (4.3.32)$$

Thus, from the monetary part of the model, we get a movement of the exchange rate that only depends on the interaction of the government expenditure differential and the endogenous private consumption differential.

In a next step, we derive a second exchange rate equation that stems from the real part of the model. Combining linearized versions of the domestic and foreign current accounts, the goods markets and the overall price levels, we reach the following expression:

$$\tilde{e}_t = \frac{(\tilde{c}_t - \tilde{c}_t^*) + \frac{\beta df_{t+1}}{\bar{p}\bar{c}(1 - \omega)} + \frac{dg_t - dg_t^*}{\bar{c}}}{2s - 1 + 2\omega\theta(1 - s)}. \quad (4.3.33)$$

The two exchange rate equations contain two endogenous terms, $\tilde{c}_t - \tilde{c}_t^*$ and df_{t+1} , and the exogenous government expenditure differential, $\frac{dg_t - dg_t^*}{\bar{c}}$. In the following,

we have to eliminate the short run consumption differential and the international bond holdings from the exchange rate equations. Remember that bond holdings are the essential link between the short and long run solution of the model. Hence, we step back to the long run consumption differential (4.3.17) and solve for the bond holdings, $\frac{df_{t+1}}{\bar{p}\bar{c}}$. Next, we use linearized versions of the short run Euler equations in order to eliminate the long run consumption differential. Then, substituting for the international bond holdings in (4.3.33) and combining it with exchange rate equation (4.3.32) in order to eliminate the short run consumption differential, gives the short run response of the exchange rate to an unanticipated fiscal shock.²¹

In the sequel, we explore both temporary and permanent asymmetric fiscal expansions so as to highlight the effects associated with the persistence of the macroeconomic disturbance.

Permanent Fiscal Expansions

We start with the analysis of the short run exchange rate response in the case of a permanent shock to government expenditures, where domestic public spending exceeds foreign spending, i.e. $dg_t = dg_{t+1} = dg_p > dg_t^* = dg_{t+1}^* = dg_p^* \geq 0$. The short run exchange rate response then reads:²²

$$\tilde{e}_t = -\frac{\frac{\theta(\theta-1)2\omega}{(\theta-1)2\omega+1}}{\bar{r}((\theta-1)(1-s)2\omega+1)(2\omega-1+2(1-\omega)\theta)+2\theta-1} \frac{dg_p - dg_p^*}{\bar{c}}. \quad (4.3.34)$$

²¹Owing to the complexity of the solution process we provide a more detailed description in Appendix A.4.

²²In the solution equations throughout the analysis of flexible exchange rates, we express the time preference β via the steady state real interest rate, i.e. $\beta = \frac{1}{1+\bar{r}}$.

For the parameter range given above ($\theta > 1$, $0.5 \leq \omega < 1$, $0 \leq s \leq 1$), an unanticipated permanent relative expansion of domestic government expenditure leads to a nominal *appreciation* of the exchange rate. The main driving force behind this result is an increase in relative domestic demand for real balances. For the sake of lean exposition, we give the economic reasoning behind the exchange rate movement for the special case of an asymmetric domestic fiscal expansion, where $dg_p > 0$ and $dg_p^* = 0$. Note, that the model also captures the more general case where both domestic and foreign government spending levels are subject to unanticipated shocks.

Consider the following adjustment process: A higher level of domestic government expenditures is financed by an increase in taxes. Therefore, the disposable income of domestic households decreases, which forces them to reduce consumption, leading to a higher marginal utility of consumption. In the short run, output and consequently hours worked are completely demand determined. In the long run, however, home residents are inclined to work more so as to achieve the optimal labor leisure trade off. The marginal utility of long run leisure rises, while the additional income spent on consumption lowers the marginal utility of long run consumption until equilibrium is restored. In that case, the long run domestic labor market will clear at a higher equilibrium work effort facilitating a re-increase of consumption. Via the Euler equations that describe the households' desire to smooth consumption - abstracting from real interest rate effects - a higher long run consumption level implies higher short run consumption. Consequently, real domestic absorption rises, which is the scale variable of money demand as we impose cash-in-advance constraints on both households and the government. In other words, the domestic government and domestic households together require extra real balances in order to carry out the desired short run

transactions. As money supply is unchanged, the aggregate domestic price level has to decrease. In light of temporarily fixed consumer prices of domestically produced goods, this decrease of the price level can only be brought about through cheaper imports. Hence, the nominal exchange rate appreciates. Note that this explanation stems from the monetary part of the model and requires that at least a small fraction of producers stick to producer-currency-pricing.

It is important to set this result in a broader context. The effect of a fiscal expansion on the exchange rate will be radically different in a standard NOEM model with money-in-the-utility or in CIA models where governments do not face a CIA constraint.²³ The very reason for this lies in the feature that in these models the scale variable of money demand is not total absorption but private consumption. In fact, an increase in relative tax-financed government expenditures then leads to a depreciation of the short run exchange rate.

We can now proceed to analyze how the degree of PTM and a possible home bias affect the response of the nominal exchange rate in the light of a domestic fiscal expansion. The partial derivative of the exchange rate with respect to the degree of PTM reads:

$$\frac{\partial e_t}{\partial s} = - \frac{\frac{\theta(\theta - 1)2\omega(2\omega\bar{r}(\theta - 1)(2\omega - 1 + 2\theta(1 - \omega)))}{(\theta - 1)2\omega + 1}}{[\bar{r}((\theta - 1)(1 - s)2\omega + 1)(2\omega - 1 + 2(1 - \omega)\theta) + 2\theta - 1]^2} \frac{dg_p - dg_p^*}{\bar{c}} \quad (4.3.35)$$

For our parameter values, the derivative is always negative when the government spending differential is positive. Higher values of s lead to a larger appreciation

²³Prominent examples for the money-in-the-utility approach in a similar model setup are Betts and Devereux (2000) and Warnock (1999). Pitterle and Steffen (2004b) provide an explicit comparison of alternative scale variables of money demand and the associated welfare implications of fiscal policy.

because the prices of less goods are then affected by a variation of the exchange rate. Consequently, the prices of the goods not subject to PTM have to change more strongly to restore equilibrium, which means that the appreciation of the exchange rate has to be more pronounced.

Likewise, a higher value of ω , representing a stronger bias for domestically produced goods, is expected to reinforce the appreciation of the exchange rate. Again, the explanation is straightforward: A smaller proportion of imported goods in the consumption basket of the household implies that the prices of these goods have to change more strongly to obtain the required movement of the overall price level. Yet, the sign of the partial derivative of the exchange rate with respect to ω is not unique.²⁴ For reasonable parameter values, however, our conjecture is validated. Figure 4.1 illustrates the effect of a variation in ω - depicted on the abscissae - on the exchange rate for three different values of s ($s = 0$, $s = 0.5$, $s = 1$), when domestic government expenditures are permanently increased by one percent, while foreign government expenditures are always zero.²⁵ On the axis of ordinates, we obtain the percentage deviation of the short run exchange rate from its initial steady state level. For the numerical simulation, we have picked parameter values which are in line with the consensus parametrization in the NOEM and Real Business Cycle literature, namely $\theta = 6$ and $\beta = 0.95$.²⁶ The choice of the time preference parameter implies a steady

²⁴The resulting analytical expression is very tedious. Hence, we restrain from explicitly presenting the partial derivative.

²⁵Throughout the remainder of the thesis, the numerical evaluation of the model will be carried out for this special case of an asymmetric domestic fiscal expansion.

²⁶See for example Warnock (2003) and Sutherland (1996). In the numerical simulation of the model, we also checked for the robustness of the results to this choice. The qualitative implications of the model do not change for reasonable alternative values of θ and β .

state annual real interest rate of roughly five percent. The value of θ yields a relatively high mark-up rate suitable for countries that are regarded as less competitive than the United States, as it is the case for most European countries, see for instance Hairault and Portier (1993).

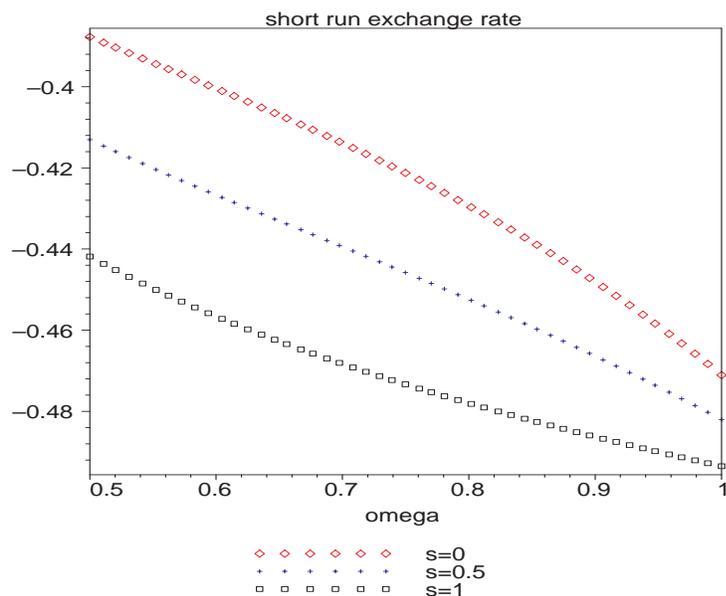


Figure 4.1: Short run exchange rate (permanent shock)

Figure 4.1 gives also some insights into the interplay of pricing-to-market and biased preferences. A stronger home bias in consumption reduces the quantitative importance of the pricing regime for the exchange rate response. If households and governments consume more goods that are produced in their own country, less goods are traded internationally. The pricing regime, however, only plays a role in international trade. Hence, for higher values of ω , the pricing regime is less relevant for the exchange rate response.

Temporary Fiscal Expansions

Let us now turn to the analysis of a temporary asymmetric fiscal expansion, where $dg_t > dg_t^*$ and $dg_{t+1} = dg_{t+1}^* = 0$. The short run response of the nominal exchange rate then reduces to:

$$\tilde{\epsilon}_t = -\frac{2\theta - 1}{\bar{r}((\theta - 1)(1 - s)2\omega + 1)(2\omega - 1 + 2(1 - \omega)\theta) + 2\theta - 1} \frac{dg_t - dg_t^*}{\bar{c}}. \quad (4.3.36)$$

Following a temporary fiscal shock, the exchange rate appreciation is more pronounced than in the case of a permanent shock. Graphically, this is illustrated in figure 4.2, where we assumed the same parameter values as in the permanent case.²⁷ Intuitively, domestic households anticipate the temporary nature of the tax burden and the implied higher consumption possibilities in the long run. Therefore, consumption smoothing is much stronger in the case of a temporary expansion. The higher level of short run absorption then requires higher real balances, which leads to a stronger exchange rate response.

Biased preferences have the same qualitative effects on the exchange rate movement as in the permanent case. However, the quantitative importance of a rising home bias is lower in the temporary case.²⁸ To provide some intuition for this result, consider the demand stimulating pattern under either specification of persistence. A stronger home bias in consumption has more beneficial effects on discounted domestic income with a permanent expansion, because demand is then persistently stimulated.

²⁷We can also show this result analytically. In exchange rate equation (4.3.34), the long run component of the permanent expansion enters positively thereby dampening the appreciation of the nominal exchange rate.

²⁸This result can be deduced from a comparison of the two exchange rate equations. While the denominator is identical, only the numerator of the permanent version is affected by ω .

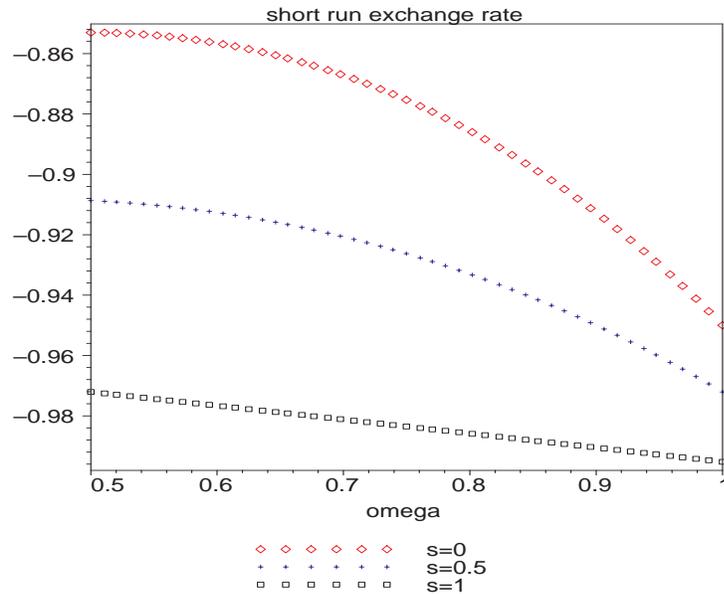


Figure 4.2: Short run exchange rate (temporary shock)

Anticipating the higher future consumption possibilities, domestic households also increase current consumption. Therefore, a marginal increase of the home bias in consumption has stronger effects on the exchange rate response if the fiscal expansion is permanent.

The interplay of pricing-to-market and a home bias in consumption is quite similar to the case of a permanent shock concerning the effects of a varying home bias on the relevance of the pricing behavior. However, in contrast to the permanent shock, the degree of pricing-to-market now substantially affects the quantitative importance of the home bias in consumption for the short run response of the exchange rate. The larger is the share of PTM producers, the lower is the impact of biased preferences.

Short Run Trade Balance Response

By now, we have derived an explicit solution for the short run exchange rate that only depends on the model parameters and on exogenous shocks to government expenditures. As noted above, the remaining variables of interest can be expressed in a semi-reduced form, i.e. in terms of the short run exchange rate response. Before turning to the short and long run consumption and output responses in both countries, we derive the short run trade balance response, which provides the intertemporal link between the short and long run solution of the model.²⁹ Solving exchange rate equation (4.3.33) for bond holdings yields:

$$\frac{df_{t+1}}{\bar{p}\bar{c}} = (1 + \bar{r})(1 - \omega) \left([2s - 1 + 2\omega\theta(1 - s)]\tilde{e}_t - (\tilde{c}_t - \tilde{c}_t^*) - \frac{dg_t - dg_t^*}{\bar{c}} \right). \quad (4.3.37)$$

Equation (4.3.37) relates domestic bond holdings to the exchange rate response and to the international real absorption differential. The exchange rate term captures both the real production differential and the price effects on the supply and demand side. The combined effect can be interpreted as the change in domestic purchasing power of nominal income. Both the appreciation of the exchange rate and the positive absorption differential work towards a deterioration of the trade balance. The aggravating effect of the exchange rate response on the trade balance stands in sharp contrast to standard NOEM models that yield depreciations which dampen current account imbalances. Replacing the short run consumption differential defined by exchange rate equation (4.3.32) we get a trade balance effect that only depends on

²⁹Note that the short run trade balance response is equivalent to the current account response as bond holdings are zero in the initial steady state. Hence, both expressions capture the evolution of the short run bond market.

the short run exchange rate movement:

$$\frac{df_{t+1}}{\bar{p}\bar{c}} = (1 + \bar{r})(1 - \omega) [(1 - s)2\omega(\theta - 1) + 1] \tilde{e}_t. \quad (4.3.38)$$

Thus, a domestic fiscal expansion causes a deterioration of the trade balance, regardless of the persistence of the shock.³⁰ With output temporarily falling due to a decline in competitiveness, and the sum of private and government consumption demand rising, domestic households resort to selling bonds in order to finance the gap between net short run income and consumption expenditures. Figures 4.3 and 4.4 provide graphical illustrations of the trade balance responses in the case of permanent and temporary shocks. As before, the percentage deviations of the trade balance from the steady state level are plotted on the axis of ordinates, while on the abscissae we depict the degree of the home bias. Comparing the two graphs reveals that the deterioration of the trade balance is more pronounced in the case of a temporary shock because domestic households then anticipate higher future income, which leads to a stronger re-increase of short run consumption.

A higher degree of pricing-to-market mitigates the deterioration of the trade balance. The economic reasoning for this result is found in the combined expenditure switching and terms of trade effects associated with the exchange rate appreciation. For instance, with $s = 1$, there is no expenditure switching to foreign goods at all. Hence, production is not shifted to the foreign country. Even though the response of the terms of trade is then negative, the positive effect on domestic production dominates and domestic households rely less on debt financing of short run consumption.

³⁰When introducing money directly via the utility function, an asymmetric fiscal expansion may lead to a short run improvement of the trade balance in the case of a permanent shock, see Betts and Devereux (2000).

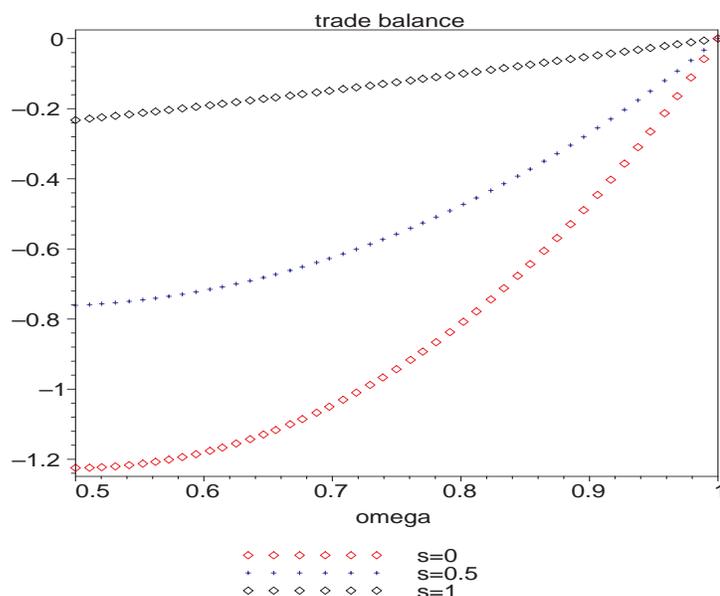


Figure 4.3: Trade balance (permanent shock)

As these short run effects are at the core of the welfare analysis of fiscal policy, we will examine them in detail in section 4.5.

As for biased preferences, a stronger home bias in consumption also dampens the trade balance response. This is basically due to the fact that a larger share of world demand is then directed towards the domestic country and domestic production is therefore relatively higher. Besides, a very strong home bias implies that the two economies are relatively isolated and that the bond market is only of low importance.

4.4 Consumption and Output Effects

We are now prepared to solve the model for the consumption and output responses in both countries. We will make extensive use of the reduced form of the short run exchange rate response and the semi-reduced trade balance response derived in the

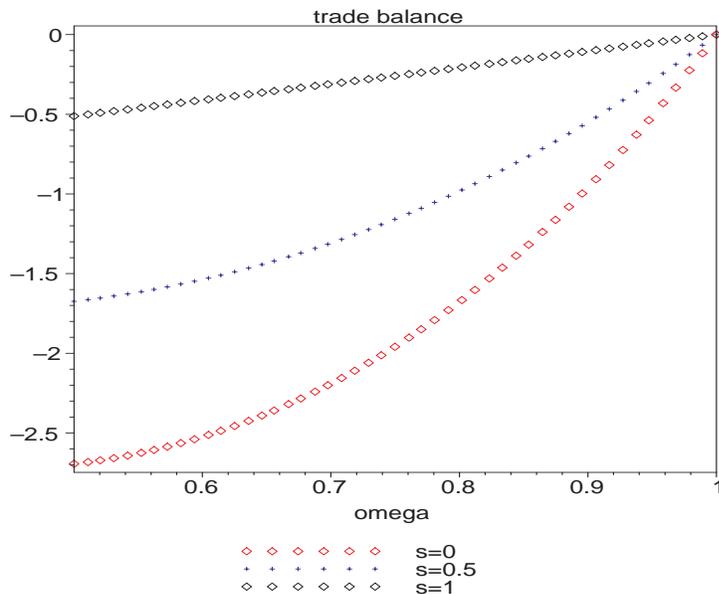


Figure 4.4: Trade balance (temporary shock)

previous section. We first establish the respective effects of fiscal expansions on world consumption and output before deriving the individual country variables. Again, we concentrate on the special case of an asymmetric domestic fiscal expansion where $dg_t > 0$, $dg_{t+1} \geq 0$ and $dg_t^* = dg_{t+1}^* = 0$. As before, the qualitative implications of the model are unaffected by this simplification of an asymmetric shock.

4.4.1 World Consumption and Output

Starting with the short run world consumption response, we add up the linearized versions of the short run money markets (4.3.18) and (4.3.19), stated in Appendix A.3:

$$\tilde{c}_t^w = -\frac{1}{2} \frac{dg_t}{\bar{c}}. \quad (4.4.1)$$

Note that price deviations cancel out via equations (4.3.30) and (4.3.31). The effect of fiscal expansions on overall world consumption is unambiguously negative, no matter whether the expansion is temporary or permanent.³¹ This is due to the fact that overall world demand has to remain unchanged as world real money balances are fixed in the short run: While the respective national money supplies do not accommodate the fiscal expansion, relative changes in the overall price levels in the two countries cancel out when aggregating world real balances. This model feature is in line with findings of the cash-in-advance literature as the cash constraint imposes a strict ceiling on transactions when prices are fixed, see Sriram (2001). As a direct consequence, short run world production, which is entirely demand determined, remains on its pre-shock level, that is $\tilde{y}_t^w = 0$.

From the linearized long run domestic and foreign current accounts and labor markets, we derive the world consumption and output responses, which are valid for all subsequent periods $t + i$ with $i = 1, 2, \dots, \infty$:³²

$$\tilde{c}_{t+1}^w = - \left(\frac{\theta - 1}{2\theta - 1} \right) \frac{1}{2} \frac{dg_{t+1}}{\bar{c}} \quad (4.4.2)$$

$$\tilde{y}_{t+1}^w = \left(\frac{\theta}{2\theta - 1} \right) \frac{1}{2} \frac{dg_{t+1}}{\bar{c}}. \quad (4.4.3)$$

From period $t + 1$ onwards, world consumption of the private sector is reduced, while world output is stimulated as long as the fiscal expansion is permanent. In that case,

³¹In the money-in-the-utility model proposed by Betts and Devereux (2000), the short run world consumption level is affected if and only if fiscal expansions are permanent.

³²As the new steady state is reached in period $t + 1$, we can simplify the notation and express long run responses via the time index $t + 1$.

domestic households permanently face a higher tax burden, which lowers disposable income. The initial reduction of long run private consumption leads to a suboptimal situation, where the marginal utility of consumption exceeds the marginal utility of leisure. Hence, domestic households give up leisure in exchange for higher consumption possibilities, i.e. they work more. However, domestic consumption remains always below its initial steady state value. Overall, the long run responses of world aggregates are mainly driven by the supply side developments in the domestic country.

As opposed to models, where the quadratic labor effort enters the households' utility function negatively - which is the case in the basic *Redux* model -, the substitutability of goods θ does affect long run world consumption and output. For lower values of θ , world consumption is reduced less against the background of fiscal expansions, while world production is increased more. Intuitively, a lower substitutability of goods implies a higher degree of monopolistic power and therefore lower steady state output and employment levels. Marginal utility of consumption is then relatively high and households have a strong incentive to consume more. This translates into a higher world production level. As a rule, fiscal policy is more effective in terms of output stimulation in economies that face substantial monopolistic distortions on goods or labor markets. In very competitive economies, production is close to its socially efficient level and hence there is only a very limited role of fiscal policy as a stabilization tool.

4.4.2 Short Run Consumption Responses

We now turn to the derivation of the short run country specific responses of consumption and then move on to the short run country specific output effects. The response of any individual variable may be stated as a combination of its world aggregate

and its differential. Using exchange rate equation (4.3.32), which stems from money market clearing, short run domestic consumption may be expressed as:

$$\begin{aligned}
\tilde{c}_t &= \tilde{c}_t^w + \frac{1}{2}(\tilde{c}_t - \tilde{c}_t^*) \\
&= \tilde{c}_t^w - \frac{1}{2} \frac{dg_t}{\bar{c}} - (1 - \omega)(1 - s)\tilde{e}_t \\
&= -\frac{dg_t}{\bar{c}} - (1 - \omega)(1 - s)\tilde{e}_t.
\end{aligned} \tag{4.4.4}$$

We see that the effect of a government spending shock on short run consumption at home can be decomposed into two parts. As mentioned before, the direct effect of an increase in tax financed government spending is - ceteris paribus - a complete crowding out of private consumption, $-\frac{dg_t}{\bar{c}}$. At the same time, the short run movement of the exchange rate facilitates consumption smoothing. An appreciation lowers the domestic price level, which allows - through the money market conditions - consumption to fall by less than the amount of taxes paid.

In the same way, we derive the foreign short run consumption response:

$$\begin{aligned}
\tilde{c}_t^* &= \tilde{c}_t^w - \frac{1}{2}(\tilde{c}_t - \tilde{c}_t^*) \\
&= \tilde{c}_t^w + \frac{1}{2} \frac{dg_t}{\bar{c}} + (1 - \omega)(1 - s)\tilde{e}_t \\
&= (1 - \omega)(1 - s)\tilde{e}_t.
\end{aligned} \tag{4.4.5}$$

The only effect on foreign's short run consumption stems from the movement of the nominal exchange rate. The appreciation reduces the amount of real balances available to foreign households and to the government via its positive impact on the

foreign overall price level, which in turn requires a fall in foreign absorption. This implies that the domestic re-increase in consumption is mirrored by a reduction of foreign consumption.

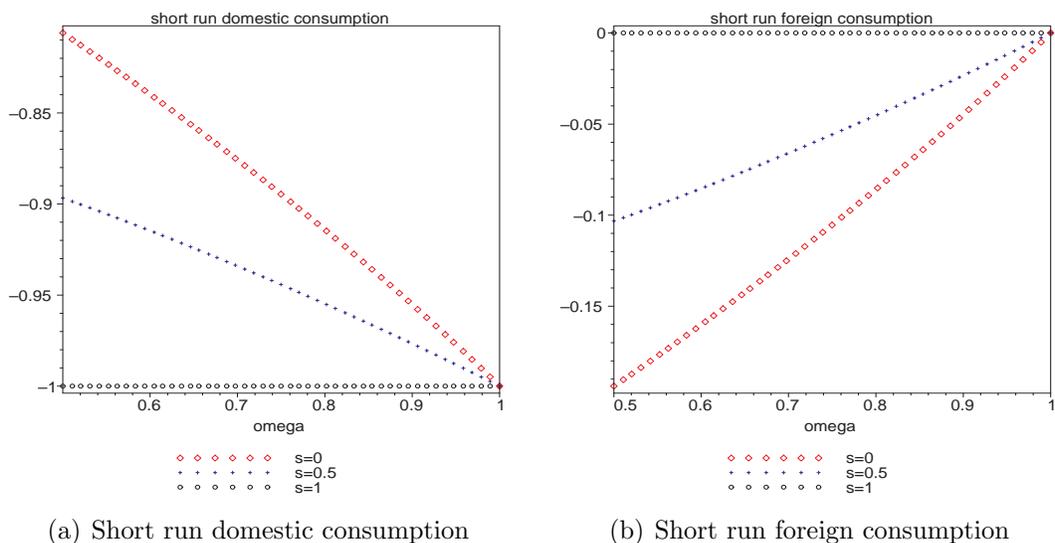


Figure 4.5: Short run consumption (permanent shock)

The effects of the exchange rate movement on short run consumption hinge both on the degree of pricing-to-market and on the home bias in consumption. As depicted in figure 4.5, both a higher degree of PTM and a stronger home bias lead to lower domestic and higher foreign consumption. This is due to the fact that the limited pass-through effect of pricing-to-market and the limited quantity effect of a home bias in consumption dominate the amplified appreciation of the exchange rate that is associated with both phenomena. In the limiting case of complete pricing-to-market, biased preferences are of no consequence for the international short run consumption profiles. In that case, all prices are fixed in the consumers' currency, the respective overall price levels remain unaffected by the appreciation of the exchange rate, and

hence the CIA constraints impede any change in the transaction volumes in the two countries.

Figure 4.6 illustrates the short run consumption responses following a temporary fiscal expansion. In general, domestic households reduce consumption by less as they

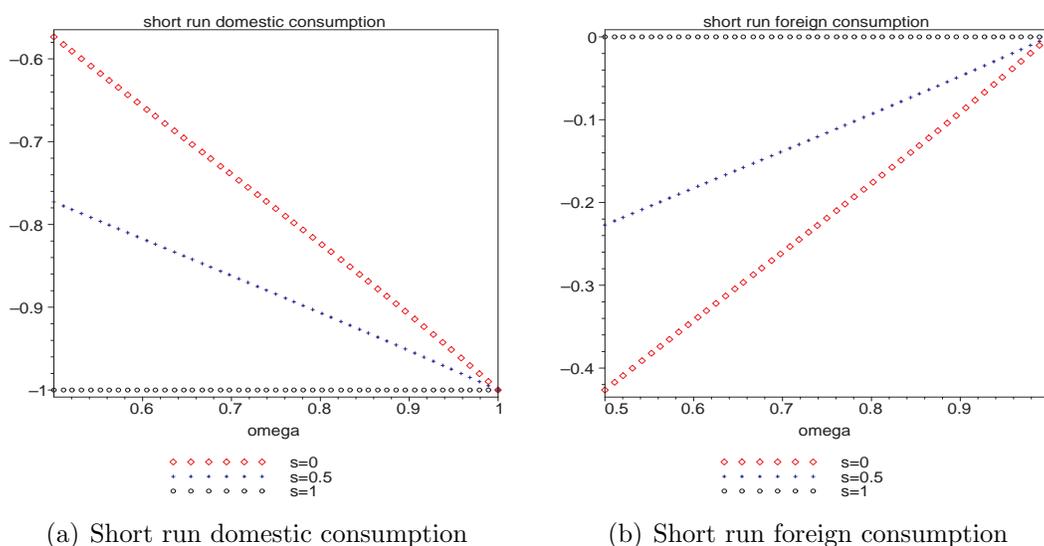


Figure 4.6: Short run consumption (temporary shock)

anticipate the temporary nature of the shock. Due to the rigid cash-in-advance constraints, foreign consumption has to decrease substantially more than with permanent expansions so as to facilitate the stronger domestic re-increase in consumption. This points to a higher international correlation of short run consumption profiles when fiscal expansions are temporary. In the case of very high degrees of biased preferences and/or of pricing-to-market, the consumption correlation is very low as the exchange rate movement does not work its way through to consumer prices. In the context of pricing-to-market, Betts and Devereux (2000) consider this model outcome as one of

the major advantages over traditional approaches that exclusively assume producer-currency-pricing because of the overwhelming empirical evidence of low international consumption correlations. Obstfeld and Rogoff (2000b), for instance, list this empirical finding as one of the six major puzzles in international macroeconomics.

4.4.3 Short Run Output Responses

As outlined above, short run world demand and consequently world production are not affected by a domestic fiscal expansion. The respective individual output responses are directly given by the aggregation of the domestic and foreign demand functions for the different types of goods:

$$y_t = (1 - s)y_t^a(h) + s(y_t^m(h) + y_t^{m*}(h)) \quad (4.4.6)$$

$$y_t^* = (1 - s)y_t^a(f) + s(y_t^{m*}(f) + y_t^m(f)). \quad (4.4.7)$$

Linearizing these conditions and substituting for the respective demand quantities via the linearized goods market equilibria we get:

$$\tilde{y}_t = \omega \tilde{c}_t + (1 - \omega)\tilde{c}_t^* + \omega \frac{dg_t}{\bar{c}} + (1 - s)(1 - \omega)2\omega\theta \tilde{e}_t \quad (4.4.8)$$

$$\tilde{y}_t^* = \omega \tilde{c}_t^* + (1 - \omega)\tilde{c}_t + (1 - \omega)\frac{dg_t}{\bar{c}} - (1 - s)(1 - \omega)2\omega\theta \tilde{e}_t. \quad (4.4.9)$$

Plugging in the domestic and foreign consumption responses, \tilde{c}_t and \tilde{c}_t^* , given by equations (4.4.4) and (4.4.5), we arrive at:

$$\tilde{y}_t = (1 - s)(1 - \omega)(2\omega(\theta - 1) + 1) \tilde{e}_t \quad (4.4.10)$$

$$\tilde{y}_t^* = -(1 - s)(1 - \omega)(2\omega(\theta - 1) + 1) \tilde{e}_t. \quad (4.4.11)$$

In the short run, the direction of the real production response depends only on the movement of the exchange rate, which determines the competitiveness of the respective goods. The expenditure switching towards foreign goods is due to the appreciation of the exchange rate as relative domestic goods prices tend to rise. Home consumers face cheaper imports, whereas domestic exports become less attractive for foreign consumers. The opposite is true for foreign goods, hence the reduction (rise) of home (foreign) production. Contrary to NOEM models with money-in-the-utility, expansive fiscal policy does not stimulate short run domestic output, but it does have a positive impact on foreign output. This is a direct consequence of the strict ceiling on total expenditure that is implied by the rigid cash-in-advance constraints, and of the exchange rate movement.³³

Figure 4.7 depicts the domestic and foreign short run production effects of a permanent domestic fiscal expansion. An increasing fraction s of PTM goods and a stronger home bias limit the expenditure switching effect as a greater share of goods prices is not subject to exchange rate movements. Therefore, the short run output effects of fiscal policy are dampened in both countries. As opposed to the international correlation of consumption, international output correlation increases with pricing-to-market and biased preferences. In a well known empirical study, Backus, Kehoe, and Kydland (1992) find that international output growth rates are more correlated than consumption growth rates. This stands in contrast to conventional wisdom which has been heavily influenced by former international macroeconomic models. Therefore, taking into account both pricing-to-market *and* biased preferences has the advantage of a better empirical fit of the model. Moreover, in contrast to analyses that

³³Remember that short run world demand is not stimulated in our model.

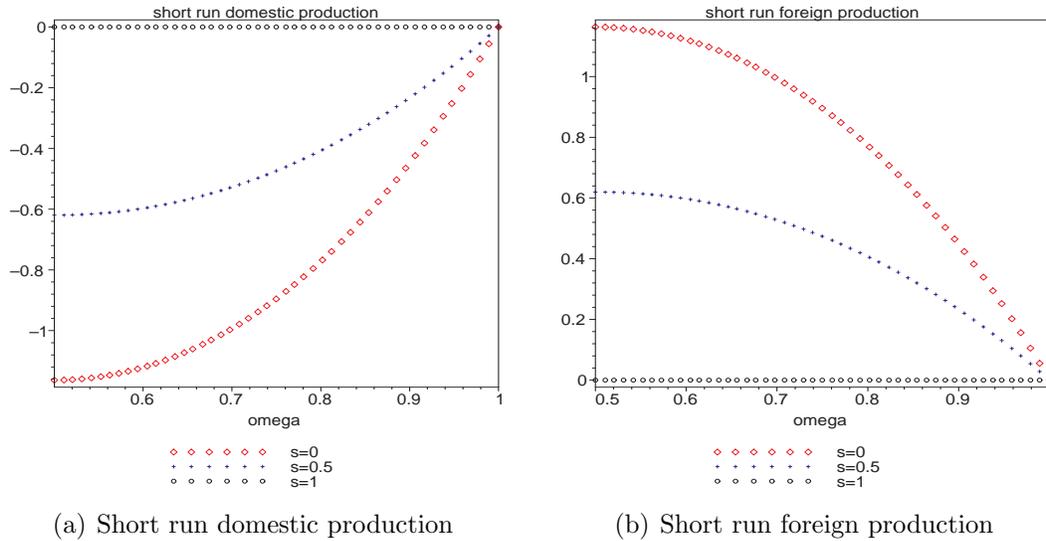


Figure 4.7: Short run production (permanent shock)

concentrate exclusively on either model feature, one does not have to rely on extremely high values of either parameter to generate the observed correlation pattern.

When compared with a permanent fiscal expansion, a temporary one, which is depicted in figure 4.8, yields much stronger output effects. Again, this is due to the more pronounced appreciation of the short run exchange rate.

4.4.4 Long Run Consumption Responses

We now turn to the country specific effects of fiscal policy on long run consumption. For this purpose, we use the short run trade balance response, given by equation (4.3.38), which in fact determines the intertemporal pattern of consumption and

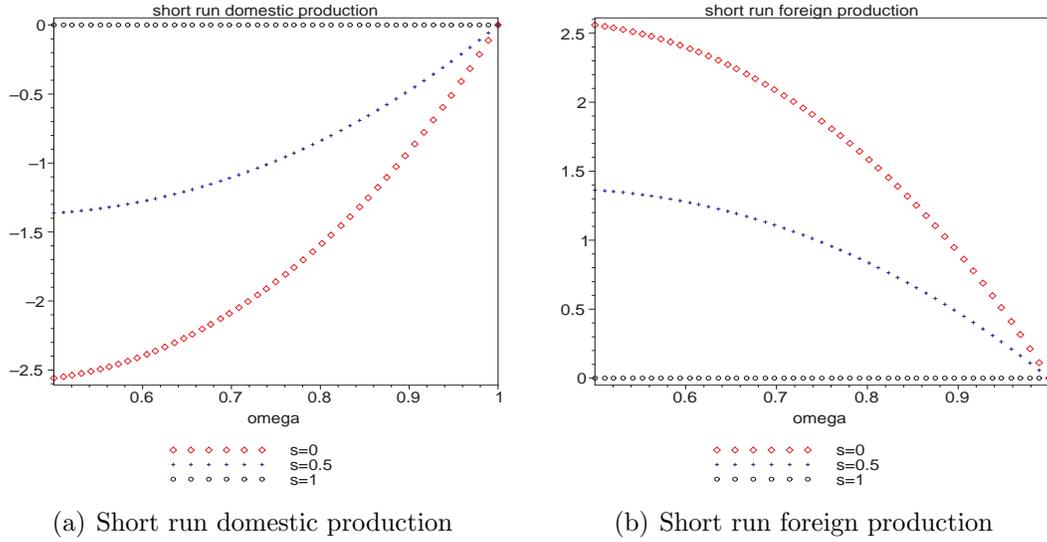


Figure 4.8: Short run production (temporary shock)

output in both countries. Long run consumption in the domestic country is given by:

$$\begin{aligned}
 \tilde{c}_{t+1} &= \tilde{c}_{t+1}^w + \frac{1}{2}(\tilde{c}_{t+1} - \tilde{c}_{t+1}^*) \\
 &= - \left(\frac{\theta - 1}{2\theta - 1} + \frac{\theta(1 - \omega)}{(2\theta - 1)(2\omega(\theta - 1) + 1)} \right) \frac{dg_{t+1}}{\bar{c}} \\
 &\quad + \frac{\bar{r}\theta}{2\theta - 1} (1 - \omega) [(1 - s)2\omega(\theta - 1) + 1] \tilde{e}_t.
 \end{aligned} \tag{4.4.12}$$

Foreign long run foreign consumption, in turn, reads:

$$\begin{aligned}
 \tilde{c}_{t+1}^* &= \tilde{c}_{t+1}^w - \frac{1}{2}(\tilde{c}_{t+1} - \tilde{c}_{t+1}^*) \\
 &= \left(\frac{\theta(1 - \omega)}{(2\theta - 1)(2\omega(\theta - 1) + 1)} \right) \frac{dg_{t+1}}{\bar{c}} \\
 &\quad - \frac{\bar{r}\theta}{2\theta - 1} (1 - \omega) [(1 - s)2\omega(\theta - 1) + 1] \tilde{e}_t.
 \end{aligned} \tag{4.4.13}$$

In the derivation we have made use of the long run world consumption aggregate (4.4.2) and the long run international consumption differential given by equation

(4.3.17). For both temporary and permanent fiscal expansions, long run domestic consumption is lower than in the initial steady state, while long run foreign consumption is higher than in the initial steady state. We can identify three driving forces that explain the international long run consumption pattern depicted in figures 4.9 and 4.10: An exogenous wealth effect from higher taxes, an endogenous wealth effect from short run debt accumulation, and an overall demand effect that is ruled by a possible stimulation and by the composition of world demand.

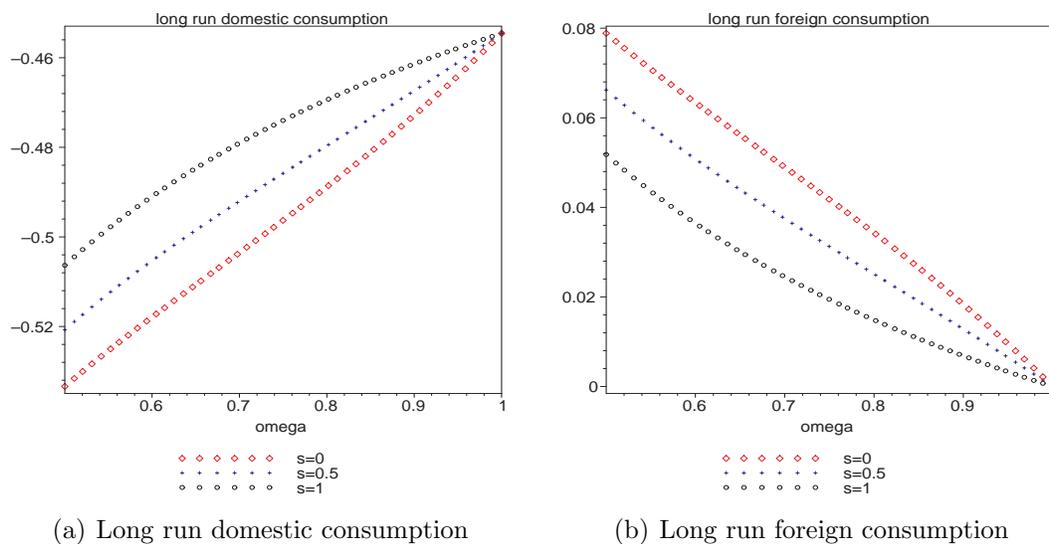


Figure 4.9: Long run consumption (permanent shock)

The tax effect is restricted to domestic households and a permanent fiscal expansion. Therefore, long run domestic consumption is far more suppressed in the case of a permanent shock. Interest payments on accumulated debt lead to lower domestic and higher foreign consumption, which is captured by the exchange rate terms in the above equations that result from the substitution of bond holdings via the short run trade balance equation. For the case of a temporary expansion, these interest

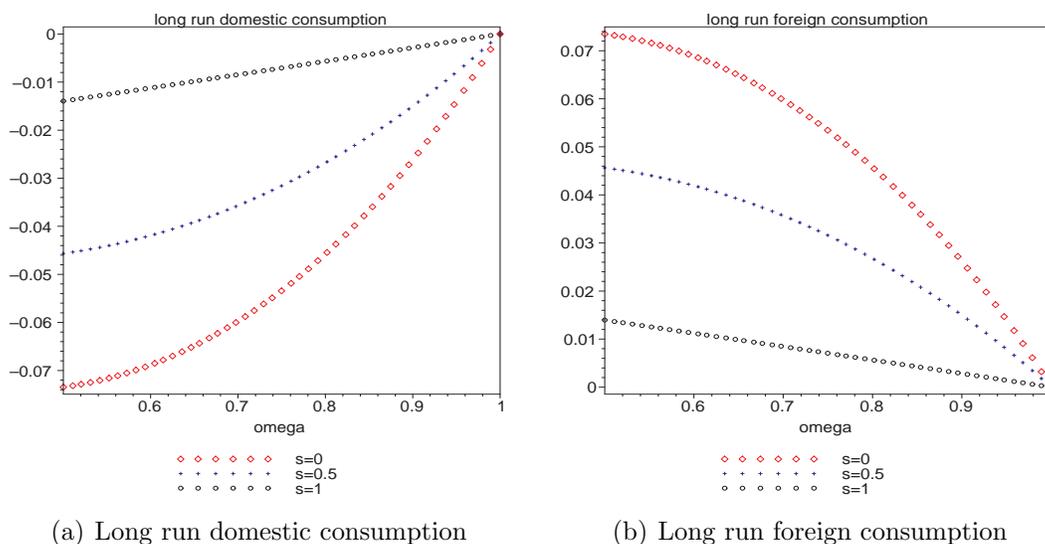


Figure 4.10: Long run consumption (temporary shock)

payments determine the long run consumption profiles. World demand stimulation only occurs in the case of a permanent fiscal expansion as follows from our discussion of the world variables. In that case, higher world production in the long run favors the domestic country asymmetrically for values of ω above 0.5.

The effects of the pricing behavior of firms on long run consumption can be explained by the sensitivity of the short run trade balance response to the degree of pricing-to-market. As derived above, a higher share of PTM goods implies a weaker response of the domestic trade balance and therefore less interest payments to foreigners in the long run. Hence, higher values of s lead to higher domestic and lower foreign consumption in the long run. A stronger home bias also results in higher domestic and lower foreign consumption. This is due to both a weaker reaction of the trade balance and a more biased composition of world demand.

4.4.5 Long Run Output Responses

Taking linearized versions of the long run goods and labor markets, we link the long run international production differential to the associated consumption differential. Replacing the consumption differential and bond holdings by exchange rate expressions and combining the result with the world output response, we arrive at the long run domestic and foreign production responses:

$$\tilde{y}_{t+1} = \frac{\theta}{2\theta - 1} \frac{dg_{t+1}}{\bar{c}} - \frac{\theta\bar{r}}{2\theta - 1} (1 - \omega) [(1 - s)2\omega(\theta - 1) + 1] \tilde{e}_t \quad (4.4.14)$$

$$\tilde{y}_{t+1}^* = \frac{\theta\bar{r}}{2\theta - 1} (1 - \omega) [(1 - s)2\omega(\theta - 1) + 1] \tilde{e}_t. \quad (4.4.15)$$

Figures 4.11 and 4.12 illustrate the international long run production effects of permanent and temporary domestic fiscal expansions. Domestic households increase their working effort in both cases, while foreign households always work less. The increase in domestic production is much stronger for a permanent expansion due to the persisting tax burden that reduces disposable income, see the first term on the right hand side of equation (4.4.14). The second term captures the production enhancing effect of a negative short run trade balance response.

Interestingly, a temporary shock leads to a stronger reduction of output in the foreign country than a permanent expansion does. This is due to the fact that the short run trade balance response is then more pronounced. As can be seen from equation (4.4.15), the increase in world demand that is associated with permanent domestic fiscal expansions has no stimulating impact on foreign output, basically because of higher relative foreign goods prices in the long run.

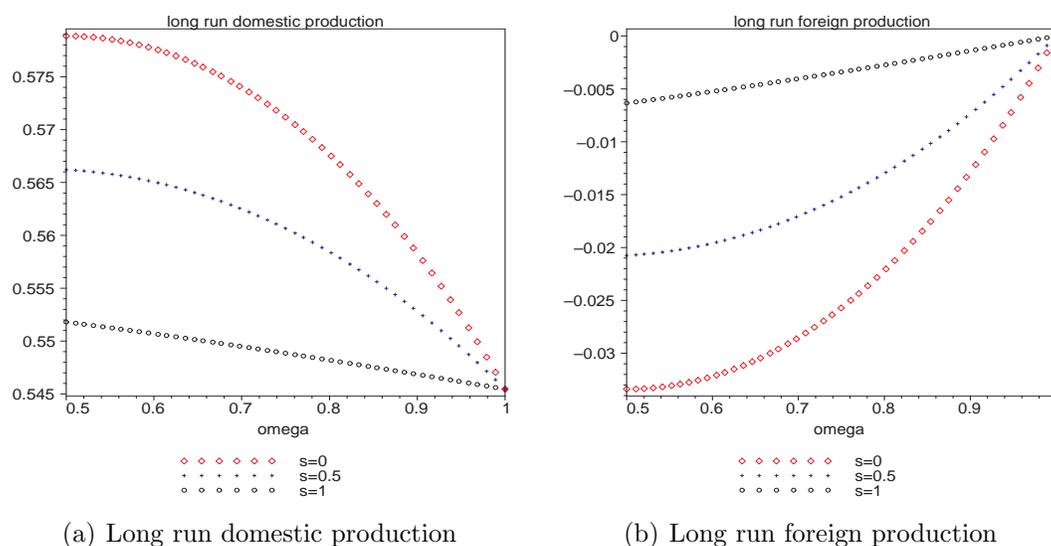


Figure 4.11: Long run production (permanent shock)

From equations (4.4.14) and (4.4.15) also follows the economic intuition for the effects of a home bias in consumption and of the pricing behavior of firms on long run production. As both a stronger home bias and a higher degree of pricing-to-market result in a weaker short run trade balance response, the domestic households' need to increase their working effort in the long run is lower. In the foreign country, the opposite reasoning applies.

All in all, the international pattern of long run consumption and output can mainly be explained by the income pattern of domestic and foreign households, which is governed by the fiscal policy induced short run current account imbalances and the persistence of the tax burden.

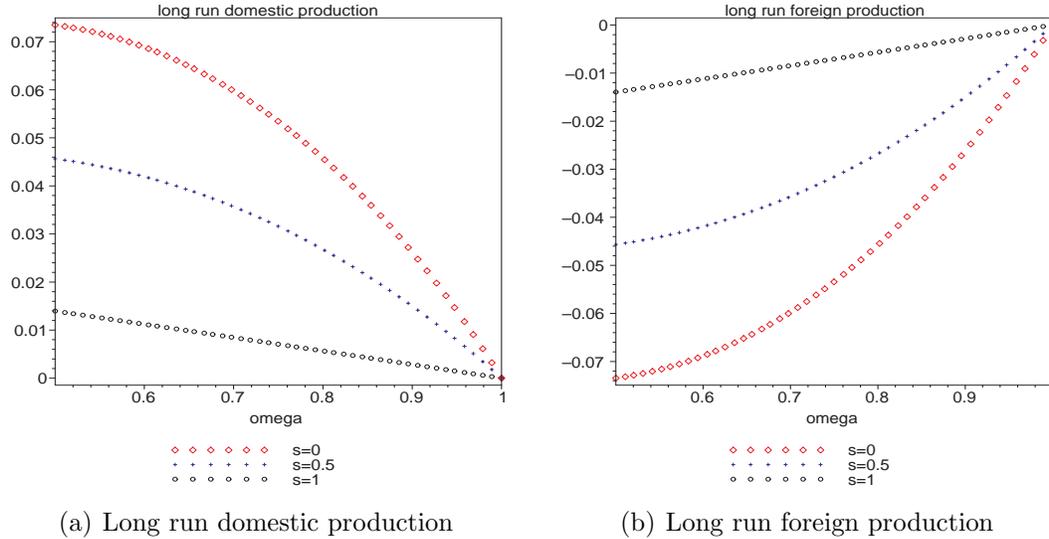


Figure 4.12: Short run production (temporary shock)

4.4.6 Net Present Value Analysis

As mentioned above, the monopolistic competition framework leads to inefficiently low production and consumption levels in the initial steady state. Hence, a policy that stimulates production may in principal be welfare improving. Before performing an explicit welfare assessment of fiscal expansions, we address the question how an expansionary fiscal policy affects the overall production and consumption pattern. Therefore, we calculate the net present values of consumption and production. Following Tille (2001), we define the net present value of the domestic production response as

$$\frac{dy_{npv}}{\bar{y}} = \tilde{y}_t + \frac{1}{\bar{r}} \tilde{y}_{t+1}, \quad (4.4.16)$$

where \tilde{y}_t and \tilde{y}_{t+1} are given by equations (4.4.10) and (4.4.14). An analogous expression holds for the foreign country. Figures 4.13 and 4.14 provide a numerical illustration of the respective overall effects on production that are associated with permanent and temporary domestic fiscal expansions.

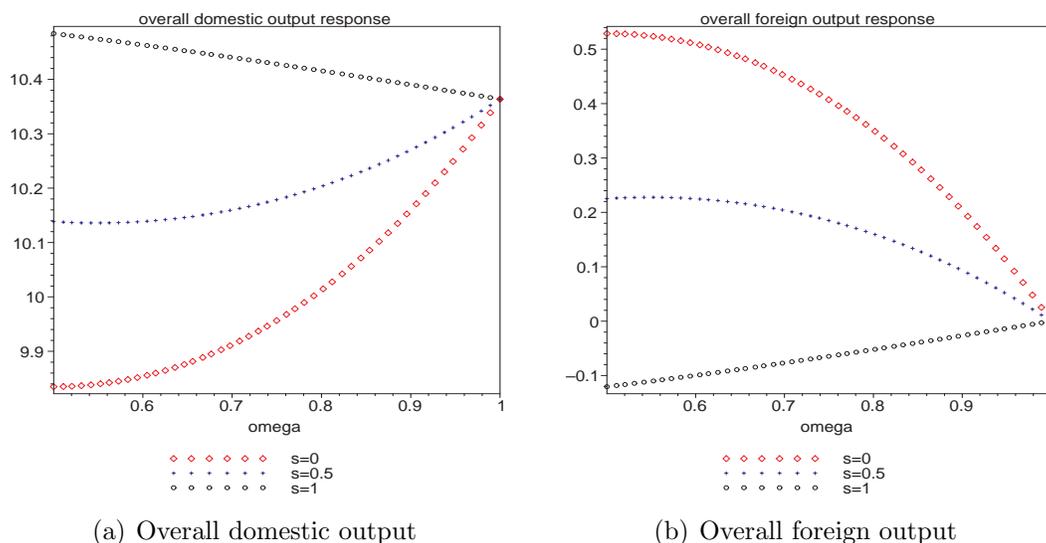


Figure 4.13: Overall output (permanent shock)

The numerical illustrations demonstrate that the underlying pricing regime and the existing home bias play a crucial role for the overall output responses in the two countries. In fact, the degree of pricing-to-market determines whether there is a positive or a negative spillover effect of a fiscal expansion on foreign output. Depending on the prevailing pricing regime, a stronger home bias leads to increases or decreases of domestic and foreign output.

It is reasonable to start with the economic intuition for the effects of a temporary expansion depicted in figure 4.14, as in this case the analysis is more transparent due to the lack of a permanent component. With complete pricing-to-market ($s = 1$), the

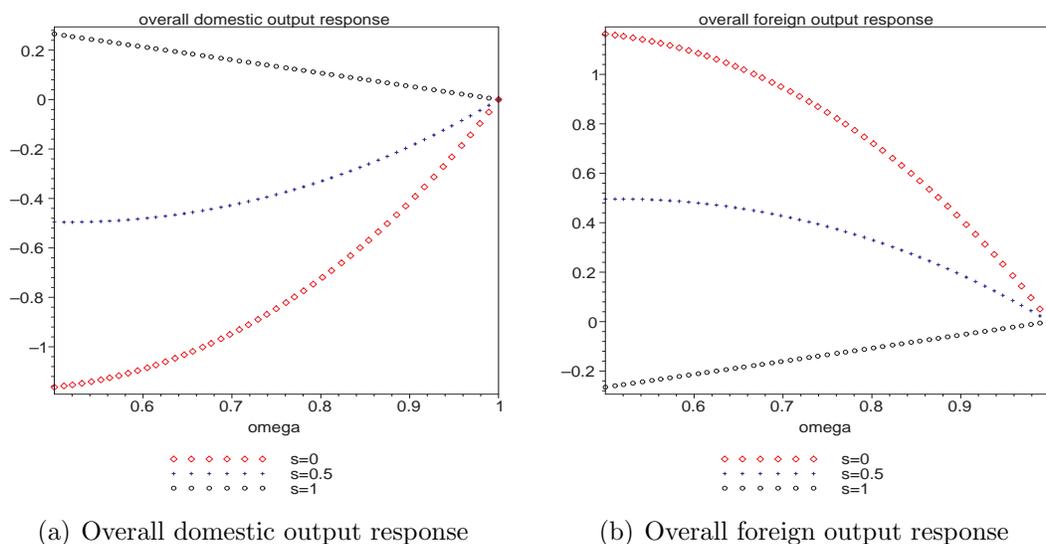


Figure 4.14: Overall output (temporary shock)

net present value of domestic production is higher than in the initial steady state. The impact on foreign production, in contrast, is negative. Hence, very high degrees of pricing-to-market imply negative spillovers of domestic fiscal policy on foreign production. The explanation for this model outcome is related to the short run response of the trade balance and the almost complete absence of expenditure switching for very high degrees of PTM. While short run production is unchanged in both countries, the short run domestic trade balance deteriorates because of strongly declining domestic revenues from exports and constant nominal expenditures. As a consequence, domestic (foreign) households face a negative (positive) long run wealth effect that translates into higher (lower) working effort and output. A stronger home bias in consumption mitigates the response of the short run trade balance and therefore closes the gap between domestic and foreign overall production.

In contrast, if many firms follow producer-currency-pricing (low s), domestic overall production is subdued while foreign production is increased. This is a striking result, as an expansionary fiscal policy is usually thought of stimulating domestic output. The lower the degree of PTM, the more pronounced is the negative (positive) impact on domestic (foreign) production. Although the short run trade balance response then deteriorates even more, it is the expenditure switching effect on short run production that dominates in the calculation of the net present values. The appreciation of the exchange rate lowers domestic production while foreign production rises because of the demand driven property of the short run equilibrium. Biased preferences again close the gap between domestic and foreign overall production: Domestic production rises with a higher home bias in consumption, while the positive spillover on foreign production is limited. From our above reasoning, less goods are subject to expenditure switching and more demand is directed towards the domestic country if the home bias in consumption is more pronounced. Naturally, overall production is then less biased towards the foreign country.

As for a permanent fiscal expansion depicted in figure 4.13, we obtain an almost identical picture for the foreign country but at a smaller scale. The driving force behind this result is the weaker response of the short run trade balance as the long run component of the domestic fiscal expansion does not affect foreign production. At first sight, the international production spillover effects might appear counterintuitive. Even though permanent expansions persistently stimulate world demand, the spillover effects on foreign production are lower than with temporary expansions. This result demonstrates the importance of nominal rigidities for the fiscal policy analysis. As long as producers cannot adjust prices in response to fiscal shocks, it

is the equilibrium exchange rate adjustment that governs the (demand determined) international production structure - the appreciation of the domestic exchange rate generally increases relative foreign production. As the appreciation of the exchange rate is more pronounced in the case of temporary shocks, the stimulation of foreign output is stronger. Once prices are flexible again, foreign households raise their real wage claims and foreign firms respond to higher world demand via higher relative prices. Thereby, our analysis has shed light on the subtle issue of the spillover effects of fiscal shocks that are unanticipated (rigid prices) and shocks that are anticipated (flexible prices).

In the domestic country, permanent fiscal expansions lead to highly stimulated overall production as households react to permanently higher tax payments by supplying more labor. This is true for all types of pricing behavior. The reasoning for the effects of biased preferences and pricing-to-market is analogous to the case of temporary fiscal expansions.

Having established the overall production pattern, we now take a look at the implied consumption possibilities in both countries. The net present values of consumption are depicted in figures 4.15 and 4.16. For both permanent and temporary fiscal expansions, the net present value of domestic consumption is negative, while the net present value of foreign consumption is positive. Take first the case of a temporary expansion. Overall domestic consumption is then reduced by more than the initial decrease in disposable income implied by the tax burden. For the polar case of $s = 1$, short run domestic consumption is totally crowded out and long run consumption is below its steady state value as the short run domestic terms of

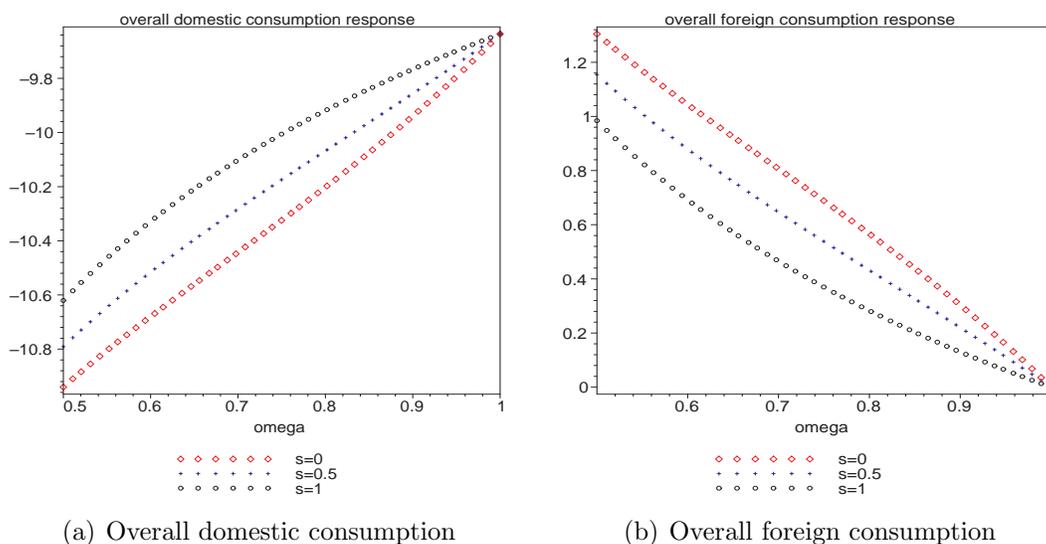


Figure 4.15: Overall consumption (permanent shock)

trade deteriorate in this case.³⁴ As long as some producers pursue producer-currency-pricing ($s < 1$), a short run expenditure switching effect comes into play that leads to lower domestic production. This in turn implies an even lower net present value of domestic consumption. Despite the short run domestic reincrease in consumption, that is facilitated by the appreciation of the exchange rate via lower domestic consumer prices, the overall domestic consumption possibilities decrease due to the strong decline in short run domestic production. Foreign firms, in turn, face higher demand which increases short run output and enables foreign households to reach a higher consumption path. Biased preferences again tighten the gap between domestic and foreign overall consumption, independently of the pricing behavior of firms. The adverse effects of the appreciation of the short run exchange rate are then limited as

³⁴The role of the terms of trade will be explored in detail in the next section, where we analyze the welfare effects of asymmetric fiscal expansions.

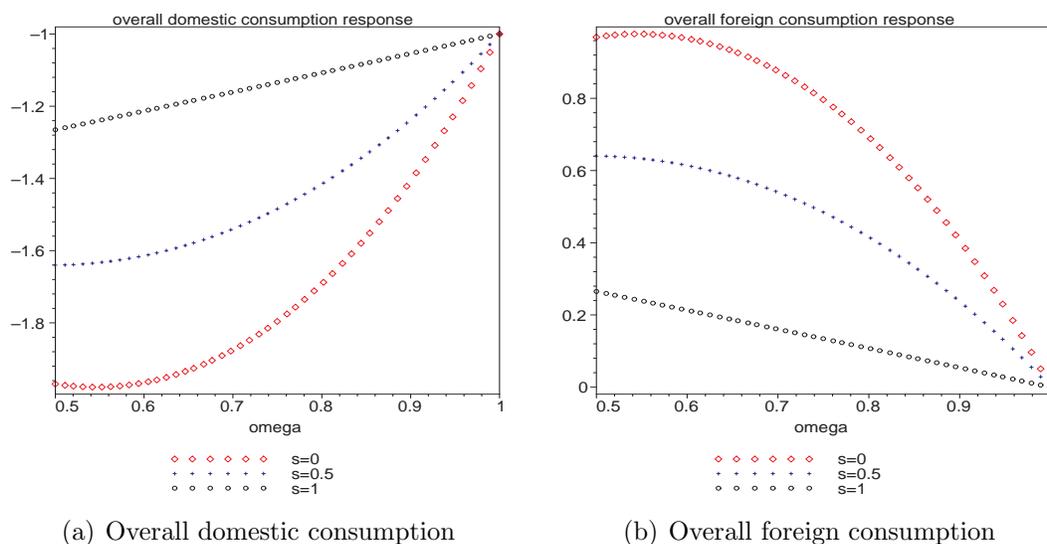


Figure 4.16: Overall consumption (temporary shock)

a smaller fraction of goods is traded internationally.

Qualitatively, permanent fiscal expansions yield a similar overall consumption pattern. However, the net present value of domestic consumption is much lower than in the case of temporary expansions due to the permanent reduction in disposable income. Foreign households, in contrast, benefit more from the domestic fiscal expansion even though the short run appreciation of the exchange rate is less pronounced. World demand is now constantly stimulated which leads to a strong improvement of the long run foreign terms of trade facilitating higher foreign consumption. Comparing figures 4.15 and 4.16 shows that the pricing regime plays a much stronger role for the net present value of consumption when the fiscal expansion is temporary. This follows from the fact that the pricing behavior of firms is irrelevant in the long run.

4.5 Welfare Analysis

So far, we have established the positive effects of unanticipated asymmetric fiscal expansions. Recall the main results and mechanisms at work: The driving force of the adjustment process is the short run response of the exchange rate. As in our model setup the scale variable of money demand is total absorption, equilibrium on the money and goods markets requires an appreciation of the exchange rate. The magnitude of the appreciation depends positively on the degree of pricing-to-market and on the home bias in consumption. Totalling the effects on nominal consumption and production reveals that the domestic country always runs a short run current account deficit. The net present value analysis of consumption and production has demonstrated that domestic (foreign) overall consumption is always below (above) steady state while the effects on overall production depend on the persistence of the shock and on the pricing behavior of firms. In the case of temporary expansions, domestic (foreign) overall production is below (above) the initial steady state level except for very high degrees of pricing-to-market. Permanent expansions, in contrast, always stimulate domestic production, while foreign production displays the same characteristics as under temporary expansions but at a lower scale.

In this section, we address the welfare implications of this adjustment process. With the microfoundations of our model at hand, we do not have to rely any longer on ad hoc welfare criteria, as for example output stimulation per se, which is the standard procedure in Mundell-Fleming type model frameworks. Due to suboptimally low steady state production levels, there is also a potential role of output stimulation to increase welfare in our model setup. However, this requires that the net present value of additional production in consumption units exceeds the accompanying loss

of utility that stems from higher working effort.

In the sequel, we identify three major welfare driving forces which depend both on the degree of pricing-to-market and on the home bias in consumption: an overall demand effect, a terms of trade effect, and an expenditure switching effect. We provide a detailed investigation of the welfare driving forces when describing the overall welfare evolution in the two countries.

To the end of a thorough short run, long run and overall welfare quantification, we totally differentiate the representative domestic household's utility function (4.2.1):

$$dU_\tau = \tilde{c}_\tau - \frac{\theta - 1}{\theta} \tilde{h}_\tau + V'(g_\tau) dg_\tau. \quad (4.5.1)$$

This expression holds in any period $\tau \in [t, \infty]$ and an analogous equation can be derived for foreign households. Private utility depends positively on consumption of households and negatively on their working effort. The degree of substitutability between the differentiated goods determines the weight attached to working effort relative to consumption and utility-increasing public expenditures. The higher is the degree of the monopolistic distortion, i.e. the lower the value of θ , the more beneficial is an increase in production that facilitates extra consumption possibilities. This implies a lower disutility of labor effort. We keep the general specification of utility stemming from public expenditures. Most of the NOEM literature assumes that government expenditures are purely dissipative, i.e. the marginal utility of public spending is zero. In contrast, part of the NOEM literature assumes that at the margin public expenditures yield the same utility as private consumption, see for instance Tille (2001). In the subsequent welfare analysis, we consider both specifications while

the graphical illustrations of the welfare effects are carried out for the fully utility enhancing case. Note however, that the issue of tax-induced welfare losses and possible compensatory utility gains from government spending is not at the focus of our analysis. Instead, our emphasis is on the interplay of the exchange rate movement and demand or supply driven consumption and output responses.

4.5.1 Short-Run Utility

We first consider the short run utility effects on both countries. Using equations (4.4.4) and (4.4.10) to substitute for consumption, \tilde{c}_t , and hours worked, \tilde{h}_t , in equation (4.5.1), we arrive at the domestic short run utility response:

$$dU_t = -\frac{dg_t}{\bar{c}} + V'(g_t) dg_t - (1 - \omega)(1 - s)\frac{1}{\theta} (2\theta - 1 + 2\omega(\theta - 1)^2) \tilde{e}_t. \quad (4.5.2)$$

The fiscal expansion reduces domestic welfare via the amount of taxes paid. If public spending yields the same marginal utility as private consumption, i.e. $V'(g_t) = \frac{1}{\bar{c}}$, the tax-induced domestic utility loss is fully compensated. The appreciation of the exchange rate, in turn, has an unambiguously positive effect on short run domestic welfare as it leads to the aforementioned re-increase in consumption and a simultaneous reduction of hours worked. The gap between income and expenditures is financed via debt, which can be deduced from the response of the short run trade balance. The negative domestic trade balance leads to temporary welfare gains as households can reach a higher consumption level without increasing their labor effort.

Carrying out the same exercise for the foreign country, we obtain the impact on short run foreign utility:

$$dU_t^* = (1 - \omega)(1 - s)\frac{1}{\theta} (2\theta - 1 + 2\omega(\theta - 1)^2) \tilde{e}_t. \quad (4.5.3)$$

Comparing equations (4.5.2) and (4.5.3) reveals that the exchange rate induced increase in domestic short run welfare comes at the expense of the foreign country. Adding up the individual changes in welfare, we see that the total effect on world welfare is given by the difference between the households' utility gains derived from additional government expenditures, $V'(g_t)dg_t$, and the utility loss associated with the reduction in disposable income, $-\frac{dg_t}{\epsilon}$. The interesting aspect of the short run analysis thus lies in the international distribution of welfare that is driven by the exchange rate movement and the implied direct expenditure switching and terms of trade effects. Furthermore, the appreciation gives way to an asymmetric composition of world demand, which tends to favor the domestic country if there is a home bias in consumption. Asymmetric fiscal expansions are thus beggar-thy-neighbor policies in the short run. Even though the overall welfare implications, which we derive in the sequel, should be the ultimate measure to assess the effects of fiscal policy, short run implications are of great relevance to policy makers due to the often limited time horizon of political decision processes.

The effects of permanent and temporary fiscal expansions on short run welfare in the two countries are illustrated in figures 4.17 and 4.18. As noted above, we consider here the case where public spending is fully utility enhancing.

Clearly, a temporary expansion yields stronger domestic welfare effects and stronger spillover effects on the foreign country. This reflects the fact that domestic households pursue more consumption smoothing if the fiscal shock is only temporary. The

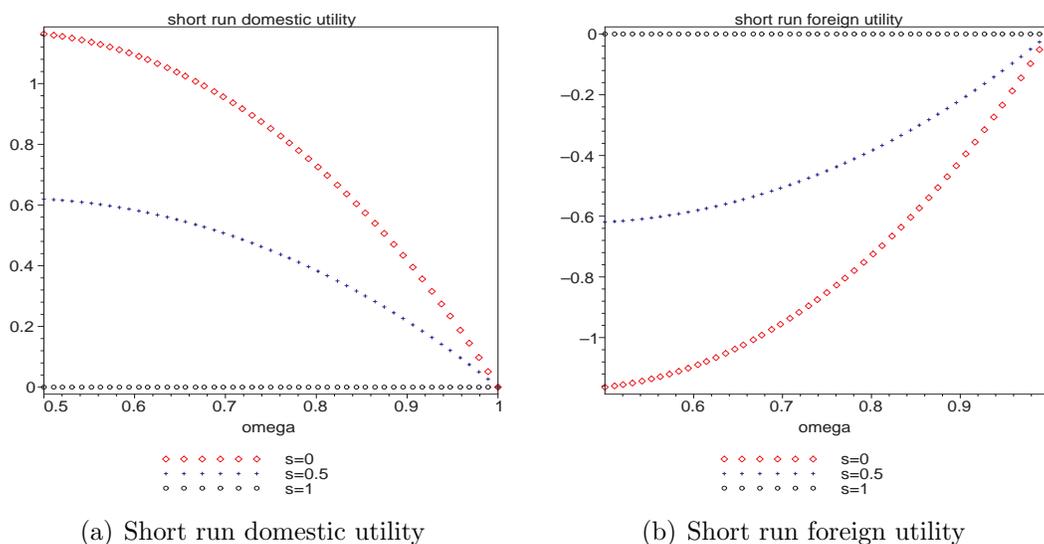


Figure 4.17: Short run utility (permanent shock)

domestic re-increase in consumption is financed by foreign households, who give up short run utility in exchange for long run utility. High degrees of pricing-to-market and a strong home bias dampen the short run welfare effects in both countries. Intuitively, both model features limit the short run adjustment of output and consumption to fiscal shocks. With total pricing-to-market ($s = 1$) or an almost complete home bias ($\omega \rightarrow 1$), there is no positive effect of the exchange rate movement on short run domestic welfare at all. Recall that complete pricing-to-market implies full crowding out of domestic private consumption via the money market equilibrium. At the same time, relative prices do not change and production remains on its initial steady state level. Therefore, domestic and foreign short run welfare are unaffected when domestic households derive full utility from government expenditures.

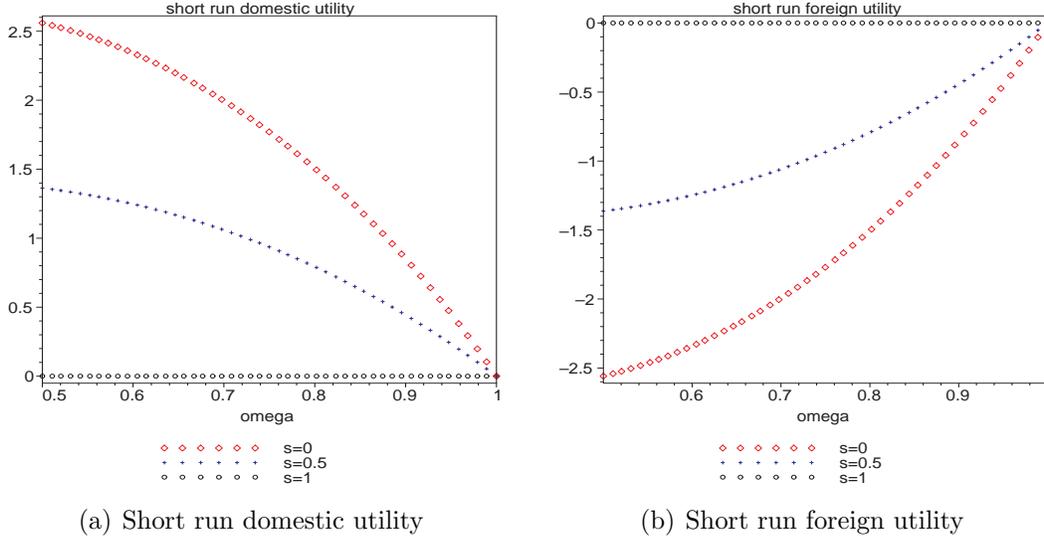


Figure 4.18: Short run utility (temporary shock)

4.5.2 Long-Run Utility

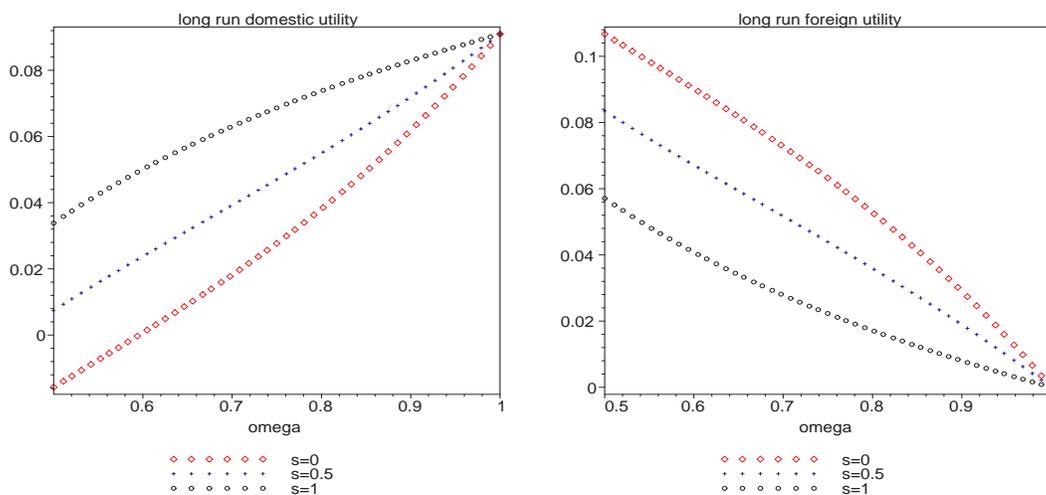
While welfare enhancing in the short run, the current account deficit of the home country has negative welfare implications in the long run via permanent interest rate payments. In addition, a permanent fiscal expansion raises long run world demand and affects the long run terms of trade. We calculate the long run welfare effects of fiscal policy, which are valid for all subsequent periods $t + i$ with $i = 1, 2, \dots, \infty$ as the new steady state is reached right after the shock period. Using the long run consumption and output responses, long run domestic welfare can be derived as

$$\begin{aligned}
 dU_{t+1} = & \bar{r}(1 - \omega) \left((1 - s)2\omega(\theta - 1) + 1 \right) \tilde{e}_t \\
 & + \frac{3\omega\theta - \theta - 2\omega + 1}{(2\omega\theta - 2\omega + 1)(2\theta - 1)} \frac{dg_{t+1}}{\bar{c}} - \frac{dg_{t+1}}{\bar{c}} + V'(g_{t+1}) dg_{t+1}, \quad (4.5.4)
 \end{aligned}$$

while the long run impact on foreign welfare is given by

$$dU_{t+1}^* = -\bar{r}(1-\omega)\left((1-s)2\omega(\theta-1)+1\right)\tilde{e}_t + \left(\frac{\theta(1-\omega)}{(2\theta-1)(2\omega\theta-2\omega+1)}\right)\frac{dg_{t+1}}{\bar{c}}. \quad (4.5.5)$$

In the above equations, the exchange rate terms capture permanent interest payments that result from the short run accumulation of bonds. The long run government expenditure terms drop out of the equations in the case of temporary expansions. The numerical illustration of the long run effects on welfare is presented in figures 4.19 and 4.20.³⁵



(a) Long run domestic utility

(b) Long run foreign utility

Figure 4.19: Long run utility (permanent shock)

A temporary fiscal expansion always lowers domestic welfare from period $t + 1$ on, while foreign welfare increases. In this case, domestic households consume less and work more in the long run than in the initial steady state in order to meet the

³⁵Remember that in the graphical illustrations we assume fully utility enhancing government expenditures.

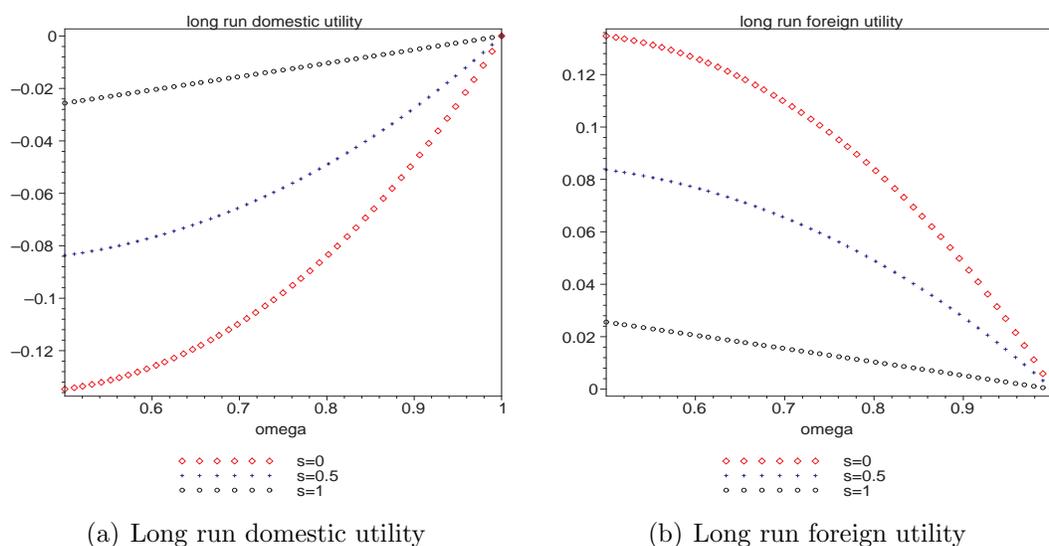


Figure 4.20: Long run utility (temporary shock)

permanent interest payments on debt accumulated in the short run. In the foreign country, the situation is the other way around: Households enjoy higher consumption levels and more leisure, which makes them better off. The respective impact of pricing-to-market and biased preferences is entirely explained by the short run trade balance response, which has been discussed above.

If the domestic fiscal expansion is permanent, the welfare effects of interest payments are qualitatively the same, however of less quantitative importance. This is due to the short run trade balance response, which is less pronounced in the case of permanent expansions. In addition, the permanent component of the domestic fiscal expansion always enhances foreign households' welfare. They benefit from both higher world demand and improved long run terms of trade. In the domestic country, the long run welfare effects of a permanent fiscal shock depend on the impact of public spending on private utility. If public spending is purely dissipative, domestic

households face an additional long run utility loss, basically due to the high tax burden that is not compensated. However, if public spending is fully utility enhancing, long run domestic utility is in general above the initial steady state level. The welfare loss from permanent interest payments is then more than offset by the stimulation of world demand. In the case of $s = 0$ and almost identical preferences, domestic long run utility is below steady state because of the very strong short run trade balance response and a weak impact of the composition of world demand in the long run.

The role of overall demand effects on the two countries becomes more transparent when taking a closer look at the government expenditure terms in equations (4.5.4) and (4.5.5) for the case of fully utility enhancing public expenditures. For $\omega \rightarrow 1$, the two economies are almost disconnected and foreign households do not benefit from the demand stimulation, that originates in the domestic economy. In this case, the entire world welfare gains, which amount to $\frac{1}{2\theta-1} \frac{dg_{t+1}}{\bar{c}}$, fall on domestic households.³⁶ For $\omega = 0.5$, in contrast, the welfare gains are equally shared by domestic and foreign households.

4.5.3 Overall Utility

To obtain the full impact of the fiscal expansion we now aggregate the short and long term utility effects. The net present value of domestic utility is given by

$$d\Omega_t = dU_t + \frac{1}{\bar{r}} dU_{t+1}, \quad (4.5.6)$$

with an analogous expression holding for the foreign country. Plugging in the respective short and long run welfare responses (equations 4.5.2 - 4.5.5), we obtain the

³⁶The world welfare gains are derived by adding up equations (4.5.4) and (4.5.5).

overall welfare effects in the two countries:

$$\begin{aligned}
 d\Omega_t &= (1 - \omega) \left(2s - 1 + \frac{1}{\theta} (1 - s)(2\omega\theta - 2\omega + 1) \right) \tilde{e}_t - \frac{dg_t}{\bar{c}} + V'(g_t) dg_t \\
 &\quad - \frac{1}{\bar{r}} \left(\frac{\theta - 1}{2\theta - 1} + \frac{\omega\theta - 2\omega + 1}{2\omega\theta - 2\omega + 1} \right) \frac{dg_{t+1}}{\bar{c}} + \frac{1}{\bar{r}} V'(g_{t+1}) dg_{t+1} \quad (4.5.7)
 \end{aligned}$$

$$\begin{aligned}
 d\Omega_t^* &= -(1 - \omega) \left(2s - 1 + \frac{1}{\theta} (1 - s)(2\omega\theta - 2\omega + 1) \right) \tilde{e}_t \\
 &\quad + \frac{1}{\bar{r}} \frac{\theta(1 - \omega)}{(2\theta - 1)(2\omega\theta - 2\omega + 1)} \frac{dg_{t+1}}{\bar{c}}. \quad (4.5.8)
 \end{aligned}$$

For the range of parameter values considered, the term preceding the exchange rate response is always positive in the domestic country, while it is negative in the foreign country. Thus, the appreciation of the short run exchange rate has a negative effect on domestic welfare and a positive effect on foreign welfare. As foreign households also benefit from a possible long run stimulation of world production, the overall welfare effect on the foreign country is unambiguously positive, independently of the persistence of the shock. A fiscal expansion therefore is a prosper-thy-neighbor instrument in terms of overall welfare. Domestic overall welfare is unambiguously below steady state if government spending is purely dissipative. In the case of utility enhancing public expenditures, we obtain competing effects on overall welfare, that stem from the exchange rate movement, the long run stimulation of output, tax payments, and government expenditures. Hence, the overall evolution of domestic welfare is a priori ambiguous.

Figures 4.21 and 4.22 reveal that in the case of fully utility enhancing government spending permanent and temporary expansions have completely different welfare implications for domestic households. A permanent fiscal expansion increases overall domestic welfare (prosper-thyself), while a temporary expansion leads to welfare losses

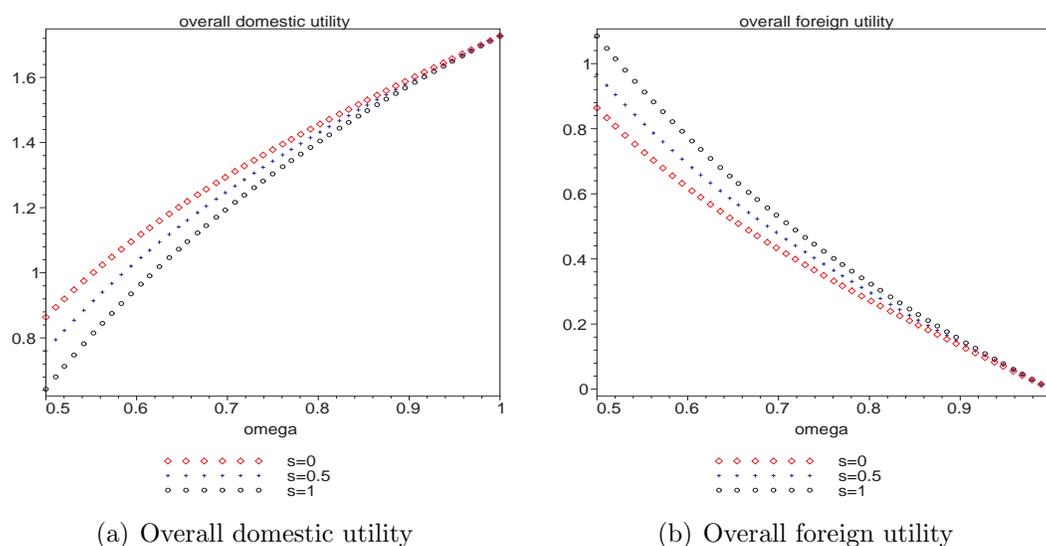


Figure 4.21: Overall utility (permanent shock)

(beggar-thyself). This can be explained by the positive impact on welfare of a higher long run production level in the case of a permanent expansion. To put this result in perspective, the prosper-thyself property of the permanent expansion hinges crucially on the assumption of fully utility enhancing government expenditures and on the additive separability of the utility components. Once government expenditures enter the households' utility function in a non-separable way, as they do in Ganelli (2003), the stimulating impact of fiscal policy is lower because more private consumption is then crowded out.

Underlying Welfare Driving Forces

In order to highlight the economic mechanisms behind the observed welfare evolution in the two countries, we now decompose the overall welfare effect into its constituent components.

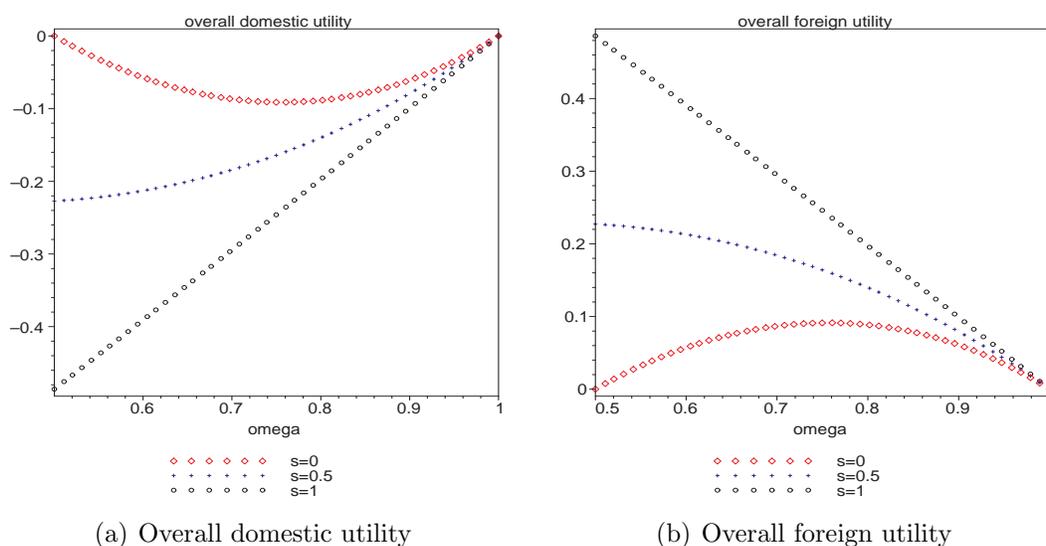


Figure 4.22: Overall utility (temporary shock)

For a permanent expansion, the dominating effect on domestic and foreign overall welfare is the anticipated stimulation of world demand in the long run (**Overall Demand Effect**). This effect is generally beneficial for both countries. In the domestic country, long run production increases and households enjoy higher consumption possibilities. In the foreign country, increased world demand translates into higher relative foreign producer prices, which offsets the demand impulse on production. Foreign households then derive welfare gains because of strongly improved long run terms of trade. A stronger home bias in consumption increases the positive impact of overall demand on domestic welfare at the expense of the foreign country as world demand falls primarily on domestic goods. For $\omega \rightarrow 1$, the entire world welfare gains accrue to domestic households.

The composition of world demand also plays a role in the short run for both types of shocks if $\omega > 0.5$. Even though short run world demand is unchanged, its

composition is then biased towards the domestic country and therefore tends to favor domestic households from an overall welfare perspective. However, quantitatively the short run overall demand effect is of second order importance under flexible exchange rates. In contrast, the composition of world demand is the major welfare driving force in a monetary union setting, which is presented in the next chapter.

While the degree of pricing-to-market is of negligible relevance for the overall demand effect, it plays a decisive role for the overall welfare effects that stem from the short run, where prices are rigid and the fiscal expansion is not anticipated. Together with the home bias in consumption, it determines the terms of trade response under an appreciation of the domestic exchange rate (**Terms of Trade Effect**) and governs the international structure of production via its impact on the degree of expenditure switching (**Expenditure Switching Effect**). As depicted in figures 4.21 and 4.22, a higher share of pricing-to-market always leads to lower domestic and higher foreign overall welfare levels, independently of the persistence of the shock. In contrast, a stronger home bias in consumption is beneficial for the domestic country and detrimental for the foreign country, except for the special case of a temporary fiscal expansion in combination with a low level of pricing-to-market and a weak home bias.

We first derive the overall welfare effects that stem from a change of the short run terms of trade. Linearizing equation (4.2.8) yields:

$$\tilde{\tau}_t = (2s - 1) \tilde{e}_t. \quad (4.5.9)$$

Both pricing-to-market and a home bias in consumption affect the terms of trade, $\tilde{\tau}_t$,

via their amplifying impact on the exchange rate response. However, the direction of the terms of trade response exclusively depends on the degree of PTM. As the short run exchange rate appreciates, the domestic terms of trade deteriorate as long as more than half of the goods are priced to market ($s > 0.5$). With $s = 0.5$, the terms of trade remain unaffected, while $s < 0.5$ yields an improvement of the domestic terms of trade. Thus, when purchasing power parity is assumed to hold as it is the standard practice in most traditional international finance models, the domestic terms of trade improve whereas the foreign terms of trade deteriorate if the domestic exchange rate appreciates.³⁷ All in all, a higher degree of pricing-to-market has a negative (positive) impact on overall domestic (foreign) welfare as it governs the international repartition of windfall gains and losses that stem from a change in the short run terms of trade.

When assessing the quantitative relevance of the terms of trade effect, one has to take into account the implications of a possible home bias in consumption. A stronger home bias implies less integrated international goods markets. Therefore, the importance of relative price changes in international trade declines. On account of this, a home bias in consumption mitigates the relevance of the respective terms of trade effects.

The second major short run channel of fiscal transmission is the expenditure switching effect that is associated with the appreciation of the short run exchange rate. The international structure of short run production hinges primarily on relative prices.³⁸ As relative prices of domestic goods generally rise, domestic production

³⁷The implications of pricing-to-market for the terms of trade response in Betts and Devereux (2000) are exactly opposed to ours, because in their model the equilibrium exchange rate depreciates.

³⁸As long as there is a home bias in consumption, the structure of short run production is also affected by the composition of world demand. However, the expenditure switching effect always dominates the latter.

is reduced while foreign production is stimulated. Abstracting from terms of trade changes, expenditure switching has a negative effect on domestic overall welfare and a positive effect on foreign overall welfare because the inefficiently low production level stemming from the monopolistic distortion is aggravated in the domestic country and mitigated in the foreign country. As for the pricing behavior of producers, pricing-to-market limits the expenditure switching effect and raises (reduces) domestic (foreign) welfare because less goods are subject to price changes originating from exchange rate movements. If $s = 1$, there are no changes in short run relative prices at all and domestic and foreign short run production remain unchanged. From the short run output equations (4.4.8) and (4.4.9), it follows that a stronger home bias in consumption also reduces the expenditure switching effect because of the diminished importance of imports in the consumption index.

Thus, pricing-to-market has opposite effects on the short run terms of trade and on short run expenditure switching. For $s = 1$, there is a strong negative terms of trade effect on domestic households and no expenditure switching. Moving towards $s = 0$, the domestic terms of trade continuously improve, whereas expenditure switching towards foreign production becomes more and more pronounced. All in all, the positive evolution of the domestic terms of trade dominates the negative expenditure switching effect and domestic welfare improves when the degree of pricing-to-market is lowered. In fact, we may show that both effects are exactly offsetting when all producers pursue producer-currency-pricing ($s = 0$). Hence, the domestic (foreign) welfare paths for high degrees of pricing-to-market are always below (above) the respective paths for low degrees of pricing-to-market. As depicted in figures 4.21 and

4.22, this result holds for both permanent and temporary expansions. The importance of pricing-to-market for the international welfare pattern can best be seen, once you have a look at the case of unbiased preferences ($\omega = 0.5$). While domestic and foreign households derive the same utility from fiscal expansions without pricing-to-market, complete pricing-to-market leads to the most asymmetric welfare pattern, which strongly works in favor of the foreign country. A home bias in consumption lowers the relevance of both the short run terms of trade and expenditure switching via the aforementioned quantity effect. Therefore, the respective PTM dependent welfare paths collapse in the case of a very strong home bias.

Finally, we consider the question how the home bias in consumption affects welfare in the two countries for given degrees of pricing-to-market. We present the analysis from the perspective of domestic households, while the opposite results and lines of argument apply for foreign households. In the case of a permanent fiscal expansion, the dominating effect of a stronger home bias again stems from the long run overall demand stimulation. In light of an asymmetric composition of world demand (higher relative domestic demand), preferences that are strongly biased favor domestic production and hence increase domestic welfare.

While the effects of a home bias in consumption on short run expenditure switching and on the terms of trade are of second order relevance for permanent expansions, they are the main driving force when the expansion is temporary, see figure 4.22. First, take the case of complete pricing-to-market ($s = 1$). The short run terms of trade are negative for the domestic country while no expenditure switching occurs. A stronger home bias in consumption then dampens the relevance of the negative terms

of trade through its quantity effect, thereby exerting a positive welfare impact on domestic households. For the intermediate case of $s = 0.5$, the short run terms of trade response is zero whereas expenditure switching favors foreign production. A stronger home bias now lowers expenditure switching and thus improves domestic welfare via its positive impact on domestic production. If purchasing power parity holds ($s = 0$), expenditure switching towards foreign goods is at its maximum, whereas the terms of trade strongly favor domestic households. A stronger home bias has now competing effects on domestic welfare, as it lowers expenditure switching (positive welfare effect) and limits the relevance of the terms of trade (negative welfare effect). From figure 4.22 follows that the overall welfare effect of the home bias in consumption is ambiguous with temporary expansions. Initially, the negative effect through the terms of trade dominates the positive effect of less expenditure switching leading to lower domestic welfare. For high levels of ω , however, the relative quantitative importance of the two effects is reversed and an increasing home bias raises domestic welfare. It is important to point out that the non-linear relationship of biased preferences and overall welfare occurs not only in the polar case of $s = 0$, but also for very low degrees of pricing-to-market.

Even though the negative relation between a home bias in consumption and domestic welfare only applies in the special case just outlined, it is relevant from both a theoretical and an empirical point of view: First, macroeconomic shocks generally tend to be temporary. Secondly, pricing-to-market behavior of firms is not considered by a large body of the literature on international macroeconomics. Thirdly, recent empirical studies suggest that the pattern of the pricing behavior diverges substantially across countries. For some countries, as for instance the United States, assuming

very low degrees of pricing-to-market appears to be a reasonable choice. Finally, the assumption of a moderate home bias in consumption can be rectified on empirical grounds, as discussed in section 3.2.

All in all, we can conclude that under a flexible exchange rate regime asymmetric domestic fiscal expansions are always beggar-thyself if the expansion is only temporary. Permanent expansions, however, may be prosper-thyself if government expenditures enhance private utility substantially. Higher degrees of pricing-to-market are detrimental to domestic households, while a stronger home bias in consumption makes domestic households generally better off. Foreign households benefit from domestic fiscal expansions. The magnitude of the prosper-thy-neighbor effect depends on the interplay of pricing to market and the home bias in consumption. The prosper-thy-neighbor property of domestic fiscal expansions is strongest when all producers pursue pricing to market and consumption is not biased.

4.6 Conclusion

In this chapter, we have analyzed the effects of tax-financed asymmetric fiscal expansions in a two-country general equilibrium model with monopolistic competition. Against the background of temporarily sticky prices the model is completely demand driven in the short run. We have considered two large open economies that interact on international goods and bond markets under a flexible exchange rate regime. We have established that accounting for the public component of money demand, for alternative pricing behaviors of firms, and for biased preferences has important implications for the exchange rate movement, current account imbalances, the international consumption and output patterns, as well as for the associated welfare effects of fiscal

expansions. We now highlight the most important results of our analysis according to the respective topics.

Exchange Rate and Current Accounts

In contrast to standard models in the realm of New Open Economy Macroeconomics, our model yields an appreciation of the short run exchange rate following an unanticipated domestic fiscal expansion. The economic intuition behind this finding lies in the assumption that total absorption is the scale variable of money demand. With relative domestic absorption rising, the short run exchange rate appreciates if prices are rigid. The appreciation is more pronounced if the fiscal expansion is only temporary as domestic households then rely more heavily on consumption smoothing. Higher degrees of pricing-to-market and more biased preferences amplify the movement of the exchange rate.

In contrast to the basic *Redux* model, where permanent fiscal shocks lead to a short run current account surplus of the domestic country, the domestic current account response in our model is always negative following a domestic fiscal expansion. As the re-increase in consumption is stronger in the case of temporary expansions, the trade balance response is more pronounced than in the case of permanent expansions. Both higher degrees of pricing-to-market and a stronger home bias in consumption result in weaker current account responses.

Output and Consumption

Next, we have addressed the issue of expansive fiscal policy as a potential stabilization tool and have analyzed the international output and consumption responses. The net present value of domestic output is positive for permanent fiscal expansions as long

run world output is then above the initial steady state level. When there is no world output stimulation, as it is the case under temporary fiscal shocks, the net present value of domestic production is negative, except for high degrees of pricing-to-market. The intuition for this unexpected result lies in the strong reduction of short run domestic production that results from expenditure switching towards foreign goods following the appreciation of the exchange rate. Thereby, our analysis cautions for the use of temporary fiscal expansions as an output stimulation instrument. For both types of shocks, the international production spillovers of expansionary fiscal policies are positive in net present value, except for high degrees of pricing-to-market. A home bias in consumption favors domestic output for a broad range of pricing-to-market levels and lowers the relevance of the pricing behavior of firms.

It is instructive to assess how the international production responses translate into consumption possibilities. The net present value of domestic consumption is always negative due to the reduction of disposable income. Foreign households reach a higher consumption path as they benefit either from short run output stimulation or from improved short and long run terms of trade. Higher degrees of pricing-to-market and more biased preferences generally lead to higher domestic and lower foreign consumption paths.

Welfare

Assuming that government spending is fully utility enhancing for domestic households, a permanent domestic fiscal expansion is a prosper-thyself instrument whereas a temporary expansion is a beggar-thyself policy. Except for the polar case of symmetric preferences and complete producer-currency-pricing - both are assumed in

the baseline *Redux* model - fiscal expansions are always a prosper-thy-neighbor instrument in a flexible exchange rate regime. Hence, we obtain the same qualitative result concerning foreign welfare as Obstfeld and Rogoff do in their *Redux* model - however, due to the introduction of a home bias in consumption and of alternative pricing behaviors, the economic reasoning behind this result is completely different. Through the combined expenditure switching and terms of trade effects, pricing-to-market is beneficial for foreign and detrimental to domestic households. Importantly, a comparison of the consumption and welfare effects reveals that pricing-to-market behavior has just opposite effects on overall welfare and on the net present value of consumption. In contrast to pricing-to-market, a home bias in consumption tends to reduce the positive spillover effects in terms of overall welfare on the foreign country as it favors domestic households.

Chapter 5

Fiscal Policy in a Monetary Union

5.1 Introduction

The recent experience of the European Monetary Union member countries revives the question, how open economies cope with asymmetric shocks when the exchange rate can no longer work as a shock absorber. Once a country abandons its sovereign monetary policy in favor of a common central bank that decides upon money supply for all member countries, it faces different international transmission mechanisms of macroeconomic shocks than before. The majority of contributions in the New Open Economy Macroeconomics literature, however, concentrates on the analysis of flexible exchange rate regimes.

In this chapter, we present a two country NOEM model in order to address the effects of asymmetric fiscal policies in a monetary union. We retain the basic setup of the model under flexible exchange rates of the previous chapter, but introduce a common central bank that controls the union-wide supply of a common currency. At the center of the analysis will be the implications of a home bias in consumption for the international transmission and the welfare effects of fiscal policy.

This chapter is organized as follows. Section 5.2 gives a description of the underlying model of our monetary union analysis. Section 5.3 provides the long and short run solutions of the linearized model with a special focus on international consumption and output differentials, and on current account imbalances. Section 5.4 presents an analysis of the output stimulation and consumption effects of fiscal expansions in a monetary union. Section 5.5 explores the welfare implications of fiscal policy on the basis of the explicit micro-foundations of the model. Finally, section 5.6 summarizes the main results of the monetary union model.

5.2 Model Setup

For the sake of direct comparability, we construct the monetary union model as close as possible to the flexible exchange rate model of the previous chapter. Obviously, the major institutional change in the model takes place on the money markets. The two countries are now members of a monetary union with an independent central bank that controls the union-wide money supply. As a consequence, the money market equilibrium differs substantially from the flexible exchange rate case: The union-wide money supply now has to match the sum of domestic and foreign money demand. Instead of the exchange rate as a means of adjustment, it is now the redistribution of money among the two countries that accommodates possible changes in relative transaction volumes.

On the supply side, we still assume that price differences cannot be arbitrated away for a fraction of goods. However, the explicit distinction between PTM and PCP firms becomes obsolete in a monetary union, because consumer prices are not only ex ante but also ex post identical across countries due to the lack of exchange

rate movements. That is, the law of one price holds for all individual goods not only in the long run but also in the short run. Remember, that under the flexible exchange rate regime the failure of the law of one price for some goods has resulted from the combination of nominal rigidities and unanticipated exchange rate movements.

Prices in both countries are now denoted in a common currency. Note, however, that the overall price levels in the two countries may differ because the consumption baskets of domestic and foreign households display a home bias. Therefore, we stick to our notation where p denotes domestic prices and p^* their foreign counterparts.

5.2.1 Households

For the sake of completeness, we restate the utility function of the representative domestic household:

$$U = \sum_{t=0}^{\infty} \beta^t [\log c_t + \log(1 - h_t) + V(g_t)], \quad (5.2.1)$$

where c_t is again a constant elasticity of substitution real consumption index that is biased towards domestically produced goods:

$$c_t = \left[\omega^{\frac{1}{\theta}} c_t^h \frac{\theta-1}{\theta} + (1 - \omega)^{\frac{1}{\theta}} c_t^f \frac{\theta-1}{\theta} \right]^{\frac{\theta}{\theta-1}}. \quad (5.2.2)$$

The two sub-baskets of domestic and foreign goods are now given in a simpler form when compared with the flexible exchange rate case as we do not have to distinguish explicitly between goods that are priced to market and goods that are priced in the producer's currency:

$$c_t^h = \left(\int_0^1 c_t(h)^{\frac{\theta-1}{\theta}} dh \right)^{\frac{\theta}{\theta-1}} \quad (5.2.3)$$

$$c_t^f = \left(\int_0^1 c_t(f)^{\frac{\theta-1}{\theta}} df \right)^{\frac{\theta}{\theta-1}}. \quad (5.2.4)$$

The price indexes that correspond to the consumption bundles are again obtained by minimizing the expenditure for one unit of the respective consumption index. They now read

$$p_t = \left(\omega p_t^{h^{1-\theta}} + (1-\omega) p_t^{f^{1-\theta}} \right)^{\frac{1}{1-\theta}} \quad (5.2.5)$$

with

$$p_t^h = \left(\int_0^1 p_t(h)^{1-\theta} dh \right)^{\frac{1}{1-\theta}} \quad (5.2.6)$$

$$p_t^f = \left(\int_0^1 p_t(f)^{1-\theta} df \right)^{\frac{1}{1-\theta}}. \quad (5.2.7)$$

Note that domestic and foreign prices are now denominated in the common currency. Maximizing the consumption index for any fixed total nominal expenditure on goods, yields the domestic demand functions for goods produced in the domestic and foreign country:

$$c_t(h) = \left(\frac{p_t(h)}{p_t} \right)^{-\theta} \omega c_t \quad (5.2.8)$$

$$c_t(f) = \left(\frac{p_t(f)}{p_t} \right)^{-\theta} (1-\omega) c_t. \quad (5.2.9)$$

The optimization problem of the domestic household is again subject to the budget constraint

$$m_t^{priv} + R_t f_{t+1} = f_t + w_t h_t + \Pi_t - p_t T_t \quad (5.2.10)$$

and the cash-in-advance constraint

$$m_t^{priv} = p_t c_t, \quad (5.2.11)$$

where nominal one period bonds are now denominated in the common currency. International real interest rate differentials therefore only arise if inflation rates differ in the two countries. Households maximize intertemporal utility (5.2.1) subject to the constraints (5.2.10) and (5.2.11). The resulting optimality conditions read

$$\beta p_t c_t = R_t p_{t+1} c_{t+1} \quad (5.2.12)$$

and

$$\frac{1}{1 - h_t} = \frac{w_t}{p_t c_t}, \quad (5.2.13)$$

while the cash-in-advance constraint (5.2.11) represents the money demand function of domestic households.

5.2.2 Central Bank and Governments

As opposed to the flexible exchange rate model presented in chapter 4, we now drop the assumption of two independent national central banks and two currencies in circulation. Instead, we consider a supranational independent central bank that controls

the union-wide supply of the common currency. Consequently, the monetary policy pursued by the central bank can only affect the union-wide price level, while country-specific inflation rates cannot be targeted. Since our focus is on fiscal policy, we assume that the central bank leaves overall money supply m^{sw} unchanged:

$$m_{t+1}^{sw} = m_t^{sw} = \bar{m}^{sw}. \quad (5.2.14)$$

The assumptions about monetary policy do not change the outcome of the analysis of fiscal policy, since both types of shocks have an additive impact on the relevant variables. One can easily extend the analysis to include monetary shocks so as to address the joint effects of fiscal and monetary policy. This is of special interest in the European Monetary Union, as national governments often face a common monetary policy that is not necessarily of their interest. Fiscal expansions may then serve as a potential policy instrument to counteract possible undesired output reductions that are associated with too restrictive monetary policies.

While monetary policy is now centralized, fiscal policy is still carried out at a national level by the respective governments. As before, the domestic government budget constraint reduces to

$$g_t = T_t \quad (5.2.15)$$

while the public cash-in-advance constraint reads

$$m_t^{gov} = p_t g_t. \quad (5.2.16)$$

Naturally, the foreign government now faces a cash-in-advance constraint that is expressed in the common currency.

5.2.3 Firms

Even though we still consider both types of firms (PTM and PCP), we do not have to distinguish between them explicitly because now the law of one price holds not only for PCP but also for PTM goods. As before, PTM producers initially set the same ex-ante price in the two countries. With exchange rate movements ruled out, unanticipated macroeconomic disturbances cannot cause price deviations across countries against the background of temporarily sticky prices.

The production function of any individual domestic firm $h \in [0, 1]$ can thus be stated as

$$y_t(h) = h_t(h). \quad (5.2.17)$$

The corresponding optimization problem is given by:

$$\max_{p_t(h)} \Pi_t(h) = p_t(h)y_t(h) - w_t h_t(h) \quad (5.2.18)$$

subject to

$$y_t(h) = \left(\frac{p_t(h)}{p_t} \right)^{-\theta} \omega(c_t + g_t) + \left(\frac{p_t(h)}{p_t^*} \right)^{-\theta} (1 - \omega)(c_t^* + g_t^*). \quad (5.2.19)$$

As all firms are identical in so far as they face the same demand functions and production costs, the optimal price of a typical domestic firm h is always given as a markup on nominal marginal production costs, i.e. on nominal wages

$$p_t^h = \frac{\theta}{\theta - 1} w_t, \quad (5.2.20)$$

where the superscript h indicates that we have adopted the concept of a representative firm.

5.3 Short and Long Run Equilibrium

So far, we have established the model setup under a monetary union. We now conduct the same policy experiment as in chapter 4. In this section, we derive and analyze the short and long run equilibrium system. The solution process corresponds by and large to the one under the flexible exchange rate regime. However, instead of the short run exchange rate movement, it is now the short run trade balance response that serves as the central solution variable.

5.3.1 Steady state

The steady state under a monetary union resembles the one in a flexible exchange rate regime, except for the money markets. Equilibrium on the money market now requires that the common central bank's money supply match the sum of domestic and foreign private and public money demand. As we assume that government expenditures are zero in the steady state, the initial money market equilibrium in the monetary union is given by

$$\bar{m}^s = \bar{m}^d + \bar{m}^{d*} = \bar{p}\bar{c} + \bar{p}^*\bar{c}^*, \quad (5.3.1)$$

where barred versions indicate initial steady state values. Due to the cash-in-advance constraints on private households, overall money supply equals total nominal consumption expenditures in the monetary union. Note that in the initial steady state all prices are identical, i.e. $\bar{p}^h = \bar{p}^f = \bar{p} = \bar{p}^{h*} = \bar{p}^{f*} = \bar{p}^*$, and denoted in the common currency.

5.3.2 Long run equilibrium

As before, prices are sticky in the short run, while producers can fully adjust them to possible disturbances in the long run. Therefore, we adopt the solution technique presented in chapter 4 and first solve for the long run consumption and output differentials before proceeding to the short run solution. Again, the short run trade balance response provides the essential link between the two periods. The long run equilibrium under a monetary union regime is defined by the following system of equations that includes market clearing and optimality conditions:

MONEY MARKET

$$\begin{aligned} m_{t+1}^s &= m_{t+1}^{priv} + m_{t+1}^{gov} + m_{t+1}^{priv*} + m_{t+1}^{gov*} \\ &= p_{t+1}(c_{t+1} + g_{t+1}) + p_{t+1}^*(c_{t+1}^* + g_{t+1}^*) \end{aligned} \quad (5.3.2)$$

CURRENT ACCOUNTS

$$p_{t+1}(c_{t+1} + g_{t+1}) + R_{t+1}f_{t+2} = p_{t+1}^h y_{t+1} + f_{t+1} \quad (5.3.3)$$

$$p_{t+1}^*(c_{t+1}^* + g_{t+1}^*) + R_{t+1}f_{t+2}^* = p_{t+1}^f y_{t+1}^* + f_{t+1}^* \quad (5.3.4)$$

GOODS MARKETS

$$y_{t+1} = \left(\frac{p_{t+1}^h}{p_{t+1}} \right)^{-\theta} \omega (c_{t+1} + g_{t+1}) + \left(\frac{p_{t+1}^h}{p_{t+1}^*} \right)^{-\theta} (1 - \omega) (c_{t+1}^* + g_{t+1}^*) \quad (5.3.5)$$

$$y_{t+1}^* = \left(\frac{p_{t+1}^f}{p_{t+1}^*} \right)^{-\theta} \omega (c_{t+1}^* + g_{t+1}^*) + \left(\frac{p_{t+1}^f}{p_{t+1}} \right)^{-\theta} (1 - \omega) (c_{t+1} + g_{t+1}) \quad (5.3.6)$$

EULER EQUATIONS

$$\beta p_{t+1} c_{t+1} = R_{t+1} p_{t+2} c_{t+2} \quad (5.3.7)$$

$$\beta p_{t+1}^* c_{t+1}^* = R_{t+1} p_{t+2}^* c_{t+2}^* \quad (5.3.8)$$

LABOR MARKETS

$$\frac{1}{1 - h_{t+1}} = \frac{\theta - 1}{\theta} \frac{p_{t+1}^h}{p_{t+1} c_{t+1}} \quad (5.3.9)$$

$$\frac{1}{1 - h_{t+1}^*} = \frac{\theta - 1}{\theta} \frac{p_{t+1}^f}{p_{t+1}^* c_{t+1}^*}. \quad (5.3.10)$$

In contrast to the flexible exchange rate regime, equilibrium on the common money market now requires that the central bank's money supply equal total money demand in the two countries. The latter is determined by the private and public cash-in-advance constraints. Long run current accounts, goods markets, Euler equations, and labor markets are basically the same as in chapter 4.¹ However, all prices are now denoted in the common currency. On account of this, we have defined producer prices always without an asterisk, i.e. $p_{t+1}^{h*} = p_{t+1}^h$ and $p_{t+1}^{f*} = p_{t+1}^f$. As the consumption baskets in the two countries are not the same for $\omega > 0.5$, the purchasing power of one unit of the common currency differs across domestic and foreign consumers despite the validity of the law of one price for all individual goods:

$$\tilde{p}_{t+1} - \tilde{p}_{t+1}^* = (2\omega - 1)(\tilde{p}_{t+1}^h - \tilde{p}_{t+1}^f). \quad (5.3.11)$$

As highlighted before, classical dichotomy applies under flexible prices, implying that the real and the monetary side of the long run system can be treated separately. Since the long run system under a monetary union differs from the one under a flexible exchange rate only with respect to the money market equilibrium, it is obvious that

¹The linearized long run system of equations is stated in appendix B.1

both exchange rate regimes lead to the same long run consumption differential, which is exclusively determined by the real side of the model:

$$\tilde{c}_{t+1} - \tilde{c}_{t+1}^* = \frac{\theta}{2\theta - 1} \frac{2(1 - \beta)df_{t+1}}{\bar{p}\bar{c}} + \left(\frac{2\omega - 1}{2\omega(\theta - 1) + 1} - \frac{\theta}{2\theta - 1} \right) \frac{dg_{t+1} - dg_{t+1}^*}{\bar{c}}. \quad (5.3.12)$$

Plugging equation (5.3.12) into the linearized international goods markets differential, yields the long run solution for the output differential:

$$\tilde{y}_{t+1} - \tilde{y}_{t+1}^* = -\frac{\theta}{2\theta - 1} \frac{2(1 - \beta)df_{t+1}}{\bar{p}\bar{c}} + \left(\frac{\theta}{2\theta - 1} \right) \frac{dg_{t+1} - dg_{t+1}^*}{\bar{c}}. \quad (5.3.13)$$

Comparing the semi-reduced long run consumption (5.3.12) and output differentials (5.3.13), reveals that both bond holdings and the ω -independent part of a long run government spending differential have opposing effects on the two differentials. Naturally, negative domestic bond holdings lower relative domestic consumption and raise relative domestic output. A positive long run government spending differential works in the same way due to the associated tax burden, which lowers relative domestic disposable income. While relative production depends only indirectly on the home bias in consumption via bond holdings, relative consumption also displays a direct home bias effect via the long run component of government spending. We come back to the impact of a home bias in consumption on the long run international consumption and output pattern in section 5.4.

5.3.3 Short Run Equilibrium

We now turn to the short run equilibrium of the model, where prices are fixed and the adjustment process to fiscal shocks is entirely demand driven. In contrast to the long

run equilibrium, the labor market clearing conditions are not binding in the short run. We can therefore describe the short run equilibrium system by the following set of equations:

MONEY MARKET

$$\begin{aligned} m_t^s &= m_t^{priv} + m_t^{gov} + m_t^{*priv} + m_t^{*gov} \\ &= p_t(c_t + g_t) + p_t^*(c_t^* + g_t^*) \end{aligned} \quad (5.3.14)$$

CURRENT ACCOUNTS

$$p_t(c_t + g_t) + R_t f_{t+1} = p_t^h y_t \quad (5.3.15)$$

$$p_t^*(c_t^* + g_t^*) + R_t f_{t+1}^* = p_t^f y_t^* \quad (5.3.16)$$

GOODS MARKETS

$$y_t = \left(\frac{p_t^h}{p_t}\right)^{-\theta} \omega(c_t + g_t) + \left(\frac{p_t^h}{p_t^*}\right)^{-\theta} (1 - \omega)(c_t^* + g_t^*) \quad (5.3.17)$$

$$y_t^* = \left(\frac{p_t^f}{p_t^*}\right)^{-\theta} \omega(c_t^* + g_t^*) + \left(\frac{p_t^f}{p_t}\right)^{-\theta} (1 - \omega)(c_t + g_t) \quad (5.3.18)$$

EULER EQUATIONS

$$\beta p_t c_t = R_t p_{t+1} c_{t+1} \quad (5.3.19)$$

$$\beta p_t^* c_t^* = R_t p_{t+1}^* c_{t+1}^*. \quad (5.3.20)$$

In order to prepare the ground for the positive analysis of fiscal policy in the next section, we first derive the international short run consumption and output differentials in semi-reduced form. We thereby highlight the effects of the trade balance for the international consumption and output pattern.

Using linearized versions of the short run current accounts (5.3.15) - (5.3.16) and goods markets (5.3.17) - (5.3.18), we derive the short run consumption differential:

$$\tilde{c}_t - \tilde{c}_t^* = -\left(\frac{dg_t - dg_t^*}{\bar{c}}\right) - \frac{1}{(1 + \bar{r})(1 - \omega)} \frac{df_{t+1}}{\bar{p}\bar{c}}. \quad (5.3.21)$$

Relative domestic consumption declines if domestic government expenditures exceed foreign expenditures, intuitively due to the higher relative tax burden. However, domestic households may resort to consumption smoothing via debt. Therefore, a negative trade balance narrows the gap between domestic and foreign consumption. A stronger home bias in consumption reinforces, *ceteris paribus*, the effect of the trade balance on the international consumption differential. Basically, the scaling effect of ω results from the current account production differential, that has been replaced via the goods markets equations. On the goods markets, a stronger home bias leads to higher relative domestic production and thereby facilitates higher relative domestic consumption.

The linearized short run goods market differential links the short run consumption differential to the short run output differential. Replacing the consumption differential via equation (5.3.21) yields:

$$\tilde{y}_t - \tilde{y}_t^* = -\frac{(2\omega - 1)}{(1 + \bar{r})(1 - \omega)} \frac{df_{t+1}}{\bar{p}\bar{c}}. \quad (5.3.22)$$

The semi-reduced short run output differential already highlights the effects of a home bias in consumption on the short run output pattern in a monetary union. With identical preferences ($\omega = 0.5$), production is equalized across countries, even though

domestic households are possibly in the need of financing a short run reincrease in consumption. In this case, the composition of short run world demand is not relevant for the international production structure. As long as preferences are biased ($\omega > 0.5$), however, a negative trade balance response results in higher relative domestic production as world demand is biased towards the domestic country.

In order to determine the sign and the amplitude of the short run trade balance effect of fiscal expansion, we combine the long run consumption differential with its short run counterpart. Eliminating the consumption differentials via the short run Euler equation differential and expressing the long run price differentials in terms of consumption and government expenditures, yields:

$$\begin{aligned} \frac{df_{t+1}}{\bar{p}\bar{c}} &= -\frac{(1-\omega)(2\theta-1)}{2\theta-1-2\omega(1-\beta)(\theta-1)} \left(\frac{dg_t - dg_t^*}{\bar{c}} \right) \\ &+ \frac{(1-\omega)(2\omega(\theta-1)^2 + 2\theta - 1)}{(2\omega\theta - 2\omega + 1)(2\theta - 1 - 2\omega(1-\beta)(\theta-1))} \left(\frac{dg_{t+1} - dg_{t+1}^*}{\bar{c}} \right). \end{aligned} \quad (5.3.23)$$

Consider an asymmetric domestic fiscal expansion, where foreign government expenditures are unchanged. In the case of a temporary expansion, the second term drops out of the equation and the trade balance response is unambiguously negative. With permanent expansions, the long run fiscal component dampens the trade balance response but it remains negative. Analogously to the flexible exchange rate regime, this can be explained by the fact that temporary expansions lead to a stronger short run reincrease of domestic consumption. Figures 5.1(a) and 5.1(b) illustrate this finding and depict the quantitative consequences of a home bias in consumption on the trade balance. The monetary union model is parameterized in the same way as the flexible exchange rate version, i.e. $\theta = 6$ and $\beta = 0.95$. As before, all figures show

the case of a one percent increase in domestic government expenditures, while foreign government expenditures remain unchanged.

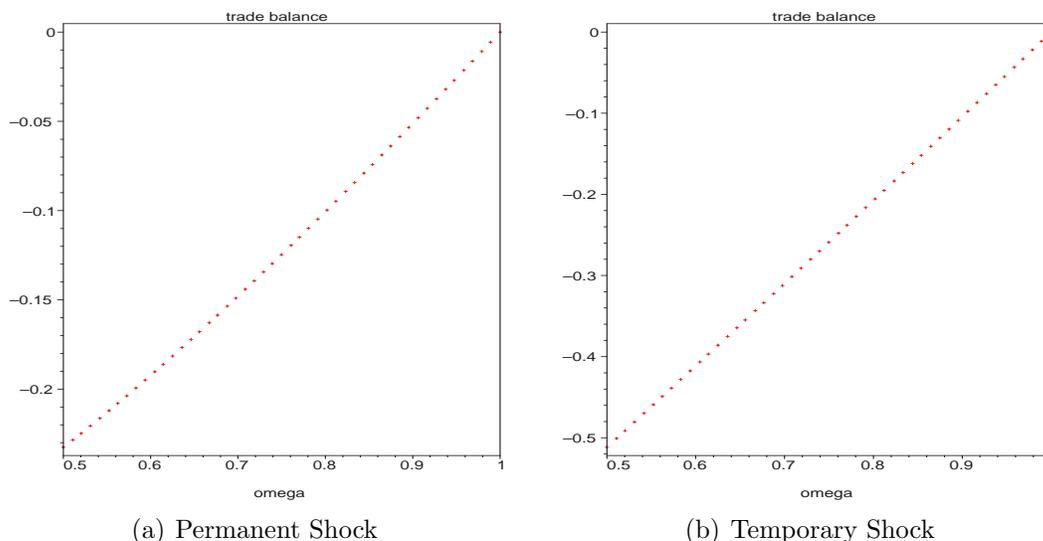


Figure 5.1: Trade balance

As opposed to the flexible exchange rate regime, where the dominating force turned out to be the combination of expenditure switching and terms-of-trade effects, it is now only the composition of world demand that governs the trade balance response. In equation (5.3.22), we have established that relative domestic production remains unchanged without a home bias in consumption. The trade balance response is then strongly negative because the increase in relative domestic absorption (given as the sum of relative consumption and government expenditures) is exclusively financed via debt. As explained above, a stronger home bias in consumption raises relative domestic production. Households then finance a larger part of short run consumption and tax payments via labor income, hence the dampening effect of a home bias in consumption on the trade balance.

5.4 Consumption and Output Effects

In this section, we derive the individual consumption and output responses following an unanticipated temporary or permanent fiscal shock. As in the flexible exchange rate regime, we consider an asymmetric domestic fiscal expansion, where $dg_t > dg_t^* = 0$ and $dg_{t+1} \geq dg_{t+1}^* = 0$. We start with the analytical derivation and the numerical simulation of the short run responses and then proceed to the long run impact of fiscal expansions. Thereafter, we analyze the net present values of consumption and output in the two countries.

5.4.1 World Consumption and Output

Short run world consumption is now derived from the union-wide money market. Linearizing the money market equilibrium condition (5.3.14), we arrive at:

$$\tilde{m}_t^s = \frac{1}{2} (\tilde{m}_t^d + \tilde{m}_t^{d*}) = \frac{1}{2} \left(\tilde{p}_t + \tilde{c}_t + \frac{dg_t}{\bar{c}} + \tilde{p}_t^* + \tilde{c}_t^* \right) = \frac{1}{2} \left(\tilde{c}_t + \tilde{c}_t^* + \frac{dg_t}{\bar{c}} \right) = 0. \quad (5.4.1)$$

As the monetary authority does not accommodate the fiscal shock, overall money demand has to remain unchanged. Furthermore, the price deviation terms \tilde{p}_t and \tilde{p}_t^* are zero as prices are sticky in the short run. The response of world consumption may therefore be stated as:

$$\tilde{c}_t^w = 0.5 \tilde{c}_t + 0.5 \tilde{c}_t^* = -\frac{1}{2} \frac{dg_t}{\bar{c}}. \quad (5.4.2)$$

Thus, a fiscal expansion in a monetary union implies complete crowding out of world consumption as it does under flexible exchange rates. As a direct consequence, short

run world production remains on its initial steady state level, that is $\tilde{y}_t^w = 0$. In the following periods $t + i$ with $i = 1, 2, \dots, \infty$ prices are flexible such that classical dichotomy applies. Therefore, long run world variables do not depend on the exchange rate regime and are given as before by:²

$$\tilde{c}_{t+1}^w = - \left(\frac{\theta - 1}{2\theta - 1} \right) \frac{1}{2} \frac{dg_{t+1}}{\bar{c}} \quad (5.4.3)$$

$$\tilde{y}_{t+1}^w = \left(\frac{\theta}{2\theta - 1} \right) \frac{1}{2} \frac{dg_{t+1}}{\bar{c}}. \quad (5.4.4)$$

With permanent expansions, long run world consumption is below steady state and world production is stimulated. Of course, temporary expansions leave the long run world aggregates unchanged.

5.4.2 Short Run Consumption Responses

The individual domestic and foreign consumption responses can be stated as the following combination of the respective world aggregate and its international differential:

$$\tilde{c}_t = \tilde{c}_t^w + \frac{1}{2}(\tilde{c}_t - \tilde{c}_t^*) \quad (5.4.5)$$

$$\tilde{c}_t^* = \tilde{c}_t^w - \frac{1}{2}(\tilde{c}_t - \tilde{c}_t^*). \quad (5.4.6)$$

²Long run world consumption and output are obtained by combining long run current accounts and labor markets.

Plugging in the semi-reduced short run consumption differential (5.3.21) and using the reduced form of the short run trade balance (5.3.23), yields

$$\begin{aligned}
\tilde{c}_t &= -\frac{dg_t}{\bar{c}} - \frac{\beta}{2(1-\omega)} \frac{df_{t+1}}{\bar{p}\bar{c}} \\
&= -\frac{dg_t}{\bar{c}} + \frac{\beta(2\theta-1)}{4\theta-2-4\omega(1-\beta)(\theta-1)} \left(\frac{dg_t}{\bar{c}} \right) \\
&\quad - \frac{\beta(2\omega(\theta-1)^2+2\theta-1)}{(2\omega\theta-2\omega+1)(4\theta-2-4\omega(1-\beta)(\theta-1))} \left(\frac{dg_{t+1}}{\bar{c}} \right)
\end{aligned} \tag{5.4.7}$$

and

$$\begin{aligned}
\tilde{c}_t^* &= \frac{\beta}{2(1-\omega)} \frac{df_{t+1}}{\bar{p}\bar{c}} \\
&= -\frac{\beta(2\theta-1)}{4\theta-2-4\omega(1-\beta)(\theta-1)} \left(\frac{dg_t}{\bar{c}} \right) \\
&\quad + \frac{\beta(2\omega(\theta-1)^2+2\theta-1)}{(2\omega\theta-2\omega+1)(4\theta-2-4\omega(1-\beta)(\theta-1))} \left(\frac{dg_{t+1}}{\bar{c}} \right).
\end{aligned} \tag{5.4.8}$$

The first line of the above equations states the semi-reduced form of the domestic and foreign consumption response, while the next lines give the reduced form. Figures 5.2(a) and 5.2(b) display the numerical illustration for permanent and temporary expansions. Note that the domestic and foreign responses are now depicted in the same graphic as we do not have to distinguish anymore between the different pricing behaviors. Both the analytical solution and the graphical illustration demonstrate the now well known fact that the permanent component of government expenditures leads to a weaker trade balance response and hence to lower (higher) short run domestic (foreign) consumption.³ In this case, consumption smoothing is weaker and more private consumption is crowded out by fiscal expenditure. The symmetric property

³For the assumed parameter space, all fractions preceding the short and long run government spending terms are positive.

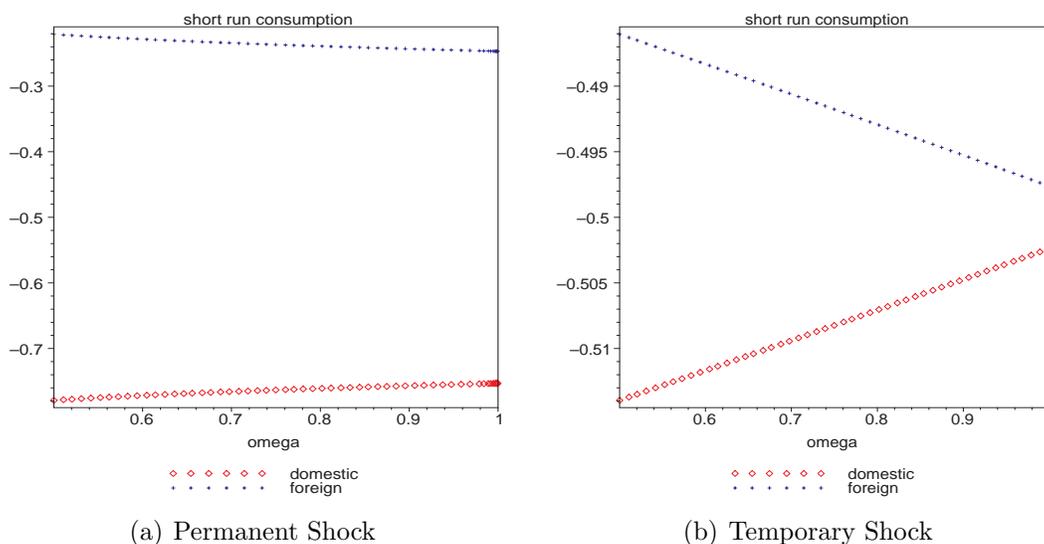


Figure 5.2: Short run consumption

of the short run consumption responses follows from the money market equilibrium, which implies that world production remains unchanged in the light of rigid prices.

If the home bias in consumption is more pronounced, the reincrease of domestic consumption is stronger because of the associated demand composition effects. For any level of ω , the overall effect on domestic expenditure, i.e. private consumption plus public expenditures, will be positive.

5.4.3 Short Run Output Responses

Having established the short run international consumption pattern, we can describe the composition of short run world demand. Domestic overall demand, which comprises private consumption and government purchases, expands while foreign demand declines. As short run relative prices are completely unchanged in a monetary union, the composition of world demand is the only determinant of short run production.

Via the international production differential (5.3.22) short run domestic and foreign production can be directly linked to the trade balance response:⁴

$$\tilde{y}_t = -\frac{\beta(2\omega - 1)}{2(1 - \omega)} \frac{df_{t+1}}{\bar{p}\bar{c}} \quad (5.4.9)$$

$$\tilde{y}_t^* = \frac{\beta(2\omega - 1)}{2(1 - \omega)} \frac{df_{t+1}}{\bar{p}\bar{c}}. \quad (5.4.10)$$

As long as there is a home bias in consumption, i.e. $\omega > 0.5$, domestic (foreign) production is above (below) the initial steady state level. Figures 5.3(a) and 5.3(b) illustrate that a stronger home bias in consumption reinforces this effect under both persistence specifications of fiscal policy.

Intuitively, higher values of ω lead to a composition of world demand that is more biased towards the domestic country. Furthermore, a larger share of the biased world demand falls on domestically produced goods.⁵ The expansive effect of fiscal policy on domestic production and its negative effect on foreign production are stronger with temporary expansions, since less domestic consumption is crowded out.

Before we derive the long run effects of a domestic fiscal expansion, we step back and clarify why it is optimal for foreign households to finance short run domestic consumption needs and to deviate from their steady state consumption path, even though this behavior leads to adverse demand composition effects. The key to this effect lies in the international bond market, where an excess demand for bonds exists

⁴Remember that short run world production remains unchanged independently of the persistence of the shock as the overall money supply is fixed and therefore short run world consumption is completely crowded out.

⁵Note that we have to consider the difference between domestic and foreign demand, as foreign households also prefer goods that are produced in their own country.

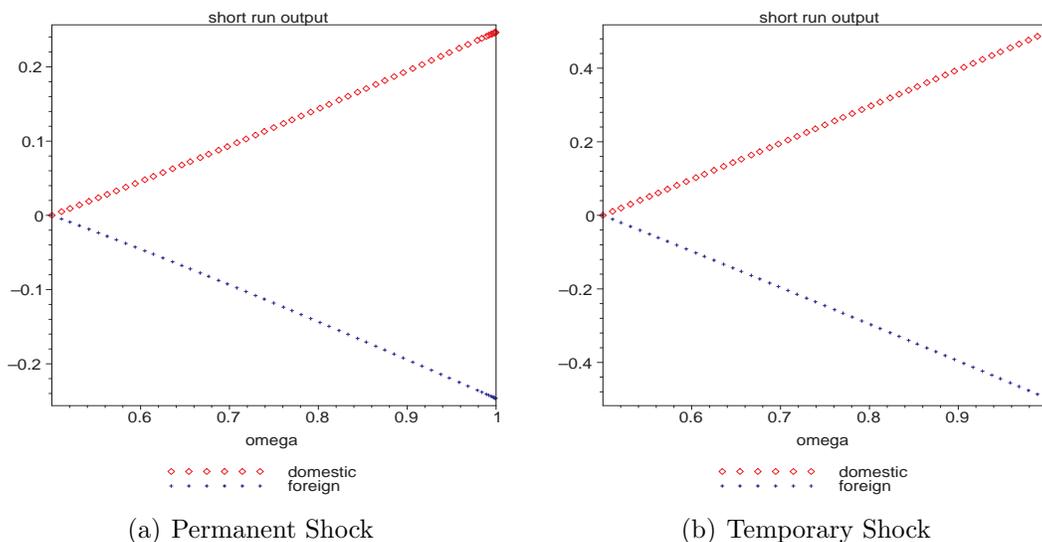


Figure 5.3: Short run output

at the steady state real interest rate. As the foreign real interest rises, foreigners are more willing to give up current consumption possibilities.⁶ Analytically, we obtain the foreign real interest rate from the linearized Euler equation (5.3.20):

$$\begin{aligned} \tilde{r}_{t+1}^* &= \frac{1 + \bar{r}}{\bar{r}} (\tilde{c}_{t+1}^* - \tilde{c}_t^*) \\ &= -\left(\frac{\theta}{2\theta - 1} + \frac{1}{2\bar{r}(1 - \omega)} \right) \frac{df_{t+1}}{\bar{p}\bar{c}} + \frac{\theta(1 - \omega)(1 + \bar{r})}{(2\omega(\theta - 1) + 1)(2\theta - 1)\bar{r}} \frac{dg_{t+1}}{\bar{c}}. \end{aligned} \quad (5.4.11)$$

Since domestic bond holdings are always negative, the short run foreign real interest rate is above its steady state level, which leads to an equilibration of current and future marginal utilities of consumption.⁷ While the short run consumption decision

⁶Remember that we do not rely on real consumption indexed bonds, and purchasing power parity does not hold in the long run. Therefore, the model allows for a real interest rate differential, i.e. $\tilde{r}_{t+1} - \tilde{r}_{t+1}^* \neq 0$.

⁷Taking into account long run price deviations, one can show that the nominal interest rate rises even more than the foreign real interest rate.

of an individual foreign household is optimal, it brings about a negative externality on aggregate foreign production. As the single household is sufficiently small, the individual decision to forego short run consumption has no impact on the composition of world demand. In the aggregate, however, the foreign consumption decisions lead to the discussed demand composition effects that are detrimental to short run foreign production.

5.4.4 Long Run Consumption and Output Responses

We now proceed to the derivation of the long run effects of a domestic fiscal expansion. Domestic households enter the long run as debtors and therefore face a negative wealth effect. This translates into a reduction of long run consumption. Moreover, if the fiscal expansion is permanent, long run domestic consumption is further reduced by the negative income effect of higher tax payments. However, consumption is not fully crowded out by increased long run government expenditure as households raise their working effort. Foreign households, in turn, benefit from a positive wealth effect and a demand stimulation effect that both translate into higher consumption.

The long run consumption responses can be derived via the long run world response (5.4.3) and the consumption differential (5.3.12):

$$\tilde{c}_{t+1} = \frac{\theta}{2\theta - 1} \frac{(1 - \beta)df_{t+1}}{\bar{p}\bar{c}} - \frac{dg_{t+1}}{\bar{c}} + \frac{\omega\theta}{2\omega\theta - 2\omega + 1} \frac{dg_{t+1}}{\bar{c}} \quad (5.4.12)$$

$$\tilde{c}_{t+1}^* = -\frac{\theta}{2\theta - 1} \frac{(1 - \beta)df_{t+1}}{\bar{p}\bar{c}} + \frac{\theta(1 - \omega)}{(2\omega\theta - 2\omega + 1)(2\theta - 1)} \frac{dg_{t+1}}{\bar{c}}. \quad (5.4.13)$$

The above equations and figures 5.4(a) and 5.4(b) illustrate the described effects on long run consumption in the two countries.

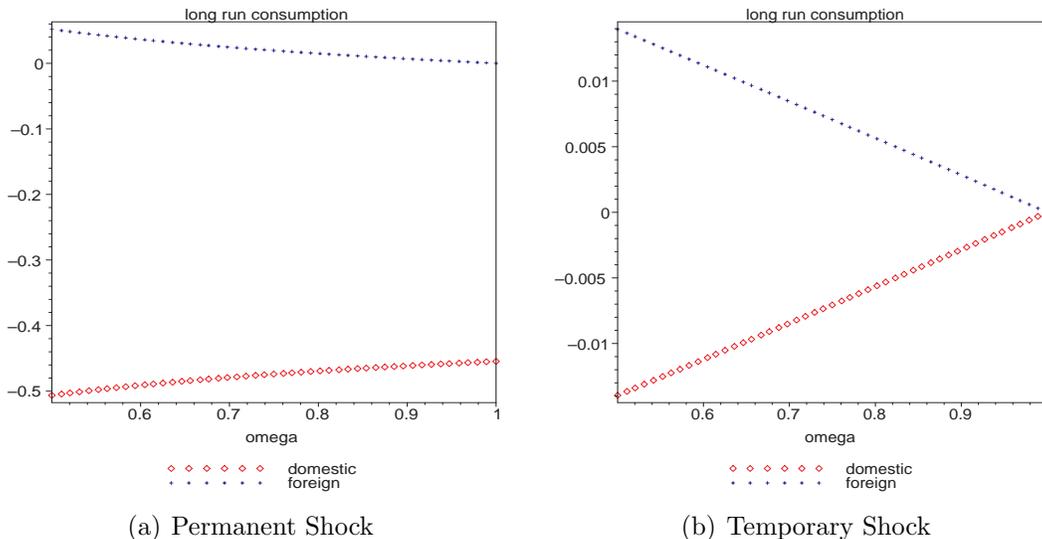


Figure 5.4: Long run consumption

Analogously, the long run output responses can be derived by combining the world aggregate (5.4.4) with the corresponding differential (5.3.13):

$$\tilde{y}_{t+1} = -\frac{\theta}{2\theta - 1} \frac{(1 - \beta)df_{t+1}}{\bar{p}\bar{c}} + \frac{\theta}{2\theta - 1} \frac{dg_{t+1}}{\bar{c}} \tag{5.4.14}$$

$$\tilde{y}_{t+1}^* = \frac{\theta}{2\theta - 1} \frac{(1 - \beta)df_{t+1}}{\bar{p}\bar{c}}. \tag{5.4.15}$$

While long run domestic production is always above the initial steady state level, foreign production falls. This result can also be seen in figures 5.5(a) and 5.5(b).

To provide a deeper explanation for the long run responses of consumption and output with respect to ω , we take a closer look at the underlying mechanisms in the case of a temporary expansion, where the long run expansionary effect of fiscal policy

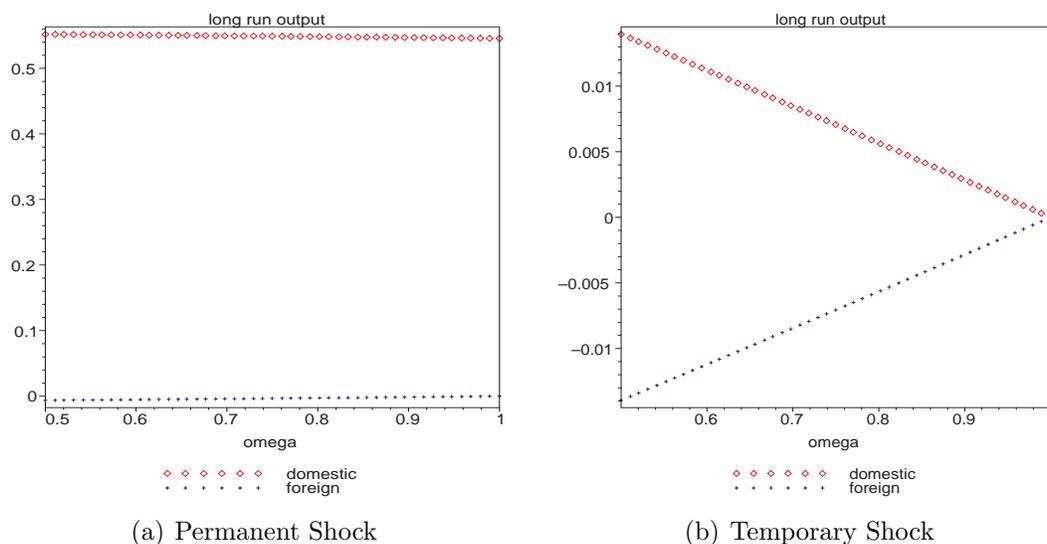


Figure 5.5: Long run production

is absent. In that case, we identify a direct wealth effect stemming from bond holdings and a real wage effect. Stepping back to the short run trade balance response, we see that a lower home bias raises financing via debt. This exerts a negative wealth effect on the domestic economy in the long run. Since consumption and leisure are normal goods, demand for both will be reduced. From this supply side perspective, domestic households enjoy less consumption and work more. In the foreign country, it is the other way around: Households consume more and work less. Therefore, a lower home bias is associated with higher foreign current account deficits in the long run.

On the demand side, less domestic and more foreign consumption point to less domestic and more foreign production as long as there is a home bias in consumption.⁸ Hence, with unchanged real wages domestic labor demand tends to fall, while foreign

⁸This follows from the composition of long run world demand which is biased towards foreign goods.

labor demand increases. In order to restore labor market equilibrium, the domestic real wage decreases while the foreign real wage rises. From the linearized long run labor leisure trade-offs follows for a temporary expansion:

$$\tilde{w}_{t+1} - \tilde{p}_{t+1} = -(\tilde{w}_{t+1}^* - \tilde{p}_{t+1}^*) = -\frac{(1-\beta)(1-\omega)}{2\theta-1-2\omega(1-\beta)(\theta-1)} \left(\frac{dg_t}{\bar{c}} \right). \quad (5.4.16)$$

A lower domestic real wage induces lower relative domestic goods prices and ensures an increase in demand for domestic products that gives way to higher domestic labor effort. Therefore, it is the response of real wages that reconciles the initial excess of domestic labor supply with the goods market clearing conditions. The real wage equation (5.4.16) shows that a strong home bias implies a weak real wage response, as the supply side driven effects on consumption and production are then less pronounced. Intuitively, a higher relative foreign real wage translates into improved foreign long run terms of trade. Hence, a stronger home bias in consumption is beneficial for domestic households as it dampens the adverse evolution of the long run terms of trade. The reasoning for the temporary shock is also valid for a permanent expansion. However, an additional effect from long run government spending comes into play that is analogous to the flexible exchange rate case and strengthens the improvement of the foreign long run terms of trade. We can see this feature when comparing the effect of the long run government spending component on foreign consumption and production, see equations (5.4.12) - (5.4.15). While foreign long run consumption is substantially increased, foreign long run production remains unaffected.

5.4.5 Net Present Value Analysis

Finally, we assess the overall impact of a domestic fiscal expansion on consumption and output via the net present value approach adopted in the flexible exchange rate model of the previous chapter, see equation (4.4.16). Figures 5.6(a) and 5.6(b) present overall production, while 5.7(a) and 5.7(b) depict the net present value of consumption.

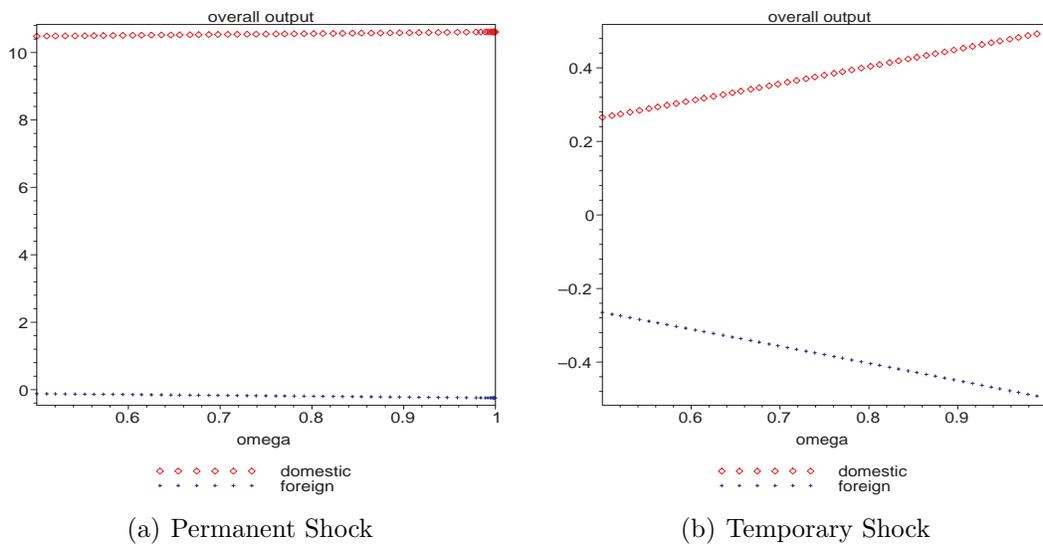


Figure 5.6: Overall output

In the domestic country, the qualitative effects of a fiscal expansion on the net present values are unambiguous: The domestic output response is always positive, while the consumption response is always negative. Quantitatively, it is the persistence of the shock and the home bias in consumption that govern the respective equilibrium responses. Permanent expansions reduce domestic disposable income far

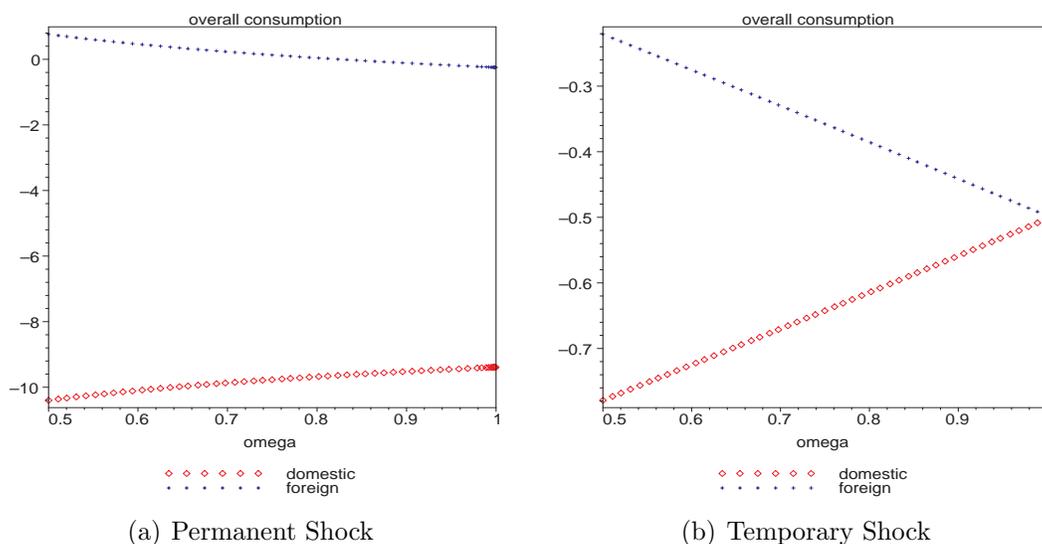


Figure 5.7: Overall consumption in a monetary union

more than temporary expansion, hence the stronger reactions of production and consumption. Biased preferences lead to higher domestic output due to the short and long run demand composition effects. At the same time, domestic consumption increases in ω , as higher production enhances consumption possibilities. This effect is reinforced by the dampening effect of biased preferences on the negative evolution of the long run domestic terms of trade.

In the foreign country, the net present value of production is unambiguously negative for both types of shocks. With identical preferences ($\omega = 0.5$), short run foreign production is unchanged, but the positive foreign trade balance response translates into lower long run production. A home bias in consumption strengthens the negative impact on foreign output due to the adverse demand composition effects. In contrast, the net present value of foreign consumption gives a mixed picture. For a temporary expansion, it is always negative since the reduction of overall production outweighs

the long run improvement of the foreign terms of trade. A stronger home bias reduces foreign consumption even further as foreign production falls and the long run terms of trade effect is weakened. With permanent expansions, the response of overall foreign consumption is mainly positive except for high values of ω . When compared with temporary expansions, foreign firms face additional demand for their goods in the long run, which translates entirely into higher foreign relative prices. This implies a further improvement of the long run foreign terms of trade that facilitates higher foreign consumption. This effect dominates the negative effect on overall production. As a stronger home bias in consumption reduces the favorable long run terms of trade effect, additional consumption possibilities of foreign households decline and eventually become negative.⁹

5.5 Welfare Analysis

With the short and long run responses of consumption and production at hand, we can now calculate and discuss the implied welfare effects of an asymmetric domestic fiscal expansion. From our discussion of the monopolistic distortion on the goods markets, we know that an increase of production, which leads to higher consumption possibilities is in principal welfare enhancing, even though increased working effort reduces *ceteris paribus* welfare. However, it is also conceivable that welfare declines if the reduction in leisure is relatively high compared with the additional consumption possibilities. In other words, the price of consumption in terms of labor effort is crucial to determine the welfare implications of fiscal policy.

⁹In the limiting case of $\omega \rightarrow 1$, the long run terms of trade effect vanishes and the short run reduction of foreign consumption is the only determinant of the net present value.

5.5.1 Short-Run Utility

In the short run, domestic and foreign welfare are given as

$$\begin{aligned}
 dU_t &= \tilde{c}_t - \frac{\theta - 1}{\theta} \tilde{y}_t + V'(g_t) dg_t \\
 &= -\frac{\beta(2\omega\theta - 2\omega + 1)}{2\theta(1 - \omega)} \frac{df_{t+1}}{\bar{p}\bar{c}} - \frac{dg_t}{\bar{c}} + V'(g_t) dg_t
 \end{aligned} \tag{5.5.1}$$

$$\begin{aligned}
 dU_t^* &= \tilde{c}_t^* - \frac{\theta - 1}{\theta} \tilde{y}_t^* \\
 &= \frac{\beta(2\omega\theta - 2\omega + 1)}{2\theta(1 - \omega)} \frac{df_{t+1}}{\bar{p}\bar{c}},
 \end{aligned} \tag{5.5.2}$$

where we plugged in the respective short run consumption and output responses that were derived in the previous section. As in the flexible exchange rate model, the domestic utility response hinges crucially on the effect of public spending on private utility. In the numerical illustration of short run utility given in figures 5.8(a) and 5.8(b), we assume again full utility enhancing government spending such that the term $-\frac{dg_t}{\bar{c}} + V'(g_t) dg_t$ vanishes in equation (5.5.1).

Domestic (foreign) short run utility is always positive (negative), independently of the persistence of the shock. Intuitively, domestic households benefit from the reincrease in consumption that is partially financed via debt and is therefore not necessarily associated with higher working effort. Remember that the initial reduction of private consumption that results from higher tax payments is entirely compensated. As can be seen in the numerical illustration, temporary expansions yield stronger welfare effects than permanent expansions because the response of the short run trade

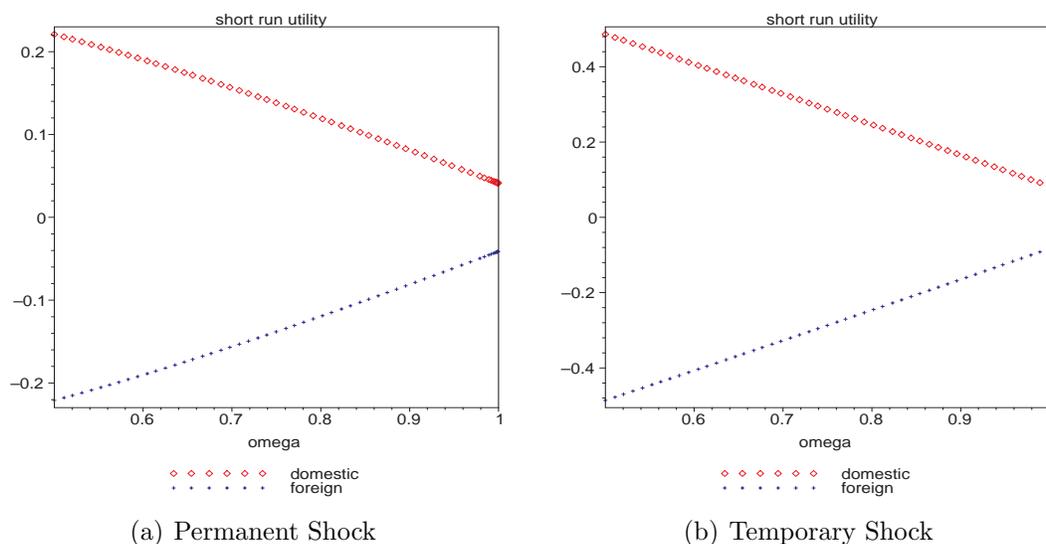


Figure 5.8: Short run utility in a monetary union

balance is then more pronounced. With identical preferences in both countries, domestic and foreign production are entirely unchanged. Hence, the entire reincrease in domestic consumption is financed via bonds, and the gap between domestic and foreign welfare is maximal. A home bias in consumption raises (lowers) both domestic (foreign) short run consumption and production. However, domestic (foreign) short run welfare declines (rises), as only a small fraction of the increase in domestic production translates into short run domestic consumption, while a large part is used for future consumption via lower debt accumulation.

5.5.2 Long-Run Utility

For the derivation of long run utility, we make use of the domestic and foreign long run consumption and output responses stated above. Remember that the new steady state is reached in period $t + 1$. Therefore, the domestic and foreign long run welfare

responses are valid for every period from $t + 1$ on:

$$\begin{aligned}
 dU_{t+1} &= \tilde{c}_{t+1} - \frac{\theta - 1}{\theta} \tilde{y}_{t+1} + V'(g_{t+1}) dg_{t+1} \\
 &= \frac{(1-\beta)df_{t+1}}{\bar{p}\bar{c}} + \frac{3\omega\theta - \theta - 2\omega + 1}{(2\omega\theta - 2\omega + 1)(2\theta - 1)} \frac{dg_{t+1}}{\bar{c}} - \frac{dg_{t+1}}{\bar{c}} + V'(g_{t+1}) dg_{t+1} \quad (5.5.3)
 \end{aligned}$$

$$\begin{aligned}
 dU_{t+1}^* &= \tilde{c}_{t+1}^* - \frac{\theta - 1}{\theta} \tilde{y}_{t+1}^* \\
 &= -\frac{(1-\beta)df_{t+1}}{\bar{p}\bar{c}} + \frac{\theta(1-\omega)}{(2\omega\theta - 2\omega + 1)(2\theta - 1)} \frac{dg_{t+1}}{\bar{c}}. \quad (5.5.4)
 \end{aligned}$$

While the long run welfare effects of temporary expansions are governed by bond holdings, which have a pure redistributive character, permanent expansions yield an additional welfare effect that is positive for both countries. This positive impact is identical to the one under flexible exchange rates. It stems from a long run expansion of output, which brings about higher consumption possibilities, and can best be seen by calculating long run world welfare. Adding up (5.5.3) and (5.5.4) one can show that world welfare again increases by $\frac{1}{2\theta-1} \frac{dg_{t+1}}{\bar{c}}$ in the case of a permanent expansion, while there is no world welfare gain under temporary expansions.

From figures 5.9(a) and 5.9(b) follows that both domestic and foreign long run welfare increase if the fiscal expansion is permanent, assuming fully utility enhancing government spending. This indicates that for domestic households the long run expansion of output dominates the negative wealth effect of permanent interest payments. In contrast, temporary expansions raise long run foreign welfare and lower domestic welfare because of the negative response of the short run trade balance and the absence of long run output stimulation effects.

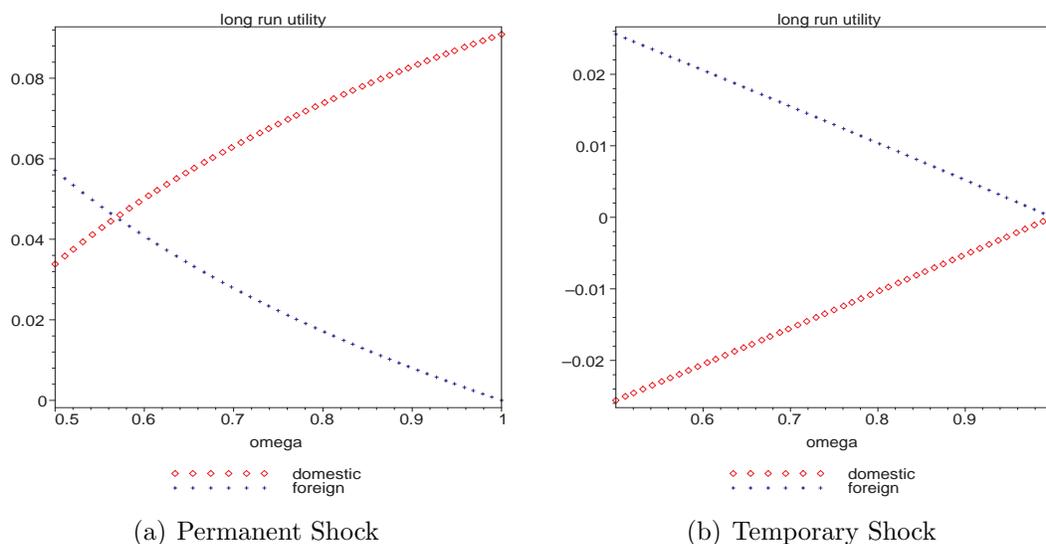


Figure 5.9: Long run utility in a monetary union

A home bias in consumption reduces the short run trade balance response which induces lower permanent interest payments of domestic households. Therefore, domestic (foreign) long run consumption increases (decreases) in ω while domestic (foreign) production decreases (increases). Moreover, in the case of permanent expansions, a stronger home bias shifts long run consumption possibilities towards the domestic country via the long run terms of trade effect.¹⁰ As the effect of the long run fiscal component on production is independent of the home bias in consumption, see equations (5.4.14) and (5.4.15), long run domestic (foreign) welfare is an increasing (decreasing) function of ω under both types of shocks.

¹⁰Remember that the long run terms of trade response, which favors foreign households, is decreasing in the home bias. This feature becomes evident when analyzing the long run government expenditure terms in the domestic and foreign long run utility equations.

5.5.3 Overall Utility

In order to assess the overall welfare impact of domestic fiscal expansions, we now calculate the net present values of welfare. This can either be done by using the net present values of consumption and production given in the previous section or by summing up the respective short run and discounted long run welfare responses just derived. Domestic and foreign overall welfare are then given by:

$$d\Omega_t = -\frac{\beta(2\omega - 1)(2\theta - 1)}{2\theta(1 - \omega)} \frac{df_{t+1}}{\bar{p}\bar{c}} - \frac{dg_t}{\bar{c}} + V'(g_t)dg_t + \frac{\beta}{1 - \beta} \left(\frac{3\omega\theta - \theta - 2\omega + 1}{(2\omega\theta - 2\omega + 1)(2\theta - 1)} \frac{dg_{t+1}}{\bar{c}} - \frac{dg_{t+1}}{\bar{c}} + V'(g_{t+1})dg_{t+1} \right) \quad (5.5.5)$$

$$d\Omega_t^* = \frac{\beta(2\omega - 1)(2\theta - 1)}{2\theta(1 - \omega)} \frac{df_{t+1}}{\bar{p}\bar{c}} + \frac{\beta}{1 - \beta} \left(\frac{\theta(1 - \omega)}{(2\omega\theta - 2\omega + 1)(2\theta - 1)} \frac{dg_{t+1}}{\bar{c}} \right). \quad (5.5.6)$$

The overall welfare effects are depicted in figures 5.10(a) and 5.10(b). While permanent expansions raise overall welfare in both countries, except for very large values of ω , temporary expansions are a prosper-thyself and a beggar-thy-neighbor instrument.¹¹ A stronger home bias in consumption always works in favor of the domestic country.

We first consider the case of a temporary fiscal expansion. As can be seen from the above equations, the entire evolution of domestic and foreign overall welfare can be attributed to the bond holding decision. With identical preferences ($\omega = 0.5$), overall

¹¹If government expenditures are purely dissipative or yield only low private utility, fiscal expansions become a beggar-thyself policy.

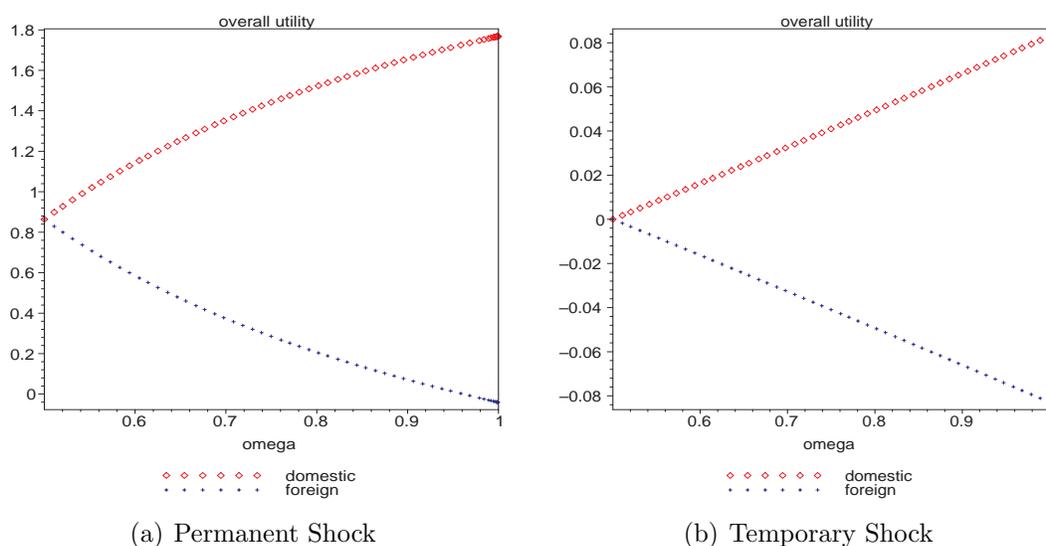


Figure 5.10: Overall utility in a monetary union

welfare in both countries is unaffected by fiscal expansions. However, if preferences are biased, the negative short run trade balance response translates into higher domestic and lower foreign overall welfare. The economic mechanism behind this result lies in a demand externality that stems from the consumption decisions taken by domestic and foreign households. When financing the short run domestic reincrease in consumption through the purchase of bonds, the individual foreign household does not include the effects on overall production into her optimization calculus. The reason for this behavior is that households are sufficiently small such that from an individual's perspective the own consumption decision has no impact on the overall production pattern. In the aggregate, however, forgoing short run consumption by foreign households leads to a composition of world demand where a larger share stems from domestic sources (consumption and public spending). As preferences are biased and the model is demand driven in the short run, domestic production is stimulated

and foreign production suppressed. Since the initial steady state of the model is characterized by suboptimally low production and consumption, the asymmetric evolution of short run production is beneficial to domestic and detrimental to foreign households. Thereby, the existence of a home bias gives rise to beggar-thy-neighbor effects of temporary asymmetric fiscal expansions. The extent of the negative spillover effects on the foreign country depends positively on the degree of biased preferences.

In the case of a permanent fiscal expansion, the short run demand externality effect is also present. However, it is quantitatively less important due to the weaker short run trade balance response. Equations (5.5.5) and (5.5.6) reveal an additional welfare effect of the long run component of permanent fiscal expansions, which is positive for both countries. The numerical illustration highlights the quantitative importance of this effect: Overall foreign welfare now increases for a very broad range of ω despite the negative short run spillovers. The long run fiscal expansion is beneficial for both countries through its positive impact on world production. While in the domestic country the monopolistic distortion is directly abated via higher production, the foreign country gains from improved long run terms of trade that result from higher demand addressed to foreign firms. A home bias in consumption shifts long run welfare gains from the foreign to the domestic country via its direct positive effect on domestic production and less favorable foreign terms of trade. For extremely biased preferences, the long run expansionary effect is only beneficial for the domestic country. Hence, foreign households suffer a small overall welfare loss due to the negative short run demand spillover effect. All in all, a permanent asymmetric fiscal expansion is a prosper-thyself and generally also a prosper-thy-neighbor policy in a monetary union setup, as world output is stimulated in the long run.

5.6 Conclusion

In this chapter, we have analyzed the effects of temporary and permanent asymmetric fiscal expansions in the context of a monetary union. We have used the basic structure of the cash-in-advance model under flexible exchange rates so as to facilitate a direct comparison of the major international transmission mechanisms and the welfare effects of fiscal policy under the two exchange rate regimes. Introducing a common currency and a supranational independent central bank that controls the union-wide money supply alters the adjustment process to fiscal shocks substantially. With the exchange rate channel being absent, equilibrium on the money market is achieved via a direct redistribution of international money holdings. While the pricing behavior of firms is irrelevant for the model results in our monetary union setting, biased preferences play a prominent role for the international distribution of consumption, production, and welfare. We now summarize the main positive results and welfare implications of fiscal expansions in a monetary union setting.

Current Accounts, Output and Consumption

Both temporary and permanent fiscal expansions yield short run domestic current account deficits as they do under the flexible exchange rate regime. However, the amplitude of the current account imbalance is now ruled by demand composition effects that result from biased preferences. Intuitively, a stronger home bias raises demand for domestic goods and hence domestic production, which reduces financing of the domestic reincrease in consumption via debt.

Our account of fiscal policy as a potential output stabilization tool in a monetary

union has demonstrated that fiscal expansions generally increase domestic production in the short and long run. If preferences are identical, domestic production is unchanged in the short run because the asymmetric composition of world demand does not translate into an asymmetric production pattern. At the same time, the foreign country always experiences negative production spillovers if preferences are biased. Even in the case of permanent fiscal expansions, where long run world output is stimulated, foreign production is slightly below steady state. A stronger home bias in consumption reinforces the positive effects on domestic output and aggravates the negative production spillovers on the foreign country.

Turning to the consumption responses in the two countries, the salient feature of the monetary union model is that the net present value of foreign consumption is always negative for temporary expansions and becomes negative even in the case of permanent fiscal expansions, if preferences are strongly biased. In both cases, it is the adverse effect of a home bias in consumption on short run production that reduces foreign consumption possibilities substantially. While domestic consumption is always below steady state due the tax burden, a stronger home bias abates the negative net present value of consumption.

Welfare

We have shown that for the polar case of a full positive utility impact of government spending, expansive fiscal policy becomes a prosper-thyself instrument under both temporary and permanent fiscal expansions. Domestic households gain utility from short and long run production increases, which result from demand composition effects and possible long run world production stimulation.

We have also established that a domestic fiscal expansion is always a beggar-thy-neighbor instrument in the case of temporary fiscal shocks. The economic mechanism behind this result lies in the negative demand externality on foreign production that is associated with a home bias in consumption. Permanent expansions, however, are generally prosper-thy-neighbor due to the long run stimulation of world production and the implied improvement of the foreign long run terms of trade.

Chapter 6

Comparison of Exchange Rate Regimes

6.1 Introduction

When deciding upon the optimal exchange rate policy, policymakers are in the need of a comprehensive account of the economic consequences of alternative exchange rate regimes. Beside the loss of monetary policy as a potential stabilization tool, the adoption of a common currency may also involve additional costs due to less favorable international transmission mechanisms of macroeconomic disturbances. So far, our analysis has investigated the manifold national and international effects of fiscal expansions under flexible exchange rates and in a monetary union. Based on these results, we now assess the consequences of a transition from flexible exchange rates to a monetary union by performing an explicit comparison of fiscal expansions under the two exchange rate regimes. In a first step, we provide a comparative analysis of the international production effects of fiscal expansions. The effectiveness of fiscal policy as an output stabilization tool is a central topic in international macroeconomics and is likely to depend on the respective exchange rate regime. At the same time, possible negative international spillovers of national fiscal policies are of great concern among

policymakers. These issues become even more important in the light of monopolistic distortions on the goods markets that create the potential for production increases to improve welfare. As demonstrated throughout the separate analyses of the respective exchange rate regimes, output stimulation does not necessarily lead to higher welfare. An overall welfare analysis rather has to take into account both the evolution of output and the associated changes in purchasing power. In a second step, we therefore compare the welfare implications of fiscal expansions under the alternative exchange rate regimes.

We limit our comparative analysis to the case of temporary expansions as permanent ones yield the same qualitative results but of lower quantitative importance. In fact, one can show that the long run component of permanent expansions has identical effects under the two exchange rate regimes.¹ Hence, the overall output and welfare differentials between the two regimes can be attributed exclusively to short run developments and their impact on the long run equilibrium via the current account channel. As short run reactions of all relevant variables are more pronounced for temporary expansions under both regimes, we obtain stronger differential effects than with permanent expansions.²

¹This feature can be seen by taking a look at the respective output and welfare equations under the two regimes. Long run government expenditures enter the equations in a completely identical way.

²We verified this result via extensive numerical simulations of the model economies. Appendix C.1 presents the graphical illustration of the overall production and welfare differentials for the case of permanent expansions. The differential effects turn out to be roughly half as high for permanent expansions as they are in the case of temporary expansions.

6.2 Output Effects of Fiscal Expansions

We start with a comparative analysis of the overall production effects of a temporary domestic fiscal expansion. As we are interested in the results of a transition from flexible exchange rates to a monetary union, we define the differential of any variable x as:

$$\Delta x = x^{MU} - x^{Flex}. \quad (6.2.1)$$

Hence, positive values of the differential imply that the size of the respective responses is larger in a monetary union than under a flexible exchange rate regime. Plugging in the net present values of production under the two regimes, we can derive the overall output effects of a transition to a monetary union. Figures 6.1(a) and 6.1(b) illustrate the overall output differentials for the two countries.

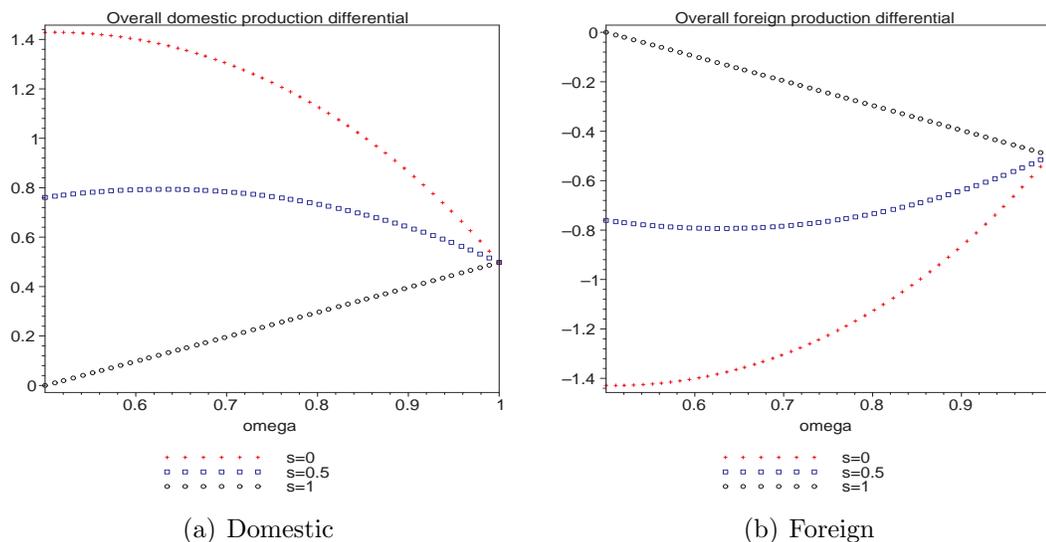


Figure 6.1: Overall production differentials (temporary shock).

In the domestic country, the overall output differential is always positive. Hence,

fiscal policy is more effective in terms of output stimulation under a monetary union regime. Stepping back to the separate regime analysis of the previous chapters, we see that domestic production is stimulated under a monetary union, while under flexible exchange rates production declines, except for very high levels of pricing-to-market. The expansive effect on production in a monetary union is mainly due to a demand composition effect in the short run, whereas the output reduction in the flexible exchange rate regime hinges on the adverse expenditure switching effect associated with the appreciation of the exchange rate.³ If the degree of pricing-to-market behavior is very high, expenditure switching is very low and overall domestic production is stimulated due to long run production increases that stem from the negative response of the short run trade balance. However, even under full pricing-to-market, domestic production is lower in a flexible exchange rate regime than in a monetary union, except for the case of unbiased preferences. In the limiting case of $s = 1$ and $\omega = 0$, overall production is identical under the two exchange rate regimes, both in the domestic and in the foreign country. All in all, higher degrees of pricing-to-market imply a lower differential of the net present value of domestic output through their limiting impact on expenditure switching under flexible exchange rates.

In contrast, the overall output differential is always negative in the foreign country, indicating that in terms of output, the transition to a monetary union is detrimental to foreign households. Recall that the net present value of foreign production is mainly positive under flexible exchange rates, while in a monetary union there is a negative international output spillover effect of fiscal expansions.

³Remember that standard NOEM models yield a depreciation of the short run exchange rate following an asymmetric fiscal expansion. The implied short run expenditure switching effects are then completely reversed.

The effects of a home bias in consumption on the net present value differentials in the two countries are very sensitive to the degree of pricing-to-market. We now analyze these effects in detail for the domestic country. For the foreign country, the opposite results and interpretations apply. First, take the case of complete pricing-to-market ($s = 1$) in figure 6.1(a). A stronger home bias then implies a higher domestic production differential. Under flexible exchange rates, the net present value of production declines in ω due to the weaker response of the short run trade balance. In a monetary union, in contrast, domestic production increases in ω , mainly because of short run demand composition effects. Hence, biased preferences render a monetary union more attractive in terms of output for domestic households if all producers follow pricing-to-market behavior.

Second, take the case of no pricing-to-market ($s = 0$). The effects of biased preferences are then completely reversed: A higher home bias in consumption now reduces the domestic production differential. Intuitively, a home bias in consumption significantly raises domestic production since it limits the relevance of negative expenditure switching effects that stem from the appreciation of the short run exchange rate. This effect of biased preferences under flexible exchange rates is stronger than the respective output stimulating demand composition effect in a monetary union - hence the decreasing output differential. It is noteworthy that the production differential reaches its maximum when pricing-to-market is absent and preferences are identical - assumptions prevailing in Obstfeld and Rogoff's (1995a) basic *Redux* model. Finally, intermediate cases of pricing-to-market reflect a combination of the respective mechanisms prevailing in the two polar cases of complete and no pricing-to-market behavior. As a consequence of these effects, a stronger home bias leads to a reduced importance

of the pricing regime for the overall production differentials. Figures 6.1(a) and 6.1(b) show that for very high levels of a home bias, the degree of PTM is almost irrelevant for the overall production differential.

From a theoretical perspective, the overall production effects of fiscal expansions are the adequate variable in order to evaluate fiscal policy regarding its potential to stimulate output. However, policymakers often have a shorter planning horizon and are concerned not only about overall effects but also about the short run impact of fiscal policy. Therefore, we briefly address the intertemporal pattern of the output differentials between the two exchange rate regimes.

Figures 6.2(a) - 6.3(b) illustrate the short and long run production differentials for the case of a temporary domestic fiscal expansion.

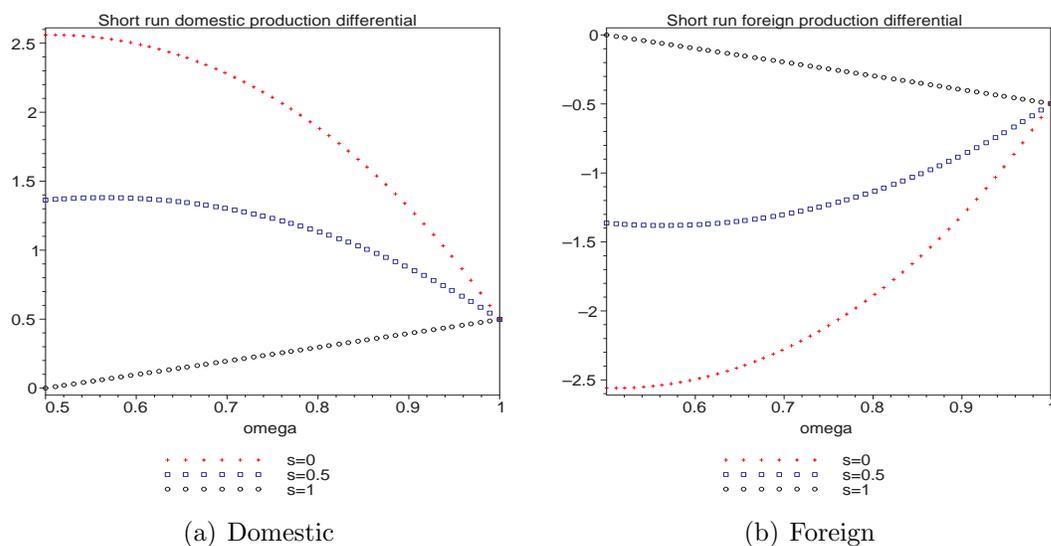


Figure 6.2: Short run production differentials (temporary shock).

The short run production differentials give roughly the same picture as the overall production differentials. However, except for complete pricing-to-market, the short

run differentials are substantially larger since the long run domestic (foreign) production differentials have negative (positive) signs. The latter result can be explained by the respective short run domestic trade balance, which deteriorates more under flexible exchange rates. The stronger negative wealth effect then implies higher (lower) long run domestic (foreign) production than in a monetary union. From a short run perspective, the transition from flexible exchange rates to a monetary union goes along with a substantial increase in domestic production in the light of fiscal expansions. In fact, the foreign country does not benefit any more from the strong short run production spillover effects that result from the appreciation of the exchange rate.

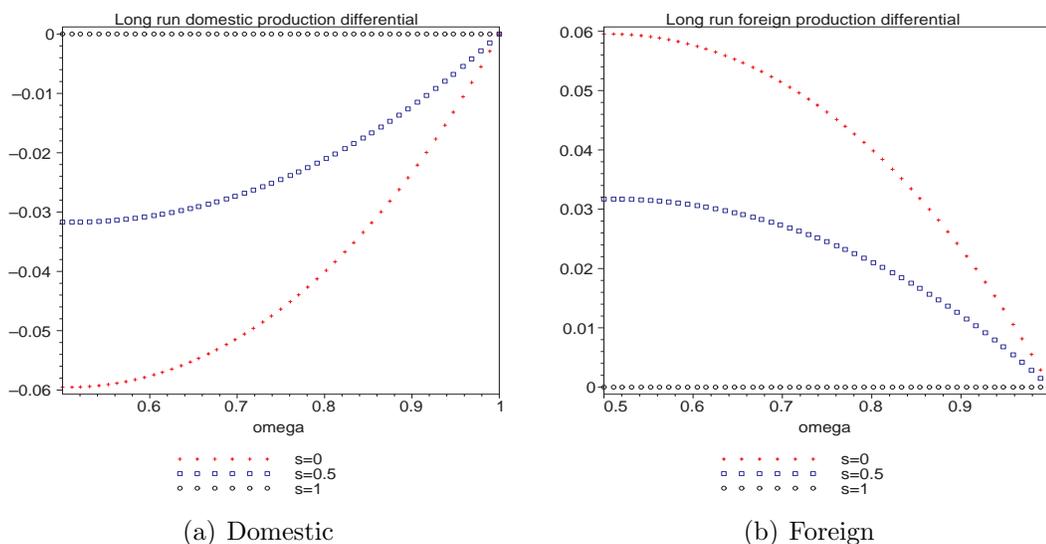


Figure 6.3: Long run production differentials (temporary shock).

6.3 Welfare Effects of Fiscal Expansions

Having established the production differentials between flexible exchange rates and a monetary union, we now turn to an explicit welfare comparison of fiscal expansions under the two regimes. The welfare analysis accounts for both production and consumption responses and therefore provides a more thorough evaluation of fiscal expansions in an international context.

As before, we first address the overall differentials between the two exchange rate regimes. Using the respective net present values of overall welfare derived in chapters 4 and 5, we calculate the differentials according to equation (6.2.1). The domestic and foreign overall welfare differentials are illustrated in figures 6.4(a) and 6.4(b).

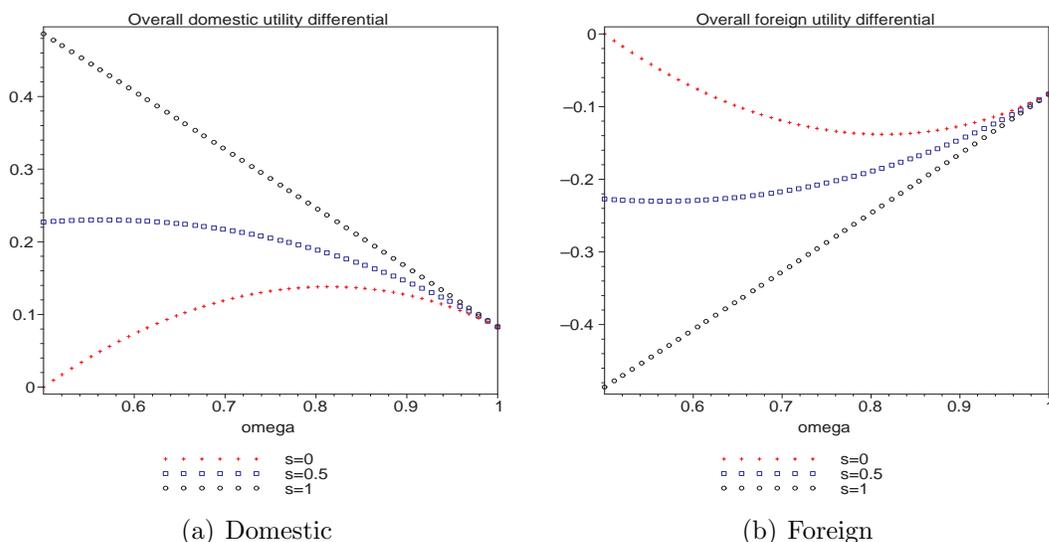


Figure 6.4: Overall utility differentials (temporary shock).

Since in the domestic country the depicted welfare differential is always positive, domestic households prefer a monetary union to a flexible exchange rate regime in

the light of domestic fiscal expansions. In contrast, foreign households are better off under flexible exchange rates, independently of the pricing behavior of firms and the home bias in consumption. In the limiting case of no pricing-to-market ($s = 0$) and identical preferences ($\omega = 0.5$), a temporary fiscal expansion leaves domestic and foreign welfare under both regimes unchanged. According to our previous analysis of flexible exchange rates, the short run expenditure switching effects are then exactly offset by the simultaneous evolution of the terms of trade. In a monetary union, the composition of world demand, which is biased towards domestic sources, does not translate into asymmetric short run production effects when preferences are identical. Hence, the exchange rate regime does not matter in terms of overall welfare in the baseline *Redux* setting if fiscal shocks are the macroeconomic disturbances under consideration. Note that this result is unaffected by the assumptions about the additive utility effect of public spending. When considering welfare differentials between the exchange rate regimes, symmetric elements simply cancel out.

In contrast to the overall production results just derived, the welfare differentials increase in the degree of pricing-to-market. In the domestic country, a higher degree of pricing-to-market makes a monetary union all the more beneficial relative to flexible exchange rates even though the production differential declines. This feature stresses the importance of incorporating the purchasing power of production when evaluating the implications of fiscal expansions. While production depends positively on the degree of pricing-to-market under flexible exchange rates, the associated negative terms of trade effects dominate the welfare results. In the foreign country, pricing-to-market makes a monetary union even less attractive if asymmetric domestic fiscal expansion are the major concern.

Analogously to our analysis of the production differentials, the qualitative effects of biased preferences on the respective overall welfare differentials depend on the degree of pricing-to-market. With complete pricing-to-market ($s = 1$), a stronger home bias in consumption reduces the overall welfare differentials in both countries. Even though domestic overall welfare increases in ω under a monetary union, the limiting effect of biased preferences (quantity effect) on the adverse terms of trade evolution under flexible exchange rates dominates. Without pricing-to-market ($s = 0$), a stronger home bias in consumption initially raises the domestic overall welfare differential and lowers the differential thereafter. This reflects the non-linear interplay between reduced expenditure switching (positive welfare effect) and the limited relevance of the terms of trade (negative welfare effect) under the flexible exchange rate regime, which has been analyzed in chapter 4. For intermediate values of pricing-to-market, we obtain again a combination of the effects that occur in the two polar cases. Figures 6.4(a) and 6.4(b) also show that for very high levels of a home bias the pricing regime is almost irrelevant for the resulting welfare differentials.

Finally, we take a brief look at the short and long run welfare differentials that lead to the overall picture just described. Figures 6.5(a) - 6.6(b) show the respective welfare differentials. In the short run, the domestic welfare differential between the two regimes is only positive for very high values of pricing-to-market. In the case of $s = 1$, the short run differential is entirely identical with the overall differential as there is no long run difference between the two regimes. Intuitively, domestic households are in the short run better off under a monetary union because they do not suffer from adverse terms of trade effects. For smaller degrees of pricing-to-market, domestic households derive short run utility losses from a transition towards a

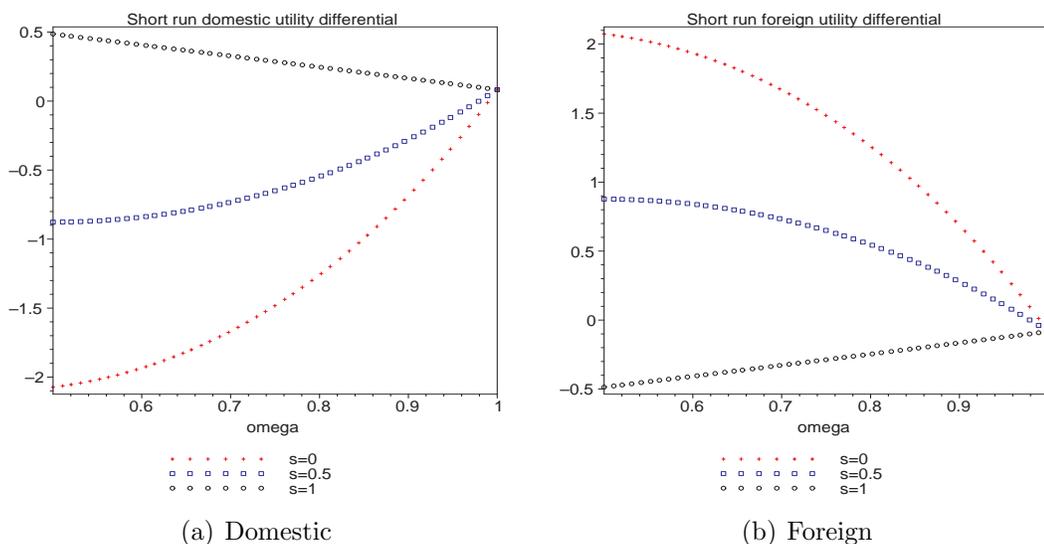


Figure 6.5: Short run utility differentials (temporary shock).

monetary union, since the expenditure switching effects of the short run appreciation of the exchange rate shifts production towards the foreign country under flexible exchange rates. Domestic households then rely more on debt financing which is beneficial in the short run, but naturally has negative welfare effects in the long run. Therefore, a monetary union leads to higher domestic welfare in the long run for all $s \neq 1$. In the foreign country, the evolution of the short and long run welfare differentials is mirroring its domestic counterparts.

As with the output analysis of fiscal policy, the question of intertemporal welfare trade-offs arises. For high degrees of pricing-to-market, the transition to a monetary union is beneficial (detrimental) to domestic (foreign) households both in the short run and from an overall perspective. In contrast, lower degrees of pricing-to-market are associated with an intertemporal trade-off: While the short run welfare differential is negative for domestic and positive for foreign households, the overall

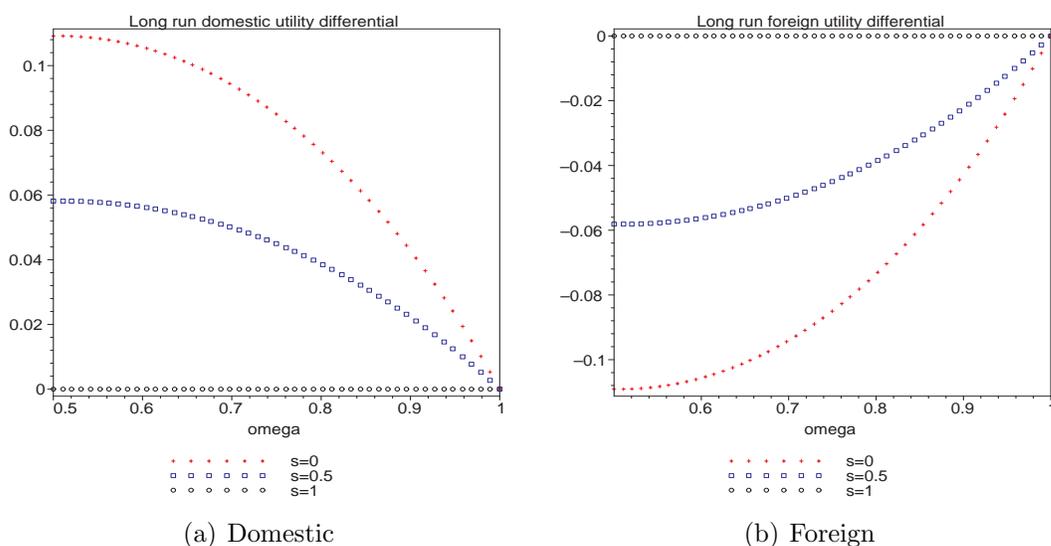


Figure 6.6: Long run utility differentials (temporary shock).

welfare implications are just opposed. Thus, from an overall perspective, domestic households favor a monetary union over a flexible exchange rate regime. However, a transition to a monetary union would be associated with short run welfare losses for domestic households. Foreign households, in turn, face the opposite trade-off. Therefore, the welfare evaluation of fiscal policy under the two exchange rate regimes hinges crucially on the time horizon of the researcher or policymaker if the degree of pricing-to-market is rather low.

6.4 Conclusion

In this chapter, we have provided a comprehensive comparison of the effects of asymmetric fiscal expansions under the two exchange rate regimes. The analysis has

demonstrated that domestic households are unambiguously better off under a monetary union than in a flexible exchange rate regime, both in terms of overall output stimulation and overall welfare. Foreign households, in contrast, prefer a flexible exchange rate regime under both welfare criteria. However, the impact of the pricing regime is completely different under the two potential policy targets. Higher degrees of pricing-to-market render a transition to a monetary union less beneficial (detrimental) to domestic (foreign) households, if overall output stimulation is the relevant policy goal, while the opposite is true, if overall welfare is considered the primary objective. The major driving forces for this result are less expenditure switching and simultaneously deteriorating terms-of-trade under flexible exchange rates. As for a home bias in consumption, the implications for the welfare differential depend on the degree of pricing-to-market. However, a stronger home bias generally tends to reduce the production and welfare differentials between the two exchange rate regimes. Moreover, a stronger home bias also reduces the importance of the pricing regime for the production and welfare differentials. From a policy perspective, our analysis suggests that individual countries have stronger incentives to pursue unexpected expansionary fiscal policies in a monetary union than they do under a flexible exchange rate regime. As demonstrated in chapter 5, our model setup implies that temporary asymmetric fiscal expansions are a beggar-thy-neighbor policy in a monetary union. A stronger home bias raises the negative effect on foreign welfare.

Chapter 7

Conclusion

In the end, what are the results and implications of our fiscal policy analysis? In this final chapter we put together the results of the theoretical models presented in the preceding chapters and then comment on some caveats and possible extensions.

7.1 Main Results

In the final sections of the preceding chapters, we have already summarized the results of asymmetric fiscal expansions under flexible exchange rates and in a monetary union in a comprehensive form. Here, we only address the major issues at stake while the reader is referred to the respective sub-conclusions for the details. Hence, the objective of this section is to present a short synthesis of the analysis conducted in the last chapters and its major results.

In order to assess the effects of asymmetric expansive fiscal policies in an international context, we have deployed a microfounded two-country general equilibrium model along the lines of Obstfeld and Rogoff (1995a). Our major deviations from the baseline *Redux* model are the inclusion of biased preferences, the possibility of pricing-to-market, and the modification of the scale variable of money demand. Given this

model setup, we have investigated the transmission of asymmetric fiscal disturbances under a flexible exchange rate regime and in a monetary union. Following a separate analysis of the two exchange rate regimes, we have provided a direct comparison of the results and the major economic mechanisms at work. In our evaluation of the effects of fiscal policy, the main focus has lain on two potential policy targets: output stabilization and overall welfare.

Our analysis has revealed that under both policy targets, households in the country where the fiscal shock originates prefer a monetary union over a flexible exchange rate regime, while the opposite result holds for households in the foreign country. Importantly, this result is independent of the persistence of the fiscal disturbance. The reason lies in the expenditure switching and terms of trade effects that are prevailing under flexible exchange rates, while being absent in a monetary union. Our assumption of an absorption based money demand function, which stands in contrast to most standard NOEM models, results in an appreciation of the short run nominal exchange rate following a domestic fiscal expansion. The associated expenditure switching effect increases foreign output at the expense of domestic output. The short run responses of output are therefore opposed to those obtained under the basic *Redux* model setup. Simultaneously, the short run movement of the exchange rate affects the terms-of-trade between the two countries. Specifically, the domestic terms of trade improve for relatively low levels of pricing-to-market, while they deteriorate, if the majority of the firms follow pricing-to-market. In terms of overall domestic welfare, we have shown that in the limiting case of no pricing-to-market at all, the negative expenditure switching effect just offsets the positive terms of trade effect. If some producers pursue PTM, the combination of these two effects results

in welfare losses of domestic households. This can be seen most clearly in the case of full pricing-to-market. Then, expenditure switching is completely absent and it is only the negative evolution of the domestic terms of trade that drives overall welfare. Altogether, fiscal expansions are always a prosper-thy-neighbor instrument under a flexible exchange rate regime. We want to emphasize that this result even holds, when no stimulation of world production in the short or the long run occurs, as it is the case for a temporary shock in our model setup. We thereby obtain the same qualitative result for foreign welfare as in the *Redux* model, however, with different adjustment processes to asymmetric fiscal disturbances. Importantly, foreign welfare depends positively on the prevailing degree of pricing-to-market and negatively on the home bias in consumption.

If, in contrast, the two countries give up monetary sovereignty and engage in a monetary union, the international transmission mechanisms of fiscal expansions are completely different. With the exchange rate channel being absent, the distinction between pricing-to-market behavior and producer currency pricing becomes irrelevant. If there is a home bias in consumption, short run domestic production is higher than in the initial state, while the foreign country experiences a negative production spillover. These short run production responses in turn translate into relative welfare gains for domestic households. In a monetary union, fiscal expansions are thus a beggar-thy-neighbor instrument if preferences are biased towards domestic products and if world output is not stimulated. This finding might provide a rationale for mechanisms to control excessive fiscal spending in a monetary union, especially if preferences are strongly biased towards domestically produced goods.

Due to the assumption of a rigid cash-in-advance constraint for both households

and governments world production remains unchanged in the short run. Hence, temporary fiscal expansions do not affect world welfare under either exchange rate regime. Permanent fiscal expansions, in contrast, lead to higher world production in the long run. As production is inefficiently low in the initial steady state, this brings about world welfare gains, which are shared asymmetrically between the two countries if there is a home bias in consumption.

Comparing the results under the two exchange rate regimes, we can conclude that in the light of a domestic fiscal expansion the introduction of a monetary union is beneficial for domestic households and detrimental to foreign households. Given this qualitative result, we have presented a thorough analysis of the quantitative implications of the interaction between the pricing behavior of firms and the prevalence of a home bias in consumption. Under the flexible exchange rate regime, higher degrees of pricing-to-market lead to less expenditure switching towards foreign goods, rendering a transition to a monetary union less beneficial to domestic households in terms of output. In contrast, if overall welfare is the primary policy goal, higher degrees of pricing-to-market make a transition to a monetary union all the more beneficial to domestic households due to the negative welfare effects stemming from the evolution of the terms of trade under flexible exchange rates. Under both exchange rate regimes, a stronger home bias in consumption tends to increase domestic output and welfare at the expense of the foreign country. In general, the positive effect of a stronger home bias on domestic country variables is more pronounced under the flexible exchange rate regime than in a monetary union, leading to a reduction in the overall production and welfare differentials between the two exchange rate regimes. However, even for an extremely biased preference structure, domestic households are

better off in a monetary union than under a flexible exchange rate regime, while the opposite is true for foreign households. At the same time, a stronger home bias in consumption lowers the importance of the pricing regime for the welfare differentials.

7.2 Caveats and Possible Extensions

We now address some caveats of our theoretical analysis and point to possible modifications and extensions of our model framework. As outlined in the preceding chapters, our findings depend on the following major assumptions. First, we impose cash-in-advance constraints on both private households and on governments, such that the scale variable of money demand is total absorption. In other words, public expenditures entirely enter the money demand function. Empirically, however, private consumption yields relatively more money demand than public expenditures. As outlined in this thesis, a MIU setting where government spending is irrelevant for money demand would lead to completely different results of asymmetric fiscal policies. Introducing a parameter that rules the need for money of the public authorities along the lines of Pitterle and Steffen (2004b) would facilitate an explicit analysis of alternative degrees of public money demand.

Second, government spending affects private utility only additively in our models, in contrast to Ganelli (2003) who considers a utility function where public spending enters in a non-separable form. As mentioned in section 2.2, however, the further insights of this approach are of minor importance. Our assumption of fully utility enhancing government spending naturally affects domestic welfare and can lead to different implications for the question whether fiscal expansions are a prosper-thyself or a beggar-thyself policy. However, as we opted for a general formulation we can

easily relax this assumption and study the case of purely dissipative government spending as in the standard *Redux* model. Obviously, the welfare implications for the foreign country are completely independent of this assumption.

Third, public and private spending display an identical home bias in our analysis. Instead, empirical observations suggest a stronger home bias in government spending than in private consumption. In the NOEM literature, some authors as for example Corsetti and Pesenti (2001) accounted for this empirical feature by assuming a complete home bias in government expenditures and identical preferences of households across countries. Intuitively, this model setup leads to a distribution of welfare that favors the domestic country at the expense of the foreign country. However, empirical work suggests that biased preferences are a broad based phenomenon which should not be restricted to governments. Probably the best fit of the model would be achieved by combining a home bias in private consumption with even stronger biased public preferences.

Fourth, our specific modelling approach of pricing-to-market, that hinges on the combination of exchange rate movements and rigid prices, precludes the analysis of alternative pricing behaviors in a monetary union. As a consequence, the law of one price always holds in our monetary union setup. Empirically however, pricing-to-market behavior can also be found in monetary unions, see for instance Bergin (2003) and Warmedinger (2004). Building on a model proposed by Bergin (2003), one could modify our analysis framework and introduce trans-log preferences. Then, pricing-to-market behavior would occur even in the monetary union version of our model. An explicit comparison of pricing-to-market behavior under alternative exchange rate regimes may add new insights on the international transmission mechanisms of fiscal

policy.

Obviously, our analysis could be extended in many more directions, as indicated by the vast amount of recent contributions to the NOEM literature. Currently, there is substantial research in the field of strategic applications of NOEM models. In this context, the integration of a home bias in consumption combined with pricing-to-market behavior may yield interesting implications for the issue of international fiscal policy coordination.

Appendix A

Appendix to Chapter 4

A.1 The Linearized Long Run Equilibrium

The log-linear version of the long run equilibrium is given by the following set of equations:

MONEY MARKETS

$$\tilde{m}_{t+1} = \tilde{p}_{t+1} + \tilde{c}_{t+1} + \frac{dg_{t+1}}{\bar{c}} \quad (\text{A-1})$$

$$\tilde{m}_{t+1}^* = \tilde{p}_{t+1}^* + \tilde{c}_{t+1}^* + \frac{dg_{t+1}^*}{\bar{c}} \quad (\text{A-2})$$

CURRENT ACCOUNTS

$$\tilde{c}_{t+1} + \tilde{p}_{t+1} + \frac{dg_{t+1}}{\bar{c}} + \frac{\beta df_{t+2}}{\bar{p}\bar{c}} = \tilde{p}_{t+1}^h + \tilde{y}_{t+1} + \frac{(1-\beta)df_{t+1}}{\bar{p}\bar{c}} \quad (\text{A-3})$$

$$\tilde{c}_{t+1}^* + \tilde{p}_{t+1}^* + \frac{dg_{t+1}^*}{\bar{c}} = \tilde{p}_{t+1}^{f*} + \tilde{y}_{t+1}^* + \frac{(1-\beta)df_{t+1}^*}{\bar{p}\bar{c}} \quad (\text{A-4})$$

GOODS MARKETS

$$\tilde{y}_{t+1} = -\theta\tilde{p}_{t+1}^h + \theta\omega\tilde{p}_{t+1} + \theta(1-\omega)(\tilde{p}_{t+1}^* + \tilde{e}_{t+1}) + \omega(\tilde{c}_{t+1} + \frac{dg_{t+1}}{\bar{c}}) + (1-\omega)(\tilde{c}_{t+1}^* + \frac{dg_{t+1}^*}{\bar{c}}) \quad (\text{A-5})$$

$$\tilde{y}_{t+1}^* = -\theta\tilde{p}_{t+1}^{f*} + \theta\omega\tilde{p}_{t+1}^* + \theta(1-\omega)(\tilde{p}_{t+1} - \tilde{e}_{t+1}) + (1-\omega)(\tilde{c}_{t+1} + \frac{dg_{t+1}}{\bar{c}}) + \omega(\tilde{c}_{t+1}^* + \frac{dg_{t+1}^*}{\bar{c}}) \quad (\text{A-6})$$

EULER EQUATIONS

$$\tilde{p}_{t+1} + \tilde{c}_{t+1} = \tilde{p}_{t+2} + \tilde{c}_{t+2} + \tilde{R}_{t+1} \quad (\text{A-7})$$

$$\tilde{p}_{t+1}^* + \tilde{c}_{t+1}^* = \tilde{p}_{t+2}^* + \tilde{c}_{t+2}^* + \tilde{R}_{t+1} + \tilde{e}_{t+2} - \tilde{e}_{t+1} \quad (\text{A-8})$$

LABOR MARKETS

$$\tilde{h}_{t+1} = \frac{\theta}{\theta-1}(\tilde{p}_{t+1}^h - \tilde{c}_{t+1} - \tilde{p}_{t+1}) \quad (\text{A-9})$$

$$\tilde{h}_{t+1}^* = \frac{\theta}{\theta-1}(\tilde{p}_{t+1}^{f*} - \tilde{c}_{t+1}^* - \tilde{p}_{t+1}^*). \quad (\text{A-10})$$

A.2 The Long Run Consumption Differential

In the derivation process of the long run consumption differential, we first take the difference of the log-linearized long run current accounts (A-3) and (A-4), considering the long run Euler equations:

$$(\tilde{c}_{t+1} - \tilde{c}_{t+1}^*) + \frac{dg_{t+1} - dg_{t+1}^*}{\bar{c}} = (\tilde{y}_{t+1} - \tilde{y}_{t+1}^*) + \frac{2(1-\beta)df_{t+1}}{\bar{p}\bar{c}} + 2(1-\omega)(\tilde{p}_{t+1}^h - \tilde{p}_{t+1}^f). \quad (\text{A-1})$$

From the definition of the long run price levels stated in Table 4.1 we get the price relation $(\tilde{p}_{t+1} - \tilde{p}_{t+1}^* - \tilde{p}_{t+1}^h + \tilde{p}_{t+1}^{f*}) = 2(\omega - 1)(\tilde{p}_{t+1}^h - \tilde{p}_{t+1}^f)$, which we use to match the endogenous price differentials. Taking differences of the linearized goods markets (A-5) and (A-6), we arrive at

$$\begin{aligned} (\tilde{y}_{t+1} - \tilde{y}_{t+1}^*) &= -4\theta\omega(1 - \omega)(\tilde{p}_{t+1}^h - \tilde{p}_{t+1}^f) \\ &\quad + (2\omega - 1)(\tilde{c}_{t+1} - \tilde{c}_{t+1}^*) + (2\omega - 1)\frac{dg_{t+1} - dg_{t+1}^*}{\bar{c}}. \end{aligned} \quad (\text{A-2})$$

Finally, the difference of the linearized labor markets (A-9) and (A-10) may be stated as

$$\frac{\theta - 1}{\theta}(\tilde{y}_{t+1} - \tilde{y}_{t+1}^*) = -(\tilde{c}_{t+1} - \tilde{c}_{t+1}^*) + 2(1 - \omega)(\tilde{p}_{t+1}^h - \tilde{p}_{t+1}^f), \quad (\text{A-3})$$

where we made use of the fact that $\tilde{y}_{t+1} - \tilde{y}_{t+1}^* = \tilde{h}_{t+1} - \tilde{h}_{t+1}^*$. All in all, we get three equations in the four endogenous terms $(\tilde{c}_{t+1} - \tilde{c}_{t+1}^*)$, $\frac{2(1-\beta)df_{t+1}}{\bar{p}\bar{c}}$, $(\tilde{y}_{t+1} - \tilde{y}_{t+1}^*)$, and $(\tilde{p}_{t+1}^h - \tilde{p}_{t+1}^f)$. Elimination of the output and price differentials yields the long run consumption differential (4.3.17) that only depends on the exogenous long term government expenditure differential, and on bond holdings that are determined in the short run. In the presence of temporary shocks, it is only bond holdings that govern the consumption differential in the long run.

A.3 The Linearized Short Run Equilibrium

The log-linear version of the short run equilibrium simplifies substantially as individual prices are fixed and drop out of the system of equations:

MONEY MARKETS

$$\tilde{m}_t = \tilde{p}_t + \tilde{c}_t + \frac{dg_t}{\bar{c}} \quad (\text{A-4})$$

$$\tilde{m}_t^* = \tilde{p}_t^* + \tilde{c}_t^* + \frac{dg_t^*}{\bar{c}} \quad (\text{A-5})$$

CURRENT ACCOUNTS

$$\tilde{p}_t + \tilde{c}_t + \frac{dg_t}{\bar{c}} + \frac{\beta df_{t+1}}{\bar{p}\bar{c}} = (1-s)\tilde{y}_t^a(h) + s\omega\tilde{y}_t^m(h) + s(1-\omega)\tilde{y}_t^{m*}(h) + s(1-\omega)\tilde{e}_t \quad (\text{A-6})$$

$$\tilde{p}_t^* + \tilde{c}_t^* + \frac{dg_t^*}{\bar{c}} + \frac{\beta df_{t+1}^*}{\bar{p}\bar{c}} = (1-s)\tilde{y}_t^a(f) + s\omega\tilde{y}_t^{m*}(f) + s(1-\omega)\tilde{y}_t^m(f) - s(1-\omega)\tilde{e}_t \quad (\text{A-7})$$

GOODS MARKETS

$$\tilde{y}_t^a(h) = \omega\tilde{c}_t + (1-\omega)\tilde{c}_t^* + \omega\frac{dg_t}{\bar{c}} + (1-\omega)\frac{dg_t^*}{\bar{c}} + (1-\omega)\theta\tilde{e}_t + \omega\theta\tilde{p}_t + (1-\omega)\theta\tilde{p}_t^* \quad (\text{A-8})$$

$$\tilde{y}_t^a(f) = \omega\tilde{c}_t^* + (1-\omega)\tilde{c}_t + \omega\frac{dg_t^*}{\bar{c}} + (1-\omega)\frac{dg_t}{\bar{c}} - (1-\omega)\theta\tilde{e}_t + \omega\theta\tilde{p}_t^* + (1-\omega)\theta\tilde{p}_t \quad (\text{A-9})$$

$$\tilde{y}_t^m(h) = \theta\tilde{p}_t + \tilde{c}_t + \frac{dg_t}{\bar{c}} \quad (\text{A-10})$$

$$\tilde{y}_t^{m*}(h) = \theta\tilde{p}_t^* + \tilde{c}_t^* + \frac{dg_t^*}{\bar{c}} \quad (\text{A-11})$$

$$\tilde{y}_t^m(f) = \theta\tilde{p}_t + \tilde{c}_t + \frac{dg_t}{\bar{c}} \quad (\text{A-12})$$

$$\tilde{y}_t^{m*}(f) = \theta\tilde{p}_t^* + \tilde{c}_t^* + \frac{dg_t^*}{\bar{c}} \quad (\text{A-13})$$

EULER EQUATIONS

$$\tilde{c}_{t+1} = \tilde{p}_t - \tilde{p}_{t+1} + \tilde{c}_t - \tilde{R}_t \quad (\text{A-14})$$

$$\tilde{c}_{t+1}^* = \tilde{p}_t^* - \tilde{p}_{t+1}^* + \tilde{c}_t^* - \tilde{R}_t + \tilde{e}_t - \tilde{e}_{t+1}. \quad (\text{A-15})$$

A.4 The Short Run Exchange Rate Response

In the sequel, we present the derivation of the short run exchange rate equation (4.3.34) in more detail. We first solve the long run consumption differential (4.3.17) for the endogenous bond holdings:

$$\frac{df_{t+1}}{\bar{p}\bar{c}} = \frac{(2\theta - 1)}{2(1 - \beta)\theta}(\tilde{c}_{t+1} - \tilde{c}_{t+1}^*) + \frac{(2\omega\theta^2 - 6\omega\theta + 3\theta + 2\omega - 1)}{2(1 - \beta)\theta(2\omega\theta - 2\omega + 1)}\left(\frac{dg_{t+1} - dg_{t+1}^*}{\bar{c}}\right). \quad (\text{A-16})$$

In order to eliminate the long run consumption differential from this equation, we calculate the difference of the linearized Euler equations (A-14) and (A-15):

$$\tilde{c}_{t+1} - \tilde{c}_{t+1}^* = \tilde{c}_t - \tilde{c}_t^* + \tilde{p}_t - \tilde{p}_t^* - \tilde{p}_{t+1} + \tilde{p}_{t+1}^* - \tilde{e}_t + \tilde{e}_{t+1}. \quad (\text{A-17})$$

Using the linearized price levels (4.3.15), (4.3.30), (4.3.31) and the long run labor market difference (A-3) to substitute for the price differentials, we obtain

$$\begin{aligned} \frac{1}{2(1 - \omega)}(\tilde{c}_{t+1} - \tilde{c}_{t+1}^*) &= \tilde{c}_t - \tilde{c}_t^* + [2(1 - \omega)(1 - s) - 1] \tilde{e}_t \\ &\quad - \frac{(2\omega - 1)(\theta - 1)}{2(1 - \omega)\theta}(\tilde{y}_{t+1} - \tilde{y}_{t+1}^*). \end{aligned} \quad (\text{A-18})$$

Now, combining linearized versions of the long run goods and labor market differences (A-2) and (A-3), we arrive at the long run production differential:

$$(\tilde{y}_{t+1} - \tilde{y}_{t+1}^*) = -(\tilde{c}_{t+1} - \tilde{c}_{t+1}^*) + \frac{2\omega - 1}{2\omega\theta - 2\omega + 1} \frac{dg_{t+1} - dg_{t+1}^*}{\bar{c}}. \quad (\text{A-19})$$

Plugging (A-19) into (A-18), we get the following relationship between short-run and long-run consumption:

$$\begin{aligned} (\tilde{c}_{t+1} - \tilde{c}_{t+1}^*) &= \frac{2(1 - \omega)\theta}{2\theta + 2\omega - 2\omega\theta - 1}(\tilde{c}_t - \tilde{c}_t^*) + \frac{2(1 - \omega)\theta(2\omega s - 2\omega - 2s + 1)}{2\theta + 2\omega - 2\omega\theta - 1} \tilde{e}_t \\ &\quad + \frac{(2\omega - 1)^2(\theta - 1)}{(2\theta + 2\omega - 2\omega\theta - 1)(2\omega - 2\omega\theta - 1)} \left(\frac{dg_{t+1} - dg_{t+1}^*}{\bar{c}}\right). \end{aligned} \quad (\text{A-20})$$

Finally, we eliminate the long run consumption differential from equation (A-16) and obtain:

$$\begin{aligned} \frac{df_{t+1}}{\bar{p}\bar{c}} = & \frac{(2\theta - 1)(1 - \omega)}{(1 - \beta)(2\theta + 2\omega - 2\omega\theta - 1)} (\tilde{c}_t - \tilde{c}_t^*) + \frac{(2\theta - 1)(1 - \omega)(2\omega s - 2\omega - 2s + 1)}{(1 - \beta)(2\theta + 2\omega - 2\omega\theta - 1)} \tilde{e}_t \\ + & \frac{(2\theta - 1)(2\omega - 1)^2(\theta - 1) + (2\omega\theta^2 - 6\omega\theta + 2\omega + 3\theta - 1)(2\omega\theta - 2\theta - 2\omega + 1)}{2\theta(1 - \beta)(2\omega\theta - 2\theta - 2\omega + 1)(2\omega\theta - 2\omega + 1)} \left(\frac{dg_{t+1} - dg_{t+1}^*}{\bar{c}} \right). \end{aligned} \quad (\text{A-21})$$

Then, substituting for the international bond holdings in (4.3.33) and combining it with exchange rate equation (4.3.32) in order to eliminate the short run consumption differential, gives us the short run response of the nominal exchange rate to an asymmetric fiscal shock. The final exchange rate equation (4.3.34) describes the impact of a permanent shock, that is for $dg_{t+1} = dg_t = dg_p$, while equation (4.3.36) applies for a temporary expansion.

Appendix B

Appendix to Chapter 5

B.1 The Linearized Long Run Equilibrium

In a monetary union, the log-linear version of the long run equilibrium is given by the following set of equations:

EQUILIBRIUM MONEY DEMANDS

$$\tilde{m}_{t+1}^d = \tilde{p}_{t+1} + \tilde{c}_{t+1} + \frac{dg_{t+1}}{\bar{c}} \quad (\text{B-1})$$

$$\tilde{m}_{t+1}^{d*} = \tilde{p}_{t+1}^* + \tilde{c}_{t+1}^* + \frac{dg_{t+1}^*}{\bar{c}} \quad (\text{B-2})$$

CURRENT ACCOUNTS

$$\tilde{c}_{t+1} + \tilde{p}_{t+1} + \frac{dg_{t+1}}{\bar{c}} = \tilde{p}_{t+1}^h + \tilde{y}_{t+1} + \frac{(1-\beta)df_{t+1}}{\bar{p}\bar{c}} \quad (\text{B-3})$$

$$\tilde{c}_{t+1}^* + \tilde{p}_{t+1}^* + \frac{dg_{t+1}^*}{\bar{c}} = \tilde{p}_{t+1}^{f*} + \tilde{y}_{t+1}^* + \frac{(1-\beta)df_{t+1}^*}{\bar{p}^*\bar{c}} \quad (\text{B-4})$$

GOODS MARKETS

$$\tilde{y}_{t+1} = -\theta\tilde{p}_{t+1}^h + \theta\omega\tilde{p}_{t+1} + \theta(1-\omega)\tilde{p}_{t+1}^* + \omega(\tilde{c}_{t+1} + \frac{dg_{t+1}}{\bar{c}}) + (1-\omega)(\tilde{c}_{t+1}^* + \frac{dg_{t+1}^*}{\bar{c}}) \quad (\text{B-5})$$

$$\tilde{y}_{t+1}^* = -\theta\tilde{p}_{t+1}^{f*} + \theta\omega\tilde{p}_{t+1} + \theta(1-\omega)\tilde{p}_{t+1} + (1-\omega)(\tilde{c}_{t+1} + \frac{dg_{t+1}}{\bar{c}}) + \omega(\tilde{c}_{t+1}^* + \frac{dg_{t+1}^*}{\bar{c}}) \quad (\text{B-6})$$

EULER EQUATIONS

$$\tilde{p}_{t+1} + \tilde{c}_{t+1} = \tilde{p}_{t+2} + \tilde{c}_{t+2} + \tilde{R}_{t+1} \quad (\text{B-7})$$

$$\tilde{p}_{t+1}^* + \tilde{c}_{t+1}^* = \tilde{p}_{t+2}^* + \tilde{c}_{t+2}^* + \tilde{R}_{t+1} \quad (\text{B-8})$$

LABOR MARKETS

$$\tilde{h}_{t+1} = \frac{\theta}{\theta - 1} (\tilde{p}_{t+1}^h - \tilde{c}_{t+1} - \tilde{p}_{t+1}) \quad (\text{B-9})$$

$$\tilde{h}_{t+1}^* = \frac{\theta}{\theta - 1} (\tilde{p}_{t+1}^{f*} - \tilde{c}_{t+1}^* - \tilde{p}_{t+1}^*). \quad (\text{B-10})$$

Appendix C

Appendix to Chapter 6

C.1 Production and Utility Differentials under Permanent Expansions

Figures C.1(a) and C.1(b) illustrate the domestic and foreign overall production differentials in the case of a permanent shock.

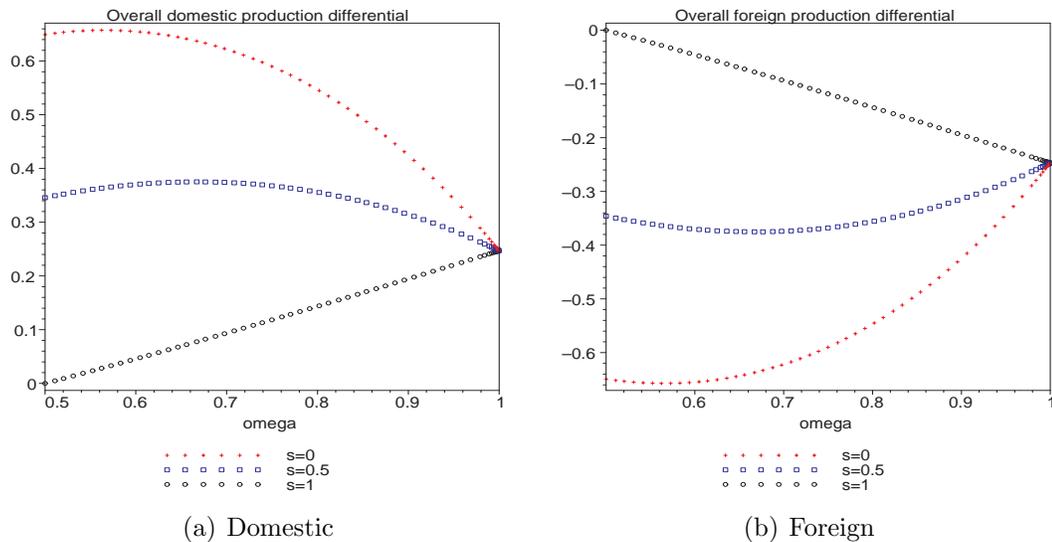


Figure C.1: Overall production differentials (permanent shock)

Figures C.2(a) and C.2(b), in turn, illustrate the domestic and foreign overall utility differentials in the case of a permanent shock.

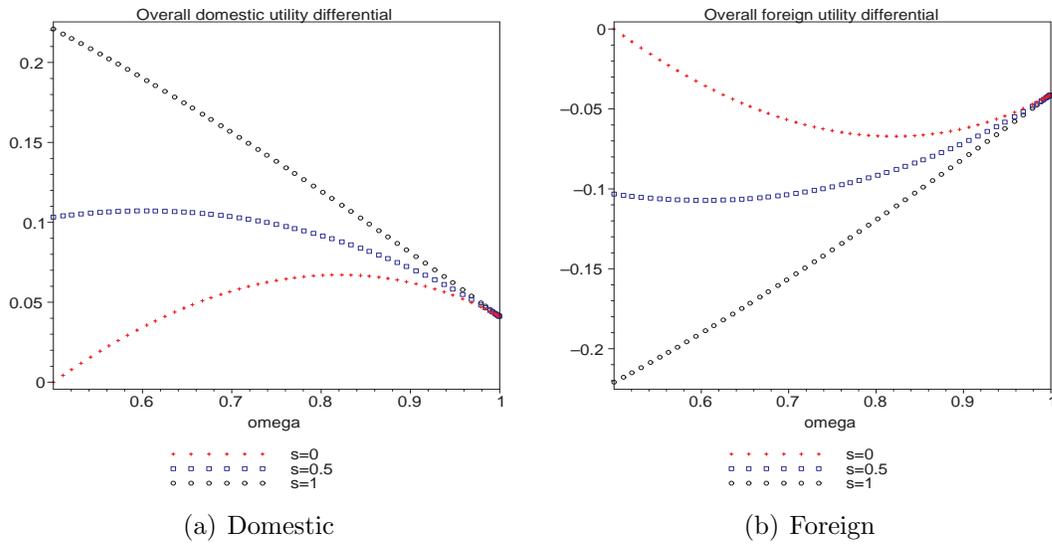


Figure C.2: Overall utility differentials (permanent shock)

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