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Expenditure-based Consolidation: Experiences and Outcomes

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Edited by Karim Triki

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European Commission

Directorate-General for Economic and Financial Affairs

Expenditure-based Consolidation: Experiences and Outcomes

Proceedings of the Public Finance Workshop organised by the Directorate-General for Economic and Financial Affairs in Brussels on 20 January 2015

Edited by Karim Triki

Abstract

A proper design of fiscal adjustment is an essential aspect of a successful approach to consolidation. Economists often advocate putting emphasis on expenditure restraint as part of a well-designed consolidation strategy. There is no optimal government size, but the common presumption is that both potential efficiency gains in spending and the opportunity cost of incremental taxation increase more than proportionately with the size of the public sector. In this context, the aim of the workshop, held by DG ECFIN on 20 January 2015, was to discuss theoretical and policy issues associated with expenditure-based consolidations. The workshop was organised in three sessions, Session 1: " Expenditure-based consolidation or tax based consolidation: evidence from a cross-country perspective", session 2: "Interaction between private and public sector in difficult times: impact of uncertain economic environments on consolidations" and session 3 "Structural and institutional reforms in the context of an expenditure-based consolidation". The proceedings display the high quality contributions that were presented in each of these sessions.

JEL Classification: E32, E47, E61, E62, F41, H3, H5.

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CONTENTS

LIST OF TABLES

LIST OF GRAPHS

LIST OF BOXES

LIST OF CONTRIBUTORS

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1. INTRODUCTION

1.1 INTRODUCTORY ADDRESS BY MARCO BUTI (ECFIN): MAIN HIGHLIGHTS

In his introduction to the workshop, Marco Buti, Director General of DG ECFIN, insisted on the relationship between the design of a fiscal consolidation plan and its success. He underlined the important implications of the composition of fiscal consolidation, the mix of expenditure and revenue measures, on output growth and fiscal variables. Displaying arguments found in an important strand of the economic literature, he argued that fiscal adjustments tilted on the expenditure side are likely to be more successful, notably because only expenditure trends can exogenously be controlled over the medium-term, as government revenue typically follows GDP. He pointed to another argument put forward by the literature, namely the smaller expected negative impact on growth, at least in the medium term. Indeed, potential efficiency gains in spending combined with the opportunity cost of incremental taxation could be beneficial to economic activity. However, he also noted that in the short-run, the debate on the composition of fiscal adjustments as well as on the size of the multiplier was left open.

Outlining the importance of the workshop, Marco Buti welcomed such a dialogue platform which allows for the discussion of issues that are of topical importance for EU Member States in the current economic environment. The issue brought forward by this workshop was already identified as topical in the 2014 Public Finance Report, where a chapter was dedicated to expenditure based consolidations. As economic imbalances and fiscal sustainability challenges persist, Marco Buti emphasized the need to pursue consolidation efforts, especially in the context of a monetary union, as well as on the subsequent need to calibrate such policy carefully.

Marco Buti then detailed other aspects to be considered carefully when implementing fiscal adjustments. First, the timing for implementing the consolidation measures should be adequately assessed: the pace of consolidation should be balanced and a full back loading of the effort should be avoided. Second, the magnitude of the consolidation should be adapted to address sustainability concerns and preserve buffers against bad times where necessary. Third, the composition of the consolidation should take into account the country-specific structure of public finances. Whilst expenditure cuts are particularly advisable in countries with a relatively large public sector; there may also be scope for tax adjustment in countries with lower expenditure. Finally, the quality of public finances and in particular the quality of public expenditure should be a priority concern; productive expenditures, such as R&D, education or public investment should be at least preserved. In this respect, Marco Buti indicated that spending-reviews are a powerful tool to prioritize cuts. The Commission, whilst advocating for fiscal adjustment, has always made clear that consolidation should respect country-specific features and remain growth friendly. These concerns are reflected in the policy advice provided by the Commission following the presentation of fiscal strategies included in the Stability and Convergence Programs.

Marco Buti finally introduced the six contributions of the workshop, split in three different sessions, each one focusing on a particular aspect of consolidation:

The first session, chaired by Lucio Pench (ECFIN), focused on the optimal design of fiscal consolidation. Two contributions, one introduced by Carlo Favero (Bocconi University) and the second presented by Jerome Creel (OFCE) discussed the respective merits of expenditure based consolidation and tax based consolidation with a cross country perspective. The discussants of this session were Pablo Hernandez De Cos (Bank of Spain) and Lucia Rodriguez Munoz (ECFIN).

The second session, chaired by Wim Suyker (CPB Netherlands Bureau for Economic Policy Analysis) aimed at analyzing the impact of uncertain economic environments on consolidations. The first paper, introduced by Jesper Lindé and the second introduced by Carlos Mulas Granados separately highlighted the importance to adjust the timing of the consolidation depending on specific circumstances, notably low credibility of the consolidation as well as possible credit constraints. The discussants of this session were Pedro Gomes (Carlos III University - Madrid) and Werner Roeger (ECFIN).

The third session, chaired by Lars Jonung, provided some examples of structural and institutional reforms backing up expenditure based consolidation. The first paper, presented by Wolf Reuter, evaluated the impact of expenditure based fiscal rules. The second paper, introduced by Stuart Adam, provided some insight on the micro level impact of the recent consolidation reforms carried out in the UK. The discussants of this session were Javier Perez (Bank of Spain) and Nicolas Carnot (ECFIN).

1.2. SESSION I ON EXPENDITURE-BASED CONSOLIDATION OR TAX BASED CONSOLIDATION: EVIDENCE FROM A CROSS-COUNTRY PERSPECTIVE

1.2.1. The composition of fiscal adjustments: new evidence by Alesina (Harvard University), Barbiero, Favero, Giavazzi and Matteo Paradisi (Bocconi University)

This paper investigates empirically the impact of public finance consolidation composition on output. First, it finds that, overall, expenditure-based consolidations are less contractionary than tax-based consolidations with regards to the effect on output. It further identifies consolidation strategies based on government consumption and investment cuts as being the least recessionary, as in some cases, non-keynesian effects are observed for these components of expenditure. One key assumption held by the authors is that fiscal policy is executed through plans which include an announced and an unanticipated component. Distinguishing between announced and unanticipated shifts in fiscal variables, and allowing them to have different effects on output, is crucial for evaluating fiscal multipliers, i.e. impact on output. By further developing the Romer and Romer (2010) narrative approach through disaggregating components of spending and revenue for a panel of 17 OECD countries, Alesina et al also provide a new data set allowing the study of individual output effects.

1.2.2. Back to fiscal consolidation in Europe and its dual trade-off: now or later, through spending cuts or tax hikes by Christophe Blot, Jérôme Creel, Bruno Ducoudré and Xavier Timbeau (OFCE)

This paper discusses the key determinants of an optimal fiscal consolidation in terms of size, composition and timing. Results presented in the paper suggest that tax-based and back loaded consolidation is more efficient to reduce public debt if spending multipliers are high. On the other hand, bringing debt levels down by frontloading the consolidation or through expenditure restraint, or both, appears to be more costly in terms of output and requires larger overall effort. The paper uses a simple reduced form model to investigate the effect on the success of fiscal consolidation of several elements: i) the euro area fiscal stance, ii) the composition of fiscal adjustments, iii) the impact of risk premium, and iv) the impact of front loading.

1.2.3. Selected comments on the discussion, by Pablo Hernandez de Cos (Bank of Spain) and Lucia Rodriguez Munoz (ECFIN)

Comments for the first session developed along the lines of the contrasting results and underlying assumptions inherent to the two papers. On the first paper, both discussants welcomed the innovation consisting of using the narrative approach to analyse the composition of successful consolidation at a disaggregated level. Pablo Hernandez De Cos underlined that further work could be done in i) explaining the underlying transmission channels for the disaggregated multipliers and ii) providing more evidence regarding the exogeneity of the measures identified through the narrative approach. On the second paper, the discussants primarily called upon the author to better explain and investigate the fiscal multipliers which determine the results. Moreover, it was underlined that the simple reduced form model used did not allow for capturing complex relations between variables, including financial variables.

1.3. SESSION II ON INTERACTION BETWEEN PRIVATE AND PUBLIC SECTOR IN DIFFICULT TIMES: IMPACT OF UNCERTAIN ECONOMIC ENVIRONMENTS ON CONSOLIDATIONS

1.3.1. Fiscal Consolidations under Imperfect Credibility, by Matthieu Lemoine (Banque de France) and Jesper Lindé (Sveriges Riksbank)

This paper is a model based study of the effects of expenditure-based fiscal consolidations when the credibility of the long lasting nature of the measures is imperfect. The paper proves two main results. On the one hand, under independent monetary policy, the adverse impact of limited credibility is relatively small, and consolidation can be expected to reduce government debt at a relatively low output cost given that monetary policy can be accommodative. On the other hand, the lack of monetary accommodation under a currency union implies that the output cost can be significantly larger when there is imperfect credibility. In this context, progress to reduce the government debt in the short- and medium-term is limited.

1.3.2. Debt reduction, fiscal adjustments and growth in credit-constrained economies by Emanuele Baldacci, Sanjeev Gupta and Carlos Mulas-Granados (International Monetary Fund)

This paper analyses empirically the role of fiscal policy on growth in the medium-term in a context of debt deleveraging and credit constraints. Results show that sizeable expenditure-based adjustments are harmful in the presence of credit constraints as the private sector does not have leeway to compensate for declined public sector expenditure. The paper suggests favouring gradual and balanced consolidation, where focus should be put on addressing non-priority expenditure and protecting growth enhancing public investments. The paper also calls for shifting the tax burden away from labour. It also stresses the need for structural reforms, in order to increase the ease of doing business and favour growth enhancing structures. The paper provides with a new data sample covering 79 episodes of debt reduction driven by discretionary action (i.e. episodes not taking into account debt relief) between 1980 and 2012 selected within a pool of 107 countries.

1.3.3. Selected comments on the discussion, by Pedro Gomez (Carlos III University - Madrid) and Werner Roeger (ECFIN)

The first discussant (W. Roeger) welcomed the first paper and recalled that the importance of credibility effects have also been demonstrated using the QUEST model (macroeconomic model of the European Commission). The second paper was also well received with the second discussant (P.Gomes) underlying the high level of technical quality combined with relevant policy implications and advice. Nevertheless, the second discussant pointed to the possibility of going further in terms of investigating the best possible fiscal adjustment composition under credit constraints. Including a measure of the monetary stance during and after an episode as a control variable was suggested. The outcome of the discussion showed that both papers pointed to the need to gradual implementation of fiscal adjustment in order to have a noticeable impact on public debt. Finally the following conclusion was drawn from the combined results of the two papers: not only the current context of low credibility of consolidation combined with credit constraints faced by the private sector appeared to have prevented governments from pursuing consolidation in a consistent way, but it also ruled out the capacity of the private sector to fill the gap left by public sector retraction.

1.4. SESSION III ON STRUCTURAL AND INSTITUTIONAL REFORMS IN THE CONTEXT OF AN EXPENDITURE-BASED CONSOLIDATION

1.4.1. Numerical expenditure rules: Design and effects by Wolf Heinrich Reuter (Vienna University of Economics and Business)

This paper analyses empirically national numerical expenditure rules and their impact on expenditure dynamics. Based on the exact legal wording of the expenditure rules in national legislation, the author

identifies the variable constrained and assesses the numerical limit imposed by the rule. This enables a joint analysis of eight expenditure rules, covering the central or general government, which were in force in the EU between 2000 and 2014. The paper shows that countries comply with their expenditure rules in approximately 60% of the years. Moreover, the econometric analysis indicates that the reduction of expenditures is twice as important when there is a binding expenditure rule in force than without (case of a country not complying with the rule in the previous year), thus stressing the usefulness of fiscal rules.

1.4.2. The effect of UK welfare reforms on the distribution of income and work incentives by Stuart Adam and James Browne (Institute for Fiscal Studies)

This paper analyses the impact of UK welfare reform on income distribution and work incentives. It provides insight on the micro level impact of recent planned structural reforms, which were implemented along with a fiscal consolidation package consisting chiefly of reductions in government expenditure. The largest structural reform studied is the introduction of a universal credit to combine six means-tested benefits for those of working age into a single payment. Other benefit cuts and tax rises that form part of the fiscal consolidation package also affect incomes and work incentives, and falling real wages over the period when these changes are being introduced tend to make work less attractive as well as making workers worse off. In the paper, micro-simulation techniques are used to estimate the distributional impact of the reforms for non-pensioner households, showing that tax rises have predominantly targeted the highest-income decile of households while welfare reforms have mainly hit the bottom half, leaving upper-middle-income households relatively unscathed. The paper also investigates whether financial work incentives will be stronger in 2015–16 than they were in 2010–11 and separate out the impact of tax changes, benefit cuts and the introduction of universal credit from the impact of wider economic changes. The main results show that the tax and benefit reforms together strengthen average incentives to be in work, reducing the mean replacement rate (the ratio of out-of-work income to in-work income). Yet, little impact on average incentives for those in work to increase their earnings is observed.

1.4.3. Selected comments from the discussion, by Javier Perez (Bank of Spain) and Nicolas Carnot (ECFIN)

The third session concluded with a discussion where it was reiterated that the papers diverged from the approach taken in the two preceding sessions, whilst acknowledging that the topics covered were still very pertinent for the overall theme. On the first paper, the discussants highlighted the fact that only a minority of expenditure rules actually covered the general government, whereas most were to be found at the central government level. They also pointed to the substantial degree of heterogeneity of the rules. Finally, the sample was also identified as being very small, which is a consequence of the relative novelty of fiscal rules. Thus the paper was welcomed as part of a developing field of study. The discussants indicated that further possible work related to the topic could include an analysis of expenditure targets which are also an important tool used to constrain public expenditure. The second paper, which covered welfare reforms, was overall welcomed but the discussants highlighted the need to include an investigation on a possible optimal taxation. In particular, the second discussant (N. Carnot) pointed out that the paper was reasoning in terms of changes with respect to the current system which itself could be ill designed. In this respect, improvements to an ill designed system do not necessarily lead to an optimal system.

2. SESSION 1

EXPENDITURE-BASED CONSOLIDATION OR TAX-BASED CONSOLIDATION:

EVIDENCE FROM A CROSS-COUNTRY PERSPECTIVE

2.1 THE COMPOSITION OF FISCAL ADJUSTMENTS: NEW EVIDENCE

By Alberto Alesina ([1]), Omar Barbiero ([2]), Carlo Favero ([3]), Francesco Giavazzi ([4]) and Matteo Paradisi ([5])([6])

2.1.1 Introduction

Many countries are struggling with the question of how to reduce public debts. A large literature (see Alesina Giavazzi and Favero (2014) for a recent assessment and new results) has shown that in general, expenditure based fiscal adjustments (i.e. deficit reduction policies achieved by means of spending cuts) are less costly in terms of short run output losses than tax based adjustments. Depending on various methodological approaches and estimation methods, the differences between the two may be found as very large, with spending cuts on average almost costless, and tax hikes creating deep and long lasting recessions, while following other approaches the differences between the two is less extreme. Different reaction of monetary policy to the two types of fiscal adjustments cannot explain these different output effects. In addition, spending based fiscal adjustments, by stopping the growth of entitlements and other automatic increases in government outlays may also be more effective at stabilizing the debt/GDP ratio in the medium run.

This literature however has not gone beyond a discussion of spending cuts versus tax hikes. There has been no disaggregation of which type spending cuts or which tax increases have been more or less effective at reducing deficits at lower output costs. We want to investigate this critical policy implication regarding the composition of fiscal adjustments (different types of spending cuts, e.g. infrastructure vs. public sector wages or different type of tax hikes, e.g. direct versus indirect taxes). By providing a new disaggregated data set of fiscal consolidations and beginning to analyze it, we believe that this paper will achieve two goals. One is to provide some answers regarding the short term costs (if any) in terms of output losses of different types of fiscal adjustments in a panel of countries, overcoming the limits coming from a simple distinction between taxes and spending. The second is that we will provide the data necessary to analyze other issues, such as distributional consequences of different types of fiscal adjustments, the political determinants of the choice of which type of adjustment to choose, long term effects over the debt/GDP ratio of different compositions of fiscal adjustments and the labor market effects of different types of fiscal consolidations.

This paper further develops the narrative approach pioneered by Romer and Romer (2010) by disaggregating the aggregate "plans" of fiscal adjustments identified by Devries et al. (2011) and breaking down various components of spending and revenues for the panel of 17 OECD countries (13 of which within the EU) and study their output effect. We focus both on spending and revenue measures because it is crucial to consider the whole structure of government budget movements in order to avoid any omitted variable bias.

Given the importance of the intertemporal design of fiscal plans, we would exploit the econometric framework of Alesina, Favero and Giavazzi (2014) to allow for different effects of past, current and planned fiscal adjustments. We would then examine how the composition of fiscal adjustments is related to their success in terms of stabilizing the debt over GDP ratio and how costly they are in terms of generating downturns or possibly, in some cases, expansions. For example: are fiscal adjustments based upon raising income taxes more or less costly than those based upon raising indirect taxes? How about direct taxes? On the spending side is it more costly to cut public investments or transfers?

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([6]) A first version of this paper was presented at the ECFIN workshop " Expenditure based consolidation: experiences and outcomes". We thank our discussants Pablo-Hernandez De Cos and Lucia Rodriguez Munoz for many insightful comments. We also thank Armando Miano for outstanding research assistance. We thank Armando Miano for outstanding research assistance.

Thus far the literature has addressed the issue of composition by simply looking at revenues versus spending in the aggregate. However, recent works by Mertens and Ravn (2013), Romer and Romer (2014) and Perotti (2014) are valuable exceptions. They however focus only on the US. This proposed paper would be the first one to present a disaggregated version of fiscal adjustment plans from an international perspective and assessing the effect of all the components of fiscal adjustments at once. We consider four different components of the government budget: consumption and investments, transfers, direct and indirect taxes. From a theoretical point of view each one of these components should have effect on GDP growth through different channels. Consumption and investments cuts will impact GDP depending on the level of government productivity in producing public goods and services. In addition these cuts generate expectations of lower taxes in the future and change the marginal utility of consumption assuming that private and public good consumption are substitutes. Transfers cuts are not directly distortionary on labor supply, but reduce the available resources for households, reducing in turn their consumption level. Like consumption and investments, transfers cuts generate room for tax reductions in the future. The main difference among direct and indirect taxes lies in their distortionary effect. An increase in the former change the marginal rate of substitution between consumption and labor, by reducing labor supply. On the other hand, indirect taxes have no impact on the marginal rate of substitution, but implicitly increase the price of consumption.

The paper is structured as follows. In the first section we illustrate the concept of fiscal plan and its importance to understand the output effect of fiscal stabilization, in the second section we illustrate the construction of the data-set, in the third section we concentrate on the econometric model, the fourth section reports empirical results and the last section concludes.

2.1.2. Fiscal Stabilization Plans

The analysis of the output effects of economic policy requires -- for the correct estimation of the relevant parameters -- identifying policy shifts that are exogenous. In this paper we concentrate on the output effect of fiscal stabilization measures, i.e. fiscal measures aimed at reducing the deficit and the debt. Exogeneity of the shifts in fiscal policy for the estimation of their output effect requires that they are not correlated with news on output growth.

The traditional steps to identify such exogenous shifts were to first estimate a joint dynamic model for the structure of the economy and the variables controlled by the policy-makers (typically estimating a VAR). The residuals in the estimated equation for the policy variables approximate deviations of policy from the rule. Such deviations, however, do not yet measure exogenous shifts in policy because a part of them represents a reaction to contemporaneous information on the state of economy. In order to recover structural shocks from VAR innovations some restrictions are required. In the case of monetary policy identification can be achieved exploiting the fact that central banks take their policy decisions at regular intervals (e.g. there are eight FOMC meetings every year) and there is consensus on the fact that it takes at least one period between two meetings before the economy reacts to such decisions. This triangular structure – innovations in the monetary policy variable reflect both monetary policy and macroeconomic shocks, but macroeconomic variables are not contemporaneously affected by monetary policy shocks – is sufficient for identification.

Fiscal policy is different, in the sense that it is conducted through rare decisions and is typically implemented through multi-year plans. A fiscal plan typically contains three components: (i) unexpected shifts in fiscal variables (announced upon implementation at time t), (ii) shifts implemented at time t but announced in previous years, and (iii) shifts announced at time t, to be implemented in future years. Considering, for simplicity, the case in which the horizon of the plan is only one year with reference to a specific country i, these are corrections announced at time t for implementation at time $t + 1$:

$$f_{i,t} = e^{u}_{i,t} + e^{a}_{i,t,0} + e^{a}_{i,t,1}$$

These features of fiscal policy generate "fiscal foresight": agents learn in advance future announced measures. The consequence of fiscal foresight is that the number of shocks to be mapped out of the VAR innovations is too high to achieve identification: technically the Moving Average representation of the VAR becomes non-invertible.

As a consequence of this specific feature of fiscal policy, after some initial effort of adapting the identification scheme used for monetary policy, attempts at mapping VAR innovations into fiscal shocks have become less successful, and an alternative strategy has been preferred, which is based on a non-econometric, direct identification of the shifts in fiscal variables. These are then plugged directly into an econometric specification capable of delivering the impulse response functions that describe the output effect of fiscal adjustments. In this "narrative" (Romer and Romer 2010) identification scheme a time-series of exogenous shifts in taxes or government is constructed using parliamentary reports and similar documents to identify the size, timing, and principal motivation for all major fiscal policy actions. Legislated tax and expenditure changes are classified into endogenous (induced by short-run countercyclical concerns) and exogenous (responses to an inherited budget deficit, or to concerns about long-run economic growth or politically motivated). In this paper we concentrate on fiscal measures designed to deal with inherited budget deficits. Therefore we concentrate on the effect of a subset of the exogenous adjustments.

Starting from narratively-identified shifts in fiscal variables we then build fiscal plans, recognizing that fiscal plans generate inter-temporal and intra-temporal correlations among changes in spending and revenues and disaggregating fiscal adjustments plans into their components . The inter-temporal correlation is the one between the announced (future) and the unanticipated (current) components of a plan − what we shall call the "style" of a plan. The intra-temporal correlation is that between the changes in revenues and spending that determines the composition of a plan. Finally, expenditure and revenues are disaggregated into four components: consumption and investment, transfers, direct taxes and indirect taxes. disaggregation will allow us to define four type of adjustments and evaluate the heterogeneity in their macroeconomic effect. As argued by Ramey (2011a, b) distinguishing between announced and unanticipated shifts in fiscal variables, and allowing them to have different effects on output, is crucial for evaluating fiscal multipliers. This approach, introduced in AFG, is an advance on the literature which so far had studied (see e.g. Mertens and Ravn 2011) the different effects of anticipated and unanticipated shifts in fiscal variables assuming that they are orthogonal.

A fiscal plan is specified by making explicit the relation between the unpredictable component of the plan and the other two components:

$$e^{a}_{i,t,1} = \varphi_{1,i} e^{u}_{i,t} + v_{1,i,t}$$

$$e^{a}_{i,t+1,0} = e^{a}_{i,t,1}$$

The first equation is a behavioral relation that captures the style with which fiscal policy is implemented. Countries that typically implement "permanent" plans will feature a positive $\varphi_{1,i}$, while temporary plans (in which a country announces that an initial fiscal action will be reversed, at least partially, in the future) will feature a negative $\varphi_{1,i}$. The second equation allows to connect announcement with implementation. Note that in the case an announced implementation at time t is only partially implemented at time $t+1$ and no new further measures are adopted we shall have

$$f_{i,t+1} = e^{u}_{i,t+1} + e^{a}_{i,t,1}$$

where $e^{u}_{i,t+1}$ will capture the difference between the actual fiscal adjustment at time $t+1$ and that announced at time t.

Finally, by tracking the different components of plans we will label them according to their composition. Plans will be distinguished into consumption and investment-based (CB), transfer-based (TRB), direct taxation -based (DB) and indirect taxation-based (IB), depending on the components that dominates the adjustment.

2.1.3. The construction of the data set

The paper focuses on exogenous fiscal shifts, meaning episodes primarily implemented to keep public deficits and debts, on a sustainable path and not dependent on current or perspective growth. The episodes capture the change in policy having effect in the current year, compared to a baseline scenario of no

policy change with respect to the previous year. In order to measure the size of the fiscal shifts, we look exclusively on contemporaneous government documents, as both Devries et al. (2011) and Romer and Romer (2010) do. We do this for two reasons. First of all because retrospective figures are rarely available and second because statements about the expected effects of a policy change are less likely to be distorted by contemporaneous cyclical factors. All the fiscal measures are scaled in percent of GDP. Data always refer to the general government.

In order to disaggregate the fiscal data provided by Devries et al. (2011) we need to classify fiscal measures in different components. In doing our classification we take into consideration the role of fiscal components in influencing economic decisions and we do not follow a mere accounting classification. In particular, we take into account the potential distortionary effects that some components may have on the labor supply. The fiscal components are: government consumption and investments, transfers, direct taxes and indirect taxes. We provide here a description of every single component with specific examples of the main measures it includes. ([7])

2.1.3.1. Spending Components

We distinguish among two different components in order to classify the measures included in the spending side by Devries et al. (2011). They are government consumption and investments and transfers. Indeed, the latter is often considered as a negative tax and thus should not be lumped together with the rest of spending measures. In the current paper we try to assess whether there exist different effects of transfers and the remainder of spending measures on our dependent variables. A discussion of our spending components follows.

2.1.3.1.1. Government consumption and investments

We include in the category current expenditures for both individual consumption goods and services and collective consumption services (including compensation of employees). We also include public sector salaries and social insurance contributions and the managing cost of state provided services such as education (public schools and universities but also training for unemployed workers) and health. Public investments lump together all the expenditures made by the government with the expectation of having a positive return. The category includes all government gross fixed capital formation expenditures (e.g. land improvements, fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, and commercial and industrial buildings). We lump together consumption and investments since we consider them to be the core part of government activity: they represent the expenditures faced when producing public goods and services. We should consider this component as everything which is not a direct resource transfer to people or corporations.

2.1.3.1.2. Transfers

We define transfer every money provision made by the government without expecting a direct economic gain. The main feature of transfers is their neutral effect on the marginal rate of substitution between consumption and labor. We include among transfers subsidies, grants, and other social benefits. For instance, they contain all non-repayable transfers on current account to private and public enterprises; grants to foreign governments, international organizations, and other government units; social security, social assistance benefits, and employer social benefits in cash and in kind. We also include in the category tax credits, tax deductions and taxes on emissions registered as negative subsidies. ([8])

2.1.3.2. Tax components

Revenues are classified in two components: direct and indirect taxes. The fundamental difference between the two is their distortionary effect on labor supply. Indeed, direct taxes are distortionary in the sense that an increase in direct taxation leads to a reduction in the number of hours worked, while indirect

([7]) The detailed data set is available following this link : http://ec.europa.eu/economy_finance/events/2015/20150120-ecfin_workshop/documents/session_11_appendix_en.pdf.

([8]) These credits and deductions, being independent of the number of hours worked and the wage, have no distortionary effects on the labor supply and therefore should not be treated as direct taxes.

taxes do not change the marginal rate of substitution between consumption and labor. We discuss the two components in details below.

2.1.3.2.1. Direct taxes

We define direct every tax imposed on a person or a property that does not involve a transaction. We include in this component income, profits, capital gains and property taxes. In particular we classify direct all taxes levied on the actual or presumptive net income of individuals, on the profits of corporations and enterprises, and on capital gains, whether realized or not, on land, securities, and other assets plus all taxes on individual and corporate properties.

2.1.3.2.2. Indirect taxes

Indirect taxes are those imposed on certain transactions, goods or events. Examples include VAT, sales tax, selective excise duties on goods, stamp duty, services tax, registration duty, transaction tax, turnover selective taxes on services, taxes on the use of goods or property, taxes on extraction and production of minerals and profits of fiscal monopolies.

2.1.3.3. Labelling of plans

Given the narrative identification of the four components of fiscal adjustments we proceed to label plans according to two alternative classifications: a four component case and a three component case. In the four component case we distinguish plans in consumption and investment-based (CB), transfer-based (TRB), direct taxation-based (DB) and indirect taxation-based (IB). In the three component case we focus on identifying the potential specific role for transfers by classifying plans in Tax-Based (TB) without distinguishing between direct and indirect taxation, consumption and investment-based (CB), and transfer-based (TRB). We report in the two following tables the classification of episodes using the two alternative schemes. Note that in each classification we have a residual category, the "not classified" category, that includes all the cases in which we could not classify a considerable part of the adjustment according to these 4 categories. The not classified episodes are dropped out when the relevant empirical model is estimated.

Table II.1.1: **Classification of fiscal plans by country - Hierarchical dummies, 4 components**

	Direct	Indirect	Consumption	Transfers	Not yet classified
AUS	3	0	0	8	0
AUT	0	1	0	6	0
BEL	2	0	1	6	3
CAN	4	0	5	6	0
DEU	1	4	0	9	5
DNK	0	0	0	2	3
ESP	3	2	4	0	1
FRA	1	2	3	4	2
GBR	3	7	1	0	0
IRL	0	5	2	0	0
ITA	2	0	6	3	1
JPN	4	3	5	0	0
PRT	0	1	3	0	2
USA	10	0	3	6	0
Tot.	**33**	**25**	**33**	**50**	**17**

Source: Authors' calculations

2.1.4. The Econometric Specification

We shall illustrate out econometric approach by constructing the final specification in several steps, in each step one more layer of generality will be added and discussed.

The first step is the baseline specification adopted in early narrative studies that concentrate on shocks rather than plans. The benchmark paper here is Romer and Romer (2010). This approach considers a moving representation relating the stationary variable of interest (for the generic country i) to a distributed lag of narratively identified fiscal shocks:

$$\Delta z_{i,t} = \alpha + B(L) f_{i,t} + \lambda_i + \chi_t + u_{i,t} \quad (1)$$

where λ_i *and* χ_t *capture resp*ectively a fixed-effect and a time-effect.

There are different ways to interpret this regression.

Favero-Giavazzi(2012) intepret (1) as a truncated moving average representation from a macro VAR model. The MA is truncated in two ways, all non-fiscal shocks are omitted and the MA is finite rather infinite. The first truncation does not cause any inconsistency of the estimates as, in the case the identification strategy is successful, the omitted structural non-fiscal shocks are orthogonal to the included variables of interest. The second truncation is unlikely to be relevant unless the dependent variable is very persistent.

Jordà-Taylor (2013) interpret (1) as an attempt to tease causal effects from observational data. They observe that $f_{i,t}$ *are* predictable and they seek to achieve identification of causal effects with new propensity-score based methods for time series data.

We interpret the evidence of predictability provided by Jorda-Taylor as a consequence of the fact that in the traditional approach the $f_{i,t}$ *are n*ot properly decomposed into plans and therefore predictability emerges as a consequence of the fact that announced corrections are effectively implemented.

In the light of this evidence more articulation in the specification of the empirical model is in order. We therefore take the following second step:

$$\Delta z_{i,t} = \alpha + B_1(L)\, e^u_{i,t} + B^2(L) e^a_{i,t,0} + \quad (2)$$

$$+\gamma^1 e^a_{i,t,1} + \lambda_i + \chi_t + u_{i,t}$$

$$e^a_{i,t,1} = \phi_{i,1} e^u_{i,t} + v_{1,i,t}$$

$$e^a_{t,0} = e^a_{t-1,1}$$

In (2) not only plans are fully tracked, but also different elasticities are allowed for unanticipated and anticipated corrections and between implemented and announced corrections. Note also that no distributed lag for the effect of future announced plans is introduced because the effect in time of announced adjustment is followed through the plan. The specification of plans makes clear that a number of restrictions are imposed when plans are collapsed into one-period adjustment without explicit recognition of their intertemporal nature. Guajardo et al (forthcoming) address the question of the output effect of fiscal adjustment by using specification (1) where "shocks" are defined (we shall call them "IMF shocks", e^{IMF}_t, *based on the common institution of these authors) as the su*m of the unexpected adjustments that occur in year t and the past announced adjustments also implemented in year t: they thus correspond to (a fraction of) the shifts in fiscal variables reported in the national accounts for year t. f^{IMF}_t are thus defined:

$$f^{IMF}_t = e^u_t + e^a_{t,0}$$

Note that using f_t^{IMF} *in* (1) can be reinterpreted as a restricted version of (2), where the restrictions imposed are $B_1(L) = B_2(L), \gamma_1 = 0$.Also a relevant consequence of collapsing plans into single period "shocks" is that they become predictable when $\phi_{i,1} \neq 0$. Such a predictability, noted by Hernandez da Cos and Moral(2012) and Jorda-Taylor(2013), has generated a relevant debate in the literature.

The third step in the specification allows us to take the into account the composition of the adjustment distinguishing between tax-based and expenditure-based adjustments. A quasi-panel is estimated allowing for two types of heterogeneity: within-country heterogeneity in the effects of TB and EB plans on the left-hand-side variable, and between-country heterogeneity in the style of a plan

$$\Delta z_{i,t} = \alpha + B_1(L)e^u_{i,t} * TB_{i,t} + B_2(L)e^a_{i,t,0} * TB_{i,t} + C_1(L)e^u_{i,t} * EB_{i,t} + C_2(L)e^a_{i,t,0} * EB_{i,t} + \quad (3)$$

$$+ \sum_{j=1}^{3} \gamma_j e^a_{i,t,j} * EB_{i,t} + \sum_{j=1}^{3} \delta_j e^a_{i,t,j} * TB_{i,t} + \lambda_i + \chi_t + u_{i,t}$$

$$e^a_{i,t,1} = \phi_{1,i}\, e^u_{i,t} + v_{1,i,t}$$

$$e^a_{i,t,2} = \phi_{2,i}\, e^u_{i,t} + v_{2,i,t}$$

$$e^a_{i,t,3} = \phi_{3,i}\, e^u_{i,t} + v_{3,i,t}$$

$$e^a_{i,t,0} = e^a_{i,t-1,1}$$

$$e^a_{i,t,j} = e^a_{i,t-1,j+1} + (e^a_{i,t,j} - e^a_{i,t-1,j+1})\; j \geq 1$$

If $$\left(\tau^u_t + \tau^a_{t,0} + \sum_{j=1}^{horiz} \tau^a_{t,j}\right) > \left(g^u_t + g^a_{t,0} + \sum_{j=1}^{horiz} g^a_{t,j}\right)$$

$$\text{then } TB_t = 1 \; and \; EB_t = 0,$$

$$\text{else } TB_t = 0 \quad B_t = 1, \forall\, t$$

where λ_i *and* χ_t *are cou*ntry and time fixed effects. (3) is the specification that we put at work to simulate the output effect of average fiscal adjustment plans (i.e. to compute impulse responses with respect to adjustment plans). By their nature impulse responses would be different across countries because of the different styles of fiscal policy (as captured by the different $\phi_{i,1}$*)* and within countries as a consequence of the heterogenous effects of plans as determined by their composition. Our moving average representation is truncated because the length of the $B(L)$ and $C(L)$ polynomials is limited to three-years. The moving-average representation is specified to allow for different effects of unanticipated and anticipated adjustments. Also different coefficients are allowed for adjustment announced in the past and implemented at time t and adjustments announced at time t for the future. To avoid double counting we exclude lags of future of $e^a_{i,t,j}$, *as their dynamic effect is captur*ed by $e^a_{i,t+j,0}$. *Th*e parameters $\phi_{1,i}$, *are* estimated on a country by country basis on the time series of the narrative fiscal shocks.

A final step allows us to consider the disaggregation of Taxation and Expenditure in their components.

In the four components model total expenditure is decomposed in government consumption and investment and transfers, while total receipts are disaggregated in indirect and direct taxes. We therefore adopt the following specification

$$\Delta z_{i,t} = \alpha + \sum_{j=1}^{2} B_{1,j}(L)e^u_{i,t} * TB_{i,t} * D^{TB}_{i,j,t} + \sum_{(j=1)}^{2} B_{2,j}(L)e^a_{i,t,0} * TB_{i,t} * D^{TB}_{i,j,t} + \quad (4)$$

$$\sum_j C_{(1,j)}(L)e^u_{i,t} * EB_{i,t} * D^{EB}_{i,j,t} + \sum_j C_{2,j}(L)e^a_{i,t,0} * EB_{i,t} * D^{EB}_{i,j,t} +$$

$$+\sum_{j=1}^{2}\gamma_j\left(\sum_{j=1}^{3}e^a_{i,t,k}\right) * EB_{i,t} * D^{EB}_{i,j,t} + \sum_{j=1}^{2}\delta_j\left(\sum_{j=1}^{3}e^a_{i,t,k}\right) * TB_{i,t} * D^{TB}_{i,j,t} + \lambda_i + \chi_t + u_{i,t}$$

$$e^a_{i,t,1} = \phi_{i,1}\, e^u_{i,t} + v_{i,t,1}, e^a_{i,t,2} = \phi_{2,i}\, e^u_{i,t} + v_{2,i,t}, e^a_{i,t,3} = \phi_{3,i}\, e^u_{i,t} + v_{3,i,t}$$

$$e^a_{i,t,0} = e^a_{i,t-1,1}, e^a_{i,t,j} = e^a_{i,t-1,j+1} + (e^a_{i,t,j} - e^a_{i,t-1,j+1})\; j \geq 1$$

$$e^u_{i,t} = \tau d^u_{i,t} + \tau i^u_{i,t} + gci^u_{i,t} + tr^u_{i,t}, e^a_{i,t,0} = \tau d^a_{i,t,0} + \tau i^a_{i,t,0} + gci^a_{i,t,0} + tr^a_{i,t,0}$$

$$\text{if} \quad max\left[\left(\tau d^u_t + \tau d^a_{t,0} + \sum_{j=1}^{horiz}\tau d^a_{t,j}\right), \left(\tau i^u_t + \tau i^a_{t,0} + \sum_{j=1}^{horiz}\tau i^a_{t,j}\right)\right] = \left(\tau d^u_t + \tau d^a_{t,0} + \sum_{j=1}^{horiz}\tau d^a_{t,j}\right) \Rightarrow$$

$D^{TB}_{i,1,t} = 1$, otherwise $D^{TB}_{i,1,t} = 0, D^{TB}_{i,2,t} = 1 - D^{TB}_{i,1,t}$

$$\text{if} \quad max\left[\left(gci^u_t + gci^a_{t,0} + \sum_{j=1}^{horiz}gci^a_{t,j}\right), \left(tr^u_t + tr^a_{t,0} + \sum_{j=1}^{horiz}tr^a_{t,j}\right)\right] = \left(\tau i^u_t + \tau i^a_{t,0} + \sum_{j=1}^{horiz}ti^a_{t,j}\right) \Rightarrow$$

$D^{EB}_{i,1,t} = 1$, otherwise $D^{EB}_{i,1,t} = 0, D^{EB}_{i,2,t} = 1 - D^{EB}_{i,1,t}$

The construction of the dummies for the type of plan allows for hierarchical organizations: the nature of plans as TB and EB is decided in a first stage. In a second stage TB plans are allocated between those based on direct taxation and those based on indirect taxation, likewise EB based plans are allocated between those based on Transfers and those based on Government Consumption and Investment.

2.1.5. Empirical Results

We put the model at work by simulating the effect of the different type of fiscal adjustments on output growth, consumption growth, fixed capital formation growth, ESI consumer's confidence and ESI business confidence for 14 OECD countries on the sample 1978-2009.Table II.1.2 reports the estimated styles of fiscal adjustments across different countries.

Table II.1.2: **The style of fiscal adjustments across different countries**

Styles of plans

	AU	*OE*	*BG*	*CA*	*DK*	*DEU*	*FR*
$\varphi_{1,i}$	0.39 (0.16)	0.36 (0.08)	0.04 (0.19)	1.3 (0.18)	0.49 (0.1)	−0.11 (0.14)	0.38 (0.12)
$\varphi_{2,i}$	−0.27 (0.14)	0	0	0.513 (0.12)	0	−0.01 (0.09)	−0.08 (0.05)
$\varphi_{3,i}$	−0.02 (0.01)	0	0	0.19 (0.09)	0	0.04 (0.03)	−0.04 (0.04)

	IR	*IT*	*JP*	*PT*	*SP*	*UK*	*US*
$\varphi_{1,i}$	0	−0.24 (0.04)	0.26 (0.03)	0.33 (0.16)	0.06 (0.06)	0.37 (0.09)	0.43 (0.36)
$\varphi_{2,i}$	0	0	−0.0005 (0.003)	0	0	0.1 (0.05)	0.32 (0.28)
$\varphi_{3,i}$	0	0	0	0	0	0	0.17 (0.24)

Source: Authors' calculations

The heterogeneity in styles implies that an initial correction of one per cent of GDP will generate plans of different size across countries. For comparability of results we compute impulse responses to a plan of the

size of one-per cent of GDP, while traditional impulse responses are computed with respect to a shock of one per cent of GDP. Equal size of the plans across countries are paired with initial shocks of different size.

In fact, by imposing equal size of the plans we have that for each country,

$$e_{i,t}^{u} + e_{i,t,1}^{a} + e_{i,t,2}^{a} = 1$$

As a consequence of the heterogeneity in the styles of adjustment across different countries we have:

$$\widehat{e_{i,t,J}^{a}} = \widehat{\phi_{J,\iota}} e_{i,t}^{u} \;\; j = 1,2$$

Therefore we can write

$$e_{i,t}^{u} + \widehat{\phi_{1,\iota}}\, e_{i,t}^{u} \; + \widehat{\phi_{2,\iota}} e_{i,t}^{u} = 1$$

To obtain a country specific size of the adjustments in each period do that the total adjustment is one per cernt of GDP

$$e_{i,t}^{u} \; = \frac{1}{1 + \widehat{\phi_{1,\iota}} + \widehat{\phi_{2,\iota}}}$$

$$e_{i,t,1}^{a} \; = \; \widehat{\phi_{1,\iota}} e_{i,t}^{u}$$

$$e_{i,t,2}^{a} \; = \; \widehat{\phi_{2,\iota}} e_{i,t}^{u}$$

As an example, in the case of Italy, for which $\phi_1 = -0.24$ and $\phi_2 = 0$, we simulate $e_t^u = 1.32$, $e_{t,1}^a = -0.32$ and $e_{t,2}^a = 0$.

Table II.1.3 reports the results of the estimation of the multicountry quasi-panel. There are two version of the model: the unrestricted version in which the effect of four different type of plans is considered and a restricted version in which the coefficients on the effect of direct taxation based and indirect taxation based plans are restricted to be same and the coefficients on Transfers based plans and Consumption and Investment based plans are also restricted to be same. The restricted version of the model allows the within country heterogeneity only for Expenditure based plans and Taxation based plans. The restrictions that delivers the TB and EB model are rejected illustrating the importance of allowing for four components based plans.

We report ten set of impulse responses for the restricted and unrestricted model in Graphs II.1.1-II.1.10 ([9]) . The evidence from the restricted model confirms the confirms the available evidence that expenditure based adjustments are less costly than tax based adjustments but the disaggregation of taxes and expenditure in their components pro- vides further important insights. The four-components disaggregation indicates that while there is no evidence of a common pattern of significant statistical difference for different components on the revenue side, on the expenditure side transfers seem to be different form consumption and investment. In fact, the effect of a transfer cut is more similar to that of an increase in taxation than to that of a cut in expenditure. This results is better understood looking at consumption growth, fixed capital formation growth, consumers' confidence and business confidence. Cuts in government consumption and investment have definitely no contractionary effect on consumption growth and there is in fact some evidence of non-Keynesian effects, while the effects of transfer cut on consumption is closer to that of an increase in taxation. The similarity of these two effects becomes striking in the case of consumers' confidence. The impact of transfers cuts and cuts to government consumption and investment on fixed capital formation growth and business confidence are more similar and lead to an overall impact on out- put growth in which the transfer effect is clearly in between that of a tax increase and a government expenditure cut.

([9]) When the four components disaggregation is considered some of the adjustments were never observed for some of the countries in our sample as a consequence in some cases we have less than four impulse responses.

Table II.1.3: **Coefficients estimated in the 4-component specification – On output growth**

Coefficients estimated in the 4-component specification - On output growth			
		4-components	EB-TB restrictions
$e^u_{i,t} * TB_{i,t}$	$D^{TB}_{Dir,i,t}$	-0.261559	-0.897938***
		(0.225133)	(0.134728)
	$D^{TB}_{Ind,i,t}$	-0.983833***	
		(0.166884)	
$e^u_{i,t} * EB_{i,t}$	$D^{EB}_{C\&I,i,t}$	0.095967	0.002661
		(0.128555)	(0.070012)
	$D^{EB}_{Tr,i,t}$	-0.272925**	
		(0.122041)	
$e^a_{i,t,0} * TB_{i,t}$	$D^{TB}_{Dir,i,t}$	-2.011456***	-1.275992***
		(0.532086)	(0.380488)
	$D^{TB}_{Ind,i,t}$	0.189110	
		(0.641736)	
$e^a_{i,t,0} * EB_{i,t}$	$D^{EB}_{C\&I,i,t}$	1.071817***	0.029106
		(0.283756)	(0.123102)
	$D^{EB}_{Tr,i,t}$	-0.178687	
		(0.162777)	
$e^u_{i,t-1} * TB_{i,t-1}$	$D^{TB}_{Dir,i,t-1}$	-0.756467***	-0.645010***
		(0.229593)	(0.136866)
	$D^{TB}_{Ind,i,t-1}$	-0.583473***	
		(0.166435)	
$e^u_{i,t-1} * EB_{i,t-1}$	$D^{EB}_{C\&I,i,t-1}$	-0.360233**	-0.423153***
		(0.165541)	(0.080739)
	$D^{EB}_{Tr,i,t-1}$	-0.461729***	
		(0.123560)	
$e^a_{i,t-1} * TB_{i,t-1}$	$D^{TB}_{Dir,i,t-1}$	-2.194177***	-1.040280***
		(0.478463)	(0.375686)
	$D^{TB}_{Ind,i,t-1}$	-0.427380	
		(0.645996)	
$e^a_{i,t-1} * EB_{i,t-1}$	$D^{EB}_{C\&I,i,t-1}$	-0.808363**	-0.146312
		(0.321306)	(0.126870)
	$D^{EB}_{Tr,i,t-1}$	-0.299516*	
		(0.155354)	
$e^u_{i,t-2} * TB_{i,t-2}$	$D^{TB}_{Dir,i,t-2}$	-0.061143	-0.115552
		(0.219279)	(0.133174)
	$D^{TB}_{Ind,i,t-2}$	-0.165438	
		(0.165031)	
$e^u_{i,t-2} * EB_{i,t-2}$	$D^{EB}_{C\&I,i,t-2}$	0.682425***	0.283873***
		(0.208453)	(0.083403)
	$D^{EB}_{Tr,i,t-2}$	0.173423	
		(0.108244)	
$e^a_{i,t-2} * TB_{i,t-2}$	$D^{TB}_{Dir,i,t-2}$	-0.306378	0.156894
		(0.521586)	(0.380858)
	$D^{TB}_{Ind,i,t-2}$	0.920485	
		(0.622753)	
$e^a_{i,t-2} * EB_{i,t-2}$	$D^{EB}_{C\&I,i,t-2}$	1.026348***	-0.180936
		(0.331779)	(0.126432)
	$D^{EB}_{Tr,i,t-2}$	-0.447274***	
		(0.143539)	
$e^u_{i,t-3} * TB_{i,t-3}$	$D^{TB}_{Dir,i,t-3}$	-0.333299	-0.451444***
		(0.251976)	(0.139449)
	$D^{TB}_{Ind,i,t-3}$	-0.591195***	
		(0.166576)	
$e^u_{i,t-3} * EB_{i,t-3}$	$D^{EB}_{C\&I,i,t-3}$	-0.153085	-0.130904*
		(0.183400)	(0.071611)
	$D^{EB}_{Tr,i,t-3}$	-0.048873	
		(0.096615)	
$e^a_{i,t-3} * TB_{i,t-3}$	$D^{TB}_{Dir,i,t-3}$	-0.027362	-0.210313
		(0.511016)	(0.374242)
	$D^{TB}_{Ind,i,t-3}$	-0.257414	
		(0.617773)	
$e^a_{i,t-3} * EB_{i,t-3}$	$D^{EB}_{C\&I,i,t-3}$	0.743463**	0.061798
		(0.327371)	(0.127926)
	$D^{EB}_{Tr,i,t-3}$	-0.289028**	
		(0.145376)	
$e^a_{i,t,1} * TB_{i,t} + e^a_{i,t,2} * TB_{i,t}$	$D^{TB}_{Dir,i,t}$	-0.402583	-0.471005*
		(0.342437)	(0.257378)
	$D^{TB}_{Ind,i,t}$	-0.307856	
		(0.416988)	
$e^a_{i,t,1} * EB_{i,t} + e^a_{i,t,2} * EB_{i,t}$	$D^{EB}_{C\&I,i,t}$	-0.624626**	-0.148321
		(0.266297)	(0.118040)
	$D^{EB}_{Tr,i,t}$	0.130986	
		(0.152676)	
Wald test -Chi-square:	100.3429	p-value:	0

SE in parentheses. p<0.1, ** p<0.05, *** p<0.01

Source: Authors' calculations

2.1.5.1. The Effect of fiscal adjustment plans on financial markets

To better understand the channels of transmission that determine the observed asymmetries in the macroeconomic effect of fiscal stabilization plans we have examined the impact of our four type of plans on asset prices. In particular, we have considered the effect of fiscal adjustments on monetary policy rates, yields on 10-year government bonds nominal effective exchange rates and annual stock market returns. The results are reported in Graphs II.1.11-II.1.14.

The response of monetary policy rates show a somewhat more restrictive stance adopted in occasion of Direct Taxes based adjustments but the level of observed heterogeneity seems to be small to explain entirely the sizeable level of heterogeneity in the response of output, and its components. The pattern of response of policy rates is mirrored by long-term yields, indicating a moderate effect of fiscal adjustment plans on risk premia. Also exchange rates show a tendency to appreciate in presence of Tax based plans paired with a tendency to depreciate in presence of Expenditure based plans. However, the variable that shows a level of heterogeneity in impulse responses comparable with the one observed in the effect on macroeconomic variables is stock market returns, in which case a very remarkable level of asymmetry is observed here between direct Tax based adjustment plans and Government Consumption and Investment based plans.

2.1.6. Conclusions

This paper has analyzed the disaggregated components of fiscal adjustments plans in many OECD countries. Our data span from the eighties to 2012 and will include both Euro area countries and non euro area ones. The main objective of this paper was to investigate further the empirical evidence of the importance of the composition of fiscal adjustment for the evaluation of their macroeconomic consequences. To this end we have constructed a new database of fiscal adjustment plans that disaggregates adjustment on the expenditure side into adjustment in government consumption and investment and adjustment in transfers, likewise we disaggregates total revenue in revenue due to direct and indirect taxation. The disaggregated analysis confirms the differential effect of tax based and expenditure based plans and allows identifying potential non-keynesian effects of reduction in government consumption and expenditure while the effect of a reduction in transfer is closer to than an increase in taxation.

2.1.7. References

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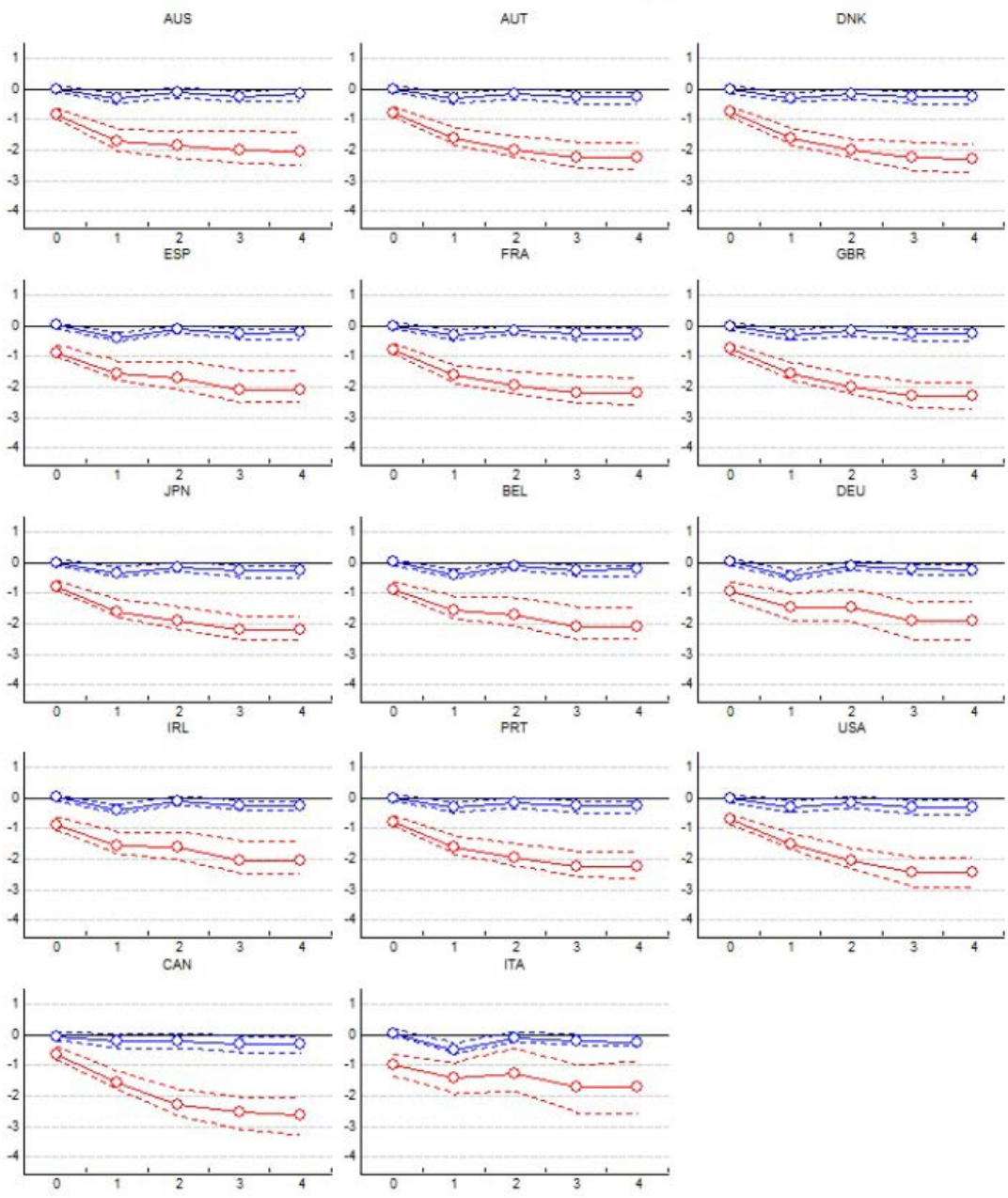
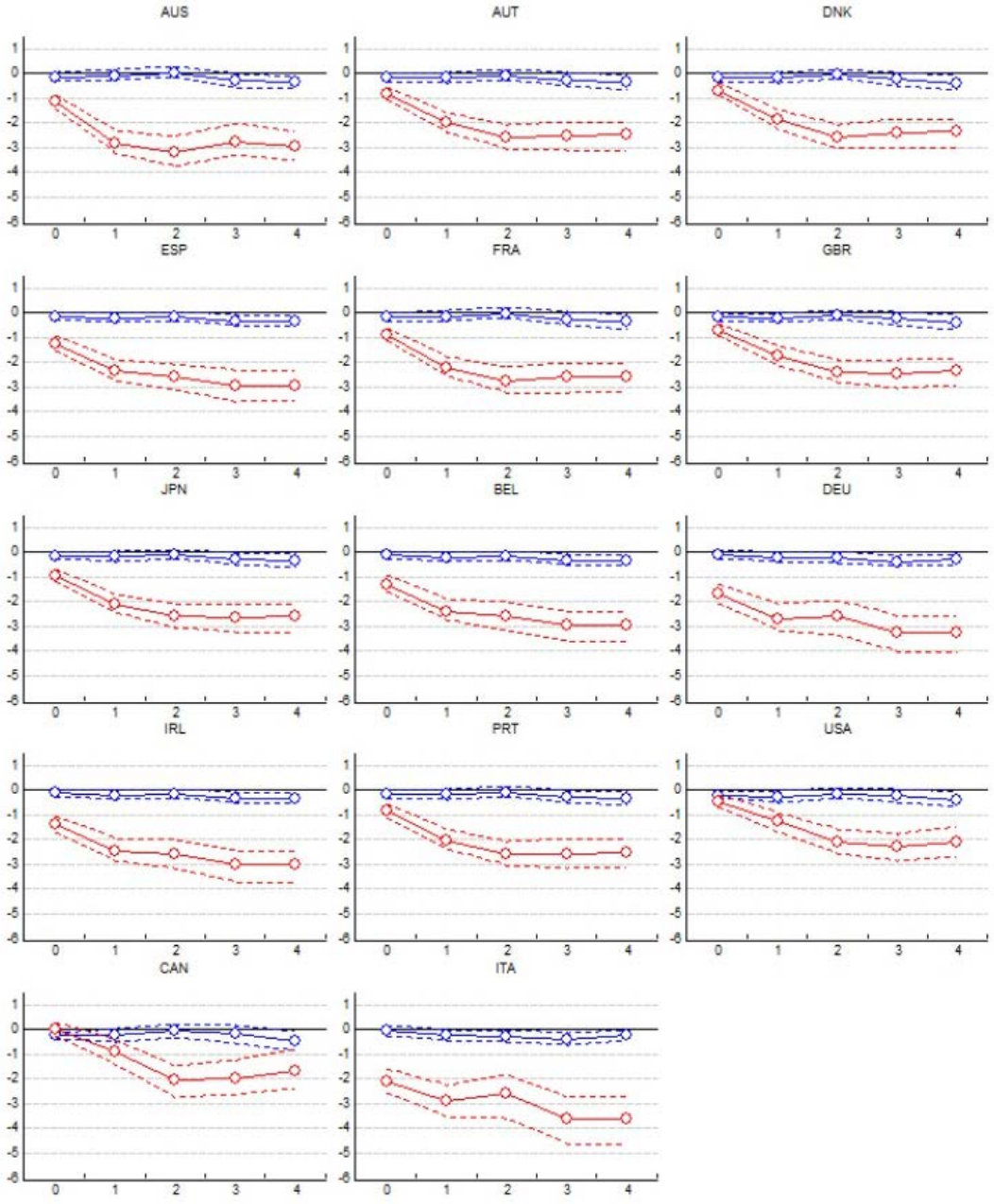
GRAPHS

Graph II.1.1: **The effect of expenditure-based and tax-based adjustments on output growth**



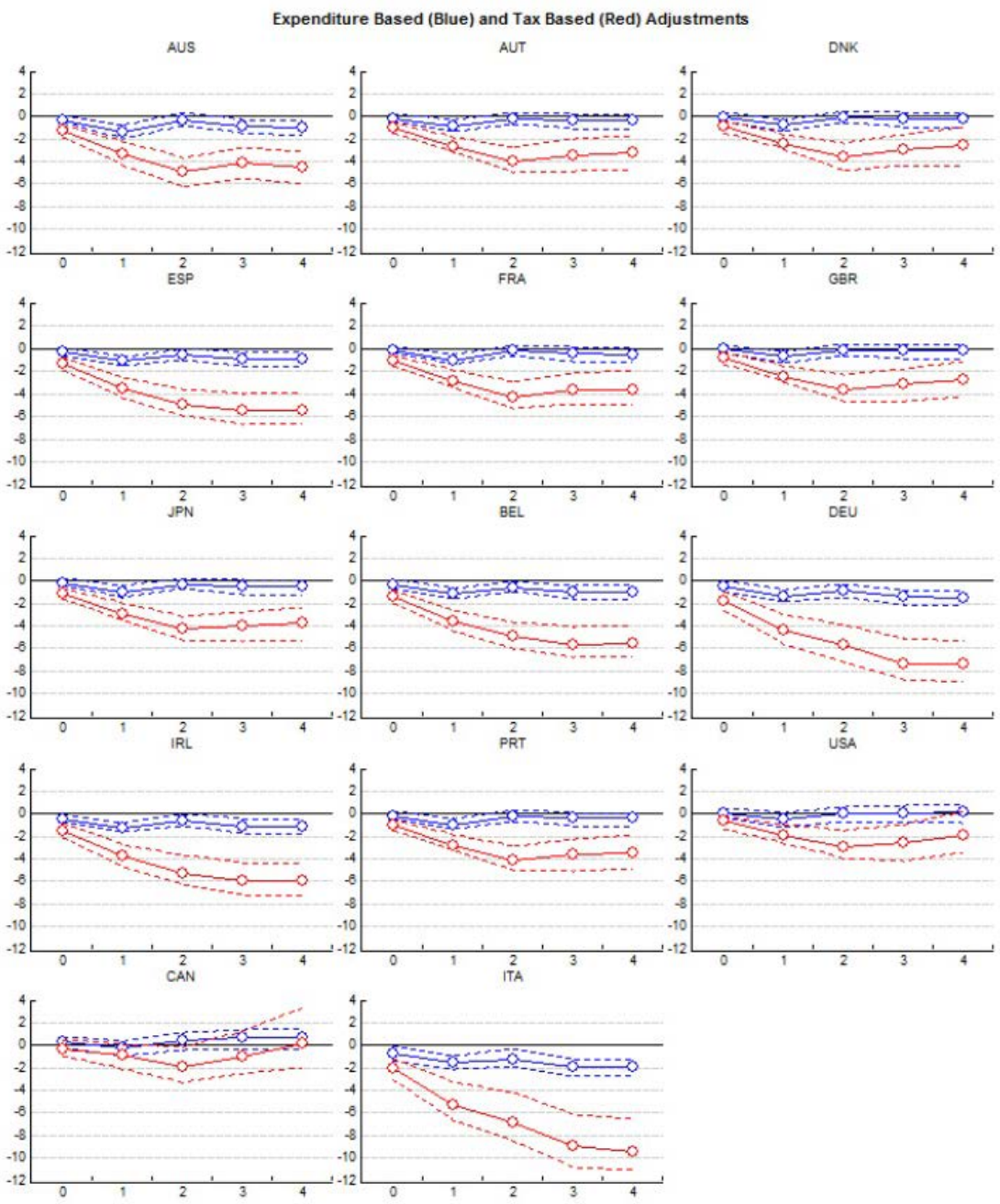
Source: Authors estimates
Note: Expenditure Based (Blue) and Tax Based (Red) Adjustments

Graph II.1.2: **The effect of expenditure-based and tax-based adjustments on consumption growth**



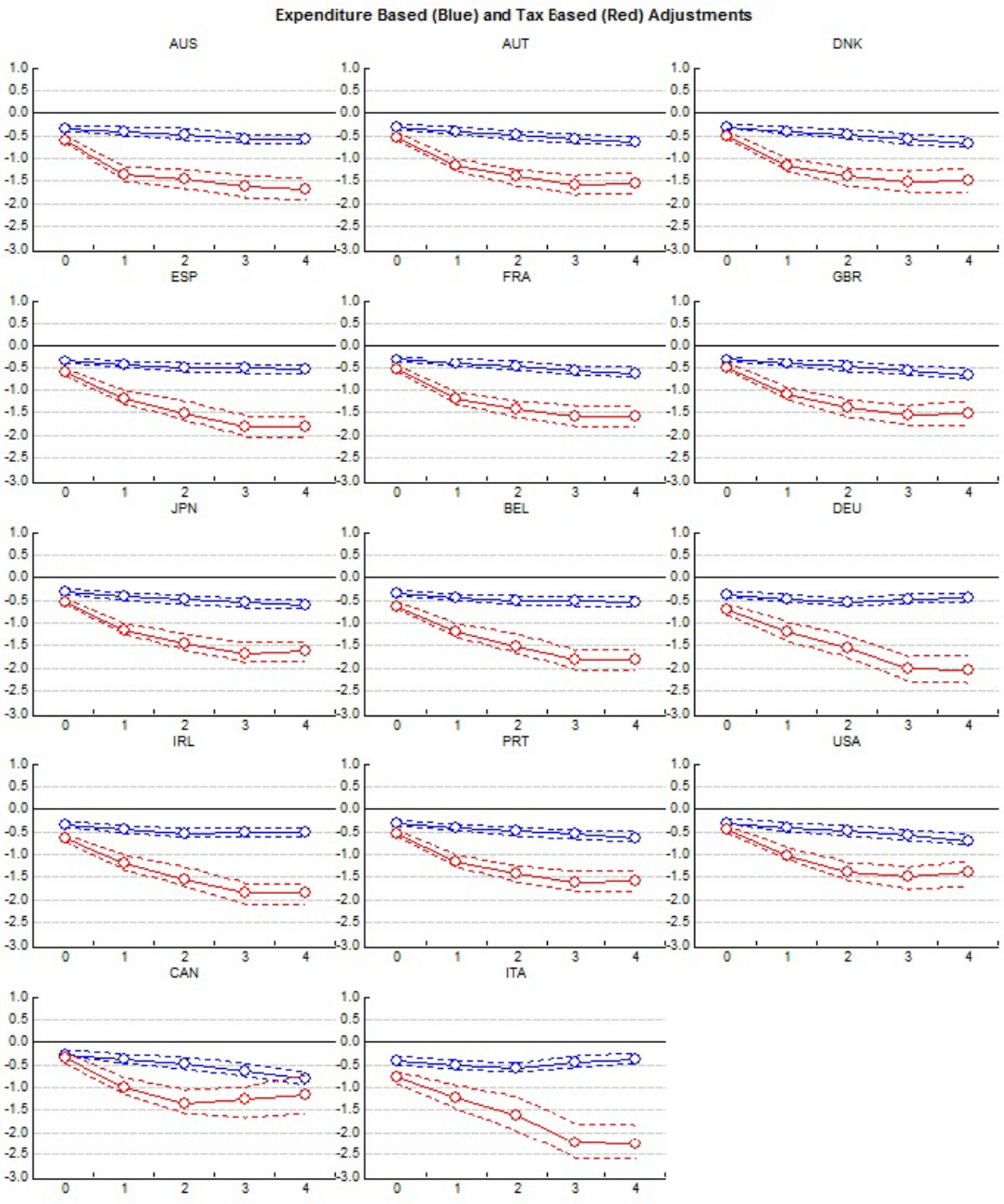
Source: Authors estimates
Note: Expenditure Based (Blue) and Tax Based (Red) Adjustments

Graph II.1.3: **The effect of EB and TB adjustments on capital formation growth**



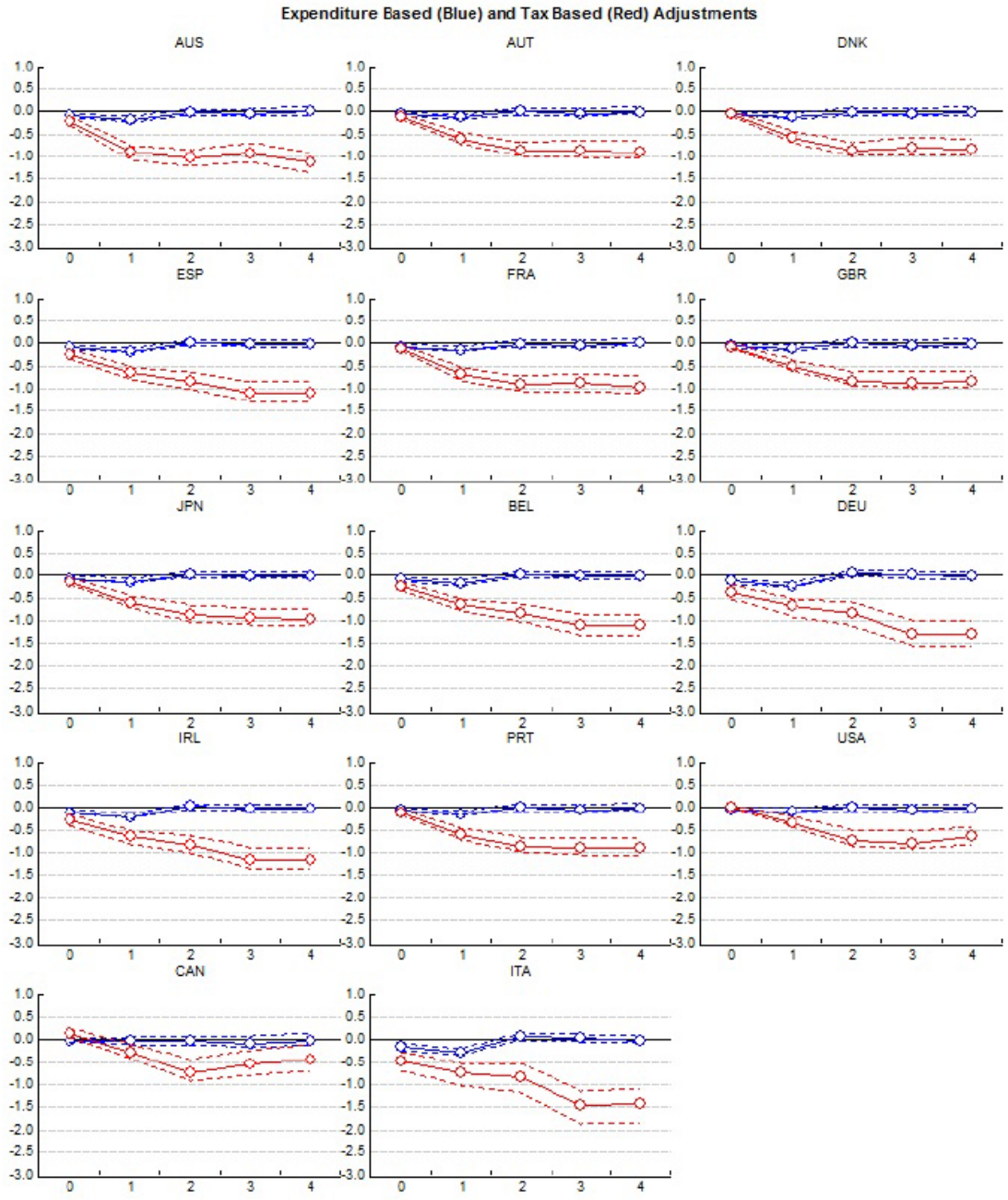
Source: Authors estimates
Note: Expenditure Based (Blue) and Tax Based (Red) Adjustments

Graph II.1.4: **The effect of EB and TB adjustments on ESI consumer confidence**



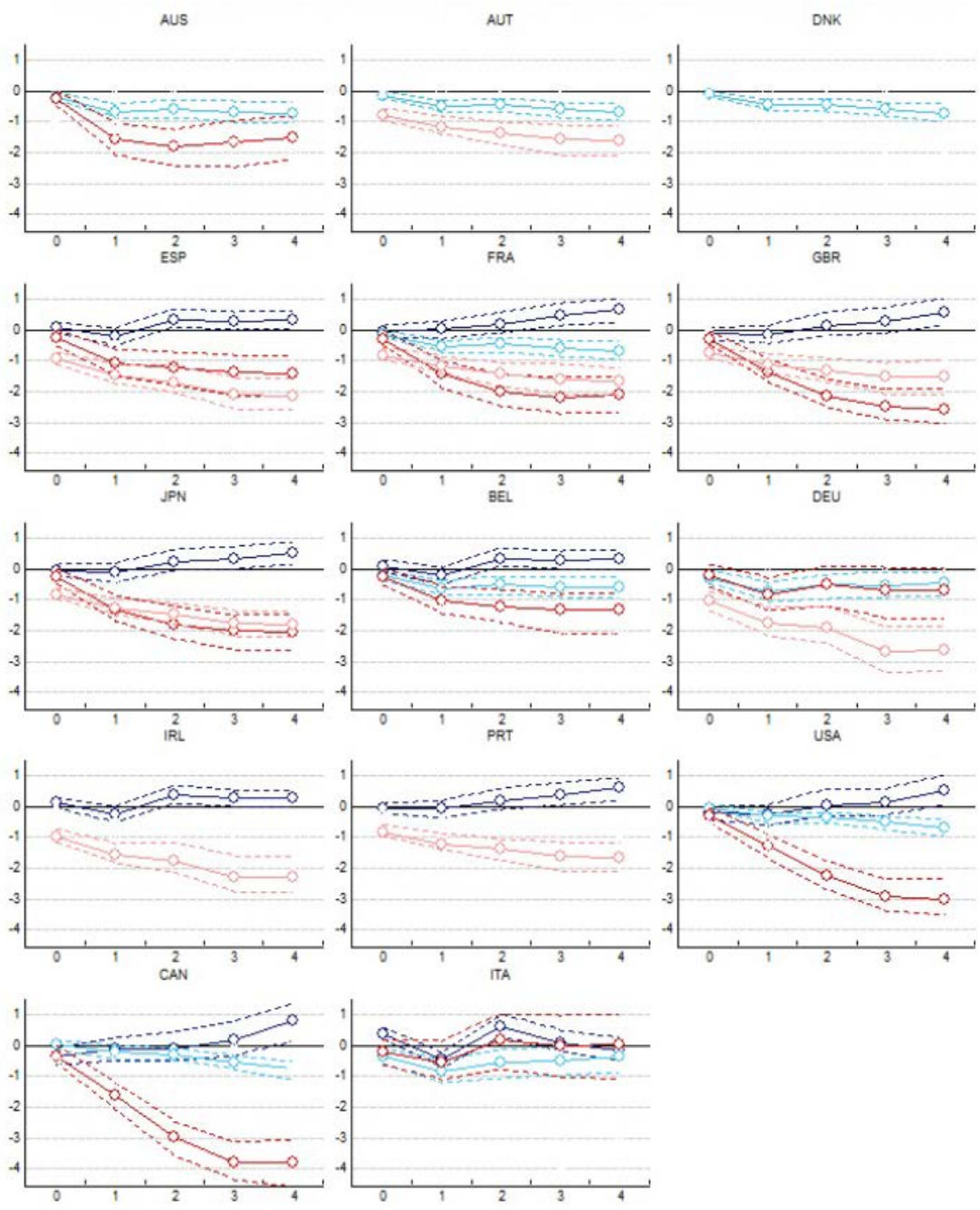
Source: Authors estimates
Note: Expenditure Based (Blue) and Tax Based (Red) Adjustments

Graph II.1.5: **The effect of EB and TB adjustments on ESI business confidence**



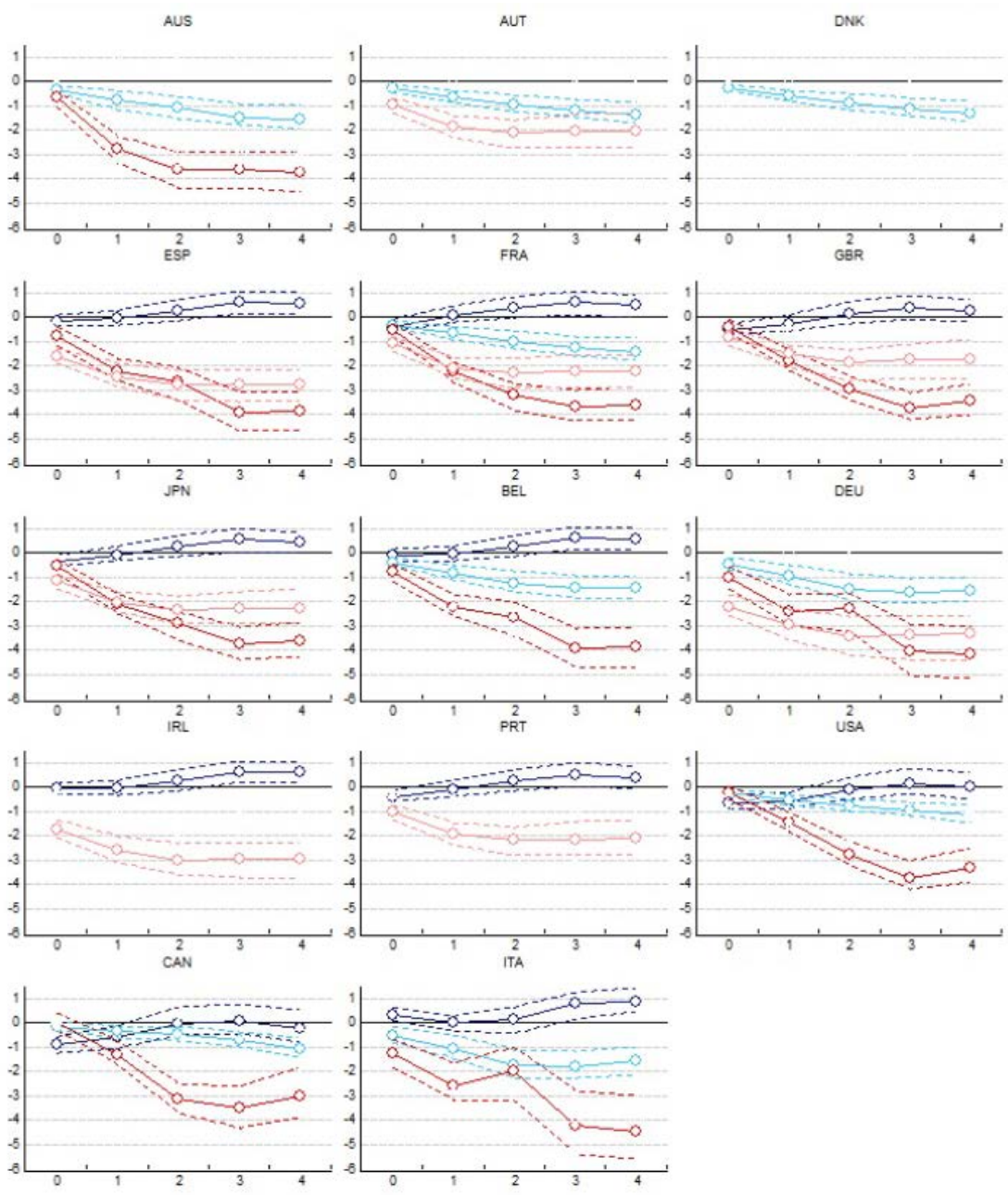
Source: Authors estimates
Note: Expenditure Based (Blue) and Tax Based (Red) Adjustments

Graph II.1.6: **The effect of CB, TRB, DB and IB adjustments on output growth**



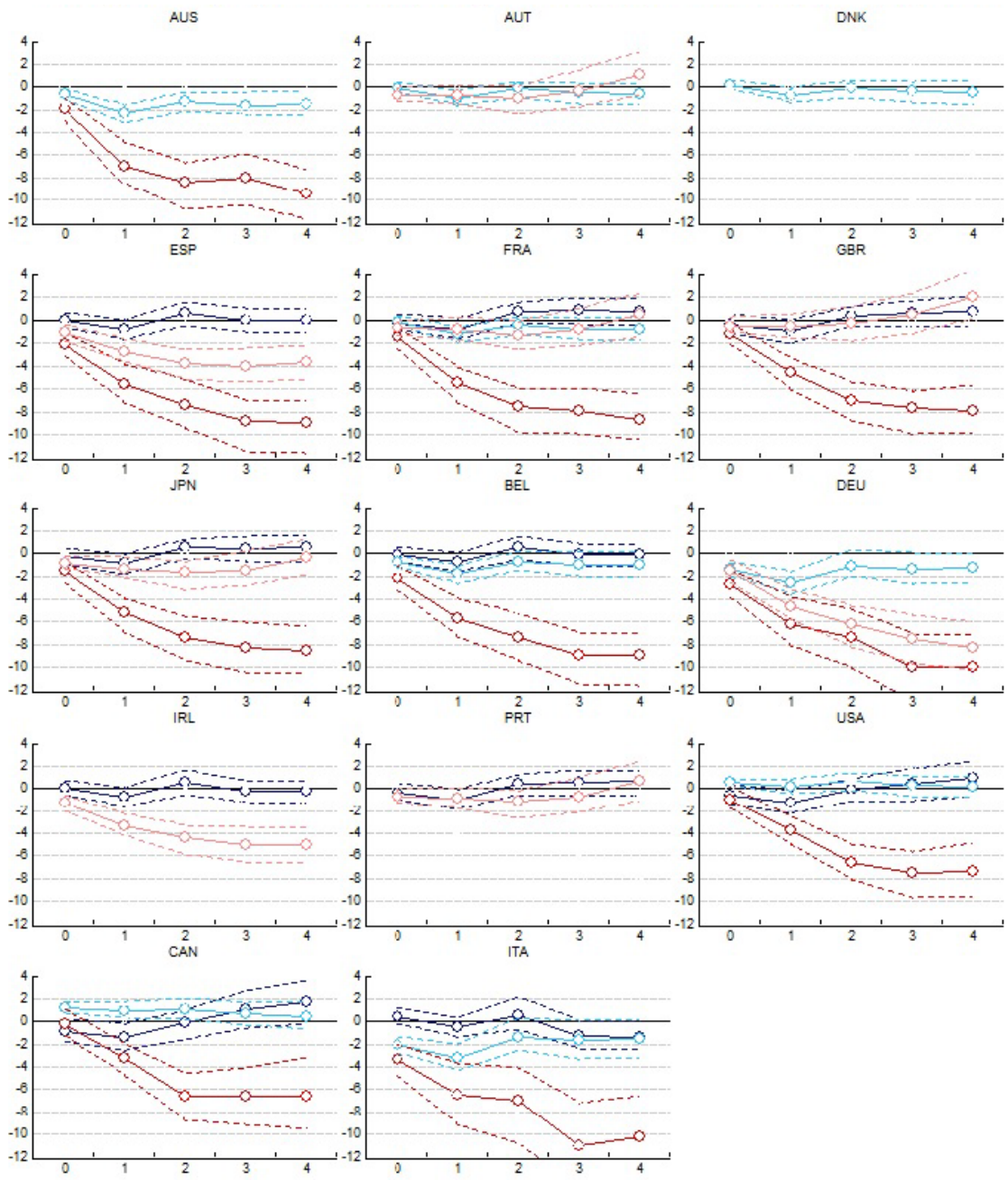
Source: Authors estimates
Note: Consumption Based (blue), Transfer Based (light blue), direct based (red) and indirect based (light red) adjustments

Graph II.1.7: **The effect of CB, TRB, DB and IB adjustments on consumption growth**



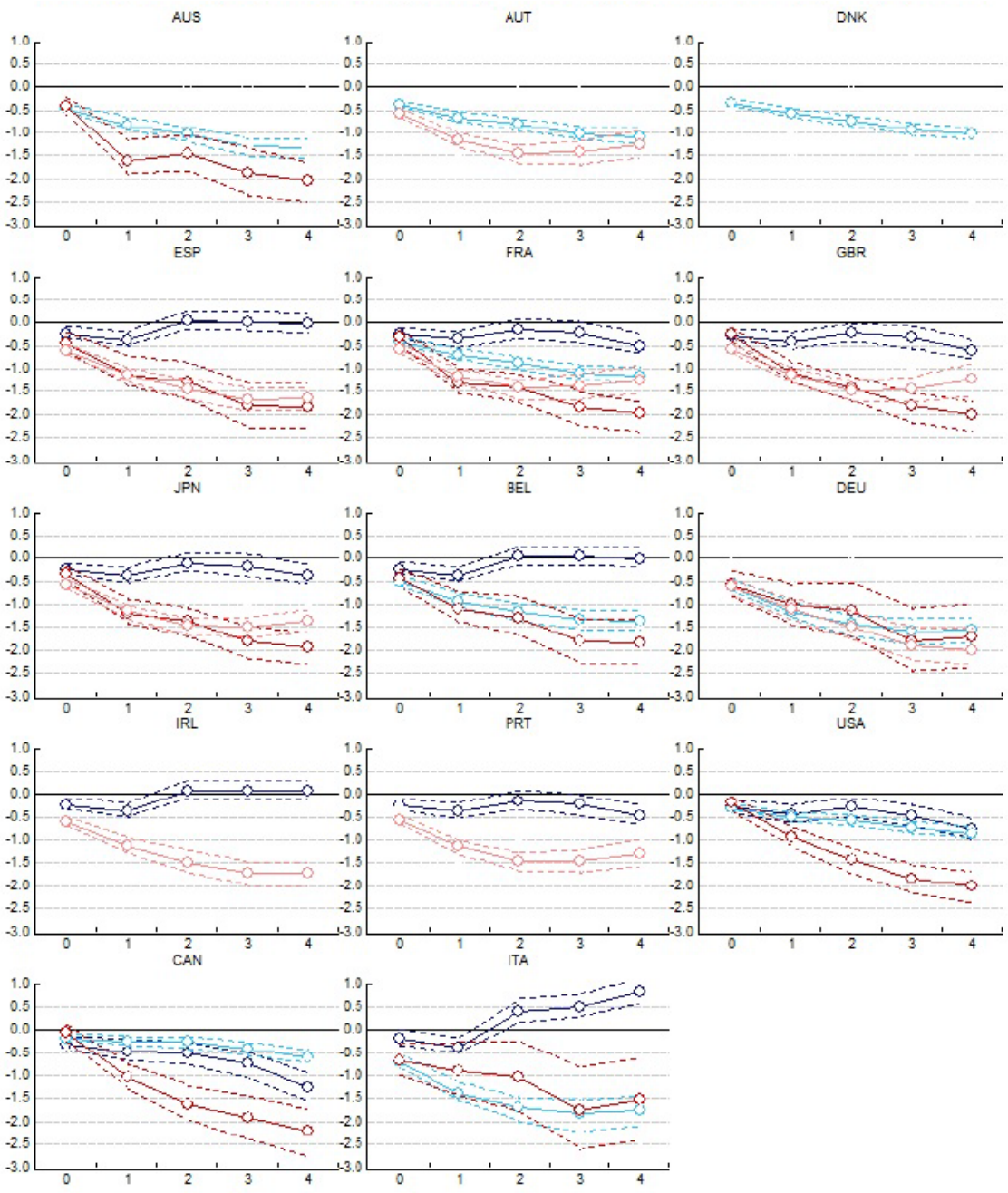
Source: Authors estimates
Note: Consumption Based (blue), Transfer Based (light blue), direct based (red) and indirect based (light red) adjustments

Graph II.1.8: **The effect of CB, TRB, DB and IB adjustments on capital formation growth**



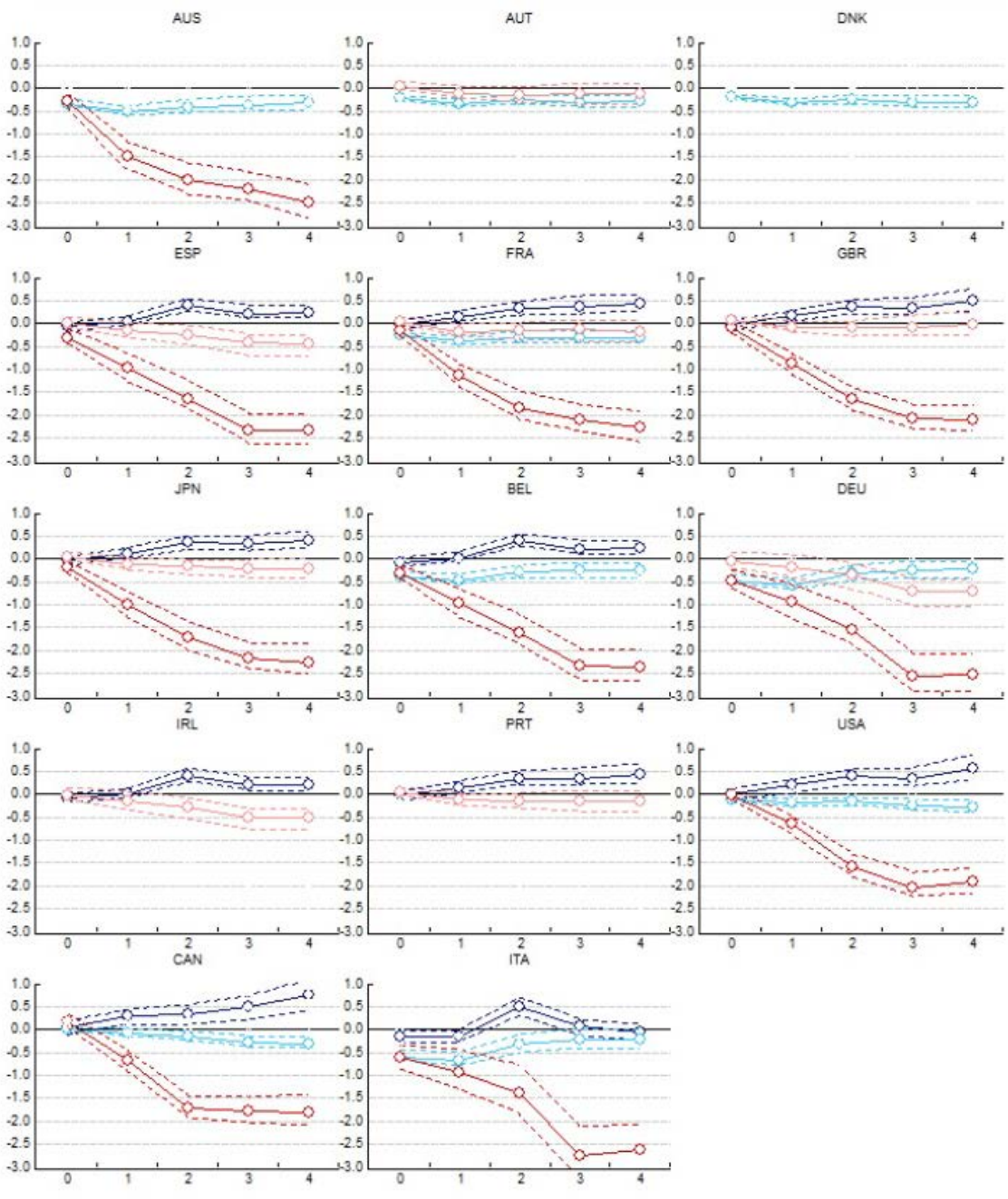
***Source*:** Authors estimates
Note: Consumption Based (blue), Transfer Based (light blue), direct based (red) and indirect based (light red) adjustments

Graph II.1.9: **The effect of CB, TRB, DB and IB adjustments on ESI Consumer confidence**



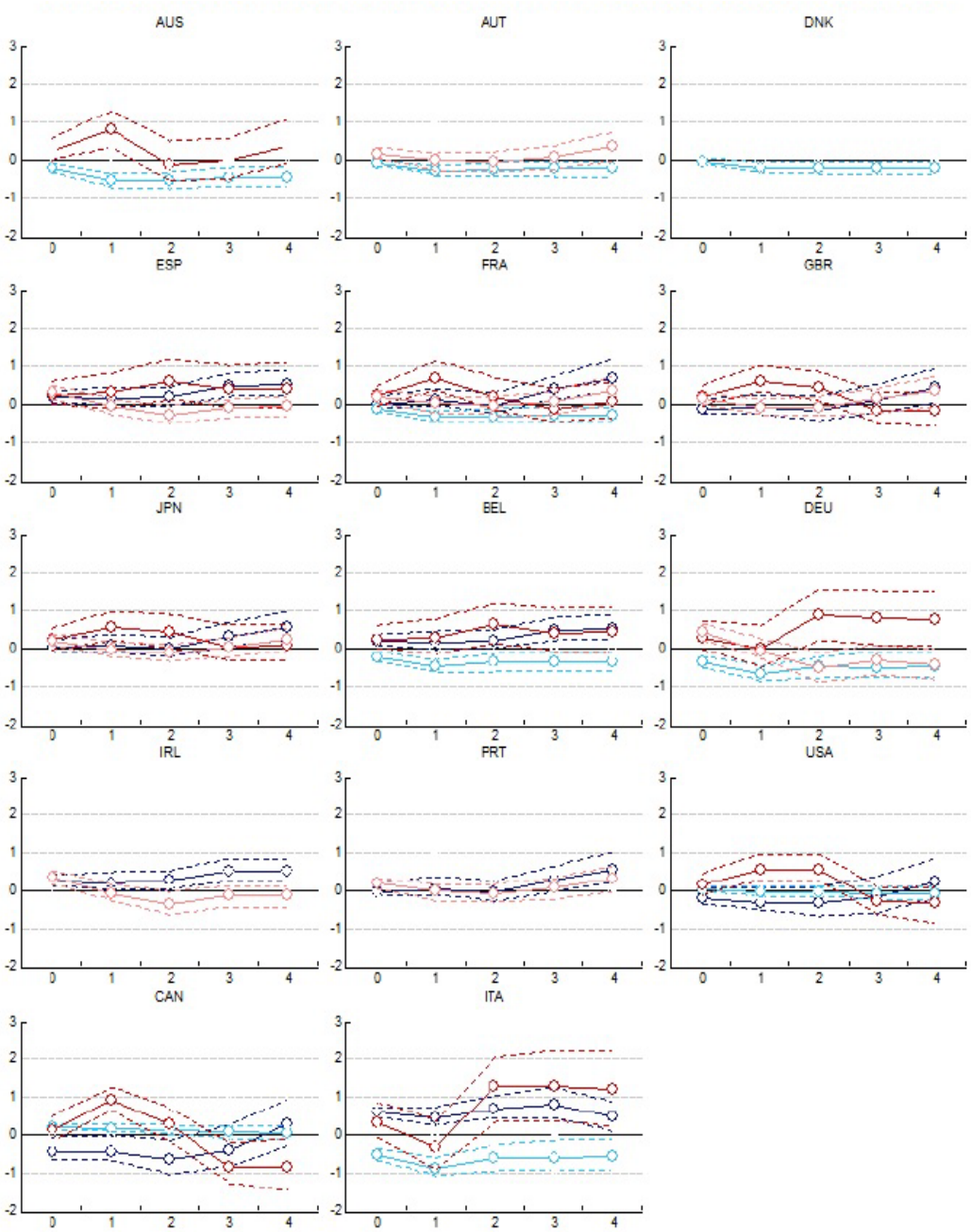
Source: Authors estimates
Note: Consumption Based (blue), Transfer Based (light blue), direct based (red) and indirect based (light red) adjustments

Graph II.1.10: **The effect of CB, TRB, DB and IB adjustments on ESI Business Confidence**



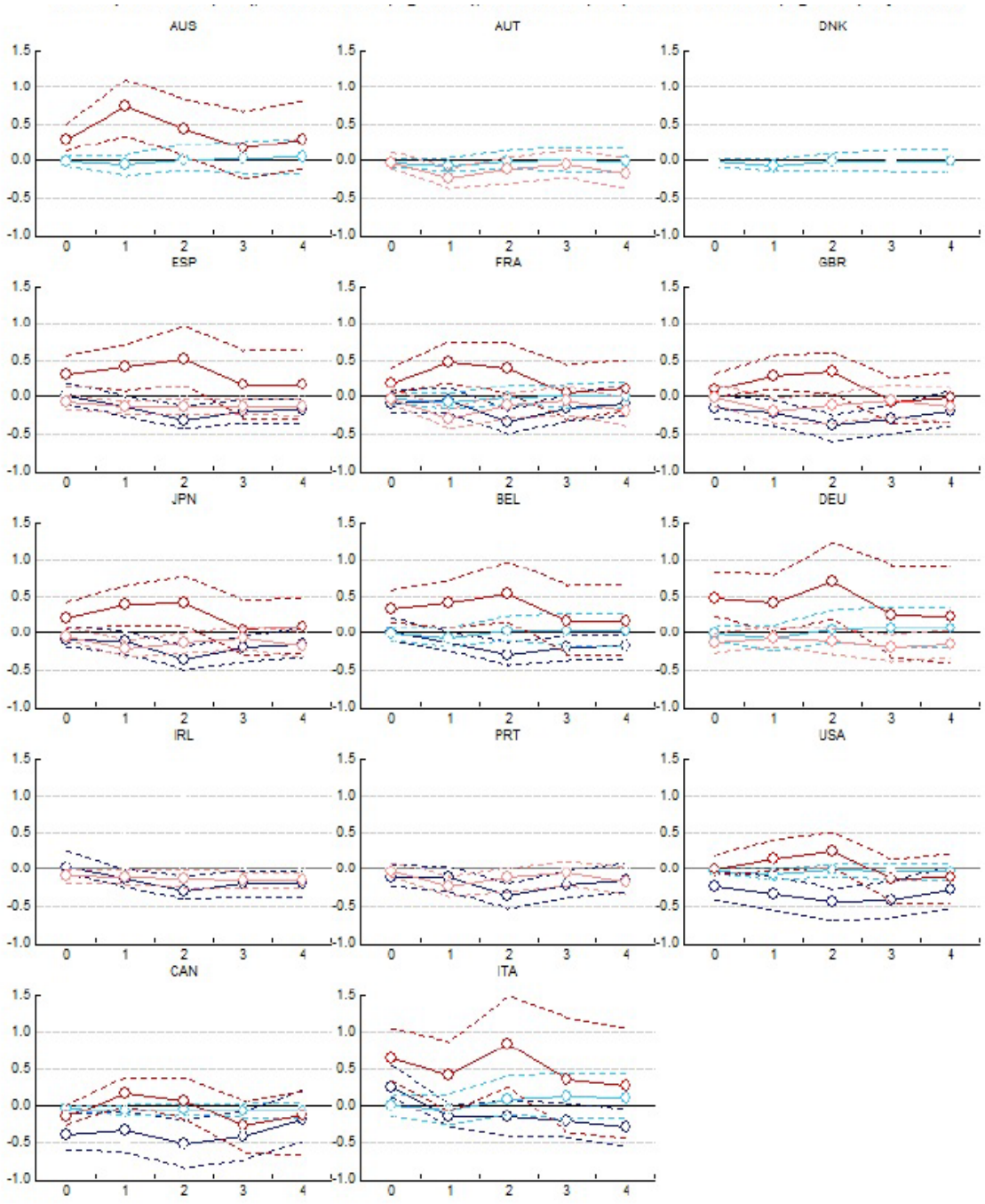
Source: Authors estimates
Note: Consumption Based (blue), Transfer Based (light blue), direct based (red) and indirect based (light red) adjustments

Graph II.1.11: **The effect of CB, TRB, DB and IB adjustments on monetary policy (change in the 3M TBills Rates)**



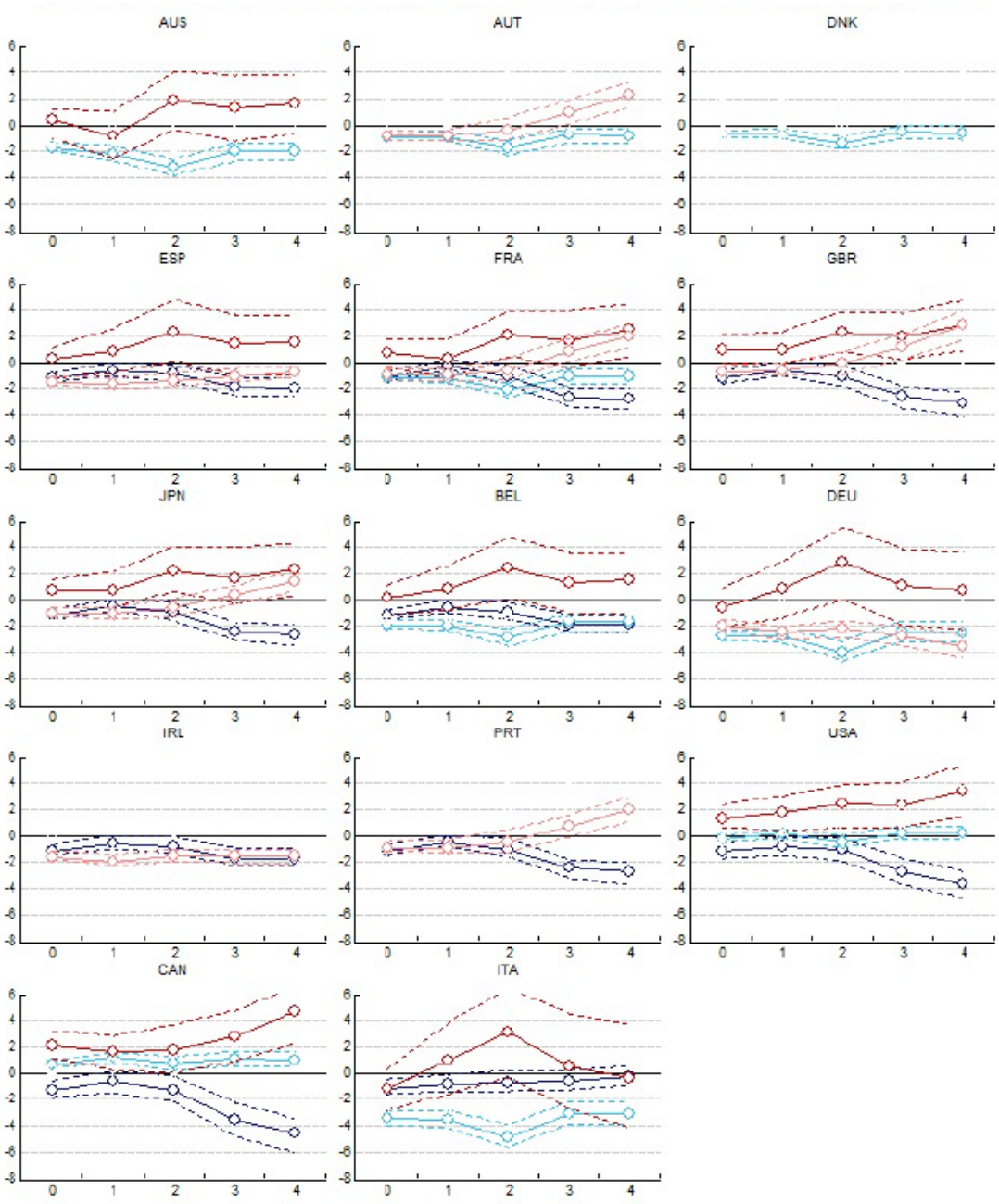
Source: Authors estimates
Note: Consumption Based (blue), Transfer Based (light blue), direct based (red) and indirect based (light red) adjustments

Graph II.1.12: **The effect of CB, TRB, DB and IB adjustments on long term interest rate on government bonds**



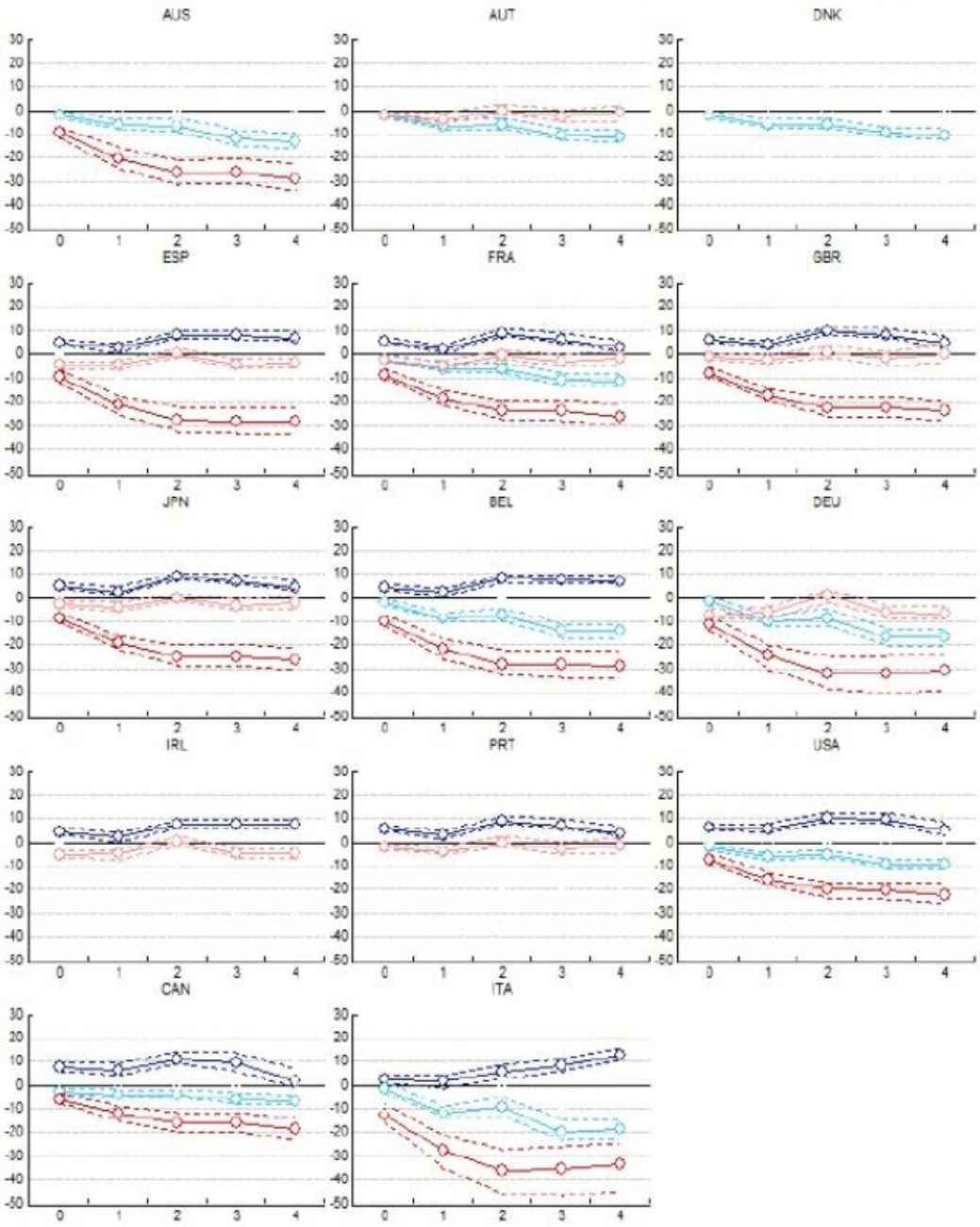
Source: Authors estimates
Note: Consumption Based (blue), Transfer Based (light blue), direct based (red) and indirect based (light red) adjustments

Graph II.1.13: **The effect of CB, TRB, DB and IB adjustments on nominal effective ex- change rate (percent change)**



Source: Authors estimates
Note: Consumption Based (blue), Transfer Based (light blue), direct based (red) and indirect based (light red) adjustments

Graph II.1.14: **The effect of CB, TRB, DB and IB adjustments on annual total stock market returns**



Source: Authors estimates
Note: Consumption Based (blue), Transfer Based (light blue), direct based (red) and indirect based (light red) adjustments

2.2 BACK TO FISCAL CONSOLIDATION IN EUROPE AND ITS DUAL TRADE-OFF: NOW OR LATER, THROUGH SPENDING CUTS OR TAX HIKES

By Christophe Blot ([1]), Jérôme Creel ([2]), Bruno Ducoudré ([3]) and Xavier Timbeau ([4])([5])

2.2.1. Introduction

After a short period of expansionary fiscal policy in 2008-2009, most Euro area countries reversed the fiscal stance and entered into a period of fiscal consolidation. Austerity was notably required to comply with the 3%-of-GDP rule, enshrined in the Stability and Growth Pact and reinforced after the adoption of the Treaty on stability, coordination and governance. Besides, the outbreak of the Greek crisis in late 2009 created fears of a possible sovereign default and contagion among Eurozone member states, leading to a panic-driven austerity as described by De Grauwe and Ji (2013).

It has been obvious that substantial domestic austerity measures coupled with a synchronized wave of fiscal consolidation in the Eurozone since 2011 have had a strong negative impact on growth that paved the way for a double-dip recession. The fact that fiscal consolidation has been implemented though the output gap had not yet recovered from the recession has made the former more costly and even self-defeating, like in Greece. A new consensus had indeed emerged about the size of fiscal multipliers since the Great Recession and they are now supposed to be time-varying and higher in time of crisis. The consolidation process has thus raised a few questions. The most frequent one has been how large are the costs of consolidation and has the Eurozone fiscal stance improved or achieved debt sustainability? Second, do these costs and sustainability depend on the composition (tax vs. spending) of the consolidation process? Third, do risk premia matter? Fourth, taking into account risk premia, which strategy among the following two, backloading vs. frontloading, can achieve the sharpest reduction in European public debts at the lowest real cost? The aim of the present paper is precisely to deal with these issues. It considers explicitly that the Eurozone member states have been facing a dual trade-off, first between labor market outcomes of consolidation and public debt dynamics and, second, between reducing public expenditures and increasing taxes.

According to the first trade-off, the frontloading strategy has relied on the argument that the gains from consolidation in terms of lower debt and interest rates have outweighed the costs in terms of lower activity and higher unemployment. Nevertheless, the size of the impact of fiscal consolidation on long-term interest rates remains disputable. This point is investigated in this paper.

According to the second trade-off, the fiscal multiplier effect is often shown stronger after a spending cut than after a tax hike. Nevertheless, in the consolidation context, political economy arguments can help to explain why spending cuts are more frequent than tax hikes. Moreover, public expenditures like investment are less visible to the public in the short run than some others and can be cut without short-run social costs ([6]). The impact of the composition effect will be investigated in this paper, on a country basis. Once all Eurozone countries are included, and their composition effect characterized, it is possible to compare the output outcomes of consolidation plans with different compositions of the fiscal effort. Thus the cost of spending-driven consolidation is assessed.

To investigate this dual trade-off, we extend the simple reduced-form model of 11 Eurozone countries (Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal and Spain) developed in Blot et al. (2014a). The model is sufficiently detailed to explicitly link all macro elements of debt sustainability and output dynamics, the composition effects and the external trade linkages. The model also includes time-varying fiscal multipliers in a dynamic macroeconomic model and assesses their consequence in terms of public debt sustainability and real costs of consolidation. It is important to acknowledge that debates continue about the value of multipliers, the evaluation of recent output gaps,

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([4]) Xavier Timbeau , OFCE, Sciences Po, France, E-mail: xavier.timbeau@ofce.sciences-po.fr
([5]) We are grateful to Lucia Rodriguez Munoz and Pablo-Hernandez De Cos for their comments on a first draft of this paper. We are also grateful to Jan in't Veld and Werner Roeger for discussions on earlier versions of the model used in this paper.
([6]) See e.g. Balassone and Franco (2000).

and hysteresis effects. For these reasons, the choice of a reduced-form model makes it possible, after some changes in the parameters, to conduct a large array of a sensitivity tests. Finally, the model also addresses the question of the optimal fiscal stance, defined as the fiscal consolidation producing the smallest real costs and achieving meanwhile public finance sustainability. The international dimension of the model also makes it possible to account for the interdependencies between Eurozone member states.

2.2.2. A brief and selective literature review

We mobilize two types of literature: the frontloading vs. backloading and the composition effect. The former depends extensively on the multiplier effect. In a chapter of the World Economic Outlook (2010), the IMF had concluded early that the costs of fiscal consolidation would be important, though not substantial. A fiscal multiplier around 0.5 was found at this time. In 2012 however, in the new issue of the Outlook, the tone was radically different. Assertions were made that fiscal multipliers had been formerly underestimated and were in a range of [0.9;1.7]. Blanchard and Leigh (2013), in a sequel of their box in WEO 2012, acknowledged that during downturns, fiscal multipliers were certainly above unity. While the former value of the fiscal multiplier urged a frontloading strategy, the latest one rather urged a backloading one. As a matter of fact, the growing body of evidence on the time-varying properties of the fiscal multiplier along the business cycle highlighted the importance in the timing of fiscal consolidation: a frontloading strategy when the output gap was widely and negatively open would become a "self-defeating strategy" (Holland and Portes, 2012). Not only would there be large real incurred costs but the debt to GDP ratio would not fall and debt sustainability would recede.

We have reviewed elsewhere the body of evidence on time-varying fiscal multipliers (Blot et al., 2014b). The list of factors which make the fiscal multiplier non-linear includes the zero-lower bound (e.g. Eggertsson, 2010), financial stress for households and firms (e.g. Corsetti et al., 2012), unemployment and the business cycle (e.g. Auerbach and Gorodnichenko, 2012), and public debt thresholds (Corsetti et al., 2013). A general conclusion of this literature is that the fiscal multiplier is higher in times of crisis than in good times (see the recent meta-analysis by Gechert and Rannenberg, 2014).

As regards the composition effect, the seminal contribution of Alesina and Perotti (1995) concluded that spending-based consolidation had smaller adverse effects than tax-based consolidation. Stated differently, the spending multiplier appeared smaller than the tax multiplier. While Erceg and Lindé (2012) achieve a similar result in a two-country Dynamic Stochastic General Equilibrium (DSGE) model with independent monetary policy, they obtain the contrary once they introduce either a monetary union or a zero-lower-bound on monetary policy. Their argument is that spending cuts require sharp falls in interest and exchange rates to crowd-in private demand. In a monetary union and under the ZLB, both channels disappear and a spending-based consolidation is costlier than a tax-based one. This is consistent with the empirical findings of, e.g. Batini et al. (2012) who conclude that spending multipliers are significantly larger than tax multipliers during downturns. According to Gechert and Rannenberg (2014, baseline estimation, Graph II.2.1), the tax multiplier is only weakly different between downturns and upturns, whereas the spending multiplier can be multiplied by 3; during downturns, the spending multiplier can therefore be on average 5 times higher than the tax multiplier. in't Veld (2013), with consideration of spillover effects of fiscal consolidation in the Eurozone, and Coenen et al. (2012), without consideration for the time-varying property of fiscal multipliers, also showed that spending multipliers were higher than tax multipliers.

2.2.3. Presentation of the model

We extend the model developed in Blot et al. (2014a) to account for a composition effect of the fiscal stance. The model is a simple macroeconomic framework combining structural and reduced-form non-linear equations. It is able to embrace alternative insights of the literature, including time-varying fiscal multipliers and hysteresis effects. It remains tractable for a large set of Eurozone countries and calibrations are consistent with actual data. Thanks to tractability, we can model supply and demand complex mechanisms which are possibly heterogeneous across countries. The model is also able to make a large set of sensitivity analyses which give rise to different scenarios.

In contrast with DSGE models, this reduced-form model does not derive from optimal behaviors. It remains that, despite optimization, DSGE models are not devoid of strong assumptions, be it e.g. on the properties of households (which part of them is liquidity constrained? which part is not? The answer to these questions is important because it has implications on the effectiveness of fiscal policy) ([7]) or on expectations, which are often forward-looking though a mix of backward-looking and forward-looking expectations might be preferred, or alternative approaches to expectations like those discussed by Woodford (2013). Moreover, these models generally do not allow to model nonlinearities such as variable fiscal multipliers over the business cycle, because they are linearized around a single point ([8]), or to model hysteresis effects which mean that the steady-state (potential) output changes over time.

The key features of the model are that it allows for an explicit representation of the main countries of the Eurozone: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal and Spain. An aggregated Eurozone is also computed in order to deal with global analysis and monetary policy. On the demand side, an open economy aggregate demand function is modelled which depends on fiscal and monetary policies, external demand (a channel for intra EU interdependencies) as well as exogenous shocks on the output gap. Hysteresis effects are introduced but they only affect the level of output in the long run whereas the growth rate of the potential output reverts to baseline path. External demand is represented using a bilateral trade matrix taking into account interdependencies between Eurozone countries. Prices are given by a Phillips curve relating current inflation to expected inflation, economic activity, imported inflation and exogenous shocks. Expectations are supposed to be backward-looking ([9]). A non-linear Taylor rule is used to set the stance of monetary policy. Fiscal balance is the sum of interest payments, cyclically-adjusted balance and cyclical components. This simple definition helps to properly assess the fiscal stance, i.e. the part of fiscal policy which is under the direct control (or discretion) of current governments. We disentangle between fiscal impulses based on expenditures and taxes. The focus is also put on the time-varying dimension of the fiscal multiplier. The model allows to compute public debt projections for Eurozone countries, taking into account the impact of the market interest rate (government-bond yield), and to assess debt sustainability. A risk-premium on long-term public interest rates is also introduced. It depends on public debt and the structural primary balance.

2.2.3.1. A simple model for open economies

To sum up, the model may boil down to 4 main equations describing demand ([10]), potential output, inflation and long-term interest as a weighted sum of future short-term interest rates. The output gap (y) (defined as the difference between current output ($\breve{y}$) and potential output (y^*)) is given by the following equation:

$$y = EFI^G + EFI^T + \delta_l.(R - \bar{R}) + \beta_l.ad \qquad (1)$$

It is driven by the usual variables, like real interest rates, external demand and fiscal policy, which is captured here by EFI^G and EFI^T, the effective fiscal impulses, cumulating past and current ex ante fiscal impulses on public expenditures and taxes. ([11]) R is the long term real interest rate and $\bar{R}$ is the long run equilibrium value of interest rate. The term $\delta_l.(R - \bar{R})$ captures the effect of monetary policy on aggregate demand via its impact on financial markets and expectations of future inflation. The term $(\beta_l.ad)$ stands for the impact of external demand by trade partners. The dynamics of the current level of output is represented by an error correction equation. Yet, with a large negative output gap, the error correction model implies growth rates which can be very large and unrealistic. Therefore, a 2.5% ([12]) *ad-hoc* restriction is introduced in the dynamics of current output. The dynamics of the potential output is described by the following equation:

([7]) See for example Wieland et al. (2012) for a comparison of fiscal policy effects on output gap for a large set of DSGE models.
([8]) Recent exceptions are papers by in't Veld (2013) drawing on a structural multi-country model and Bi et al. (2013) drawing on a small, open economy, DSGE model.
([9]) More precisely, expected inflation depends on the gap between past inflation and the inflation target.
([10]) More details on the equations of the model are described in Blot et al. (2014a), as major changes stem from the introduction of a composition effect of the fiscal multiplier.
([11]) It is an *ex ante* multiplier in the sense that it does not take into account monetary policy effects and spillover effects from external trade on GDP.
([12]) It does not imply that growth rate is strictly bounded at 2.5% during a recovery since short-term dynamics resulting from monetary and fiscal policy or external demand can also drive growth.

$$y_t^* = y_{t-1}^* + H.y_t + \varepsilon_t^s \quad (2)$$

where *H* is an hysteresis parameter and ε_t^s *is an exogenous shock on aggregate supply*. GDP prices are set according to a New Keynesian hybrid Phillips curve. Inflation depends on past inflation, expected inflation, output gap, and imported inflation and we rely on estimates by Fuhrer and Moore (1995), Rudd and Whelan (2006), and Paloviita (2008) for calibration:

$$\pi_t = \eta_1.\pi_{t-1} + (1-\eta_1).\pi_{t+1}^e + \eta_2.y_t + \eta_3.\sum_j w_{m,j,c}(\Delta\pi_t^c) + \varepsilon_t^\pi \quad (3)$$

Actually, a distinction is made between short-term (or one-period ahead forecast) entering the Phillips curve equation 0 and long-term forecasts, which is used for the long term real interest rate. For one-period ahead forecasts (π_t^e), we rely on backward-looking expectations, and we assume that inflation is expected to converge to the ECB target at a given speed. For financial markets, long-run expected inflation is modelled as the discounted sum of forward-looking inflation rates, in a similar fashion as nominal long-term rates, in order to keep expectations consistent at this (more than one-year ahead) horizon.

Monetary policy is described through a non-linear Taylor rule where, under non-ZLB circumstances, the short term interest rate moves with the gap between Eurozone inflation π_t^{EA} and the ECB target π^* on the one hand, and with the Eurozone output gap y_t^{EA} on the other hand. The ZLB is fixed at 0 %. According to the expectations theory, the long term interest rate for German public bonds is set equal to the expected sum of future short term interest rates for which expectations are supposed to be rational (following Shiller, 1979).

$$i_t^{Taylor} = r^* + \pi_t^{EA} + \Psi_1.(\pi_t^{EA} - \pi^*) + \Psi_2.y_t^{EA} \quad (4)$$

The long-term public may include a risk premium $\varepsilon_t^{I_{pub}}$. It is supposed to be equal to zero in the baseline scenario where we consider that long term interest rates all converge as observed in the pre-crisis period. A sensitivity analysis accounts for an endogenous linear risk premium, increasing with public debt. The assumption that the risk premium is sensitive to public debt rather than deficits is consistent with results reported by Beirne and Fratzscher (2013) after 2008. The risk premium is zero when public debt is below 60% and when the country reaches a structural primary balance which stabilizes debt.

$$\varepsilon_t^{I_{pub}} = \kappa B_t \;\; if\; B_{t-1} > 60\%\; and\; if\; SPS_t < \overline{SPS_t} \quad (5)$$

where $\overline{SPS_t}$ is the primary structural balance stabilizing public debt. It must be noticed that for countries that entered the EFSF, the long term interest rate is supposed to be exogenous. The real long term interest rate, entering equation 0 is equal to the nominal long term rate minus long run expected inflation.

Finally, imports of each country increase with the output gap (eq.6). Then, as imports in each country are exports for other countries, we define external demand to country *c* as the weighted sum of imports of the other EMU countries (eq.7). As the model considers only Eurozone countries, the external demand only accounts for intra-Eurozone trade.

$$m_t = \Omega.y_t \quad (6)$$

$$ad_t = \sum_j w_{m,j,c} m_t \quad (7)$$

Calibration of the model is described in the appendix.

2.2.3.2. Public finances and fiscal policy

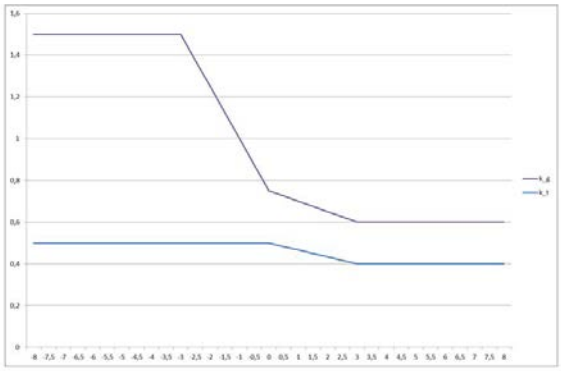
The fiscal block of the model includes public debt dynamics and hinges extensively on the structural primary balance. The latter evolves according to the differentiated impulses on public spending (FI^G) *and taxe*s (FI^T) *but also a*ccording to changes in taxes which are due to variations in the gap between

potential production and the baseline. As a matter of fact, a permanent downward shift in potential output relative to the baseline entails a permanent fall in taxes, then a permanent fall in the structural primary balance. The cyclical balance depends on the overall sensitivity of revenues and expenditures to the business cycle. The average interest rate on debt evolves according to the long term nominal interest rate on newly issued public bonds.

The impact of fiscal policy depends on the state of the economy as emphasized by the growing literature surveyed by Parker (2011). Hence, we build a time-varying fiscal multiplier μ_t *which depends on t*he output gap and on the composition of the adjustment. Tax-based and spending-based multipliers can be described by the illustrative Graph II.2.1. We consider the same shape for the two fiscal multipliers. Yet μ^T_{max} *(respectively* μ^T_{min} *and* μ^T_0 *) may differ from* μ^G_{max} *(respectively* μ^G_{min} *a*nd μ^G_0 *).* The calibrated values for the fiscal multipliers are based on the meta-regression analysis provided by Gechert and Rannenberg (2014) where they show that the spending-based multiplier is very sensitive to the state of the economy whereas the tax-based multiplier is flatter.

The values of fiscal (tax and spending) multipliers are maximal in very bad times, whereas they are minimal in very good times. Such a representation of the fiscal multiplier does not directly account for all the possibilities highlighted in the empirical literature. Yet, as monetary policy is endogenous and constrained by the zero lower bound, the effect of fiscal policy becomes stronger when the output gap is negative and monetary policy constrained by the ZLB since there is no increase in the interest rate that can mitigate the impact of fiscal policy. Since the banking sector is not represented in the model, the state of the financial system has no incidence on the fiscal multiplier([13]). Nevertheless, we may suppose that a situation of distressed banking system would be accompanied by a negative output gap, a feature which is explicitly introduced in the model via the time-varying nature of the fiscal multiplier. Besides, fiscal multipliers are higher when the unemployment rate is high as liquidity constraints become more stringent for firms and households. In such a case, the Ricardian hypothesis does not hold. Finally, there is one situation that seems to be more controversial if public debt is high or increases quickly: Corsetti et al. (2013) argue that the fiscal multiplier would be low. The analyses will yet also include a situation where a risk premium in the interest rate increases with public debt. Though it may not strictly correspond to the effect illustrated by Corsetti et al. (2013), it will mitigate our conclusion on the cost of consolidation when public debt is high.

Graph II.2.1: **Example of the value of the multiplier for public spending and taxes according to the output gap**



Note: $\mu^G_{max} = 1.5$, $\mu^G_{min} = 0.6, \mu^G_0 = 0.75$, $\mu^T_{max} = 0.5$, $\mu^T_{min} = 0.4$, $\mu^T_0 = 0.5$, $y_{int} = -3\%$, and $y_{sup} = 3\%$. Values are supposed to be identical across countries.

Source: OFCE

Beyond fiscal impulses which represent discretionary decisions (in % of GDP) on government spending and taxes, we compute effective fiscal impulses (EFI, based on public spending and taxes), as the *ex-ante*

([13]) We thank Pablo Hernandez de Cos for raising this issue.

cumulative real effect of current and past fiscal impulses at time *t*. Thus, with $\psi_k . \mu_{t-k}^j$ (for $j = G, T$) the fiscal multiplier at time *t* of a fiscal impulse that occurred k years ago, one has:

$$\Delta EFI_t^j = \psi_0 . \mu_t^j . FI_t^j + \psi_1 . \mu_{t-1}^j . FI_{t-1}^j + \psi_2 . \mu_{t-2}^j . FI_{t-2}^j + \psi_3 . \mu_{t-3}^j . FI_{t-3}^j + \psi_4 . \mu_{t-4}^j . FI_{t-4}^j + \psi_5 . \mu_{t-5}^j . FI_{t-5}^j + \psi_6 . \mu_{t-6}^j . FI_{t-6}^j + \psi_7 . \mu_{t-7}^j . FI_{t-7}^j \quad (8)$$

$$\Sigma FI_t^j = \Sigma FI_{t-1}^j + \mu_t^j . FI_t^j \quad (9)$$

Equation (8) ensures that the impact of a fiscal impulse depends on the fiscal multiplier that prevailed when the fiscal impulse occurred. Seven lags are retained to account for the possibility of long lasting effects of fiscal impulses. The total impact of a sequence of fiscal impulses is then computed using the accumulation of fiscal impulses times the multiplier (eq.9).

2.2.4. Public Debt and output gap dynamics under alternative compositions of fiscal adjustment

We aim to provide simulations on the paths of public debt and output gap of Eurozone member states according to the path of consolidation and the composition of the adjustment under different scenarios.

The baseline scenario incorporates time-varying fiscal multipliers and hysteresis effects, but does not introduce the risk premium effect on long-term interest rates. First, we take into account the *observed* amount of fiscal consolidation from 2011, which is the starting year for all simulations, and derive the public debt dynamics until 2034. We investigate whether, under *observed* fiscal stances, Eurozone countries may achieve the 60% debt-to-GDP target.

Then, we analyze different paths of consolidation with three alternative instruments: purely expenditure-based adjustment, purely tax-based adjustment and a mixed-adjustment. Finally, in a third step, we introduce an endogenous risk premium.

2.2.4.1. Public debt in 2034 under the current adjustment

In the baseline scenario, we simulate the path of public debt-to-GDP ratios until 2034, which is the horizon of the 1/20th debt rule incorporated in the revised SGP and in the Fiscal Compact. The simulated path of public debt depends on the fiscal impulses which have been forecasted in the Eurozone from 2011 to 2016 ([14]). We then assume zero fiscal impulses beyond 2016. Under this scenario, the fiscal multiplier is supposed to be time-varying as described in Graph II.2.1. Hysteresis effects are also introduced in the model so that a negative (respectively positive) demand shock will have negative (respectively positive) long-term effects on GDP. We suppose that sovereign spreads will vanish after 2015. Results are reported in Table II.2.1 and hypotheses regarding the set of initial conditions are described in box 1.

Columns (1)-(4) report public debt and structural balance respectively in 2020 and 2034 (20-year horizon). 2020 is the year for which the output gap has returned to zero for almost all countries. The cumulative fiscal impulse for 2011-2016, is reported in column (5) and sums up the short-term fiscal stance for all Eurozone countries. Growth performances (GDP growth rates) are reported in columns (6) and (7). For GDP growth, we report the average growth rate over the period for which we have information on realized fiscal stance (2011-2014). Beyond 2020, GDP growth converges to the long-term growth rate.

([14]) For 2015 and 2016, we consider planned fiscal impulses.

Table II.2.1: **Public finance and output performances under the baseline scenario**

	Public debt (% of GDP)		Structural balance (% of GDP)		Cumulative fiscal impulse	GDP growth rate (%)		Sovereign yield (%)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	2020	2034	2020	2034	2011-2016*	2011-2014	2015-2034	2012-2018
Germany	51	6	1,9	3,0	-1.8	1,5	1,1	1,9
France	93	99	-3,1	-3,9	-2.5	0,8	1,6	2,3
Italy	112	57	1,1	2,9	-2.1	-0,8	0,5	3,4
Spain	92	71	-1,4	-1,0	-5.7	-0,4	1,7	3,3
Netherlands	71	66	-1,6	-1,8	-2.3	0,0	1,5	2,1
Belgium	86	52	-0,3	0,5	-1.1	0,8	1,7	2,4
Portugal	115	83	-1,0	-0,2	-7.4	-1,4	1,4	3,2
Ireland	82	8	2,4	4,6	-6.3	1,5	2,2	2,8
Greece	148	58	1,7	4,9	-11.1	-4,8	1,7	3,4
Finland	65	74	-2,3	-3,3	-1.8	0,1	1,9	2,1
Austria	69	56	-1,1	-1,0	0.3	1,3	1,5	2,2
Eurozone	82	54	-0,3	0,2	-2.8	0,4	1,3	2,6

Source: iAGS model

Given initial conditions and realized and expected fiscal impulses, Table II.2.1 shows that public debt would significantly decrease between 2020 and 2034 for all countries but France and Finland. Moreover, Germany, Italy, Belgium, Ireland, Greece and Austria would meet the 60% target by 2034.

In 2020, despite substantial fiscal efforts, France, Spain, the Netherlands, Portugal, Finland and Austria would not be able to bring their cyclically-adjusted deficit under the Fiscal Compact limit of 0.5% of GDP. Among these countries, France, Spain, the Netherlands, Portugal and Finland would not comply with the fiscal rule on public debt and would stand above the 60 % threshold in 2034 despite their fiscal efforts to bring back debt to this ratio.

Finally, the baseline scenario questions the issue of public debt sustainability in the Eurozone. Sustainability is assessed regarding the ability of countries to meet the objective of bringing back the debt ratio to 60 % of GDP by 2034, consistently with the recent fiscal framework which fixes a 20-year horizon for assessing debt evolution. Sustainability refers to the ability of the general government to pay back its domestic debt. Its ability depends on the future available scope for spending cuts and tax hikes, but also on future economic growth. Though some countries in our baseline simulations do not reach this 60% threshold, it is noticeable that they achieve substantial reductions in public debt-to-GDP ratios. This downward trend in public debt implies enhanced debt sustainability *stricto sensu*. However the social costs as well as the cost in terms of fiscal balance could make this adjustment unrealistic (see Buiter and Rahbari, 2014). For Greece, Italy and Ireland, it would require structural primary surpluses close or above 3% of GDP for many years. This obviously questions the ability of these countries to maintain such a high primary surplus, a situation which has rarely been observed in the history of fiscal consolidations.

For countries, where public debt would fall significantly below 60 %, it raises the opportunity to pursue a fiscal stimulus as existing fiscal rules state that public debt must remain below 60 %, hence leaving some possible leeway to expand in the future. One may consider that the baseline scenario is economically, politically and socially costly: it goes beyond the requirements of fiscal sustainability, beyond the requirements of EU fiscal rules and beyond the social resilience of European citizens. For Germany, the primary surplus would reach 3.0% by 2034 under the current scenario. As the optimal level of public debt is unknown *a priori*, there is no reason to consider that this situation will correspond to a long-term equilibrium. The German government may decide to expand fiscal policy in the years after 2016. ([15])

([15]) Blanchard et al. (2014) report the different channels through which a fiscal stimulus in Germany may be fruitful in the periphery. In't Veld (2013) reports a positive impact of a fiscal stimulus in Eurozone surplus countries (e.g. Germany) but does not report a comparison with a fiscal stimulus in deficit countries. Blot et al. (2014a) show that such a fiscal stimulus in

It must be acknowledged that the projections can be sensitive to alternative hypotheses. Blot and al. (2014a) notably show that the value of fiscal multipliers and the hysteresis effect play a significant role to gauge the dynamics of public debt. Initial output gap and long-term growth are also critical hypotheses. ([16]) Fiscal impulses have been high for most of Eurozone countries and sometimes exceeding 5% in Spain, Portugal, Ireland and Greece. They may be even larger if years 2015 and 2016 are excluded as the fiscal stance would turn positive for some countries according to AMECO forecasts (see Table II.2.3). For most countries average growth rates have been low during the 2011-2014 period. It must be recalled that over these years, the model has been calibrated to mimic the *observed* growth, public debt, public balance and interest rates. Thereafter, due to less contractionary or even expansionary fiscal impulses in 2015 and 2016, GDP would recover faster: Eurozone growth rate would reach 1.3% and 2.9% respectively. It would also result from a more expansionary monetary policy and to the error correction effect introduced in the model.

2.2.4.2. Does composition matter?

We assess whether countries can achieve the public debt target in 2034 by resorting to alternative instruments of consolidation. For the sake of simplicity and with regard to the literature on fiscal multipliers, we consider an instrument for which the fiscal multiplier is high, called here expenditure-based adjustment and the other for which the fiscal multiplier is low, called tax-based adjustment as emphasized in Graph II.2.1.

For each instrument, we calculate a sequence of fiscal impulses over 2011-2034 and we assess whether or not the country achieves the target and what is the output dynamics under the adjustment. For simplicity, we set fiscal impulses at - / + 0.5 from 2011 on. Austerity (a negative impulse) is reversed once the public debt-to-GDP ratio falls below 60% in 2034. For example, Spanish public debt stands at 71% of GDP in 2034 in the baseline scenario. We start with replacing the 2011 observed fiscal impulse by -0.5 and then, by iteration, we introduce additional negative fiscal impulses of -0.5 until the debt-to-GDP ratio reaches 60% in 2034. Once the target has been reached, we introduce positive impulses insofar as they do not breach the target.

The ability to comply with the debt objective is analysed separately with three instruments (expenditure-based, tax-based and mix-adjustment). In the mix-adjustment case, we consider that countries for which consolidation is needed resort to the instrument with the lowest fiscal multiplier (taxes) whereas countries where an expansionary fiscal policy is possible resort to the instrument with the highest multiplier (expenditures). In all cases, it is assumed that interest rates converge among Eurozone countries.

First, with maximum yearly consolidation of -0.5% of GDP based only on expenditures from 2011 on (Table II.2.4), only three countries (Spain, Portugal and Greece) would not reach the debt target in 2034. For those countries the cumulative fiscal impulse would amount to 11.5% of GDP. For France, the Netherlands and Austria, a significant additional amount of consolidation is needed when compared to Table II.2.1. In the case of Italy, reaching 60% with -0.5 point of consolidation per year would involve 3.1 points of consolidation which is close to the -2.1 that were realized between 2011 and 2016 ([17]). For Germany, fiscal stance would turn to a positive figure reflecting the fiscal space of the country. With a neutral fiscal stance, Belgium would also be able to reach the 60% debt-to-GDP ratio. Finally, it must be stressed that average growth would be significantly higher between 2011 and 2014, in comparison with the baseline scenario, thanks to lower requirements for consolidation. For the Eurozone as a whole, average growth would have been 0.6 point higher. The most striking difference would concern Greece, with an averaged recession of -0.9 instead of -4.8. Yet it must be reminded that under this adjustment path, Greece would still be unable to reach the debt target. Under this scenario, the cumulative fiscal impulse would be substantially higher than under the baseline (incorporating observed and planned fiscal

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Germany, which would not jeopardize public debt sustainability, would be less effective than if it happened in Spain: the almost close output gap in Germany does neither favor a strong impact of fiscal policy in Germany nor in the Eurozone via spillover effects.

([16]) Simulations also depend on starting debt levels. In the present context, however, initial debt levels are *actual* ones, and cannot therefore be modified.

([17]) Here we also take into account planned consolidation or expansion for 2015 and 2016.

Box 1: Main hypotheses for the baseline simulations

All simulations begin in 2011. To do so, we need to set starting point values in 2010 for some key variables. Output gaps for 2010 come from OECD database. We have taken the Economic Outlook 88 database (December 2010) which was the latest information available to policymakers when they decided upon domestic fiscal stances for 2011 and beyond. Output gaps are frequently revised and an alternative calibration might be to use more recent OECD estimates. Long-term projections for growth rates are OFCE hypotheses (see Table 2) where long-term growth is decomposed between the growth of the labor force and labor productivity. These hypotheses are necessarily open to debate but they may only be seen as exogenous projections since the model does not properly account for a long term analysis of the growth rate equilibrium. Concerning fiscal policy and budget variables, the main hypotheses are as follows:

– Public debts and fiscal balances in 2010 come from Eurostat;

– Fiscal impulses and the composition of the adjustment are taken from AMECO database (see Table 3). For 2015-2016, fiscal impulses are planned ones. Fiscal impulses take into account the one-off measures and correspond to the underlying primary cyclically-adjusted fiscal balance.

– Sovereign spreads for 2015-2016 are supposed to vanish progressively in the baseline scenario. It is assumed that the announced ECB program of unlimited debt-buying on the secondary market (Outright Monetary Transactions, up to a 3-year maturity) has been effective and achieves its goal of bringing down interest rates for Italy and Spain. Regarding countries relying on the ESM (formerly EFSF) for debt financing, we assume that Ireland gets full access to financial markets in 2014, Portugal in 2015 and Greece in 2016. We discuss a scenario with endogenous risk premium hereafter.

Table II.2.2. Main hypotheses for 2010
in %

	Public debt	Fiscal balance	output gap	potential growth
Source	**Eurostat**	**Eurostat**	**OECD**	**OFCE**
Germany	82.5	-4.2	-3.7	1.0
France	82.8	-6.8	-3.3	1.4
Italy	115.3	-4.5	-4.4	0.2
Spain	61.7	-9.4	-6.5	1.4
Netherlands	63.4	-5.1	-2.4	1.3
Belgium	96.6	-3.8	-3.8	1.5
Portugal	94.0	-11.2	-2.3	1.0
Ireland	91.2	-9.1	-11.7	1.8
Greece	148.3	-10.9	-7.3	1.5
Finland	48.8	-2.5	-6.0	1.6
Austria	72.5	-4.5	-2.5	1.4

Source: OECD, Eurostat and OFCE

(Continued on the next page)

Box (continued)

Table II.2.3. Fiscal impulses – 2011-2016
in % of GDP

	2011 – 2014		2015-2016	
	Expenditures	Taxes	Expenditures	Taxes
Germany	-1.5	-0.7	0.1	0.3
France	-3.9	1.1	0.4	-0.1
Italy	-2.2	-0.5	0.5	0.2
Spain	-1.9	-4.1	-0.1	0.4
Netherlands	-1.7	-1.3	0.5	0.2
Belgium	-2.9	1.4	0.6	-0.3
Portugal	-3.9	-4.4	0.3	0.6
Ireland	-1.3	-4.8	1.7	-1.9
Greece	-7.0	-5.5	1.3	0.1
Finland	-3.9	4.0	-0.4	0.6
Austria	-1.6	0.0	-0.2	0.0

Sources: OECD, Eurostat and AMECO.

stances between 2011 and 2016), but since it would be spread over a longer horizon, the gains in terms of short-term growth would be relatively substantial, whereas the long-term costs would be minimal.

Turning to the case of purely tax-based adjustment (Table II.2.5), only Portugal would not comply with the debt target. Public debt would reach 92%, which is significantly lower than in the expenditure-based adjustment, where it stood at 150%. This scenario is certainly and not surprisingly better for all Eurozone countries since, needed adjustment is lower and consolidation is less costly. Average growth in the Eurozone would now have reached 1.2 between 2011 and 2014, with average growth between 2015 and 2034 similar with the baseline scenario.

This conclusion certainly hinges on the assumption that the tax multiplier is always lower than the spending multiplier. Resorting to the instrument associated with the lowest multiplier in times of consolidation is optimal, all else equal. This is of course untrue when an expansion is possible. Thus, we consider a fourth scenario of mixed-adjustment (Table II.2.6). Here, countries with fiscal room for maneuver resort to expenditure-based expansion whereas countries implementing consolidation resort to tax-based adjustment. The differences with the pure tax-based adjustment are rather small. Public debt for Portugal is only reduced by 1 percentage point. Average growth for the Eurozone is 0.1 point higher between 2011 and 2014 and similar on average afterwards. It must be stressed that the main country for which there is fiscal room for maneuver is Germany. Though it is the biggest Eurozone country, the spillover effects from a German expenditures-based expansion are found to be small (see footnote 15).

Let us briefly return to the superiority of tax-based adjustment over spending-based adjustment in the model. It shall not be considered tautological. Indeed, the model introduces spillover effects via trade which do not modify the discrepancy between both types of adjustment: the adjustment with the assumed lowest real costs (tax-based adjustment) also produces the lowest spillover effects on partners, hence the lowest (negative) feedback effects from partners. However, the model includes a monetary policy setting which reduces the discrepancy: the adjustment with the assumed lowest real costs produces the smallest reduction in the nominal interest rate, hence the lowest compensation for demand. The argument that spending-based consolidation should be the preferred strategy during consolidation episodes drew

Table II.2.4: **+ / - 0.5 adjustment - expenditure-based adjustment**

	Public debt (% of GDP)		Structural balance (% of GDP)		Cumulative fiscal impulse	GDP growth rate (%)	
	2020	2034	2020	2034	2011-2034	2011-2014	2015-2034
Germany	70	60	-1,1	-1,1	1,2	2,2	1,0
France	95	60	-1,1	0,8	-6,8	1,4	1,4
Italy	122	60	1,1	3,4	-3,1	-0,7	0,4
Spain	127	**100**	-3,6	2,0	-11,5	0,1	1,4
Netherlands	85	60	-0,6	-0,3	-5,0	0,1	1,4
Belgium	87	60	-1,0	-0,2	0,0	1,7	1,6
Portugal	160	**150**	-4,6	0,1	-11,5	-0,1	0,9
Ireland	122	60	-0,8	2,4	-7,0	1,9	1,9
Greece	163	**110**	-2,2	4,4	-11,5	-0,9	1,0
Finland	58	60	-1,8	-2,4	0,9	1,3	1,7
Austria	74	60	-1,4	-1,2	-2,1	1,1	1,5
Eurozone	96	67	-1,1	0,5	-3,8	1,0	1,1

Source: Source: iAGS model

Table II.2.5: **+ / - 0.5 adjustment - tax-based adjustment**

	Public debt (% of GDP)		Structural balance (% of GDP)		Cumulative fiscal impulse	GDP growth rate (%)	
	2020	2034	2020	2034	2011-2034	2011-2014	2015-2034
Germany	72	61	-1,1	-1,1	1,0	2,1	1,0
France	84	60	-0,9	-0,5	-4,2	1,8	1,4
Italy	114	60	0,7	2,8	-1,7	-0,2	0,4
Spain	111	60	-2,4	2,8	-9,2	0,6	1,6
Netherlands	72	60	-1,3	-1,2	-2,6	0,6	1,4
Belgium	88	63	-1,1	-0,5	0,2	1,7	1,6
Portugal	142	**92**	-3,2	3,8	-11,5	0,4	1,0
Ireland	105	60	-0,6	0,7	-3,8	2,6	2,0
Greece	139	60	-0,4	4,6	-7,6	-0,2	1,1
Finland	59	61	-1,8	-2,4	0,7	1,1	1,8
Austria	71	60	-1,4	-1,3	-1,5	1,5	1,4
Eurozone	89	61	-1,0	0,3	-2,6	1,2	1,2

Source: iAGS model

Table II.2.6: **+ / - 0.5 adjustment - mix-adjustment (expenditure-based expansion and fiscal-based consolidation)**

	Public debt (% of GDP)		Structural balance (% of GDP)		Cumulative fiscal impulse	GDP growth rate (%)	
	2020	2034	2020	2034	2011-2034	2011-2015	2016-2034
Germany	70	60	-1,1	-1,1	1,2	2,2	1,0
France	84	60	-0,9	-0,5	-4,2	1,8	1,4
Italy	114	60	0,7	2,8	-1,7	-0,2	0,4
Spain	111	60	-2,4	2,8	-9,2	0,6	1,6
Netherlands	72	60	-1,3	-1,2	-2,6	0,6	1,4
Belgium	87	62	-1,1	-0,4	0,2	1,8	1,6
Portugal	142	92	-3,2	3,8	-11,5	0,4	1,0
Ireland	105	60	-0,6	0,7	-3,8	2,6	2,0
Greece	139	60	-0,4	4,6	-7,6	-0,2	1,1
Finland	58	61	-1,8	-2,5	1,0	1,3	1,7
Austria	71	60	-1,4	-1,3	-1,5	1,5	1,4
Eurozone	89	61	-1,0	0,3	-2,5	1,3	1,2

Source: Source: iAGS model

extensively on the reversed crowding-out effect: a fall in expenditure would be followed by a fall in interest rate and a consecutive increase in private investment([18]). This argument is strongly dependent on the existence of the ZLB (unless the liquidity trap is driven by shock on households' confidence, as in Mertens and Ravn, 2010): once the ZLB has been reached, spending-based consolidations cannot produce a compensating increase in private demand. Moreover, the higher the fiscal multiplier, the faster a ZLB episode is reached. Consequently, the time frame for a reversed crowding-out effect to happen is shorter under a spending-based consolidation than a tax-based one.

2.2.4.3. Does credibility matter?

The assumption that interest rates will converge across Eurozone member states was included in the former scenarios. Yet, recent experience has shown that countries with high public debt underwent a sharp loss of credibility which materialized in risk premia increases. This situation has induced countries to implement sharper consolidation to restore credibility vis-à-vis financial markets, a situation already described by, e.g. Guichard et al. (2007). Thus we consider scenarios with endogenous risk premia on sovereign debts, as shown in eq. (5) ([19]). We focus on pure expenditure-based and pure tax-based scenarios. Results are reported in Tables II.2.7 and II.2.8, in difference with results reported in tables II.2.4 and II.2.5 respectively. The endogenous risk premium, given by eq. (5) on the national interest rate appears in the last-but-one column of each table. It might not be directly compared with the sovereign yield given in table (1) as the scenario is not the same. The relevant comparison would be with Tables II.2.4, 5 and 6) where risk premium is zero by construction. It may also be stressed that a zero risk premium does not mean that there is no spread with the safe asset (here the German sovereign bond) as convergence is supposed to occur slowly in the model as explained for the baseline scenario.

It should be straightforward that the ability to reach the debt target when there is an endogenous risk premium is lower because positive risk premium increases the debt burden and weighs down on growth, reducing the advantage of a smoother path of consolidation.

In the case of an expenditure-based policy (Table II.2.7), the introduction of a risk premium requires a sharper consolidation of 1.1 percentage point of GDP for the Eurozone, with a strong discrepancy between France (with an additional cumulative fiscal impulse of almost -5 percentage points) and Belgium (with an additional cumulative fiscal impulse of +0.5). Despite stronger consolidation, the Eurozone average public debt increases by 5 percentage points of GDP, in comparison with the previous scenario, and Greece, Portugal and Spain are still unable to reach the debt target in 2034. Real GDP growth rates are almost similar, on average between 2011 and 2014 and between 2015 and 2034 though these average figures hide some real costs which may cumulate in output gaps. Indeed, in the case of France and Portugal, between 2011 and 2034, the negative output gap would widen by 16 and 22 percent respectively. On average for the Eurozone, the output gap would widen by 5 percent. Risk premia would be higher for France or Finland, compared to a situation without endogenous risk premium but yet sovereign spreads with German interest rate would still be close or above 100 basis points in Greece, Italy, Portugal and Spain between 2012 and 2018.

The real costs of a tax-based adjustment (Table II.2.8) would be substantially lower than after a spending-based one, once a risk premium is introduced. The cumulative fiscal impulse would reach a mere -0.3 percentage points of GDP for the Eurozone, and the cumulative loss of output gap would be 0.5 percent. In this case again, risk premia would be lower compared to the expenditure-based consolidation but may still be substantial for France and Portugal. Finally the debt target would not be achieved in 2034 for Spain, Portugal and Greece.

The response of sovereign spreads to increases in public debt in the simulations are quite in line with the literature which reports relatively low values, e.g. Gruber and Kamin (2012). Results of the simulations concerning the peripheral countries of the Eurozone can be brought close to the empirical conclusions of Schaltegger and Weder (2015), though they study only developing countries. They show that fiscal adjustments do not have a strong impact on the probability of default, and that a composition effect exists: spending-based adjustments are not successful at reducing the probability of default, whereas tax-based

([18]) The argument is present in, e.g. Giudice et al. (2003) and Corsetti et al. (2013).
([19]) Dewachter and Wouters (2014) introduce endogenous financial risk in a DSGE model via a perturbation-based approach, but they do not model either a multi-country setting or risk premia on sovereign bonds.

ones are. In a scenario of endogenous risk premia, spending-based and tax-based adjustments give almost similar sovereign spreads (they are a bit higher in the latter than in the former, though the difference is probably not significant), but public debt increases less in the latter than in the former case. A composition effect thus arises.

Table II.2.7: **+/- 0.5 fiscal impulses - endogenous risk-premium - expenditure-based adjustment – in difference with table II.2.4**

	Public debt (% of GDP)		Structural balance (% of GDP)		Cumulative fiscal impulse	GDP growth rate (%)		Risk premium (pts)	Cumulative OG
	2020	2034	2020	2034	2011-2034	2011-2014	2015-2034	2012-2018	2011-2034
Germany	0	0	-0,1	0,0	0,1	0,0	0,0	0.1	0,9
France	6	0	-1,0	3,2	-4,7	0,0	-0,2	0.9	-16,1
Italy	5	0	0,2	0,4	-0,9	-0,2	0,0	0.4	-4,5
Spain	7	32	-1,3	-1,8	0,0	-0,1	0,0	1.1	-6,4
Netherlands	2	0	-0,3	0,4	-0,3	0,0	0,0	0.6	-1,0
Belgium	0	0	-0,1	-0,1	0,5	0,1	0,0	0.0	2,9
Portugal	12	102	-2,4	-9,7	0,0	-0,2	-0,2	1.4	-22,1
Ireland	2	0	-0,2	0,3	-0,4	0,1	0,0	0.3	1,1
Greece	0	0	-0,1	0,1	0,0	0,0	0,0	0.6	1,6
Finland	0	0	-0,1	0,1	0,0	0,1	0,0	0.0	2,5
Austria	0	0	-0,1	0,0	0,4	0,0	0,0	0.0	1,1
Eurozone	3	5	-0,4	0,4	-1,1	0,0	0,0		-5.0

Source: iAGS model

Table II.2.8 **+/- 0.5 fiscal impulses - endogenous risk-premium - tax-based adjustment – In difference with table II.2.5**

	Public debt (% of GDP)		Structural balance (% of GDP)		Cumulative fiscal impulse	GDP growth rate (%)		Risk premium (pts)	Cumulative OG
	2020	2034	2020	2034	2011-2034	2011-2014	2015-2034	2012-2018	2011-2034
Germany	2	2	-0,1	0,0	0,2	0,0	0,0	0.1	0,9
France	3	0	0,0	0,2	-0,5	0,0	0,0	0.6	-0,5
Italy	0	-1	0,0	0,1	-0,2	-0,1	0,0	0.2	-0,8
Spain	6	7	-1,1	1,7	-2,3	-0,1	0,0	1.1	-5,2
Netherlands	0	0	-0,1	0,0	0,2	0,1	0,0	0.1	1,6
Belgium	-1	-4	0,2	0,3	0,0	0,0	0,0	0.0	0,4
Portugal	10	42	-2,0	-2,4	0,0	-0,2	0,0	1.4	-7,6
Ireland	1	0	-0,1	0,0	0,0	0,1	0,0	0.2	2,4
Greece	0	0	-0,1	0,0	0,0	0,0	0,0	0.4	1,0
Finland	0	0	-0,1	-0,1	0,0	0,1	0,0	0.0	1,8
Austria	1	1	-0,1	0,0	0,3	0,0	0,0	0.0	0,5
Eurozone	2	2	-0,2	0,2	-0,3	0,0	0,0		-0,5

Source: iAGS model

2.2.5. Backloading vs. frontloading

In this section, we address the issue of frontloading according to the choice of instruments (expenditures or taxes). In the case of a frontloaded adjustment, countries implement the bulk of the fiscal consolidation early. This is clearly the choice that has been made in the Eurozone since 2011. Despite negative output gaps, Eurozone countries have engaged massive consolidation plans as emphasized in Table II.2.3 where it appears that for some countries fiscal consolidation between 2011 and 2014 exceeded 10 percentages

points of GDP. On the one hand, under the assumption that fiscal multipliers are high in time of crisis, this strategy may be ill-designed, implying high output losses. It may even be counterproductive for very high value of fiscal multiplier since public debt is hardly reduced because of the feedback effect from bad growth performance. On the other hand, spreading (or postponing) the adjustment may undermine the credibility of government and trigger speculative attacks on sovereign debt markets. Interest rates would go up. We illustrate the trade-off between backloading and frontloading by comparing the scenario of +/- 0.5 percentage point of GDP with a scenario where the adjustment amounts to +/- 1 percentage point of GDP. We keep on distinguishing between spending-based and tax-based adjustments, and also retain the endogenous risk premium. As in previous scenarios, adjustments start in 2011 and are pursued until debt-to-GDP ratios reach 60%.

The frontloading strategy under a spending-based consolidation would substantially alleviate the debt problem in Greece, Portugal and Spain though in the former two countries, the debt target would remain unreachable in 2034, despite strong negative fiscal impulses. This setback is all the more unfortunate that it would be accompanied by a high real cost: Greece and Portugal would face a negative output gap of 3 and 4% per year during 20 years respectively. For the Eurozone, frontloading would be preferable to backloading in terms of public debt and real activity in the long run, at the expense of the short-run where real growth would be reduced by 0.4%.

Frontloading under a tax-based adjustment gives better outcomes. All countries are able to reach the debt target in 2014 and in the Eurozone, the requirement to implement a contractionary fiscal policy is relieved by almost 1 percentage point of GDP between 2011 and 2034. The cumulative output gap is improved by 2% during the same period. Relief is substantial for Portugal and Spain who gain 0.5% per year during 20 years. In the short-run however, there is a minor real cost with frontloading in comparison with backloading.

It remains to be acknowledged that sovereign spreads are substantially reduced by the recourse to a frontloading strategy. In countries where interest rates spreads are high, like Italy, Spain and Portugal, the fall amounts to an average of 0.4 if consolidation is spending-based. Stronger austerity measures means that the peak for public debt and the stabilizing primary surpluses are reached more rapidly reducing the risk premium.

Table II.2.9: **+/- 1 fiscal impulses - endogenous risk-premium - expenditure-based adjustment – In difference with the scenario described in Table II.2.7**

	Public debt (% of GDP)		Structural balance (% of GDP)		Cumulative fiscal impulse	GDP growth rate (%)		Risk premium (pts)	Cumulative OG
	2020	2034	2020	2034	2011-2034	2011-2014	2015-2034	2012-2018	2011-2034
Germany	0	-1	0,0	0,0	0,0	0,0	0,0	-0,1	-0,1
France	-10	-1	1,3	-4,1	5,4	-0,8	0,3	-0,8	16,8
Italy	-7	1	-0,3	-0,6	0,9	-0,3	0,1	-0,4	4,0
Spain	-4	-72	4,3	3,8	-1,9	-0,8	0,1	-0,3	-11,0
Netherlands	-10	1	-0,5	-0,9	1,6	-0,5	0,2	-0,6	8,2
Belgium	0	0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Portugal	10	-168	7,2	26,5	-23,0	-1,6	-0,5	-0,3	-93,3
Ireland	-6	0	0,7	-1,2	1,4	-1,0	0,2	-0,3	1,4
Greece	18	-22	2,5	7,8	-11,5	-1,1	-0,4	0,1	-65,2
Finland	0	0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Austria	-1	0	0,0	0,0	0,0	0,0	0,0	0,0	-0,3
Eurozone	-5	-11	0,9	-0,2	0,8	-0,4	0,1		0,9

Source:: iAGS model

Table II.2.10: **+/- 1 fiscal impulses - endogenous risk-premium - tax-based adjustment – in difference with the scenario described in table II.2.8**

	Public debt (% of GDP)		Structural balance (% of GDP)		Cumulative fiscal impulse	GDP growth rate (%)		Sovereign yield (%)	Cumulative OG
	2020	2034	2020	2034	2011-2034	2011-2014	2015-2034	2012-2018	2011-2034
Germany	0	0	0,0	0,0	0,0	0,0	0,0	-0,1	0,0
France	-10	0	-0,3	-0,7	1,0	-0,1	0,0	-0,6	3,1
Italy	-1	0	-0,1	-0,1	0,1	0,0	0,0	-0,2	0,2
Spain	-21	-7	2,8	-4,0	5,0	-0,2	0,1	-0,9	9,1
Netherlands	-3	0	0,0	-0,2	0,1	0,0	0,0	0.0	0,0
Belgium	0	0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Portugal	-27	-74	6,1	1,4	2,1	-0,2	0,1	-1,0	10,0
Ireland	-5	0	-0,2	-0,3	0,3	-0,2	0,0	-0,2	0,2
Greece	-13	0	1,1	-1,6	1,8	-0,3	0,1	-0,4	2,2
Finland	0	0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Austria	0	0	0,0	0,0	0,0	0,0	0,0	0,0	0,1
Eurozone	-6	-2	0,4	-0,7	0,9	-0,1	0,0		2,1

Source: iAGS model,OFCE

There are two arguments which may make a frontloading strategy preferable to a backloading one. ([20]) The first one relates to uncertainty. Of course, if one knows today that the fiscal multiplier will be much lower tomorrow, backloading consolidation is always a superior strategy. But a question arises: can one be sure that the fiscal multiplier will be significantly lower in a reasonable number of years? As a matter of fact, if the lower multiplier tomorrow is not confirmed, backloading may make public finances worse, because it maintains the cumulative consolidation needs. The second argument relates to the political economy of reforms. It is hard to argue that newly elected governments in the future will or should commit to the commitments of incumbent governments. Hence, consolidation should be implemented as soon as possible.

A counter-argument can be given by the baseline scenario (Table II.2.1): it shows that the real costs of a sharp consolidation when the output gap is negative are not negligible and produce a self-defeating strategy where public debts continue to grow in countries which implemented the most negative impulses.

2.2.6. Conclusion

Turning back to the questions raised in the introduction, it is time for answers.

First, the simulations performed with the iAGS model showed that there have been quite substantial costs with the fiscal stance endorsed by Eurozone member states since 2011. It involves unrealistic improvements in public finances which stop the recovery under way after the Global Financial Crisis. Meanwhile the model confirms that this fiscal strategy will be unable to achieve, or sometimes to improve, public finance sustainability. Second, the simulations show that a composition effect is at work. Despite an active monetary policy, but only until the short-run nominal interest rate hits the zero-lower-bound, spending-based consolidations are less effective than tax-based ones in terms of public finance sustainability; they are also more costly in terms of economic growth. Third, introducing endogenous risk premia does not alter these results, nor does the simulation of a frontloading strategy.

The conclusion is that it is not only important to implement a fiscal adjustment based on the instrument associated with the lowest fiscal multiplier but also to neutralize the risk premium through an accommodative monetary policy. Our results show that fiscal consolidations do not prove themselves very effective at improving credibility. Indeed, though Spain or Greece implemented strong measures to

([20]) We thank Pablo Hernandez de Cos for clarifying this point.

reduce their public balance, risk premia kept rising in 2011 and 2012 and went down only after Mario Draghi declared that the ECB would do "whatever it takes" to save the Euro.

The introduction of different shapes for the multiplier effect on tax and spending, and the inclusion of a banking and financial systems with frictions in the model are left to future research.

2.2.7. Appendix – Calibration

2.2.7.1. Aggregate demand and supply

We calibrate the error-correction equation stemming from equation (3) by distinguishing short run and long run effects of monetary policy and external demand on GDP. Long run effect of long term yields (δ_l) *is higher* than the short run one (δ_s), *to* take into account delays in the transmission of monetary policy. As for heterogeneity between Eurozone member states in the transmission of interest rate shocks, empirical literature has not provided very conclusive results to date. Peersman (2004) reports diverging results so that any calibration remains hazardous. We choose to avoid a strong heterogeneity, which is consistent with the convergence in the transmission process before the crisis emphasized by Boivin et al. (2008) or Barigozzi et al. (2014). Boivin et al. (2008) notably suggest that the effect of an increase in the interest rate is higher for Spain and Italy than for France and Germany. The effect of interest rate shocks is therefore supposed to be lower for "Northern countries". We set β_l (the long-run impact of foreign demand on output) equal to the share of exports in the country's GDP, and β_s (*short*-run impact) equal to half β_l.

Table II.2.11: **Calibration of monetary policy and external demand effects on output**

	δ_s	δ_l	β_s	β_l
Austria	-0.40	-0.60	0.29	0.58
Belgium	-0.40	-0.60	0.40	0.81
Finland	-0.40	-0.60	0.23	0.46
France	-0.30	-0.50	0.13	0.27
Germany	-0.30	-0.50	0.25	0.50
Greece	-0.40	-0.60	0.13	0.25
Ireland	-0.40	-0.60	0.50	1.00
Italy	-0.30	-0.40	0.14	0.28
Netherlands	-0.40	-0.60	0.40	0.79
Portugal	-0.40	-0.60	0.17	0.34
Spain	-0.30	-0.40	0.15	0.30

Source: iAGS Model, OFCE.

The critical point in calibrating the error-correction equation is to set the speed of convergence of output to its long run equilibrium. The speed depends on values of λ (impact of variables in level) and α (impact of past growth rate), which are set equal across countries. We fix α at 0.1 and λ at -0.3. These values ensure that the speed of convergence of output to its long-run value is comparable under normal times to that of a standard DSGE model. With these values, the output gap is closed about 5 years after a shock.

Concerning equation (4), long run effects on potential GDP come from hysteresis effects. The risk-premium effect depends on the sensitivity of the sovereign yield on public debt as described in eq. (7).

Table II.2.12: **Risk premium and sensitivity of the sovereign yield on public debt**

Hysteresis	Risk-premium
H	κ
0.15	0.01

Source: iAGS Model, OFCE

The hysteresis effect parameter is fixed at 0.15 in order to obtain qualitatively similar impacts of transitory and permanent fiscal impulses on potential growth, as those obtained with QUEST III (see Blot et al. (2014a) for a comparison with QUEST III model). For the simulation, fiscal rules are unplugged and shocks occur on the share of government consumption to GDP ratio.

2.2.7.2. Public finances

The most important parameter to set for public finances is Φ, the overall sensitivity of revenues and expenditures to the business cycle. To do so we use the European Commission estimates. To compute the average interest rate on public debt, we compute an average maturity (MAT) of public debts using national sources on public debt maturity structures in 2011.

Table II.2.13: **Calibration of public finances parameters**

	Φ	*MAT*
Austria	0,47	8,1
Belgium	0,54	6,8
Finland	0,50	5,0
France	0,49	6,9
Germany	0,51	6,1
Greece	0,43	11,3
Ireland	0,40	6,9
Italy	0,50	6,6
Netherlands	0,55	7,0
Portugal	0,45	6,1
Spain	0,43	6,8

Source: European Commission (2005), OFCE.

2.2.7.3. External trade and finance

We set the sensitivity of imports to output gap equal to the share of imports in country's GDP. The matrix of trade exchanges between countries comes from the Chelem Database for year 2003.

As regards the parameters of the Taylor rule, they are set according to Taylor (1993). The sensitivity of forward-looking expectations in long-run expected inflation is set at 0.82 which makes the long-run nominal interest rate equal to 4% (see Shiller, 1979; Fuhrer and Moore, 1995).

Table II.2.14: **Calibration of the sensitivity of imports to output gap**

	Ω
Austria	0.5
Belgium	0.8
Finland	0.4
France	0.3
Germany	0.4
Greece	0.3
Ireland	0.8
Italy	0.3
Netherlands	0.7
Portugal	0.4
Spain	0.3

Source: Chelem (CEPII).

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3. SESSION 2

INTERACTION BETWEEN PRIVATE AND PUBLIC SECTOR IN DIFFICULT TIMES:

IMPACT OF UNCERTAIN ECONOMIC ENVIRONMENTS ON CONSOLIDATIONS

3.1: FISCAL CONSOLIDATIONS UNDER IMPERFECT CREDIBILITY

By Matthieu Lemoine ([1]) and Jesper Lindé ([2])([3])

3.1.1. Introduction

The global financial crisis and slow ensuing recovery have put severe strains on the fiscal positions of many industrial countries, and especially many peripheral economies in the euro area. Between 2007 and 2013, debt/GDP ratios climbed considerably in many euro area countries, including Greece (+66.6pp), Ireland (+98.0pp), Portugal (+60.5pp), Spain (+57.6pp) and Italy (+29.3pp). Mounting concern about high and rising debt levels, especially in the wake of the run-up in borrowing costs, has spurred efforts to implement sizable and long-lived fiscal consolidation plans. Thus far, many of the fiscal consolidation plans that have received legislative approval in the peripheral euro area economies appear to have broadly similar features - they are typically fairly front-loaded, and more focused on spending cuts than tax-hikes.

However, as can be seen in Graph III.1.1, the debt ratios in these economies have apparently not improved much in the last two years despite significant consolidation efforts, and output growth appears to have been low relative to European peers which have not pursued fiscal austerity to the same extent. Hence, the evidence during this period does not seem to support the popular policy recipe, prominently advocated by Alesina and Ardagna (2010), Alesina and Perotti (1995, 1997) and Giavazzi and Pagano (1990), that large spending-based fiscal consolidations are likely to have expansionary effects on the economy.

In this paper, we seek to analyze the impact that imperfect commitment to follow through on the announced consolidation efforts has on the output cost of fiscal austerity and their effectiveness to reduce debt-ratios in the short- and medium term. Given the outsized consolidation plans, we believe that economic actors - both households and investors - may have had considerable doubts about the ability of politicians to follow through on the implementation of them, and we seek to understand how these doubts may have affected their efficiency. Our paper makes a purely positive assessment of this issue by, first, making an assessment if imperfect credibility of permanent spending cuts seems to be a relevant issue empirically, and second, by investigating how the economic impact of expenditure-based consolidation depends on the degree of credibility that the spending cut will indeed be permanent and not transient.

To examine the first issue, we decompose data on government spending (as share of trend output) into permanent and temporary component for a selected set of peripheral euro area economies. ([4]) Our simple decomposition supports the notion that credibility is imperfect for many of the economies under consideration; in particular, we find that credibility for permanent spending cuts is impaired for Greece.

Given this finding, we attack the second issue, which is to quantify the economic impact of imperfect fiscal credibility in two variants of a dynamic stochastic general equilibrium (DSGE henceforth) model of an open economy. We start out our analysis using the analytically tractable benchmark model of Clarida, Gali, and Gertler (2001), and then check the robustness of our findings in a fully-fledged workhorse open economy model used by Erceg and Linde (2010, 2013). This model features "rule of thumb" households who consume all of their after-tax income as in Erceg, Guerrieri, and Gust (2006) as ample micro and macro evidence suggests that such non-Ricardian consumption behavior is a key transmission channel for fiscal policy. ([5]) On other dimensions, this model is a relatively standard two country open economy

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([3]) We are grateful for very useful comments by our discussant Werner Roeger and other participants at the European Commission workshop on "Expenditure-based consolidations: experiences and outcomes in Brussels on January 20, 2015. The views expressed in this paper are solely the responsibility of the authors and should not be interpreted as reflecting the views of neither Banque de France nor Sveriges Riksbank or of any other person associated with these institutions.
([4]) For a point of comparison of our procedure, we also perform the decomposition for Germany and the United States.
([5]) Using micro data from the Consumer Expenditure Survey, Johnson et al (2006) and Parker et al. (2011) find evidence of a substantial response of U.S. household spending to the temporary tax rebates of 2001 and 2008. On the macro side, Gali, Lopez-Salio and Valles (2007) present evidence from structural VARs that government spending shocks tend to boost private

model with endogenous capital formation which embeds the nominal and real frictions that have been identified as empirically important in the closed economy models of Christiano, Eichenbaum, and Evans (2005) and Smets and Wouters (2003), as well as analogous frictions relevant in an open economy framework (such as costs of adjusting trade flows). Given the importance of financial frictions as an amplification mechanism - as highlighted by the recent work of Christiano, Motto and Rostagno (2010) - the model also incorporates a financial sector following the basic approach of Bernanke, Gertler, and Gilchrist (1999).

To begin with, we assume that the consolidating economy has the means to pursue independent monetary policy (IMP henceforth), here defined as the ability for the central bank to tailor nominal interest rates (and hence the exchange rate) to stabilize inflation around target and output around its efficient level.

After considering IMP as a useful reference point, we move on to the benchmark case in which the consolidating economy is a small member of a currency union (CU henceforth), without the means to exert any meaningful influence on currency union policy rates and its nominal exchange rate. The latter case, we believe, is the most interesting one given the current situation for many European peripheral economies.

Our main findings are as follows. First, under IMP, the adverse impact of limited credibility is relatively small, and consolidation can still be expected to reduce government debt at a relatively low output cost given that monetary policy provides more accommodation that it would have to do under perfect credibility. Second, the lack of monetary accommodation under CU membership implies that the output cost can be significantly larger under imperfect credibility, implying that progress to reduce government debt in the short- and medium-term is limited when the consolidation is implemented quickly. For a small CU member, a gradual approach to consolidation plan has the dual benefit of mitigating the need for monetary accommodation and building credibility for the cuts to be permanent more quickly. While the benefit of acting gradually due to the less need of monetary accommodation have been pointed out previously by Corsetti, Meier and Muller (2012) and Erceg and Linde (2013), we show that imperfect credibility is an additional argument why it may be advantageous to proceed in a gradual fashion.

After having established these preliminary results in the stylized model, we move to a more serious quantitative analysis in the fully-fledged model of Erceg and Linde (2013), in which we allow for interest rates spreads in the periphery to respond endogenously to path of expected debt and deficits. In this model, we find that fiscal consolidation may even be expansionary if the government enjoys a sufficiently large degree of credibility. Even so, the favorable results under endogenous spreads are sensitive to the implementation of the consolidation. In particular, if the government pursues an ambitious spending-based consolidation program that seeks to reduce the debt-ratio even in the short-run through aggressive spending cuts, they run the risk of chasing their own tail and withdraw too much demand in the economy which may have a counter-productive impact on the debt-ratio in the short- and medium-term. Thus, echoing the benefits of acting gradually in the stylized model, a more effective route for the government to reduce debt quickly at low output cost is to implement permanent spending-cuts and be a bit patient until private demand is crowded in, tax revenues rise, and debt starts falling.

Perhaps somewhat surprisingly, relatively few papers have analyzed the role imperfect credibility might play for shaping the effects of fiscal consolidations in a DSGE framework. First, Clinton et al (2011) show with the GIMF model that credibility plays a crucial role in determining the size of output losses, by analyzing sensitivity of these losses to the length of an initial period without any credibility. Focusing on spillover issues, in't Veld (2013) uses as a benchmark scenario a multi-year consolidation with gradual learning, i.e. where austerity measures are considered as temporary in a learning period and are expected to be permanent only after this learning period. He shows that, in the short-run, output losses would be considerably smaller if consolidations gains credibility earlier. Simulations of consolidations with ECB's NAWM model also deliver larger multipliers in the case of "imperfect credibility" (modeled in the same way with a learning period where fiscal shocks are initially perceived as temporary, see Box 6 of ECB,

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consumption, and show how the inclusion of rule-of-thumb agents in their DSGE model helps it account for this behavior. Blanchard and Perotti (2002) and Monacelli and Perotti (2008) obtain similar empirical findings

2012). ([6]) Concerning the interaction of fiscal consolidation and interest rate spreads, an empirical paper of Born et al. (2014) provides estimates of a panel VAR on a dataset of 26 emerging and advanced economies. Consistent with the findings in our workhorse model, it shows that a cut in government consumption that is perceived to be temporary can induce a short-term rise in spreads, whereas spreads fall following a permanent spending cut.

The reminder of the paper is organized as follows. Section 3.1.2 assesses the empirical relevance of imperfect credibility. Section 3.1.3 presents the simple benchmark model, discusses its calibration, and examines the role imperfect credibility plays in this stylized model under monetary independence and currency union membership. In Section 3.1.4, we then examine the robustness of the results for the stylized model in the large-scale model with hand-to-mouth households and financial frictions. Finally, Section 3.1.5 concludes.

3.1.2. An Empirical Assessment of Imperfect Credibility for Selected Euro Area Countries

In this section, we attempt to decompose government spending into permanent and temporary components. This empirical study will be useful for calibrating models under imperfect credibility. Indeed, as we will show in quantitative simulations of the paper, the larger is the weight of the permanent component, relative to the temporary one, the easier it is to extract this permanent component and the more credible becomes a permanent consolidation of government spending.

Here, we focus on countries of the euro area periphery over the period $1999Q1$-$2008Q4$ (i.e. from the launch of the euro to the financial crisis): Ireland, Italy, Portugal, Spain and Greece. We also add Germany and the United States as benchmarks. To do this analysis, we use OECD national accounts quarterly series for "Government final consumption expenditures" and GDP in constant prices. Concerning the sample period, we choose a start date with the launch of the euro area ($1999Q1$), because we don't have a longer span for Greece (the time series even starts in $2000Q1$), and we choose an end date in $2008Q4$, in order to avoid to get results influenced by the specific evolution of government spending after the financial crisis.

Then, we measure government spending as a ratio of government consumption over (lagged) trend output, as in Gali et al (2007). Finally, we decompose the log of government spending into permanent and transitory components by using a HP filter with a parameter λ=6400. The parameter 6400 is the upper value of λ (equal to four times the benchmark value of 1600) proposed in Hodrick and Prescott (1997). We choose such a high value in order to be conservative with respect to the ability to extract the signal: with a high value of λ, the HP filter delivers a permanent component, which has a smaller variance relative to that of the temporary component and is hence more difficult to extract. With such a filter, we get permanent components shown in Graph III.1.2 with actual government spending. We see that, over this period, the permanent component of government spending: has grown in Italy, Spain and Portugal; has been quite stable in Ireland; has decreased in Greece and the United States.

Then, we fit simple time series models (detailed formally in Subsection 3.1.2) to both components: a persistent model for the permanent component, which can be an $AR(1)$ or an $AR(2)$, and an unconstrained $AR(1)$ with a persistence ρ^{temp} *for t*he temporary component. Auto-regressive parameters of the first model are governed by two parameters through the following formula: $1+\rho_1^{perm}-\rho_2^{perm}$ *and* $-\rho_1^{perm}$. *T*his model is an $AR(1)$ process if we impose $\rho_1^{perm}=0$.

We report standard errors of permanent and temporary innovations in Table III.1.2, as well as the corresponding signal-noise ratios. In the $AR(1)$ case, which corresponds to front-loaded consolidations, we compute permanent innovations as the residuals of an $AR(1)$ model of the permanent component with a persistence calibrated to $1-\rho_2^{perm}=0.999$. We compute temporary innovations as residuals of an

([6]) A key difference between our approach and that by in't Veld (2013) and the ECB is that the degree of credibility in our setup depends on the path of government spending and is not assumed exogenously given for a fixed number of quarters.

$AR(1)$ model of the temporary component with an estimated persistence ρ^{temp}. *Signal-noise rat*ios are obtained by dividing the standard errors of both components:$\sigma_{perm}/\sqrt{1-\left(\rho_2^{perm}\right)^2}$ and

$\sigma_{temp}/\sqrt{1-(\rho^{temp})^2}$. *By this procedure, we get signal-noise ratios above 1 for Italy, Portugal, Spain and the United States. For* Germany and Ireland we obtain intermediate ratios (0.42 and 0.81, respectively), and for Greece we obtained a ratio close to 0 (0.12 to be exact).

We also consider a case in which the permanent component is assumed to follow an $AR(2)$ process and report in Table III.1.2 the parameters of the permanent component in this case. We think about this as corresponding to gradual consolidations. The higher the parameter ρ_1^{perm} the more gradual is the consolidation and the later will be the trough of the government spending cut. After the trough, government spending goes back toward zero with a slope governed by ρ_2^{perm}. *Here, we set* $\rho_1^{perm} = 0.8$ and $\rho_2^{perm} = 4.36E-04$. When we draw a single innovation at date 0, these values generate the trough after five years and bring back government spending at the same level as in the $AR(1)$ case (96% of the maximum value of the shock) after ten years (40 quarters). Concerning the standard deviation of permanent innovations, we set it for each country at a value consistent with the signal-noise ratio obtained in the $AR(1)$ case.

In following sections, we use the results for Ireland - which are in the mid-range of the SN-ratios - in our model simulations. This should give us reasonable assessment of how important credibility issues may be. Nevertheless, we acknowledge that our empirical results for Germany are counter-intuitive and we are working on refining and examining the robustness of our findings with an alternative empirical strategy.

3.1.3. Imperfect Credibility in a Stylized Small Open Eco- nomy Model

We start our model in a simple stylized DSGE model. In Section 3.4 we examine the robustness of our results in a workhorse large scale model.

3.1.3.1. Model

Our stylized model is very similar to the small open economy model of Clarida, Gali, and Gertler (2001). Households consume a domestic and foreign good that are imperfect substitutes. To rationalize Calvo-style price rigidities, the domestic good is assumed to be a comprised of a continuum of differentiated intermediate goods, each of which is produced by a monopolistically competitive firm. The government consumes some of the domestic good and finances itself through lump-sum taxes. The home economy is small in the sense that it does not influence any foreign variables, and financial markets are complete. To save space, we present only the log linearized model in which all variables are expressed as percent or percentage point deviations from their steady state levels, and we omit all foreign variables.

Under an independent monetary policy, the key equations are given by:

$$x_t = E_t x_{t+1} - \hat{\sigma}^{open}\left(i_t - E_t\,\pi_{t+1} - r_t^{pot}\right) \quad (1)$$

$$\pi_t = \beta E_t\,\pi_{t+1} + \kappa_x x_t \quad (2)$$

$$i_t = \gamma_\pi \pi_t + \gamma_x x_t \quad (3)$$

$$y_t = \hat{\sigma}^{open}\tau_t + g_y g_t + \left(1-g_y\right)(1-\omega)\nu_c \nu_t \quad (4)$$

$$y_t^{pot} = \left(\frac{1}{\varphi_{mc}\hat{\sigma}^{open}}\right)\left[g_y g_t + \left(1-g_y\right)(1-\omega)\nu_c \nu_t\right] \quad (5)$$

$$\tau_t^{pot} = -\left(\frac{1}{\hat{\sigma}^{open}}\right)\left(1-\left(\frac{1}{\varphi_{mc}\hat{\sigma}^{open}}\right)\right)[g_y g_t + (1-g_y)(1-\omega)\nu_c\nu_t] \quad (6)$$

$$r_t^{pot} = E_t\tau_{t+1}^{pot} - \tau_t^{pot} \quad (7)$$

where $\sigma^{open} = (1-g_y)[(1-\nu_c)(1-\omega)^2\sigma + \omega(2-\omega)\varepsilon_P]$ and the superscript `pot' denotes the level that would prevail under completely flexible prices.

As in Clarida et al, the first three equations represent the New Keynesian open economy IS curve, Phillips Curve, and monetary rule, respectively, that jointly determine the output gap ($x_t = y_t - y_t^{pot}$), price inflation (π_t), and the nominal policy rate (i_t). Thus, the output gap x_t *depends* inversely on the deviation of the real interest rate ($i_t - E_t\pi_{t+1}$) from the potential real interest rate r_t^{pot}, *wi*th the sensitivity parameter $\hat{\sigma}^{open}$ *varying positively with the household*'s intertemporal elasticity of substitution in consumption σ and substitution elasticity ε_P between foreign and domestic goods (the relative weight on the latter rises with trade openness ω). The Phillips curve slope κ_x in equation (2) is the product of parameters determining the sensitivity of inflation to marginal cost κ_{mc} and of marginal cost to the output gap φ_{mc}, i.e. $\kappa_x = \kappa_{mc}\varphi_{mc}$. *From* equation (5), a contraction in government spending g_t (g_y is the government spending share of steady state output) or negative taste shock v_t (v_c *is a scaling parameter) reduces potential output* y_t^{pot}. *Even so, both of these exogenous shocks, if negative, cause the the potential terms of trade* τ_t^{pot} to depreciate (a rise in τ_t^{pot} in equation 6) because they depress the marginal utility of consumption (noting $\varphi_{mc}\hat{\sigma}^{open} > 1$). If both shocks follow stationary $AR(1)$ processes, and hence have front-loaded effects, a reduction in government spending or negative taste shock reduces r_t^{pot}. *Finally, the nominal exchange rate* $e_t$equals $p_t + \tau_t$ *where* $p_t = p_{t-1} + \pi_t$.

Given that the form of the equations determining output, inflation, and interest rates is identical to that in a closed economy -- as emphasized by Clarida et al -- results from extensive closed economy analysis, e.g., Erceg and Lindé (2010a) are directly applicable for assessing the impact of government spending shocks within this open economy framework.

We next consider how the model is modified for the CU case (largely following the analysis of Corsetti et al 2011). A CU member takes the nominal exchange rate as fixed, so that the terms of trade τ_t is simply the gap between home and foreign price levels, i.e., $\tau_t = -(p_t - p_t^*) = -p_t$.([7]) Moreover, the home economy is assumed to be small enough that the policy rate is effectively exogenous. Given that equation (4) implies that the output gap is proportional to the terms of trade gap, i.e.

$$x_t = \hat{\sigma}^{open}(\tau_t - \tau_t^{pot}) \quad (8)$$

the price setting equation (2) may be expressed as a second order difference equation in the terms of trade, yielding a solution of the form:

$$\tau_t = \lambda\tau_{t-1} + \kappa_x\hat{\sigma}^{open}\frac{\lambda}{1-\beta\rho\lambda}\tau_t^{pot} \quad (9)$$

The persistence parameter $\lambda = 0.5(a - \sqrt{a^2 - \frac{4}{\beta}})$, where $a = ((1/\beta))(1 + \beta + \kappa_x\hat{\sigma}^{open})$, lies between 0 and unity, and ρ is the persistence of the shock processes (assumed to be the same for the taste shock and government spending). Equation (9) has two important implications. First, because $\lambda > 0$, a contraction in government spending -- which raises τ_t^{pot} *by* equation (6) -- moves τ_t *in the same direction, implying* a depreciation. Together with equation (4), this implies that the government spending multiplier m_t *is strictly less* than unity, i.e., $m_t = \frac{1}{g_y}\frac{dy_t}{dg_t} = 1 + \frac{\hat{\sigma}^{open}}{g_y}\frac{d\tau_t}{d\tau_t^{pot}}\frac{d\tau_t^{pot}}{dg_t} < 1$ (recalling that $\frac{d\tau_t^{pot}}{dg_t} < 0$). Second, as $\kappa_x\hat{\sigma}^{open}$ *becomes very small*, λ rises toward unity and the coefficient on τ_t^{pot}

([7]) As the real exchange rate is proportional to τ_t, we use the terms interchangeably.

shrinks, implying very gradual adjustment of the terms of trade to τ_t^{pot} (and hence to a change in government spending); conversely, the terms of trade adjustment is more rapid if $\kappa_x \hat{\sigma}^{open}$ is larger. In economic terms, the terms of trade adjusts more quickly if the Phillips Curve slope is higher (high κ_x), *or if aggre*gate demand is relatively sensitive to the terms of trade (high $\hat{\sigma}^{open}$).

3.1.3.2. The Signal extraction problem

To allow for imperfect credibility, we make the standard assumption that agents in the economy have to solve a signal extraction problem to filter out permanent (g_t^{perm}) and transient (g_t^{temp}) spending components from observed overall government spending, g_t. *Thus, total government spending is the sum o*f the permanent and temporary components which are assumed to be given by the following exogenous processes:

$$g_t - \bar{g} = (g_t^{perm} - \bar{g}) + g_t^{temp}$$

$$\Delta(g_t^{perm} - \bar{g}) = \rho_1^{(perm)} \Delta(g_{t-1}^{perm} - \bar{g}) - \rho_2^{perm} (g_{t-1}^{perm} - \bar{g}) + \frac{1}{g_y}\varepsilon_t^{perm}$$

$$g_t^{temp} = \rho^{temp} g_{t-1}^{temp} + \frac{1}{g_y}\varepsilon_t^{temp}$$

where the standard errors of $\varepsilon_{p,t}$ and $\varepsilon_{q,t}$ are denoted σ_{perm} and σ_{temp}, respectively.

These equations can be rewritten in the following state-space form:

$$g_t - \bar{g} = HZ_t$$

$$Z_t = FZ_{t-1+}\frac{1}{g_v}V_t$$

where

$$Z_t = \begin{bmatrix} g_t^{perm} - \bar{g} & g_{t-1}^{perm} - \bar{g} & g_t^{temp} \end{bmatrix}', V_t = \begin{bmatrix} \varepsilon_t^{perm} & 0 & \varepsilon_t^{temp} \end{bmatrix}' \sim N(0, Q),$$

$$F = \begin{bmatrix} 1 + p_1^{perm} - p_2^{perm} & -p_2^{perm} & 0 \\ 1 & 0 & 0 \\ 0 & 0 & p^{temp} \end{bmatrix}, H = [1 \quad 0 \quad 1], Q = \begin{bmatrix} \sigma_{perm}^2 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & \sigma_{temp}^2 \end{bmatrix}$$

In the "Full credibility" case, private agents know the present and future path of the permanent shock. In the "No credibility" case, they believe that all shocks are temporary. In the "Imperfect credibility" case, they do not observe shocks, but they learn them through Kalman filtering. This is a standard device used in the learning literature for modelling a learning process (Evans and Honkapohja, 2001), because this algorithm is optimal for extracting a signal from a given sample in real-time (Harvey, 1989).

In the "imperfect credibility" case, we assume that agents compute recursively unobserved components through the following Kalman filter:

$$Z_{t|t} = FZ_{t-1|t-1} + L_t(g_t - \bar{g} - HFZ_{t-1|t-1})$$

with $g_t - \bar{g} - HFZ_{t-1|t-1}$ the forecast error and L_t the gain of the filter, related to the Kalman gain through the formula $K_t = FL_t.L_t$ measures the weight given to forecast errors relative to previous forecasts, for updating estimates of unobserved components of government spending. In such a case, private agents would react as if government spending was hit by the 3-dimensional vector of exogenous shocks $V_{t|t} = g_y L_t(g_t - \bar{g} - HFZ_{t-1|t-1})$. ([8])

Finally, optimal forecasts of government spending at a horizon h are given by

$$g_{t+h|t} = \bar{g} + HF^h Z_{t|t}.$$

3.1.3.3. Calibration

For the calibration of the Phillips Curve parameter relating inflation to marginal cost, we set $\kappa_{mc} = .012$, towards the low end of empirical estimates (see e.g. Altig et al., 2011, Galí and Gertler, 1999, and Lindé, 2005). If factors were completely mobile, this calibration would imply mean price contract durations of about 10 quarters, but -- as emphasized by an extensive literature (e.g., Altig et al, 2011 and Smets and Wouters, 2007) -- the reduced form slope could be regarded as consistent with much shorter contract durations under reasonable assumptions about strategic complementarities.

For other parameters, we adopt a standard quarterly calibration by setting the discount factor β =0.995, and steady state net inflation π =.005 so that i =.01. We set σ =1 (log utility), the capital share α =0.3, the Frisch elasticity of labor supply $\frac{1}{\chi}$ =0.4, the government spending share g_y =0.2, and the taste shock parameter ν_c =0.01 (implying $\varphi_{mc} = \frac{\chi}{1-\alpha} + \frac{1}{\sigma^{open}} + \frac{\alpha}{1-\alpha} = 5.1$). In the absence of CU membership, monetary policy completely stabilizes output and inflation (achieved by making γ_π (or γ_x) in eq. 3 arbitrarily large). Finally, the open economy parameters ω = 0.3, and ε_p = 1.5.

For government spending, the parameters are calibrated by fitting $AR(1)$ and $AR(2)$ models to both components extracted with a HP filter of government spending (see Section 3.1.2). All the simulations in the paper are based on a calibration with the Irish signal-to-noise ratio in Table III.1.1, which appears to be in the mid-range of estimated SN-ratios. As a benchmark specification, we consider a front-loaded consolidation which we implement by letting the permanent component follow an $AR(1)$ unit root process. Subsequently, we assess the impact of a more gradual consolidation strategy, which we implement by letting the actual and permanent component follow the $AR(2)$ process specified in the Table. Still, we currently investigate, if we could estimate the signal-noise ratio by minimizing the sum of squared deviations between observed data and one year-ahead expected government spending and the corresponding inflation expectations implied by our state-space model. This distance is computed with forecasts from OECD economic outlooks from Jun-1999 to May-2013.

3.1.3.4. Results

We now proceed to discuss the quantitative results in the stylized model, assuming that the actual and permanent spending path follows an $AR(1)$ unit root process. We first discuss the reference case with independent monetary policy (Graph III.1.3), and then turn to the case where the consolidating economy is a small member of a currency union (Graph III.1.4 and 5).

3.1.3.5. Independent monetary policy

Graphs III.1.3 provide the results under IMP for three alternative assumptions about credibility. The blue solid line shows results under perfect credibility: in this case the government cuts spending aggressively with 1 percent of trend GDP today and everyone believes this cut to be near permanent, as indicated by the solid black line in the bottom panels. The dotted green line shows the "No credibility" case, in which

([8]) Notice that even if the true variance of the second state innovation is equal to 0, its filtered estimate will differ from 0 when the permanent component follows an AR(2) process.

agents in the economy in each period think that spending will revert quickly back to baseline (0) as indicated by the thin red lines in the bottom left panel. This simulation follows in't Veld (2013) by assuming that agents never update their expectations regarding the persistence of the cut although the government keeps actual spending at the same level as under perfect credibility. Finally, the red dash-dotted red line shows the "Imperfect credibility" case, in which agents solve the signal extraction problem outlined above to filter out the transient and permanent component of the spending cut. Although the spending cut is very persistent, it will take about a year before the permanent component exceeds the transient component as shown in the bottom right panel. Given our calibration of the parameters in learning process, it will take as long as 5 years before the permanent component equals 3/4 of the actual spending cut.

What are now the economic consequences of the alternative assumptions on credibility. Within the context of the simple model, the nominal exchange rate and thus the terms of trade, τ_t, depreciates considerably on impact as shown in the next-to-top right panel in the graph. This result can be shown analytically by combining eqs. (5) and (4), and recognizing that an unconstrained aggressive monetary policy rule which fully stabilizes inflation will keep actual output at its potential level (as shown by the top left and right panels in the graph). So under IMP, an aggressive policy rule with engineers a sharp depreciation of the nominal exchange rate can keep the paths for τ_t, y_t^{pot} and y_t unaffected by the degree of credibility. Even so, the effects on the potential real rate differ, implying that different levels of monetary policy are called for. In the "Perfect credibility" case, r_t^{pot} remains roughly unchanged as it is determined by the expected change in τ_t (see eq. 7). Accordingly, no major cuts in the nominal policy rate are needed, inflation and the output gap can be kept at target levels nevertheless.

In the "No credibility" case, however, r_t^{pot} will fall substantially because τ_t in each point in time is expected to start to revert (i.e. appreciate) back towards its baseline value. This happens because agents in the model do not expect that the spending cut will be long-lasting. Accordingly, the central bank needs to cut the policy rate in tandem with the fall in the potential real rate to keep output at potential and inflation at its targeted rate. The "Imperfect credibility" case is somewhere in between these two polar cases (depending on the signal-to-noise ratio) and thus requires some additional monetary policy accommodation by the central bank. To wrap up, within the context of the simple model outlined above, impaired credibility implies that some additional monetary policy accommodation is needed to ameliorate adverse effects on the output gap and inflation during front-loaded fiscal consolidations. Notice, that even when the consolidation is perfectly credible, the central bank ensures that output is kept at potential and inflation at target by engineering a sharp depreciation of the nominal exchange rate and the terms-of-trade.

3.1.3.6. Currency union membership

We now redo the same experiment as in Graph III.1.3, but assume that the consolidating economy is a small member of a currency union. In all other respects the nature of the experiment remains identical to the IMP case discussed previously.

The CU results are reported in Graph III.1.4. The direct difference w.r.t. the IMP results is that neither the nominal exchange rate nor the nominal interest rate changes, as seen in the upper panels. Because the foreign price level, p_t^*, *is unchanged (follows* from our SOE assumption), any changes in the terms-of-trade has to happen through movements in domestic inflation when the nominal exchange rate is fixed. Hence, inflation (next-to-upper-left panel in Graph III.1.4) has to fall in order for the actual τ_t *to depre*ciate and close the gap to the potential τ_t shown in the next-to-upper-right panel in Graph III.1.4. Even so, because prices are sticky inflation will not fall enough in the short-term and τ_t will therefore only depreciate gradually, resulting in an important negative terms-of-trade gap ($\tau_t - \tau_t^{pot} < 0$). This negative terms of trade gap, will trigger a negative output gap according to equation (8), and output therefore falls below its potential level, as seen in the next-to-last panel in the left column.

The CU membership thus triggers a negative output gap and a fall in the inflation regardless of whether credibility is impaired or not. Even so, the lower the ability of policy makers to establish credibility for the cuts to be long-lasting, the more adverse the effects on the economy are under CU membership. In the full credibility case, actual output falls roughly four times more than potential output, but the output gap

is closed after roughly 4 years. In the no credibility case, the sustained decline in output is about three times larger than that of potential output. The imperfect credibility case is somewhere in between; sizeable but signifcantly less persistent compared to the no credibility case. An easy way to understand why the output costs are more substantial in the no-credibility case is to look at real interest rate gap. As we noted in Graph III.1.3, the r_t^{pot} fell much more in the no-credibility case compared to full credibility. Therefore, although the actual real interest rate rises less in the NC case compared to the FC case, as seen in the next-to-bottom-right panel in Graph III.1.4, the NC case is associated with a significantly larger adverse impact on the real interest rate gap, $r_t - r_t^{pot}$, *compa*red to the FC case, and this explains why the output gap falls much less in the FC case, although the actual real interest rate rises by less in the NC case. Again, adverse impact on the real interest rate gap for the imperfect credibility case in somewhere in between these polar cases.

This latter experiment shows that CU constraints might impose significant headwinds for front-loaded aggressive consolidations to reduce output at low output costs, especially when credibility is impaired. And some papers in the literature has therefore suggested that consolidations should be implemented more gradually, as more gradual consolidations does not require the same dose of monetary accommodation as front-loaded consolidations do. We now proceed to show that impaired credibility, in addition to the monetary constraints posed by CU membership, is an additional reason to proceed in a gradual fashion.

As explained in further detail in Section, we implement a more gradual consolidation profile by letting actual and permanent spending follow an $AR(2)$-process with the parameters taken from Table III.1.2. It is imperative to understand that both the front-loaded consolidation approach studied in Graphs III.3-4 and the gradual approach studied in Graph III.1.5 features exactly the same signal-to-noise ratio; so a higher signal-to-noise ratio is not the reason why the filtered permanent component catches up so quickly with the actual spending cut in the gradual case (see lower right panel in Graph III.1.5). Instead, the reason why the filtered permanent components swamps the transient component after just two quarters is the profile of the spending cut. Under the assumption that the temporary component follows $AR(1)$ uncorrelated residuals, agents simply find it highly unlikely that several negative temporary shocks cause the gradual decline in actual spending they observe in Graph III.1.5. As such, a gradual path are more credible compared to the front-loaded path studied earlier. This is counter to the conventional wisdom, in which a front-loaded spending cut is mean to build credibility for a persistent spending cut. This intuition might be right, but our analysis makes clear it rests on "political capital" arguments, and not economic arguments.

Turning to the results in Graph III.1.5, we see that the difference between the FC and IC cases are very small, reflecting that agents quickly learn that the spending cut is very persistent. For the NC case, there are no differences as the transient component by construction will be the same regardless if the consolidation is front-loaded or gradual. But in the realistic case where there is indeed some learning, Graph III.1.5 show that private agents learn quickly that the fiscal consolidation is permanent if the consolidation is implemented gradually. Hence, the response with imperfect credibility is very close to that obtained under perfect credibility.

Since the different spending profiles in Graphs III.1.4 and 5 makes it hard to compare the relative impact on output, we compute the cumulated spending multipliers as a final exercise. Table III.1.1 shows the present value government spending multiplier as in Uhlig (2010), which at horizon K is defined as

$$m_K = \frac{1}{g_y} \frac{\sum_0^K \beta^K \Delta y_{t+K}}{\sum_0^K \beta^K \Delta g_{t+K}} \tag{10}$$

Thus, the impact multiplier m_o is simply given by $\frac{1}{g_y}\frac{\Delta y_t}{\Delta g_t}$. Table III.1.1 reports results for the impact, 4, 12, 20 and 40 quarter cumulated multipliers.

Table III.1.1: **Cumulated spending multipliers.**

	Front-loaded Consolidation					Gradual Consolidation				
	CU multiplier					CU Multiplier				
Cred. Assumption	m_0	m_4	m_{12}	m_{20}	m_{40}	m_0	m_4	m_{12}	m_{20}	m_{40}
No Credibility	0.91	0.82	0.70	0.65	0.61	0.91	0.84	0.72	0.66	0.61
Perfect Credibility	0.84	0.67	0.45	0.37	0.29	0.56	0.49	0.37	0.31	0.26
Imperf. Credibility	0.88	0.75	0.57	0.49	0.41	0.77	0.60	0.42	0.34	0.28
	IMP Multiplier - Full Stab.					IMP Multiplier - Full Stab.				
All cred. ass.	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21

Note: CU multiplier is the multiplier computed according to equation (10) using the data in Figures 3-5. m_0 is the impact multiplier, and m_K where $K = 4, 12, 20, 40$ the cumulated 1-, 3-, 5- and 10-year multiplier. The "Front-Loaded Consolidation" refers to the AR(1) case, and the "Gradual Consolidation" to the AR(2) case. IMP Multiplier is the corresponding multiplier when monetary policy is able to provide full stabilization for both consolidation profiles. The multiplier schedules are in this case invariant to all alternative credibility assumptions, and are simply reported as "All cred. ass".

Source: Authors' calculation

As can be seen from Table III.1.1, the results show that the cumulated multiplier schedule is flat under IMP which is able to keep output at its potential level. Given equation (5), this is to expected and the multiplier simply equals $\frac{1}{\varphi_{mc}\sigma^{open}}$. *It is important t*o notice though, that significantly less monetary accommodation is needed for the gradual consolidation to keep output at it potential level, implying the multiplier would be more elevated in the front-loaded case if monetary policy were able to provide less stimulus (for instance by being constrained by the effective lower bound on interest rates).

Turning to the CU results in the first three rows with multipliers, we see that the multipliers are highest in the NC case, regardless of the consolidation is gradual or front-loaded. In fact, for the NC case the short- and long-run cumulated multipliers is independent of the consolidation profile. This is expected because of the way we add unanticipated shocks to the temporary spending process to keep actual spending at the target path in the NC case. When credibility if perfect, we see that the multiplier schedule is significantly lower in the gradual case, especially in the shorter-term. The similar finding hold when agents solve the signal-extraction problem (imperfect credibility), with the interesting twist that the short-term multipliers (m_0 and m_4) are relatively high even under under a gradual profile while the long-run multiplier is substantially lower (m_{40} =0.28 instead of 0.41) and quite close to the FC long-run multiplier (which equals 0.26). However, because relatively small spending cuts are undertaken in the short run under gradual strategy, the still somewhat elevated multiplier in the short run is less damaging to the level of output compared to a front-loaded strategy. Thus, the table clearly identifies imperfect credibility as an additional reason to pursue a more gradual consolidation strategy and confirms the visual results in Graphs III.1.4 and 5. ([9])

3.1.4. Robustness in a Large-Scale Open Economy Model

In this section, we examine the robustness of our results in Section 3.1.3 in a fully-fledged open economy model. Before we turn to the results in Sections 3.1.4.3 and 3.1.4.4, we provide a model overview with a focus on the modeling of fiscal policy and discuss the calibration of some key parameters. A complete description of the model is available in Appendix A.

([9]) Note that the impact multiplier m_0 differ in the $AR(1)$ and $AR(2)$ cases for the imperfect credibility case, although the SN-ratio for the transient and permanent components are the same for both parameterizations. The identical SN-ratio implies that the agents filter out the same share of the permanent and temporary component in the first period spending is cut (about 40 percent of the total spending cut is perceived to be permanent in the first period). Nevertheless m_0 differ, because the agents, conditional on observing actual spending in period 0, expect that the path for the permanent component will differ going forward: In the $AR(1)$ case, they essentially believe the permanent component will remain unchanged; in the $AR(2)$ case, they expect the permanent spending component to fall even further in future periods (due to the specification of the $AR(2)$ process). Because the different permanent paths affect the potential and actual real rates differently and this influences agents decisions upon impact, this causes m_0 to differ under CU membership although the SN-ratio is the same.

3.1.4.1. Model

The model is adopted from Erceg and Lindé (2010, 2013) aside from some features of the fiscal policy specification (as discussed in further detail below), and consists of two countries (or country blocks) that differ in size, but are otherwise isomorphic. The first country is the home economy, or "Periphery", while the second country is referred to as the "Core." The countries share a common currency, and monetary policy is conducted by a single central bank, which adjusts policy rates in response to the aggregate inflation rate and output gap in the currency union. By contrast, fiscal policy may differ across the two blocks. Given the isomorphic structure, our exposition below largely focuses on the structure of the Periphery.

Abstracting from trade linkages, the specification of each country block builds heavily on the estimated models of Christiano, Eichenbaum and Evans (2005), CEE henceforth, and Smets and Wouters (2003, 2007), SW henceforth. Thus, the model includes both sticky nominal wages and prices, allowing for some intrinsic persistence in both component; habit persistence in consumption; and embeds a Q-theory investment specification modified so that changing the level of investment (rather than the capital stock) is costly. However, our model departs from CEE and SW in two substantive ways. First, we assume that a fraction of the households are "Keynesian", and simply consume their current after-tax income; this evidently contrasts with the analysis in our stylized model which assumed that all households made consumption decisions based on their permanent income. Galí, López-Salido and Vallés (2007) show that the inclusion of non-Ricardian households helps account for structural VAR evidence indicating that private consumption rises in response to higher government spending. Second, we incorporate a financial accelerator following the basic approach of Bernanke, Gertler and Gilchrist (1999).

On the open economy dimension, the model assumes producer currency pricing as in the benchmark model, but allow for incomplete international financial markets (the stylized model in Section 3.3 presumed complete financial markets domestically and internationally).

To analyse the behaviour of the model, we log-linearize the model's equations around the non-stochastic steady state. Nominal variables are rendered stationary by suitable transformations. To solve the unconstrained version of the model, we compute the reduced-form solution of the model for a given set of parameters using the numerical algorithm of Anderson and Moore (1985), which provides an efficient implementation of the solution method proposed by Blanchard and Kahn (1980). Since the Periphery is assumed to be very small relative to the Core country block, there is no need to take the ZLB into account as the actions of the Periphery will only have a negligible impact on the currency union as a whole.

The approach to analysing the impact of imperfect credibility for fiscal consolidation is the same as in the stylized model, but because we are also interested in assessing the implications for the evolution of government debt, some further details on the modelling of debt stabilization are in order.

As noted in the description of the model in Section 3.1.7 (Appendix A), we presume that governments in Periphery and the Core has the capability to issue debt. In our benchmark specification, we further assume that policymakers adjust labour income taxes gradually to keep both the debt/GDP ratio, b_{Gt}, *and the gross deficit,* Δb_{Gt+1}, *close to thei*r targets (denoted b^*_{Gt} and Δb^*_{Gt+1}, *respe*ctively). Thus, the labor tax rate evolves according to:

$$\tau_{Nt} - \tau_N = \nu_{\tau_0}(\tau_{Nt-1} - \tau_N) + (1 - \nu_{\tau_0})[\nu_{\tau_1}(b_{Gt} - b^*_{Gt}) + \nu_{\tau_2}(\Delta b_{Gt+1} - \Delta b^*_{Gt+1})]. \quad (11)$$

So when the government cuts the discretionary component of spending, g_t, *in order to reduce government debt, we assume that the labor income* tax τ_{Nt} will deviate from its steady state value τ_N gradually if a gap emerges between actual and desired debt and deficit levels. ([10])

([10]) Lower case letters are used to express a variable as a percent or percentage point deviation from its steady state level. Note that real government debt $b_{G,t}$ is defined as a share of steady state GDP and expressed as percentage point deviations from their steady state or "trend" values. That is, $b_{G,t} = (\frac{B_{G,t}}{P_t Y}) - b_G$, where $B_{G,t}$ is nominal government debt, P_t is the price level, and Y is real steady state output.

Our main simulations assume that the government in the Periphery desires to reduce its debt target b^*_{Gt}. *It is r*ealistic to assume that policymakers would reduce the debt target gradually to help avoid potentially large adverse consequences on output. To capture this gradualism, we assume that the (end of period t) debt target b^*_{Gt+1} follows an $AR(2)$ process:

$$b^*_{Gt+1} - b^*_{Gt} = \rho_{d_1}(b^*_{Gt} - b^*_{Gt-1}) - \rho_{d_2} b^*_{Gt} + \varepsilon_{d^*,t} \tag{12}$$

where the coefficient ρ_{d_1} is set to 0.99 and ρ_{d_2} *is* set to close to 0 (10^{-8}) so that the reduction in debt is gradual ($\rho_{d_1} > 0$) and essentially permanent ($\rho_{d_2} \approx 0$). The target path for Periphery government debt is plotted in Graph III.1.6 (black dashed line) and is set so that it closely mimics the actual debt path under full credibility (the blue solid line). Thus, in the full credibility case, there is little movement of the labour income tax rate as the gap between actual and desired debt and deficit levels is negligible.

The Core is assumed to simply follow an endogenous tax rule as in (11), but does not change its debt target.

3.1.4.2. Calibration

Here we discuss the calibration of the key parameters pertaining to fiscal policy and trade; the remaining parameters − which are adopted from Erceg and Lindé (2013) − are reported and discussed in Appendix A.

The model is calibrated at a quarterly frequency. Structural parameters are set at identical values for each of the two country blocks, except for the parameter ζ determining population size (as discussed below), the fiscal rule parameters, and the parameters determining trade shares.

The parameters pertaining to fiscal policy are intended to roughly capture the revenue and spending sides of euro area government budgets. The share of government spending on goods and services is set equal to 23 percent of steady state output. The government debt to GDP ratio, b_G, *is* set to 0.75, roughly equal to the average level of debt in euro area countries at end-2008. The ratio of transfers to GDP is set to 20 percent. The steady state sales (i.e., VAT) tax rate τ_C is set to 0.2, while the capital tax τ_K is set to 0.30. Given the annualized steady state real interest rate (2 percent), the government's intertemporal budget constraint then implies that the labour income tax rate τ_N equals 0.42 in steady state. The coefficients of the tax adjustment rule (11) are set so that labour income taxes respond very gradually, which is achieved by setting ν_{τ_0} =0.985 and $\nu_{\tau_1} = \nu_{\tau_2}$ =.1. This implies that τ_{Nt} *in the l*ong-run is decreased (increased) by 0.1 percentage points in response to target deviations from debt ($b_{Gt} - b^*_{Gt}$) and deficit ($\Delta b_{Gt+1} - \Delta b^*_{Gt+1}$) with 1 percentage points. However, because ν_{τ_0} is set close to unity, the short-run response is substantially smaller. For the Core, we assume the same unaggressive tax rule.

The size of the Periphery is calibrated to be a very small shares of euro area GDP, so that ζ =0.02. This corresponds to the size of Greece, Ireland or Portugal in euro area GDP. Identifying the mentioned countries as the Periphery to calibrate trade shares, the average share of imports of the Periphery from the remaining countries of the euro area was about 14 percent of GDP in 2008 (based on Eurostat). This pins down the trade share parameters ω_C and ω_I for the Periphery under the additional assumption that the import intensity of consumption is equal to 3/4 that of investment. Given that trade is balanced in steady state, this calibration implies a very small export and import share for the Core countries as share of GDP.

3.1.4.3. Benchmark results

The results in the benchmark calibration of the workhorse model are reported in Graph III.1.6 for the CU case. By comparing the paths for government spending in the bottom panels to those in Graphs III.1.3 and 4, we see that they are the same as those in the stylized model when the permanent spending component follows an $AR(1)$-process. This ensures us that the modelling of government spending is identical as that in the simple model.

Turning to the other variables, we see that the main features of the results are very similar to those reported for the stylized model. The potential real rate falls the most in the "No credibility" case and the

least under "Perfect credibility", but because the Periphery is a small member of the currency union, nominal interest rates in the Periphery and the Core are essentially unaffected (as can be seen from the upper panels). As a result, inflation and output falls substantially more when credibility is impaired and progress to reduce debt is significantly slower, implying that a large wedge between actual and the target level of government debt opens up. This is particularly the case under "No credibility", when debt is essentially unaffected for almost three years in our calibration. The unresponsiveness of government debt to GDP ratio in this case reflects lower tax revenues and higher service costs of debt, plus the fact that GDP itself falls.

3.1.4.4. Results with endogenous spreads

In the benchmark calibration of the model, we assumed that interest rates faced by the government and banks in the Periphery and Core were equal to the currency area interest rate set by the CU central bank (notwithstanding a tiny difference to imply stationary dynamics of Periphery net foreign assets). To examine conditions under which fiscal consolidation may be expansionary, we follow Erceg and Lindé (2010) and Corsetti, Kuester, Meier and Muller (2012) and assume that the interest rate faced by the government and banks in the Periphery equals the interest rate set by the CU central bank plus a risk-spread that depends positively on the government deficit and debt level. If we let i_t^{Per} denote the interest rate in Periphery, we thus have

$$i_t^{Per} - i_t = \psi_b(b_{Gt+1} - b_G) + \psi_d(b_{Gt+1} - b_{Gt}), \tag{13}$$

where we recall that b_{Gt+1} *is t*he end-of-period t government debt level and i_t *the* interest rate set by the CU central bank. The specification in (13) is motivated by the spread equation estimated by Laubach (2010) for the Euro area, and captures the idea that countries with high government deficits and debt levels face higher spreads due to a higher risk of default. There is a substantial empirical literature that has examined the question of whether higher deficits and debt lead to increasing interest rates, but it has provided at best mixed evidence in favour of positive values of ψ_b and ψ_d, *see e.g.* Evans (1985, 1987). However, the papers in this literature have typically used data from both crisis periods and non-crisis periods, and as argued by Laubach (2010) this approach is likely to bias downward the estimates, as the parameters tend to be positive in crisis periods only (close to zero in non-crisis periods). As we are examining the effects of fiscal consolidations under fiscal stress (i.e. high actual and projected debt and deficit) periods, we believe it is worthwhile to entertain the assumption that ψ_b *and* ψ_d are both positive.

As a tentative calibration, we set ψ_b =0.025 and ψ_d =0.05, implying that a one percent decline in government debt decreases the spread by 2.5 basis points, and that a one percent decline in the budget deficit decreases the spread with 5 basis points. While these elasticities are somewhat on the upper side relative to the evidence reported by Laubach (2010), they are nevertheless useful to help gauge the potential implications of this channel. All other aspects of the experiment remain the same as in Section 3.1.4.3.

The results with endogenous spreads are reported in Graph III.1.7. As seen from the figure, the output costs of aggressive spending-based consolidation can be reduced substantially if long-term interest rate spreads fall (upper left panel), especially when the degree of credibility to follow through and make the spending cuts permanent is high. In our specific calibration, long-term spreads in the Periphery fall enough in order for the consolidation to have expansionary effects on the economy after roughly two years even under imperfect credibility (dash-dotted red line).

Consequently, these results present a favourable case for the view that aggressive consolidation can be an efficient tool to reduce public debt at low output cost. However, it is important to point out that this finding hinges crucially on how the consolidation program is implemented, and the results may be much less benign under an alternative – arguably equally empirically realistic – modelling of the consolidation program.

Specifically, we assume the government drops the gradual labour income tax rule (11) and instead uses government spending entirely to achieve its fiscal targets. Thus, total government spending (g_t^{tot}) is now comprised of an endogenous component, denoted g_t^{endo} henceforth, as well the discretionary component

g_t which is the same as before. Following Erceg and Linde (2013), g_t^{endo} is assumed to adjust endogenously according to the rule:

$$g_t^{endo} = \nu_{g0} g_{t-1}^{endo} + (1 - \nu_{g0})[\nu_{g1}(b_{Gt} - b_{Gt}^*) + \nu_{g2}(\Delta b_{Gt+1} - \Delta b_{Gt+1}^*)]. \quad (14)$$

In this alternative specification, the Periphery labor income tax rate is assumed to be constant (at its steady state value of τ_N); however, the Core is still assumed to use the labor income tax rule to stabilize debt. We assume rather aggressive coefficients in the spending rule (14) by setting ν_{g0} =0.8, ν_{g1} =-1 and ν_{g2} =-0.5. Given our steady-state share of government spending (0.23), these coefficients imply that g_t^{endo} in the long-run is decreased by 0.25 and 0.125 percent of trend GDP, respectively, in response to target deviations from debt ($b_{Gt} - b_{Gt}^*$) and deficit ($\Delta b_{Gt+1} - \Delta b_{Gt+1}^*$). In the short-run, our choice of ν_{g0} implies that the response is reduced by 4/5.

In Graph III.1.8 we compare results of the gradual labour income tax rule with the above-mentioned more aggressive spending-based rule to stabilize debt and deficts around their targets when interest rate spreads are endogenous. We focus on the case with imperfect credibility, implying that the results for the solid blue lines just restate the results in the dash-dotted red lines in Graph III.1.7.

From the figure, we see that the results for the more aggressive spending-based rule are much less benign. In a nut-shell, the government ends up chasing its own tail and cuts spending too much in the near-term and therefore cause output to fall a lot and debt to rise in the short− and medium-term. Reflecting the rise in government debt and deficits, interest rate spreads therefore go up in the short-- and medium-term before starting to fall.

3.1.5. Conclusions

Our paper has focused on the economic implications imperfect credibility have for expenditure-based fiscal consolidation. We have found that the role of credibility is likely to be less of an issue if monetary policy can provide suitable degree of accommodation − as under an IMP − whereas imperfect credibility may be a source of substantially larger output losses when monetary policy is constrained by CU membership (or the ZLB). In this latter situation, progress in reducing government debt as share of GDP may also be significantly slower.

Although we have focused on only one type of spending cuts to highlight the importance of monetary constraints for fiscal consolidation, actual consolidation programs deploy a wide array of fiscal spending adjustments. The transmission of these alternative fiscal measures to the real economy may differ substantially from the one considered, with potentially important consequences. For instance, infrastructure spending presumably boosts the productivity of private capital, while spending on education enhances the longer-term productivity of the workforce. Accordingly, cuts in these areas would presumably have more adverse effects on the economy's longer-term potential output than in our framework which does not take account of these effects, and possibly weaken aggregate demand more even at shorter horizons. On the other hand, reducing certain types of transfers might have less adverse effects than the cuts we consider, particularly in the long-run. For example, a gradual tightening of eligibility requirements for unemployment benefits might well reduce the natural rate of unemployment in the long-run, and hence raise potential output. ([11]) In future research, it would be desirable to extend our modelling framework to better capture the implications of a wider range of potential spending cuts.

Some other extensions of the basic modelling framework would also seem useful. First, it would be of interest to extend our approach to imperfect credibility with the approach of Debortoli and Nunes (2012). Finally, our model assumes that the government issues only one period nominal debt. Allowing for

([11]) The near-term effects of transfers is likely to depend on how the transfers are distributed across house- holds. In this vein, recent research using large-scale policy models (Coenen et al, 2012) suggests that cuts in transfers that are concentrated on households facing liquidity constraints - the HM households in our setup- are likely to be associated with a larger multiplier compared to cuts to general transfers to all households.

multi-period nominal liabilities could have potentially important consequences for the evolution of government debt.

3.1.6. References

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Further TABLE and GRAPHS

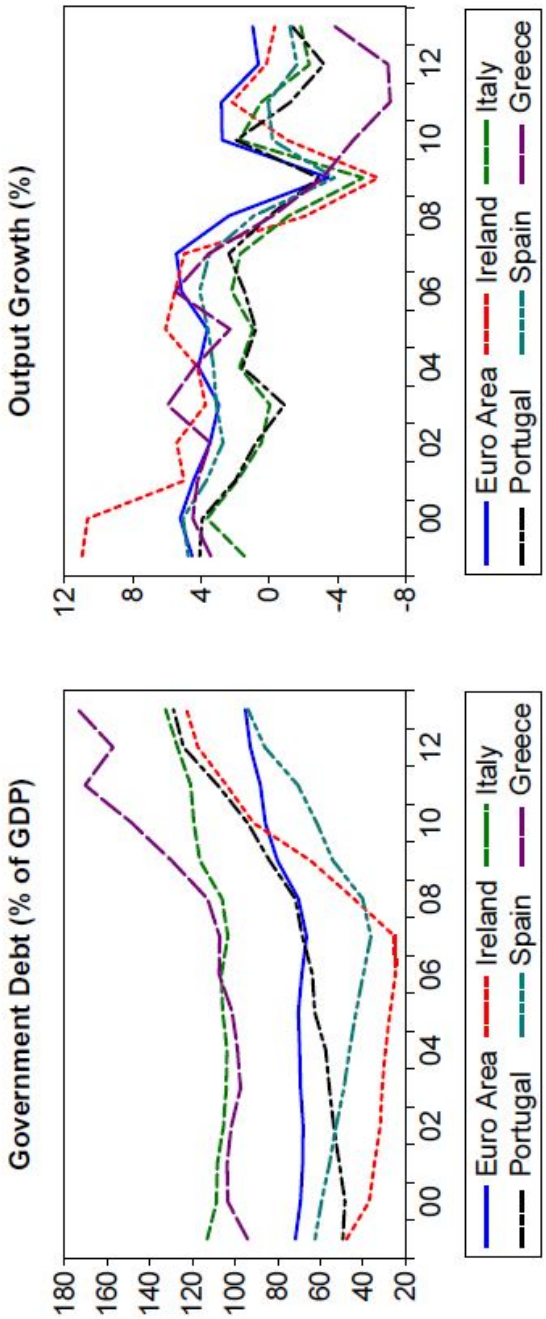
Table III.1.2: **Parameters of the government spending process**

	IR	IT	PT	SP	GR	GE	US
Parameters of the permanent component in the AR(1) case							
$\rho_{g,1}^p$	0	0	0	0	0	0	0
$\rho_{g,2}^p$	0.001	0.001	0.001	0.001	0.001	0.001	0.001
σ_g^p	8.36E-04	8.99E-04	9.69E-04	5.17E-04	1.19E-04	1.62E-04	6.41E-04
Parameters of the permanent component in the AR(2) case							
$\rho_{g,1}^p$	0.8	0.8	0.8	0.8	0.8	0.8	0.8
$\rho_{g,2}^p$	4.36E-04	4.36E-04	4.36E-04	4.36E-04	4.36E-04	4.36E-04	4.36E-04
σ_g^p	2.47E-04	2.66E-04	2.86E-04	1.53E-04	3.50E-05	4.78E-05	1.89E-04
Other parameters in both cases							
ρ_g^t	0.78	0.91	0.88	0.46	0.63	0.67	0.76
σ_g^t	1.44E-02	3.87E-03	4.50E-03	6.00E-03	1.69E-02	6.38E-03	6.49E-03
SNR	0.81	2.16	2.28	1.71	0.12	0.42	1.44

Legend: signal-noise ratios (SNR) follow the formula: $SNR = \frac{\sigma_g^p}{\sqrt{1-(\rho_g^p)^2}} / \frac{\sigma_g^t}{\sqrt{1-(\rho_g^t)^2}}$.

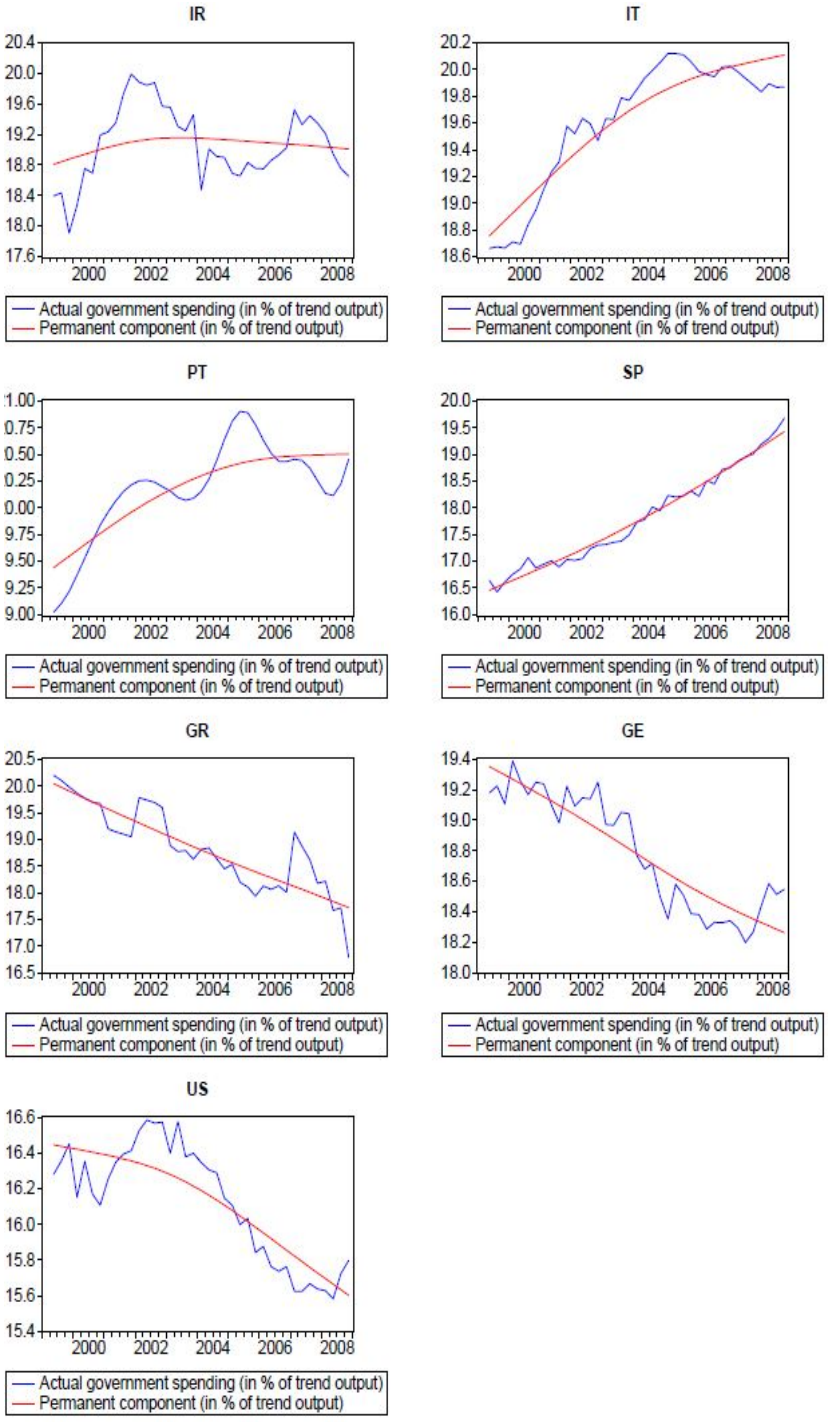
Source: Authors' calculation

Graph III.1.1: **Debt and growth in peripheral economies and the Euro area**



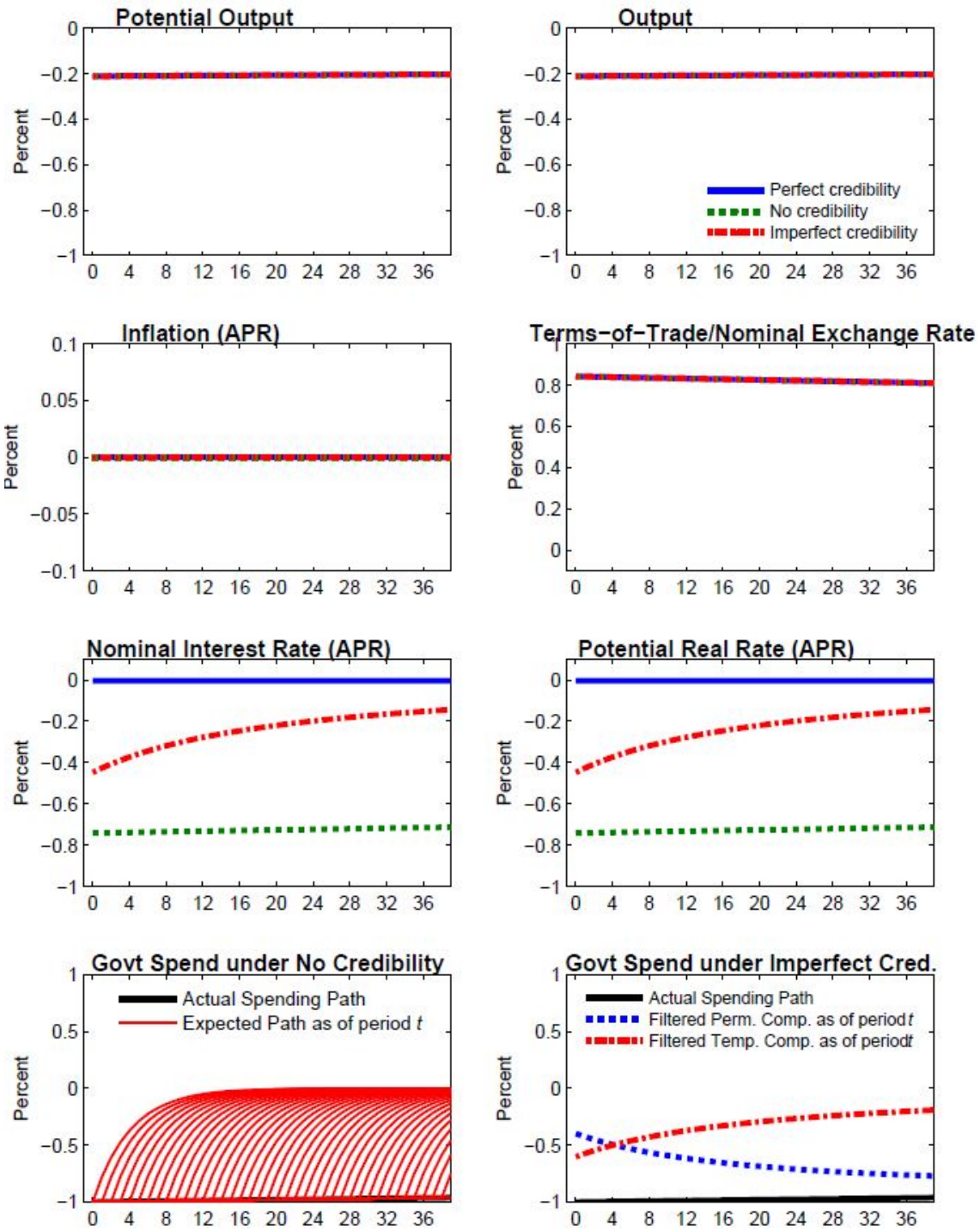
Source: Authors' calculation

Graph III.1.2: **Decomposing government spending into permanent and temporary components**



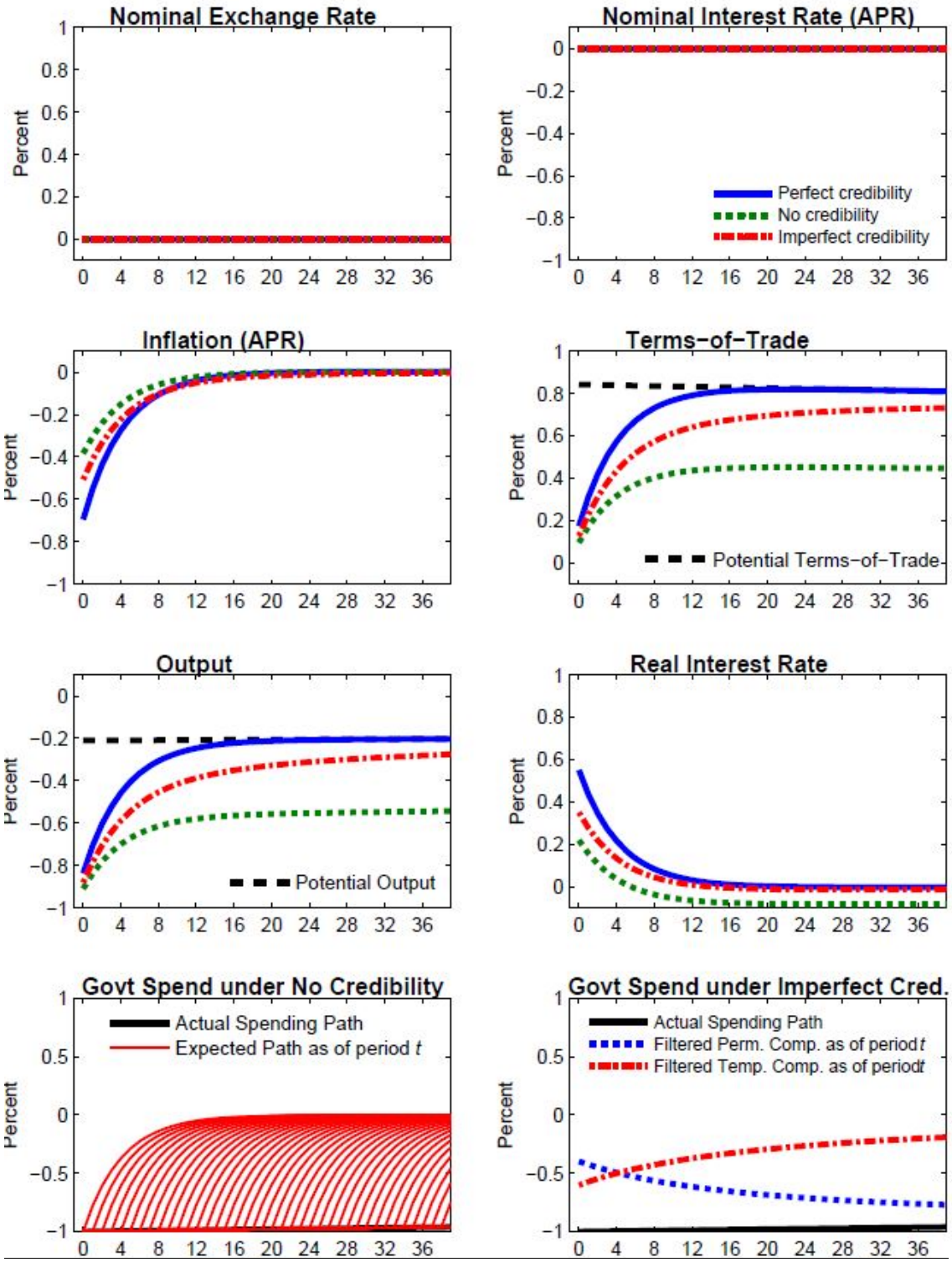
Source: Authors' calculation

Graph III.1.3: **Fiscal consolidation under alternative assumptions about credibility: independent monetary policy.**



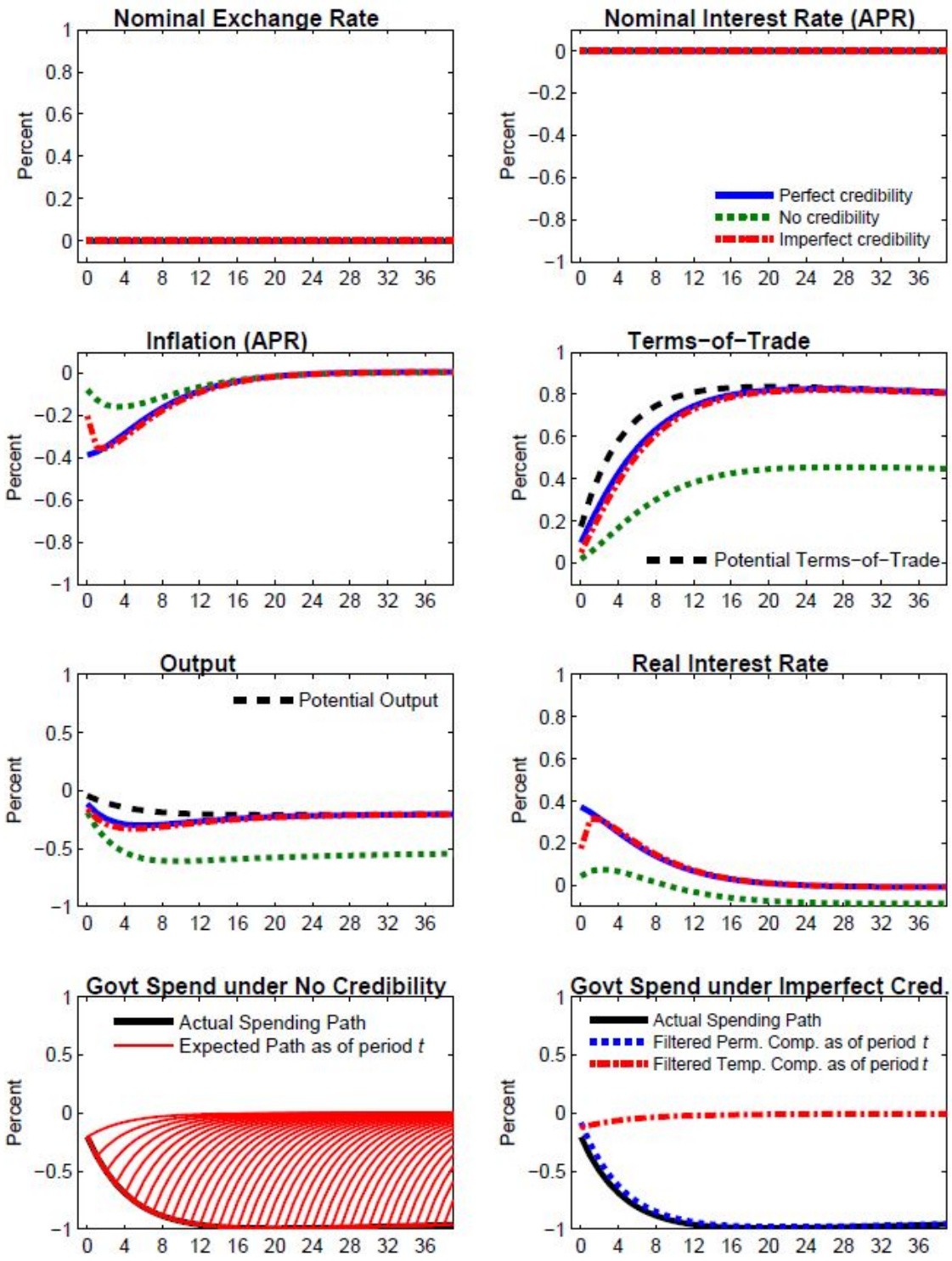
Source: Authors' calculation

Graph III.1.4: **Fiscal consolidation under alternative assumptions about credibility in a currency union.**



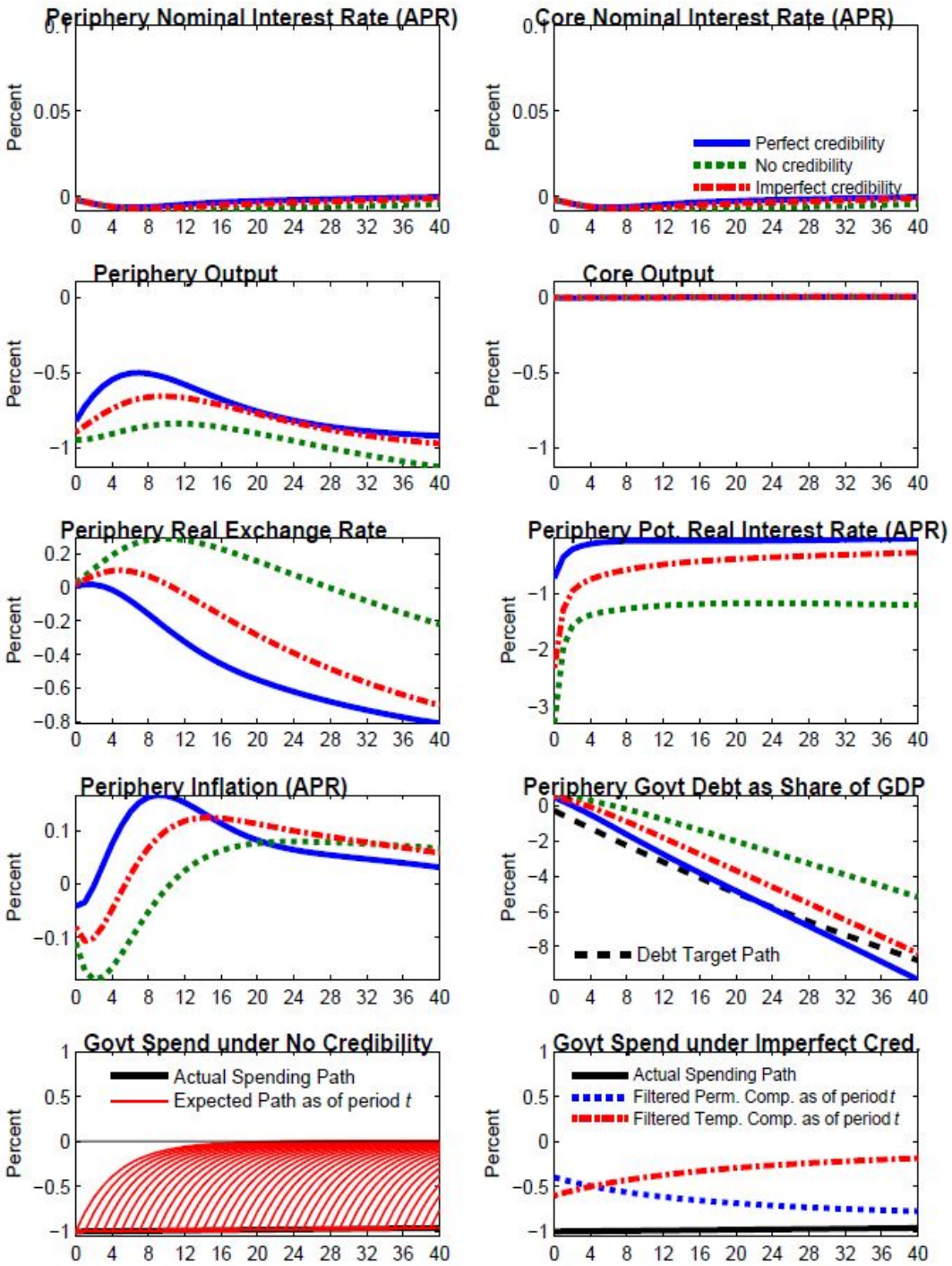
Source: Authors' calculation

Graph III.1.5: **Gradual fiscal consolidation under currency union membership**



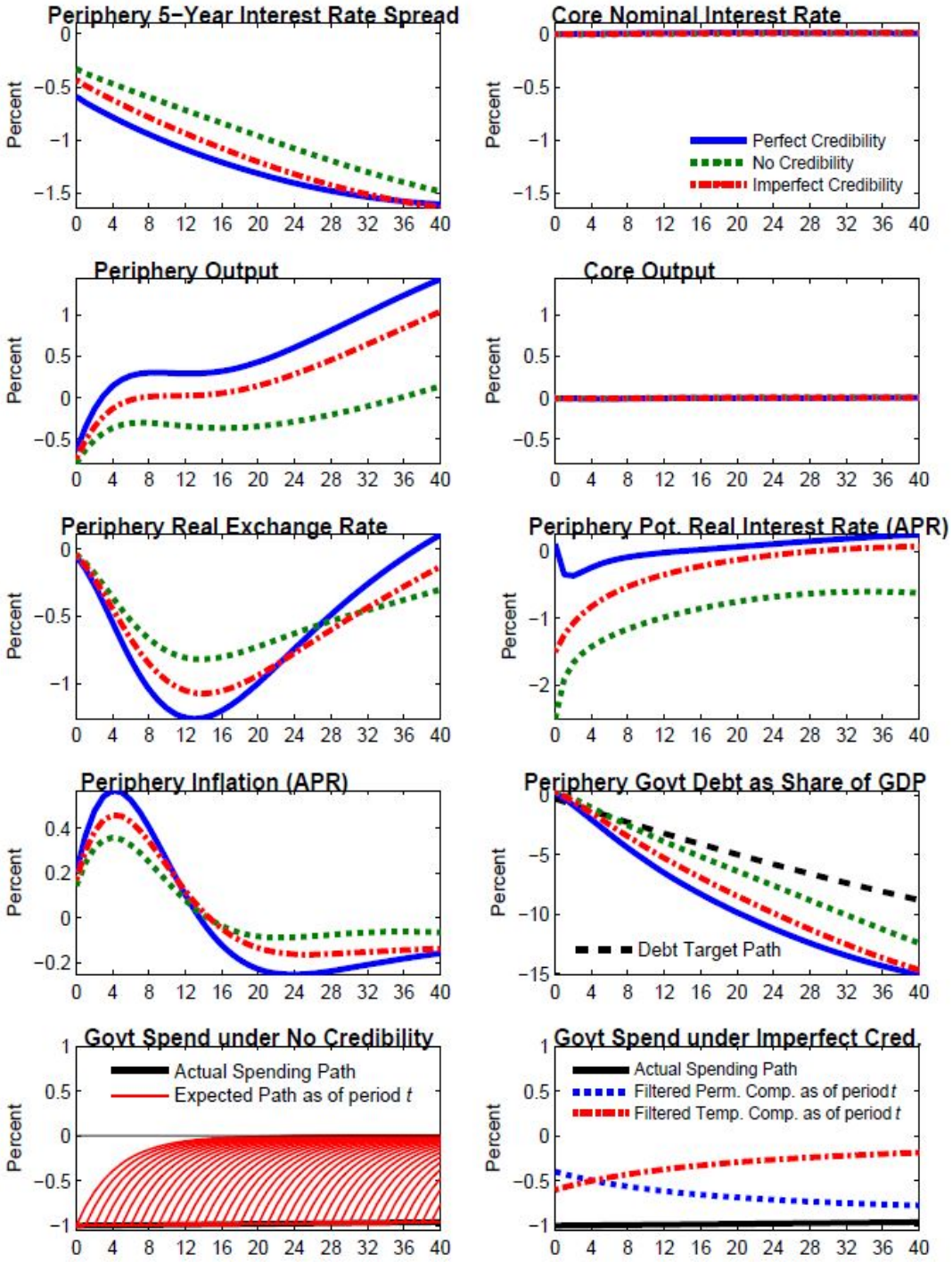
Source: Authors' calculation

Graph III.1.6: **Fiscal consolidation in large scale model in a currency union under alternative credibility assumptions for the periphery.**



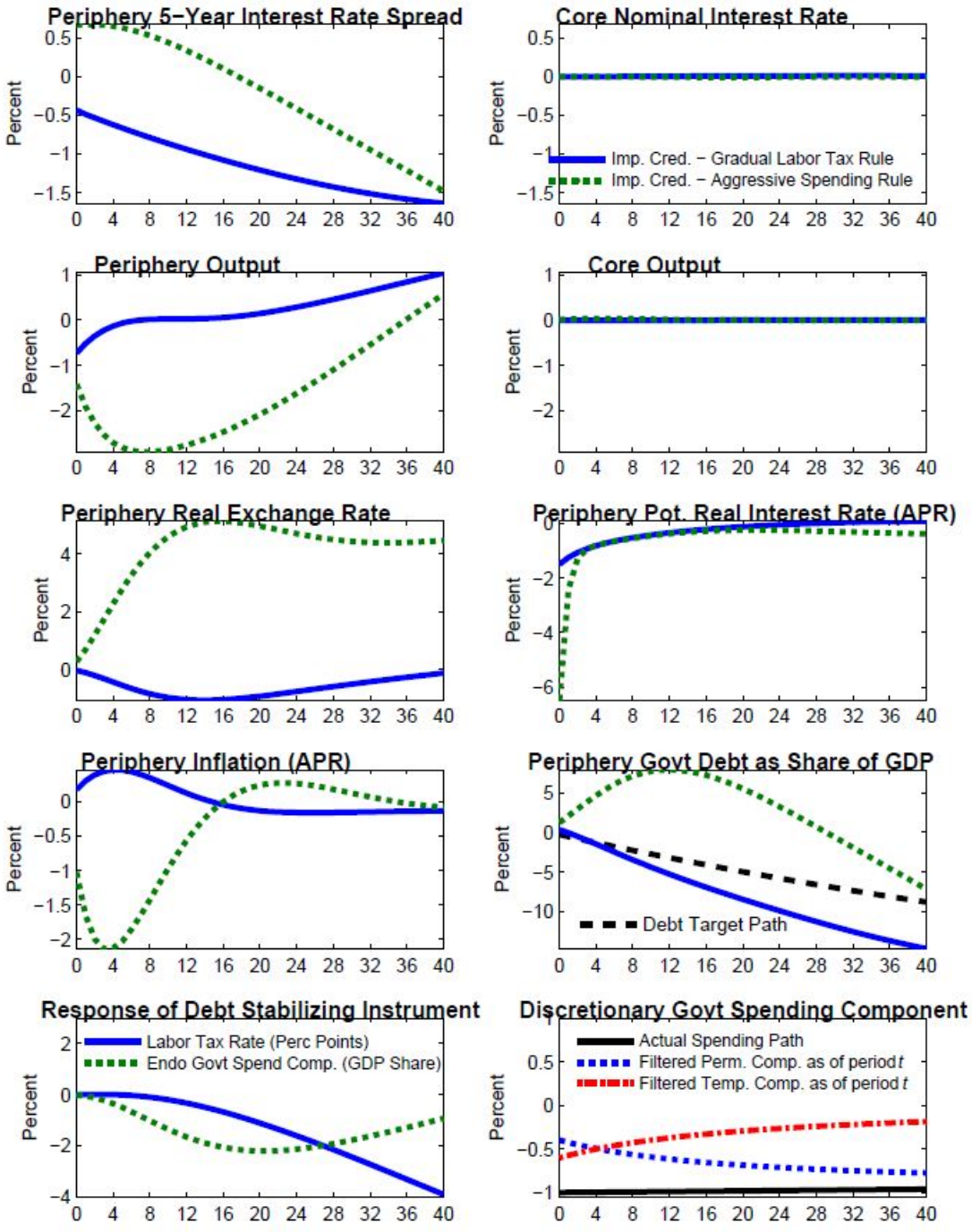
Source: Authors' calculation

Graph III.1.7: **Fiscal consolidation in large scale model in currency union when allowing for endogenous interest rate spreads: gradual tax debt rule.**



Source: Authors' calculation

Graph III.1.8: **Fiscal consolidation in large scale model in currency union with endogenous Int. rate spreads: aggressive spending vs. gradual tax debt rule.**



Source: Authors' calculation

3.1.7. Appendix A – The Large-scale open economy model

Following Erceg and Lindé (2013), this appendix contains a complete description of the large-scale model used in Section 3.1.3.4.

As the recent recession has provided strong evidence in favour of the importance of financial frictions, our model also features a financial accelerator channel which closely parallels earlier work by Bernanke, Gertler, and Gilchrist (1999) and Christiano, Motto, and Rostagno (2008). Given that the mechanics underlying this particular financial accelerator mechanism are well-understood, we simplify our exposition by focusing on a special case of our model which abstracts from a financial accelerator. We conclude our model description with a brief description of how the model is modified to include the financial accelerator (Section 3.1.7.6).

3.1.7.1. Firms and price setting

Production of domestic intermediate goods

There is a continuum of differentiated intermediate goods (indexed by $i \in [0,1]$) in the Periphery, each of which is produced by a single monopolistically competitive firm. In the domestic market, firm i faces a demand function that varies inversely with its output price $P_{Dt}(i)$ and directly with aggregate demand at home Y_{Dt} :

$$Y_{Dt}(i) = \left[\frac{P_{Dt}(i)}{P_{Dt}}\right]^{\frac{-(1+\theta_p)}{\theta_p}} Y_{Dt} \tag{A.1}$$

where $\theta_p > 0$, and P_{Dt} is an aggregate price index defined below. Similarly, firm i faces the following export demand function:

$$X_t(i) = \left[\frac{P^*_{Mt}(i)}{P^*_{Mt}}\right]^{\frac{-(1+\theta_p)}{\theta_p}} M^*_t \tag{A.2}$$

where $X_t(i)$ denotes the quantity demanded of domestic good i in the Core block, $P^*_{Mt}(i)$ denotes the price that firm i sets in the Core market, P^*_{Mt} is the import price index in the Core, and M^*_t is an aggregate of the Core's imports (we use an asterisk to denote the Core's variables).

Each producer utilizes capital services $K_t(i)$ and a labor index $L_t(i)$ (defined below) to produce its respective output good. The production function is assumed to have a constant-elasticity of substitution (CES) form:

$$Y_t(i) = \left(\omega_K^{\frac{\rho}{1+\rho}} K_t(i)^{\frac{1}{1+\rho}} + \omega_L^{\frac{\rho}{1+\rho}} \left(Z_t L_t(i)\right)^{\frac{1}{1+\rho}}\right)^{1+\rho} \tag{A.3}$$

The production function exhibits constant-returns-to-scale in both inputs, and Z_t is a country-specific shock to the level of technology. Firms face perfectly competitive factor markets for hiring capital and labour. Thus, each firm chooses $K_t(i)$ and $L_t(i)$, taking as given both the rental price of capital R_{Kt} *and the aggr*egate wage index W_t (defined below). Firms can costlessly adjust either factor of production, which implies that each firm has an identical marginal cost per unit of output, MC_t. *The* (log-linearized) technology shock is assumed to follow an $AR(1)$ process:

$$z_t = \rho_z z_{t-1} + \varepsilon_{z,t} \tag{A.4}$$

We assume that purchasing power parity holds, so that each intermediate goods producer sets the same price $P_{Dt}(i)$ in both blocks of the currency union, implying that $P^*_{Mt}(i) = P_{Dt}(i)$ and that $P^*_{Mt} = P_{Dt}$. *The prices of* the intermediate goods are determined by Calvo-style staggered contracts (see Calvo, 1983). In each period, a firm faces a constant probability, $1 - \xi_p$, of being able to re-optimize its price ($P_{Dt}(i)$). This probability of receiving a signal to reoptimize is independent across firms and time. If a firm is not allowed to optimize its prices, we follow Christiano, Eichenbaum and Evans (2005) and Smets and Wouters (2003), and assume that the firm must reset its home price as a weighted combination of the

lagged and steady state rate of inflation $P_{Dt}(i) = \pi_{t-1}^{\iota_p} \pi^{1-\iota_p} P_{Dt-1}(i)$ for the non-optimizing firms. This formulation allows for structural persistence in price-seeing if ι_p exceeds zero.

When a firm i is allowed to reoptimize its price in period t, the firm maximizes:

$$\max_{P_{Dt}(i)} E_t \sum_{j=0}^{\infty} \psi_{t,t+j} \xi_p^j \left[\prod_{h=1}^{j} \pi_{t+h-1} \left(P_{tD}(i) - MC_{t+j} \right) \left(Y_{Dt+j}(i) + X_t(i) \right) \right] \tag{A.5}$$

The operator E_t *represents the c*onditional expectation based on the information available to agents at period t. The firm discounts profits received at date $t + j$ by the state-contingent discount factor $\psi_{t,t+j}$; *f*or notational simplicity, we have suppressed all of the state indices. ([12])

The first-order condition for setting the contract price of good i is:

$$E_t \sum_{j=0}^{\infty} \psi_{t,t+j} \xi_p^j \left(\frac{\prod_{h=1}^{j} \pi_{t+h-1}(i) P_{Dt}(i)}{(1+\theta_p)} \right) - MC_{t+j}(Y_{Dt+j}(i) + X_t(i)) = 0 \tag{A.6}$$

Production of the Domestic Output Index

Because households have identical Dixit-Stiglitz preferences, it is convenient to assume that a representative aggregator combines the differentiated intermediate products into a composite home-produced good Y_{Dt}:

$$Y_{Dt} = \left[\int_0^1 Y_{Dt}(i)^{\frac{1}{1+\theta_p}} di \right]^{1+\theta_p} \tag{A.7}$$

The aggregator chooses the bundle of goods that minimizes the cost of producing Y_{Dt}, *taking* the price $P_{Dt}(i)$ of each intermediate good $Y_{Dt}(i)$ as given. The aggregator sells units of each sectoral output index at its unit cost P_{Dt}*:*

$$P_{Dt} = \left[\int_0^1 P_{Dt}(i)^{\frac{-1}{\theta_p}} di \right]^{-\theta_p}. \tag{A.8}$$

We also assume a representative aggregator in the Core who combines the differentiated Periphery products $X_t(i)$ into a single index for foreign imports:

$$M_t^* = \left[\int_0^1 X_t(i)^{\frac{1}{1+\theta_p}} di \right]^{1+\theta_p} \tag{A.9}$$

and sells M_t^* at price P_{Dt}.

Production of consumption and investment goods

Final consumption goods are produced by a representative consumption goods distributor. This firm combines purchases of domestically-produced goods with imported goods to produce a final consumption good (C_{At}) according to a constant-returns-to-scale CES production function*:*

([12]) We define $\xi_{t,t+j}$ to be the price in period t of a claim that pays one dollar if the specified state occurs in period $t + j$ (see the household problem below); then the corresponding element of $\psi_{t,t+j}$ equals $\xi_{t,t+j}$ divided by the probability that the specified state will occur.

$$C_{At} = \left(\omega_C^{\frac{\rho_C}{1+\rho_C}} C_{Dt}^{\frac{1}{1+\rho_C}} + (1-\omega_C)^{\frac{\rho_C}{1+\rho_C}} (\phi_{Ct} M_{Ct})^{\frac{1}{1+\rho_C}} \right)^{1+\rho_C} \tag{A.10}$$

where C_{Dt} *denotes th*e consumption good distributor's demand for the index of domestically-produced goods, M_{Ct} *denotes th*e distributor's demand for the index of foreign-produced goods, and ϕ_{Ct} reflects costs of adjusting consumption imports. The final consumption good is used by both households and by the government. The form of the production function mirrors the preferences of households and the government sector over consumption of domestically-produced goods and imports. Accordingly, the quasi-share parameter ω_C *may b*e interpreted as determining the preferences of both the private and public sector for domestic relative to foreign consumption goods, or equivalently, the degree of home bias in consumption expenditure. Finally, the adjustment cost term ϕ_{Ct} *i*s assumed to take the quadratic form:

$$\phi_{Ct} = \left[1 - \frac{\phi_{M_C}}{2} \left(\frac{\frac{M_{Ct}}{C_{Dt}}}{\frac{M_{Ct-1}}{C_{Dt-1}}} - 1 \right)^2 \right] \tag{A.11}$$

This specification implies that it is costly to change the proportion of domestic and foreign goods in the aggregate consumption bundle, even though the level of imports may jump costlessly in response to changes in overall consumption demand.

Given the presence of adjustment costs, the representative consumption goods distributor chooses (a contingency plan for) C_{Dt} and M_{Ct} to minimize its discounted expected costs of producing the aggregate consumption good:

$$\min_{(C_{Dt+k}, M_{Ct+k})} E_t \sum_{k=0}^{\infty} \psi_{t,t+k} \left\{ (P_{Dt+k} C_{Dt+k} + P_{Mt+k} M_{Ct+k}) + P_{Ct+k} \left[C_{A,t+k} - \left(\omega_C^{\frac{\rho_C}{1+\rho_C}} C_{Dt+k}^{\frac{1}{1+\rho_C}} + (1-\omega_C)^{\frac{\rho_C}{1+\rho_C}} (\phi_{Ct+k} M_{Ct+k})^{\frac{1}{1+\rho_C}} \right)^{1+\rho_C} \right] \right\} \tag{A.12}$$

The distributor sells the final consumption good to households and the government at a price P_{Ct}, which may be interpreted as the consumption price index (or equivalently, as the shadow cost of producing an additional unit of the consumption good).

We model the production of final investment goods in an analogous manner, although we allow the weight ω_I *in the investment index to differ from that of th*e weight ω_C *in the co*nsumption goods index. ([13])

3.1.7.2. Households and wage setting

We assume a continuum of monopolistically competitive households (indexed on the unit interval), each of which supplies a differentiated labour service to the intermediate goods-producing sector (the only producers demanding labour services in our framework) following Erceg, Henderson and Levin (2000). A representative labour aggregator (or "employment agency") combines households' labour hours in the same proportions as firms would choose. Thus, the aggregator's demand for each household's labour is equal to the sum of firms' demands. The aggregate labour index L_t has the Dixit-Stiglitz form*:*

$$L_t = \left[\int_0^1 \left(\zeta N_t(h) \right)^{\frac{1}{1+\theta_w}} dh \right]^{1+\theta_w} \tag{A.13}$$

where $\theta_w > 0$ and $N_t(h)$ is hours worked by a typical member of household h. The parameter ζ is the size of a household of type h, and effectively determines the size of the population in the Periphery. The aggregator minimizes the cost of producing a given amount of the aggregate labour index, taking each

([13]) Notice that the final investment good is not used by the government.

household's wage rate $W_t(h)$ as given, and then sells units of the labor index to the production sector at their unit cost W_t:

$$W_t = \left[\int_0^1 W_t(h)^{\frac{-1}{\theta_w}} dh\right]^{-\theta_w} \tag{A.14}$$

The aggregator's demand for the labour services of a typical member of household h is given by

$$N_t(h) = \left[\left(\frac{W_t(h)}{W_t}\right)\right]^{-\frac{1+\theta_w}{\theta_w}} L_t/\zeta \tag{A.15}$$

We assume that there are two types of households: households that make intertemporal consumption, labour supply, and capital accumulation decisions in a forward-looking manner by maximizing utility subject to an intertemporal budget constraint (FL households, for "forward-looking"); and the remainder that simply consume their after-tax disposable income (HM households, for "hand-to-mouth" households). The latter type receive no capital rental income or profits, and choose to set their wage to be the average wage of optimizing households. We denote the share of FL households by $1-\varsigma$ and the share of HM households by ς.

We consider first the problem faced by FL households. The utility functional for an optimizing representative member of household h is

$$E_t \sum_{j=0}^{\infty} \beta^j \left\{ \frac{1}{1-\sigma}\left(C^O_{t+j}(h) - \varkappa C^O_{t+j-1} - \nu_{ct}\right)^{1-\sigma} + \frac{\chi_0 Z_{t+j}^{1-\sigma}}{1-\chi}\left(1 - N_{t+j}(h)\right)^{1-\chi} + \mu^0 F\left(\frac{MB_{t+j+1}(h)}{P_{Ct+j}}\right)\right\} \tag{A.16}$$

where the discount factor β satisfies $0< \beta <1$. As in Smets and Wouters (2003, 2007), we allow for the possibility of external habit formation in preferences, so that each household member cares about its consumption relative to lagged aggregate consumption per capita of forward-looking agents C^O_{t-1}. *The* period utility function depends on an each member's current leisure $1-N_t(h)$, his end-of-period real money balances, $\frac{MB_{t+1}(h)}{P_{Ct}}$, *and a* preference shock, ν_{ct}. *The subutility* function $F(.)$ over real balances is assumed to have a satiation point to account for the possibility of a zero nominal interest rate; see Eggertsson and Woodford (2003) for further discussion. ([14])

The (log-linearized) consumption demand shock ν_{ct} *is assumed to f*ollow an AR(1) process:

$$\nu_{ct} = \rho_\nu \nu_{ct-1} + \varepsilon_{\nu_c,t.} \tag{A.17}$$

Forward-looking household h faces a flow budget constraint in period t which states that its combined expenditure on goods and on the net accumulation of financial assets must equal its disposable income

$$P_{Ct}(1+\tau_{Ct})C^O_t(h) + P_{It}I_t(h) + MB_{t+1}(h) - MB_t(h) + \int_s \xi_{t,t+1}B_{Dt+1}(h) \tag{A.18}$$

$$-B_{Dt}(h) + P_{Bt}B_{Gt+1} - B_{Gt} + \frac{P^*_{Bt}B_{Ft+1}(h)}{\varphi_{bt}} - B_{Ft}(h)$$

$$= (1-\tau_{Nt})W_t(h)N_t(h) + \Gamma_t(h) + TR_t(h) + (1-\tau_{Kt})R_{Kt}K_t(h) +$$

$$P_{It}\tau_{Kt}\delta K_t(h) - P_{Dt}\varphi_{It}(h).$$

([14]) For simplicity, we assume that μ_0 is sufficiently small that changes in the monetary base have a negligible impact on equilibrium allocations, at least to the first-order approximation we consider.

Consumption purchases are subject to a sales tax of τ_{Ct}. Investment in physical capital augments the per capita capital stock $K_{t+1}(h)$ according to a linear transition law of the form:

$$K_{t+1}(h) = (1-\delta)K_t(h) + I_t(h) \tag{A.19}$$

where δ is the depreciation rate of capital.

Financial asset accumulation of a typical member of FL household h consists of increases in nominal money holdings ($MB_{t+1}(h) - MB_t(h)$) and the net acquisition of bonds. While the domestic financial market is complete through the existence of state-contingent bonds B_{Dt+1}, cross-border asset trade is restricted to a single non-state contingent bond issued by the government of the Core economy. ([15])

The terms B_{Gt+1} *and* B_{Ft+1} *rep*resents each household member's net purchases of the government bonds issued by the Periphery and Core governments, respectively. Each type of bond pays one currency unit (e.g., euro) in the subsequent period, and is sold at price (discount) of P_{Bt} *and* P^*_{Bt}, *respectively*. To ensure the stationarity of foreign asset positions, we follow Turnovsky (1985) by assuming that domestic households must pay a transaction cost when trading in the foreign bond. The intermediation cost depends on the ratio of economy-wide holdings of net foreign assets to nominal GDP, P_tY_t, and are given by:

$$\varphi_{bt} = exp\left(-\varphi_b\left(\frac{B_{Ft+1}}{P_tY_t}\right)\right) \tag{A.20}$$

If the Periphery is an overall net lender position internationally, then a household will earn a lower return on any holdings of foreign (i.e., Core) bonds. By contrast, if the Periphery has a net debtor position, a household will pay a higher return on its foreign liabilities. Given that the domestic government bond and foreign bond have the same payoff, the price faced by domestic residents net of the transaction cost is identical, so that $P_{Bt} = \frac{P^*_{Bt}}{\varphi_{bt}}$. The effective nominal interest rate on domestic bonds (and similarly for foreign bonds) hence equals $i_t = 1/P_{Bt} - 1$.

Each member of FL household h earns after-tax labor income, $(1-\tau_{Nt})W_t(h)N_t(h)$, where τ_{Nt} *is a* stochastic tax on labor income. The household leases capital at the after-tax rental rate $(1-\tau_{Kt})R_{Kt}$, *where* τ_{Kt} is a stochastic tax on capital income. The household receives a depreciation write-off of $P_{It}\tau_{Kt}\delta$ per unit of capital. Each member also receives an aliquot share $\Gamma_t(h)$ of the profits of all firms and a lump-sum government transfer, $TR_t(h)$ (which is negative in the case of a tax). Following Christiano, Eichenbaum and Evans (2005), we assume that it is costly to change the level of gross investment from the previous period, so that the acceleration in the capital stock is penalized:

$$\varphi_{bt} = exp\left(-\varphi_b\left(\frac{B_{Ft+1}}{P_tY_t}\right)\right) \tag{A.21}$$

In every period t, each member of FL household h maximizes the utility functional (A.16) with respect to its consumption, investment, (end-of-period) capital stock, money balances, holdings of contingent claims, and holdings of domestic and foreign bonds, subject to its labor demand function (A15), budget constraint (A.18), and transition equation for capital (A.19). In doing so, a household takes as given prices, taxes and transfers, and aggregate quantities such as lagged aggregate consumption and the aggregate net foreign asset position.

Forward-looking (FL) households set nominal wages in staggered contracts that are analogous to the price contracts described above. In particular, with probability $1-\xi_w$, *each m*ember of a household is allowed to reoptimize its wage contract. If a household is not allowed to optimize its wage rate, we assume each household member resets its wage according to:

$$W_t(h) = \omega_{t-1}^{\iota_w}\omega^{1-\iota_w}W_{t-1}(h) \tag{A.22}$$

([15]) Notice that the contingent claims B_{Dt+1} are in zero net supply from the standpoint of the Periphery as a whole.

where ω_{t-1} *is* the gross nominal wage inflation in period $t-1$, i.e. W_t/W_{t-1}, *and* $\omega = \pi$ is the steady state rate of change in the nominal wage (equal to gross price inflation since steady state gross productivity growth is assumed to be unity). Dynamic indexation of this form introduces some element of structural persistence into the wage-setting process. Each member of household h chooses the value of $W_t(h)$ to maximize its utility functional (A.16) subject to these constraints.

Finally, we consider the determination of consumption and labour supply of the hand-to-mouth HM households. A typical member of a HM household simply equates his nominal consumption spending, $P_{Ct}(1+\tau_{Ct})C_t^{HM}(h)$, to his current after-tax disposable income, which consists of labor income plus lump-sum transfers from the government:

$$P_{Ct}(1+\tau_{Ct})C_t^{HM}(h) = (1-\tau_{Nt})W_t(h)N_t(h) + TR_t(h). \tag{A.23}$$

The HM households are assumed to set their wage equal to the average wage of the forward-looking households. Since HM households face the same labor demand schedule as the forward-looking households, this assumption implies that each HM household works the same number of hours as the average for forward-looking households.

3.1.7.3. Monetary policy

We assume that the central bank follows a Taylor rule for setting the policy rate of the currency union, subject to the zero bound constraint on nominal interest rates. Thus:

$$i_t = max\{-i, (1-\gamma_i)(\tilde{\pi}_t + \gamma_\pi(\tilde{\pi}_t - \pi) + \gamma_x\tilde{x}_t) + \gamma_i i_{t-1}\} \tag{A.24}$$

In this equation, i_t *is the quarterly n*ominal interest rate expressed in deviation from its steady state value of i. Hence, imposing the zero lower bound implies that i_t *cannot fall below* $-i$. $\tilde{\pi}_t$ *is pric*e inflation rate of the currency union, π the inflation target, and $\tilde{\pi}_t$ *is the ou*tput gap of the currency union. The aggregate inflation and output gap measures are defined as a GDP-weighted average of the inflation rates and output gaps of the Periphery and Core. Finally, the output gap in each member is defined as the deviation of actual output from its potential level, where potential is the level of output that would prevail if wages and prices were completely flexible.

3.1.7.4. Fiscal policy

Intertemporal Budget Constraint The government does not need to balance its budget each period, and issues nominal debt B_{Gt+1} *at the end of* period t to finance its deficits according to:

$$P_{Bt}B_{Gt+1} - B_{Gt} = P_{Ct}G_t + TR_t - \tau_{Nt}W_tL_t - \tau_{Ct}P_{Ct}C_t - (\tau_{Kt}R_{Kt} - \delta P_{It})K_t \tag{A.25}$$
$$-(MB_{t+1} - MB_t),$$

where C_t is total private consumption. Equation (A.25) aggregates the capital stock, money and bond holdings, and transfers and taxes over all households so that, for example, $TR_t = \int_0^1 TR_t(h)\,dh$. The taxes on capital τ_{Kt} *and consumption* τ_{Ct} *are assumed to be fixe*d, and the ratio of real transfers to (trend) GDP, $tr_t = \frac{TR_t}{P_tY}$, *is als*o fixed. ([16])

Government purchases have no direct effect on the utility of households, nor do they affect the production function of the private sector.

3.1.7.5. Resource constraint and net foreign assets

The domestic economy's aggregate resource constraint can be written as:

([16]) Given that the central bank uses the nominal interest rate as its policy instrument, the level of seigniorage is determined by nominal money demand.

$$Y_{Dt} = C_{Dt} + I_{Dt} + \varphi_{It} \tag{A.26}$$

where φ_{It} *is th*e adjustment cost on investment aggregated across all households. The final consumption good is allocated between households and the government:

$$C_{At} = C_t + G_t \tag{A.27}$$

where C_t *is tota*l private consumption of FL (optimizing) and HM households:

$$C_t = C_t^O + C_t^{HM} \tag{A.28}$$

Total exports may be allocated to either the consumption or the investment sector abroad:

$$M_t^* = M_{Ct}^* + M_{It}^* \tag{A.29}$$

Finally, at the level of the individual firm:

$$Y_t(i) = Y_{Dt}(i) + X_t(i) \; \forall i. \tag{A.30}$$

The evolution of net foreign assets can be expressed as:

$$\frac{P_{B,t}^* B_{F,t+1}}{\varphi_{bt}} = B_{F,t} + P_{Mt}^* M_t^* - P_{Mt} M_t \tag{A.31}$$

This expression can be derived from the budget constraint of the FL households after imposing the government budget constraint, the consumption rule of the *HM* households, the definition of firm profits, and the condition that domestic state-contingent non-government bonds (B_{Dt+1}) are in zero net supply.

Finally, we assume that the structure of the foreign country (the Core) is isomorphic to that of the home country (the Periphery).

3.1.7.6. Production of capital services

We incorporate a financial accelerator mechanism into both country blocks of our benchmark model following the basic approach of Bernanke, Gertler and Gilchrist (1999). Thus, the intermediate goods producers rent capital services from entrepreneurs (at the price R_{Kt}*) rather than direc*tly from households. Entrepreneurs purchase physical capital from competitive capital goods producers (and resell it back at the end of each period), with the latter employing the same technology to transform investment goods into finished capital goods as described by equations (A.19) and (A.21). To finance the acquisition of physical capital, each entrepreneur combines his net worth with a loan from a bank, for which the entrepreneur must pay an external finance premium (over the risk-free interest rate set by the central bank) due to an agency problem. Banks obtain funds to lend to the entrepreneurs by issuing deposits to households at the interest rate set by the central bank, with households bearing no credit risk (reflecting assumptions about free competition in banking and the ability of banks to diversify their portfolios). In equilibrium, shocks that affect entrepreneurial net worth – i.e., the leverage of the corporate sector – induce fluctuations in the corporate finance premium. ([17])

3.1.7.7. Calibration of parameters

Here we report calibration of the parameters not discussed in the main text.

We assume that the discount factor β =0.995, consistent with a steady-state annualized real interest rate $\bar{r}$ *of 2 percent. B*y assuming that gross inflation π =1.005 (i.e. a net inflation of 2 percent in

([17]) We follow Christiano, Motto and Rostagno (2008) by assuming that the debt contract between entrepreneurs and banks is written in nominal terms (rather than real terms as in Bernanke, Gertler and Gilchrist, 1999). For further details about the setup, see Bernanke, Gertler and Gilchrist (1999), and Christiano, Motto and Rostagno (2008). An excellent exposition is also provided in Christiano, Trabandt and Walentin (2007).

annualized terms), the implied steady state nominal interest rate i equals 0.01 at a quarterly rate, and 4 percent at an annualized rate.

The utility functional parameter σ is set equal to 1 to ensure that the model exhibit balanced growth, while the parameter determining the degree of habit persistence in consumption $\varkappa$ =0.8. We set χ =4, implying a Frisch elasticity of labor supply of 1/2, which is roughly consistent with the evidence reported by Domeij and Flodén (2006). The utility parameter χ_0 is set so that employment comprises one-third of the household's time endowment, while the parameter μ_0 on the subutility function for real balances is set at an arbitrarily low value (so that variation in real balances do not affect equilibrium allocations). We set the share of HM agents ς =0.47, implying that these agents account for about 20 percent of aggregate private consumption spending (the latter is much smaller than the population share of HM agents because the latter own no capital).

The depreciation rate of capital δ is set at 0.03 (consistent with an annual depreciation rate of 12 percent). The parameter ρ in the CES production function of the intermediate goods producers is set to -2, implying an elasticity of substitution between capital and labor $(1+\rho)/\rho$, of 1/2. The quasi-capital share parameter ω_K − together with the price mark-up parameter of $\theta_P = 0.20$ − is chosen to imply a steady state investment to output ratio of 15 percent. We set the cost of adjusting investment parameter φ_I =3, slightly below the value estimated by Christiano, Eichenbaum and Evans (2005). The calibration of the parameters determining the financial accelerator follows Bernanke, Gertler and Gilchrist (1999). In particular, the monitoring cost, μ, expressed as a proportion of entrepreneurs' total gross revenue, is set to 0.12. The default rate of entrepreneurs is 3 percent per year, and the variance of the idiosyncratic productivity shocks to entrepreneurs is 0.28.

Our calibration of the parameters of the monetary policy rule and the Calvo price and wage contract duration parameters − while within the range of empirical estimates − tilt in the direction of reducing the sensitivity of inflation to shocks. These choices seem reasonable given the resilience of inflation in most euro area countries in the aftermath of the global financial crisis. In particular, we set the parameters of the monetary rule such that γ_π =1.5, γ_x =0.125, and γ_i =0.7, implying a considerably larger response to inflation than a standard Taylor rule (which would set γ_π =0.5). The price contract duration parameter ξ_p =0.9, and the price indexation parameter ι_p =0.65. Our choice of ξ_p *implies a Phi*llips curve slope of about 0.007, which is a bit lower than the median estimates in the literature that cluster in the range of 0.009-0.014, but well within the standard confidence intervals provided by empirical studies (see e.g. Adolfson et al (2005), Altig et al. (2010), Galí and Gertler (1999), Galí, Gertler, and López-Salido (2001), Lindé (2005), and Smets and Wouters (2003, 2007)). Our choices of a wage markup of θ_W = 1/3, a wage contract duration parameter of ξ_w =0.85, and a wage indexation parameter of ι_w =0.65, together imply that wage inflation is about as responsive to the wage markup as price inflation is to the price markup. ([18])

We assume that $\rho_C = \rho_I$ =2, consistent with a long-run price elasticity of demand for imported consumption and investment goods of 1.5. The adjustment cost parameters are set so that $\phi_{M_C} = \phi_{M_I}$ =1, which slightly damps the near-term relative price sensitivity. Finally, the financial intermediation parameter φ_b is set to a very small value (0.00001), which is sufficient to ensure the model has a unique steady state.

([18]) Given strategic complementarities in wage-setting, the wage markup influences the slope of the wage Phillips Curve.

3.2 DEBT REDUCTION, FISCAL ADJUSTMENT, AND GROWTH IN CREDIT-CONSTRAINED ECONOMIES

By Emanuele Baldacci ([1]), Sanjeev Gupta ([2]) and Carlos Mulas-Granados ([3])

Disclaimer: The authors were invited by the Commission to present their ongoing work which was published in the Journal of Applied Economics in May 2015 (see below). This paper is not the property of the European Commission and is therefore not published with the rest of the proceedings of the workshop. However, it is available online, following the links displayed below.

Abstract:

This paper assesses the effects of fiscal consolidations associated with public debt reduction on medium-term output growth during periods of private debt deleveraging. The analysis covers 107 countries and 79 episodes of public debt reduction driven by discretionary fiscal adjustments during the 1980–2012 period. It shows that expenditure-based, front-loaded fiscal adjustments can dampen growth when there are credit supply restrictions. Instead, fiscal adjustments that are gradual and rely on a mix of revenue and expenditure measures can support output expansion, while reducing public debt. In this context, protecting public investment is critical for medium-term growth, as is the implementation of supply-side, productivity-enhancing reforms.

The version presented at the workshop is available at:

http://ec.europa.eu/economy_finance/events/2015/20150120-ecfin_workshop/documents/session_22_en.pdf

The final version of the paper was published in the Journal of Applied Economics, Volume 18, Issue 1, May 2015, Pages 71–97. The full version is available at:

http://www.sciencedirect.com/science/article/pii/S1514032615300040

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4. SESSION 3

STRUCTURAL AND INSTITUTIONAL REFORMS IN THE CONTEXT OF AN EXPENDITURE-BASED CONSOLIDATION

4.1 NUMERICAL EXPENDITURE RULES: DESIGN AND EFFECTS

By Wolf Heinrich Reuter ([1])

4.1.1. Introduction

In the last decades governments, especially in the EU, more and more relied on statutory expenditure rules to control government spending and consolidate public budgets. Compared to other types of fiscal rules, expenditure rules are especially often used to constrain public expenditures of the general or central government, as opposed to e.g. balanced budget rules which are used more often on the regional or local government level. In the aftermath of the sovereign debt crisis, supranational expenditure rules also play an important role in the strengthened fiscal governance framework of the EU.

While policy makers are introducing expenditure rules, there is mixed evidence in the academic literature about their effectiveness and implications. On the one hand, empirical studies, like Debrun et al. (2008) or Nerlich & Reuter (2013), find no significant effect of expenditure rules on public finances, as op- posed to balanced budget or debt rules. On the other hand, one key advantage of expenditure rules pointed out by the theoretical literature (e.g. Wierts 2008, Holm-Hadulla et al. 2010, Ayuso i Casals 2012) is that they are more targeted, better suited to tackle the deficit bias and not as pro-cyclical as other fiscal rules.

The various expenditure rules introduced in a wide range of countries differ in many aspects, a.o. with regards to the variables chosen to be constrained and even if some are constraining the same variables, they are setting different numerical limits. Additionally the full legal articles usually also include several exceptions and cumbersome instructions on how to calculate the constrained variables. Some countries have rules which are very strict and others have rules which are very loose such that they are always complied with. Some rules account for the current economic situation in the design of the numerical constraint, others do not. Previous studies were not able to take this into account and classified the various expenditure rules according to important characteristics using dummy variables or composite indices.

This paper makes use of a new dataset and analyses the performance of the various expenditure rules as well as the policy reaction to (non-)compliance. This data allows a joint analysis with different types and different implementations of expenditure rules. Furthermore, it reduces the problems associated with the so far used composite indices, which are largely time invariant, do not consider the actual numerical targets of the various rules and ignore the fiscal situation of a country with respect to this limit.

The paper is organized as follows: Section 4.1.2 introduces the data on expenditure rules and several definitions Section 4.1.3 presents statistical observations regarding the design of expenditure rules and the (non-)compliance of countries. Section 4.1.4 specifies the econometric exercises performed in this paper and Section 4.1.5 presents the results of these exercises. Finally, Section 4.1.6 concludes.

4.1.2. Data

There are two major data sets, published by the European Commission (2012) and the IMF (2013), describing national numerical fiscal rules. The data sets include balanced budget, debt, expenditure and revenue rules covering different levels of government for the EU28 (European Commission 2012) and 81 countries worldwide (IMF 2013) respectively. In total the two data sets present 169 fiscal rules for the EU28 countries from 1985-2014, of which 102 are covering the general or central government and of which 123 are enshrined in law or constitution. Of those 169 rules there are 76 balanced budget, 39 debt, 44 expenditure and 10 revenue rules. This paper focuses on the 18 expenditure rules, mentioned in these data sets, covering the general or central government and enshrined in statutory law (none of those rules is enshrined in the constitution of the countries). This choice is motivated for theoretical reasons and data availability: i) fiscal rules enshrined in statutory law cannot easily be changed every year and are said to be more credible than mere political commitments or coalitional agreements, ii) statutory rules are set out

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in legal documents which are publicly available, iii) economic data on the general and central government are more reliable and more significant for the consolidation of public finances than those for the regional or local governments, and iv) the compliance of local or regional governments with their expenditure rules would not be possible to determine on an aggregate level.

The analysis of this paper is based on the dataset, presented Reuter (2014), of the exact text passages from constitutional and statutory documents of the EU countries that set out the expenditure rules mentioned above. With the help of native speakers, translators and lawyers the respective legal document and law paragraphs (plus related paragraphs) defining each of these fiscal rules were collected. Based on this information the actual and forecast values of the numerical limit (F^R) set by the expenditure rules, as well as the constrained variable (F) on which the rule is imposed on, are calculated. Data for the actual and forecast values are taken from various vintages of the AMECO database of the European Comission. As an robustness check the actual values were also calculated based on the Government Finance Statistics database of the IMF. To be able to compare the behavior of governments in times before and after an expenditure rule is introduced in legislation, the constrained variables and numerical limits were also calculated for the years in which the rules were not in force yet or anymore (i.e. assuming the respective expenditure rule would have been effective over the full sample period).

For the empirical analysis of this paper only eight out of the 14 countries having one of the expenditure rules mentioned above can be used, as i) three rules (AT, CZ and SE) are in fact medium term budgetary (expenditures) frame- works, changed quite regularly and constraining only single years, ii) two rules (IE and IT) only cover very small fractions of the government (expenditures for pharmaceutical products and contributions to the pension reserve fund, respectively) for which data are not available, and iii) one rule (SK) cannot be calculated using international databases (as the rule entails the difference be- tween planned and actual expenditures). The resulting eight expenditure rules used in this paper, together with simplified versions of the respective rules as set out in the legal documents, are shown in Table IV.1.1.

Table IV.1.1: National numerical expenditure rules included in this paper

Cty[1]	Time	EC[2]	IMF[3]	Simplified Rule
BG	12-	x	x	$E_t^Y(GG) <= 40\%$
ES	11-	x	x	$\delta(PE_t(CG) - UnempB_t(CG)) \leq \varnothing_9 \delta Y_t$
FR	11-	x	x	$Max(\delta RE_t(CG), \delta PE_t(CG)) <= 0$
HR	12-	x	x	$\Delta E_t^Y(GG) <= -1\%$
HU	09	-	-	$PE_t <= PE_{t-1}$
HU	10-11	-[4]	x	$\delta RPE_t(GG) < 0.5\delta RY_t$
LT	08-	x	x	if $\varnothing_5 BB_t(GG) < 0 : \delta E_t(GG) <= 0.5\varnothing_5 \delta R_t(GG)$
PL	11-	x	x	$\delta RPE_t(CG) <= 1\%$
RO	10-	-	x	if $BB_t(GG) < 0$: $\delta E_t(GG) < \delta Y_t$

Notes: [1] Country name; [2] "x" if rule is included in European Commission (2012), deviations from European Commission (2012) in notes; [3] "x" if rule is included in IMF (2013), deviations from IMF (2013) in notes; [4] in European Commission (2012) included as Debt Rule; δ growth rate from $t-1$ to t, $\varnothing_\theta$ θ-year average, with Y always ratio of GDP, E total expenditures, PE Primary expenditures, RE real expenditures, RPE real primary expenditures, $UnempB$ expenditures for unemployment benefits, Y gross domestic product, RY Real gross domestic product; CG central government, GG general government.

Source: Author's calculations

As can be seen the various rules differ in various respects. Different definitions of variables are chosen to be constrained and even if rules use the same definition, they are setting different numerical limits. Table IV.1.1 only presents the main rules, but often there are various exceptions and escape clauses stated in the legal documents. For the empirical exercises of this paper, those exemptions are also taken into account either by calculating the variables reduced by the exemptions or by omitting the observation where no quantification of the exemption is given in the legal text. Nevertheless, some vagueness remains, as parts of some rules can be read in an ambiguous way (maybe to leave some room for interpretation for policy makers) and for specific parts of some rules data were not available for all exceptions. But both problems usually affect both the constrained variable and the numerical limit in the same way and the missing data

makes up only very small fractions of the total variables, such that it should not be a problem in the empirical exercises.

The calculation of the numerical limit and the constrained variable is based on data from the AMECO database of the European Commission. For the actual values (2000-2014) the autumn 2014 vintage of the database is used (as a robustness check the actual values are also taken from the IMF Government Finance Statistics database) and the forecasts are taken from the semi-annual vintages between spring 1998 and autumn 2014. Using data from the European Commission instead of national data has two opposing implications: i) Countries might still (not) comply with their expenditure rule in national data, but (do) not in the EU data, which would result in biased estimates of the reaction of governments to (non-) compliance. But if one assumes that national and EU data are fairly close and governments are not able to exactly steer the economic variables towards (non-) compliance with their rules, then this should only be a minor concern. ii) The forecasts of the European Commission (opposed to the own forecasts of the governments, as e.g. used in Frankel & Schreger 2013) might be more resilient to the political influence of governments and national interest groups. The sources of all variables used in this paper are given in Section 4.1.8 (Appendix A) and Section 4.1.10 (Appendix C) presents graphical illustrations of all the constrained variables and numerical limits used in this paper.

All constrained variables and numerical limits are transformed into percent- age of GDP figures, to enable a joint analysis accross countries. Furthermore, some variables are inverted (multiplied by -1) such that a homogenous meaning in respect of the compliance with expenditure rules is given, i.e. if the constrained variable is larger than the numerical limit, the country does not comply with the rule, otherwise it does.

The variable which is constrained by the expenditure rule (e.g. level of general government expenditures to GDP, growth rate of central government expenditures, etc.) is denoted *as* $F_{i,t,\tau}$*, i.e. the constrained* variable for year t of the numerical expenditure rule of country i. Parts of this paper also look at the forecast values and thus variables are available for each year t at six different points in time: the actual value (taken from the autumn 2014 vintage of the AMECO database; represented by $\tau = 0$), the autumn forecast in the same year t ($\tau = -1$), the spring forecast in the same year t (τ = -2), the autumn forecast of the previous year $t-1$ (τ = -3), the spring forecast of the previous year $t-1$ (τ = -4) and the autumn forecast of two years before $t-2$ ($\tau = -5$). The numerical limit set by the expenditure rule is denoted as $F^{R}_{i,t,\tau}$ *and represent*s the constraint set by the expenditure rule of country i forecast in period τ (or the actual value if $\tau = 0$) for the year t.

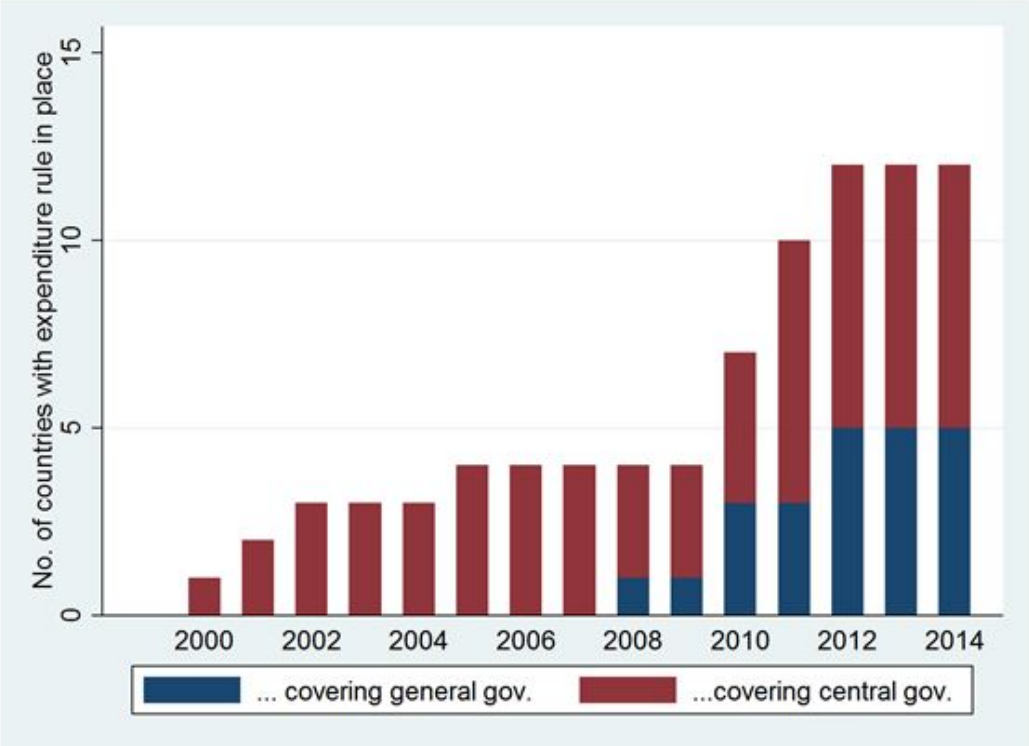
4.1.3. Compliance Statistics

In the last one and a half decades countries all over the world introduced more and more numerical fiscal rules (see e.g. Schaechter et al. (2012) for an overview). They are used to constrain e.g. the budget balance or debt level of different levels of government, but also public expenditures and revenues. During this period (especially from 2009 to 2012) also numerical expenditure rules have become popular, especially those covering the central or general government.

Graph IV.1.1 shows the number of countries of the EU28 which have or had an expenditure rule covering the general or central government enshrined in its national legislation. While in 1999 no country of the EU28 had such a rule in place, almost half of the countries had one in 2012. Also the coverage of the expenditure rules increased to five countries having rules that cover the finances of the general government in 2012.

By calculating the constrained variable and the numerical limit the annual (or forecast) compliance with the expenditure rules can be observed. The dummy variable $N_{i,t,\tau}$ defined in Equation 1 is one, if country i is not complying with its expenditure rule in forecast τ of year i, i.e. the constrained variable is larger than the constraint imposed by the fiscal rule.

Graph IV.1.1: **EU28 countries with expenditure rule**



Source: Author's estimates

$$N_{i,t,\tau} := \begin{cases} 1 \; if \; F^R_{i,t,\tau} < F_{i,t,\tau} \\ 0 \; otherwise \end{cases} \tag{1}$$

The respective percentage of years in which the countries did comply with their expenditure rules while they were in force, is presented in Table IV.1.2. In general the countries complied with their expenditure rules in 61% of the years and also in around 62% of the forecasts.

When looking at how compliance changed over time it can be noted that in a third of the years a country changed to compliance with the rule in year t, when it did not comply with it three years ahead or in the forecasts two years ahead. The closer to the actual values the years or forecasts get, the less did the governments change from non-compliance to compliance. This is a first indication that policy makers do want to change from non-compliance (in previous years or in early forecasts) to compliance with their expenditure rules, but they need time for this change to materialize. A change from compliance in the previous years to non-compliance can be observed more often the closer one gets to the actual year. This might indicate that non-compliance of countries with their expenditure rules happens because of unexpected shocks which cannot be corrected fast enough, rather than long planned expenditure increases.

As can already be seen in Table IV.1.1, the various expenditure rules differ strongly with regards to how they constrain the public expenditures. Table IV.1.3 presents the same compliance statistics as Table IV.1.2 before, but for subsamples of the countries according to some broad classification. About half of the expenditure rules used in this paper target variables of the general government and the other half of the central government. The compliance with the rules is slightly higher with the expenditure rules targeting only the central government (67% vs. 58% in the actual values and 50% vs. 46% in the forecasts). Further- more, half of the countries cover more than 50% of their general government finances by the expenditure rules, and half cover less (sometimes only very small fractions). Compliance is higher with the rule covering smaller fractions of the general government expenditures, especially so in the forecasts. Both observations indicate that it is easier for governments to comply with (especially in the forecasts) expenditure rules that are targeting only the central government and smaller fractions of the

general government expenditures. This might be a result of not always easy or successful negotiation processes with lower levels of government, as general government expenditures also include the budgets of those.

Table IV.1.2: **Compliance with the numerical expenditure rules in force**

overall compliance in actual values ($\mathcal{N}_{i,t,0} = 0$):		61%			
		$t-1$	$t-2$	$t-3$	
compl. in t, changed from non-compl. in...		19%	21%	32%	
non-compl. in t, changed from compl. in...		31%	33%	18%	
overall compliance in forecasts ($\mathcal{N}_{i,t,\tau} = 0$):		62%			
	$\tau =$ -1	-2	-3	-4	-5
compl. in $\tau = 0$, changed from non-compl. in...	18%	10%	29%	33%	33%
non-compl. in $\tau = 0$, changed from compl. in...	18%	19%	14%	25%	21%

Notes: Percentage of years (upper panel) or forecasts (lower panel) in which countries complied (or did not comply) with their expenditure rules while they were in force between 2000-2014.

Source: Author's calculations

Four countries in the sample use automatic corrections mechanisms or sanctions to enforce their expenditure rules. Those are almost always complied with in the forecasts, but only slightly more complied with in the actual values. This could indicate that governments try to always comply with their expenditure rules if they are enforced by sanctions or correction mechanisms, but unexpected shocks reduce the actual compliance. Furthermore, one-third of the countries have definitions of the constrained variables using the level of expenditures, and two-thirds various forms of the growth rate. There is no difference in the compliance with those rules and the picture is very similar when comparing how the upper bound of the fiscal rule is defined. Generally a higher compliance (in actual and forecast values) can be observed with rules that are defined in real instead of nominal terms. And rules that apply only in bad times are much less complied with in the forecasts, but then have a higher compliance in the actual level.

Some policy makers and authors in the literature (e.g. Guichard et al. 2007) advocate the use of combinations of fiscal rules. The bottom panel of Table IV.1.3 shows the compliance statistics for countries which combine expenditure rules with other types of rules. Especially in combination with balanced budget rules (which three of the countries in the sample have) and in forecasts the compliance is higher.

The difference between the constrained variable and the numerical constraint for the same time period and the same forecast shows how far away the fiscal variables are from the limit set by the expenditure rule (Equation 2). As all variables have been transformed to have a homogenous meaning with respect to the expenditure rule, this difference $\Delta^R F_{i,t,\tau}$ is negative if the country complies with the rule, i.e. the constrained variable is below the limit set by the fiscal rule, and positive otherwise.

$$\Delta^R F_{i,t,\tau} := F_{i,t,\tau} - F^R_{i,t,\tau} \tag{2}$$

Graph IV.1.2 shows the average of this variable $\Delta^R F_{i,t,\tau}$ for the different forecast periods split by the years when the expenditure rule was in force and the years when it was not. The average distance is above the numerical limit for the forecasts one and two years ahead, while it is below the limit in the forecasts of the actual year. Generally the average distance in years with fiscal rules in force is lower than in years without a fiscal rule. Furthermore the compliance statistics of Table IV.1.2 are confirmed as the average distance is negative for the years with expenditure rules and slightly positive for the years without.

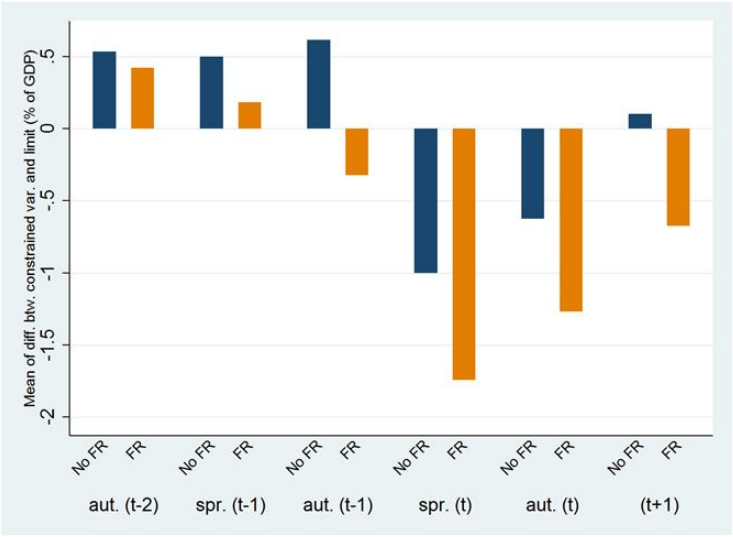
Table IV.1.3.: **Compliance and characteristics of the numerical expenditure rules included in this paper**

Compliance in...	Actual ($\tau = 0$)	Forecast $t-2$ ($\tau = -5$)	Countries
General	61%	48%	
General Gov.	58%	46%	BG, HR, HU, LT, RO
Central Gov.	67%	50%	ES, PL, FR, (IE, IT, SK)
Coverage of GG: $< 50\%$	63%	80%	FR, LT, PL, (IE, IT, SK)
Coverage of GG: $> 50\%$	58%	18%	BG, HR, HU, RO, ES
Sanctions or automatic corr. mechanisms.	67%	94%	HR, ES, PL, (SK)
None	58%	35%	FR, LT, BG, HU, RO, (IE, IT)
Nominal rule	56%	37%	HR, LT, RO
Real rule	75%	67%	ES, HU, PL
Rule in 'Level'	61%	48%	BG, (IE, IT, SK)
Rule in 'Growth rate'	60%	39%	HR, FR, HU, LT, PL, RO, ES
Upper bound is a 'number'	60%	50%	BG, FR, HR, PL, RO
... is notion of growth	62%	36%	ES, HU, LT
Rule applies continuously	53%	54%	BG, ES, FR, HR, HU, PL
.. only in bad fiscal times	71%	33%	LT, RO
Combination with other fiscal rules covering general or central government			
any	60%	50%	BG, HU, HR, LT, PL, ES, (SK)
BBR	63%	71%	BG, HU, ES
DR	59%	42%	BG, HU, HR, LT, PL, (SK)
none	57%	25%	RO, FR, LT, (IE, IT)

Notes: Percentage of years (column 2) or forecasts (column 3) in which countries complied with their expenditure rules while they were in force between 2000-2014, split by characteristics shown in column 1. GG= General government expenditures, BBR = Balanced Budget Rules, DR = Debt Rules.

Source: Author's calculations

Graph IV.1.2: **Difference between constrained variable and numerical limit per fore- cast period (in % of GDP) split by years when expenditure rule was in force (FR) and when it was not (No FR)**



Source: Author's calculations

4.1.4. Empirical framework

Section 4.1.3 already presented some assumptions about the reaction of policy makers to (non-)compliance with their expenditure rules. The empirical analysis investigates this behaviour in more detail

and analyzes the determinants of the change of the difference between the constrained variable and the numerical limit.

First, the effect of the dummy variable indicating if the expenditure rule was not complied with ($N_{i,t-1}$) in the previous year, on the change of the difference between the constrained variable and numerical limit ($\Delta^t(\Delta^R F_{i,t,0})$) is analyzed. As the constrained variable and the numerical limit are calculated for the full sample period (2000-2014, i.e. not only the years the expenditure rule was acutally in force in), it is important to distinguish between years in which the expenditure rule was actually in force in and enshrined in statutory law. The dummy variable $R_{i,t}$ is one if this is the case for country i in year t, and zero otherwise. This enables a distinction between a general behaviour of fiscal policy and the actual effect of introducing a fiscal rule in national legislation. The basic setting is presented in Equation 3:

$$\Delta^t(\Delta^R F_{i,t,0}) = \beta_0 + \beta_1 R \times N_{i,t-1} + \beta_2 R_{i,t} + \beta_3 N_{i,t-1} + \mu_i + \nu_t + \varepsilon_{i,t,0} \quad (3)$$

Rule/ country fixed effects (μ_i) and time fixed effects (ν_t) are included, and $\varepsilon_{i,t,0}$ *repres*ents the idiosyncratic error term. Hausman tests on omitting the rule or time fixed effects were all rejected and robustness checks of leaving out the rule or time fixed effects, which are quantitatively and qualitatively very similar, are shown in Table IV.1.7 in Section 4.1.9 (Appendix B - Robustness checks).

$$\Delta^t(\Delta^R F_{i,t,0}) = \beta_0 + \beta_1 R_{i,t} \times \Delta^R F_{i,t-1,0} + \beta_2 R_{i,t} + \beta_3 \Delta^R F_{i,t-1,0} + \mu_i + \nu_t + \varepsilon_{i,t,0} \quad (4)$$

Second, the policy reaction might be different depending on how far away the constrained variable is from the limit set by the expenditure rule. Thus, Equation 4 investigates the effect of the difference between the constrained variable and numerical limit ($\Delta^R F_{i,t-1,0}$) on the change of this variable to the next period ($\Delta^t(\Delta^R F_{i,t,0})$), depending on the fact that the fiscal rule is in force or not ($R_{i,t}$). Two different forms of this change/ differences are defined to distinguish between i) the difference of the constrained variable from one forecast to the next (half a year later) for the same year t, and ii) the annual difference between the actual values ($\tau = 0$) betwenn two consecutive years. Equation 5 represents the difference in forecasts and Equation 6 the difference in actual values.

$$\Delta^{\tau}_{i,t,\tau} := F_{i,t,\tau} - F_{i,t,\tau-1} \quad (5)$$

$$\Delta^{t}_{i,t,0} := F_{i,t,0} - F_{i,t-1,0} \quad (6)$$

The reaction of policy makers might also be different depending on which side of the numerical constraint the variables are. Thus, the difference between constrained variable and numerical limit ($\Delta^R F_{i,t,\tau}$) can also be split into a positive (when the country does not comply with its rule, Equation 7) and a negative part (when the country complies with the rule, Equation 8).

$$\Delta^{R+} F_{i,t,\tau} := \begin{cases} \Delta^R F_{i,t,\tau} & \text{if } F^R_{i,t,\tau} < F_{i,t,\tau} \\ 0 & otherwise \end{cases} \quad (7)$$

$$\Delta^{R-} F_{i,t,\tau} := \begin{cases} \Delta^R F_{i,t,\tau} & \text{if } F^R_{i,t,\tau} > F_{i,t,\tau} \\ 0 & otherwise \end{cases} \quad (8)$$

Equation 4 is then also estimated using those split values instead of $\Delta^R F_{i,t-1,0}$.

As a robustness check all equations are also estimated including a wide range of control variables which are standard in the literature as determinants of fiscal policy variables. For a detailed description of the variables and the reasons for including them see e.g. Nerlich & Reuter (2013) and Section 4.1.8 (Appendix A). The controls can be grouped into three categories: i) economic variables (lagged debt levels, lagged output gap, dependency ratio, population and openness), ii) political variables (ideology of government, ideological distance of parties in government, fragmentation of parliament and district magnitude), and iii) institutional variables (delegation or contract approach to governance, and stability and growth pact). The results stay qualitatively the same with or without control variables included.

After analyzing the reaction to annual compliance also the change in the distance between constrained variable and numerical limit from forecast to forecast is analyzed. Basically all above mentioned Equations 3 and 4 are also estimated using (t, τ) and $(t, \tau - 1)$ instead of $(t, 0)$ and $(t - 1{,}0)$. The full Equation 4 using the explanatory variable split into positive and negative values and including the control variables for the difference between forecasts is presented in Equation 9.

$$\Delta^{\tau}(\Delta^{R}F_{i,t,\tau}) = \beta_0 + \beta_1 R_{i,t} \times \Delta^{R+}F_{i,t,\tau-1} + \beta_2 R_{i,t} \times \Delta^{R-}F_{i,t,\tau-1} + \beta_3 R_{i,t} + \beta_4 \Delta^{R+}F_{i,t,\tau-1} + \beta_5 \Delta^{R-}F_{i,t,\tau-1} + x'_{i,t} + \mu_i + \nu_t + \varepsilon_{i,t,\tau} \quad (9)$$

4.1.5. results

The main purpose of introducing expenditure rules is to get policy makers to restrict their spending and force them to comply with the rules set out in the legal documents. As seen in Section 3 this is only the case in approximately 61% of the years. A secondary goal of introducing expenditure rules would be to at least steer the policy variables towards the numerical limit in case of non- compliance. I.e. if e.g. an unexpected shock leads to an increase in expenditures which breaks the constraint set by the rule, then policy makers should at least move the variable in the right direction and towards compliance in the following periods. This Section tests if this behavior can be observed in the data.

Reaction to annual (non-)compliance with expenditure rules

Table IV.1.4 presents the estimation results for the annual change in the difference between constrained variable and the numerical limit $(\Delta^{t}(\Delta^{R}F_{i,t,0}))$. Column (1) shows the results for Equation 3. As already seen in previous studies, we cannot observe a direct effect of having a fiscal rule in force or not (R_t) on the constrained variable. This indicates that there is no general level effect on the constrained variable of introducing an expenditure rule, but only an effect on the reaction of fiscal policy to (non-)compliance. This will remain valid throughout the estimations of annual differences. When looking at a fictional rule over the full sample period (N_{t-1}), we do see a strong effect towards the numerical limit, if the rule was not complied with in the previous period. This effect is much stronger when an expenditure rule is actually enforced in national legislation $(R \times N_{t-1})$. So while also without an expenditure rule governments reduce their constrained variables in times when they would not comply with a fictional rule, the effect is much stronger (approximately three times the size) when the expenditure rule is actually in force. Nevertheless, the results so far also show a significant increase of the constrained variables towards the numerical limit from below, i.e. if the (fictional) expenditure rules are complied with.

To investigate if the distance between the constrained variable and the numerical limit matters, Column (2) estimates Equation 4. The results confirm the findings for Column (1), i.e. if countries do not comply with their expenditure rules then policy makers lower the constrained variable in the next period and this effect is stronger if the rule is actually in force. The only shortcoming of this finding is that this estimation did not differentiate between times when the rule is complied with or not. This is why the actual effect might be larger than what is seen in Column (2). Furthermore, again this also means that policy makers use their "space" by increasing the constrained variable if they comply with the rule.

To address this issues, Column (3) splits the distance between constrained variable and numerical constraint into positive $(\Delta^{R+}F_{t-1,0})$, i.e. the distance in times of non-compliance), and negative $(\Delta^{R+}F_{t-1,0})$, i.e. the distance in times of compliance), values. A more detailed picture emerges: First, the adjustment towards the numerical constraint is much stronger (and more significant) in times when the (fictional) rule is not complied with, i.e. the tendency towards the numerical limit is much stronger from above than from below. Second, the expenditure rule actually being in force doubles the adjustment in times of non-compliance, but is not significant for times of compliance. The results suggest that introducing expenditure rules does not have a significant effect in times of compliance with them. Countries still slightly increase their constrained variables towards the numerical limit. But when fiscal variables are above (do not comply with the) numerical constraints, the adjustment is twice as strong with expenditure rules being in force. As an robustness check Column (4) also includes a wide range of control variables, but the results stay qualitatively and quantitatively the same.

Reaction to forecast (non-)compliance with expenditure rules

Table IV.1.4 **Regression results: Annual change of difference between constrained variable and numerical limit (Dep. Var: $\Delta^t(\Delta^{R+}F_{t-1,0})$)**

	(1)	(2)	(3)	(4)
$\mathcal{R}_t$	0.631	−0.142	0.541	1.030
	(0.987)	(0.548)	(1.113)	(1.460)
$\mathcal{N}_{t-1}$	−2.636***			
	(0.813)			
$\mathcal{R} \times \mathcal{N}_{t-1}$	−5.369***			
	(1.650)			
$\Delta^R\mathcal{F}_{t-1,0}$		−0.826***		
		(0.130)		
$\mathcal{R}_t \times \Delta^R\mathcal{F}_{t-1,0}$		−0.495***		
		(0.177)		
$\Delta^{R+}\mathcal{F}_{t-1,0}$			−1.079***	−1.198***
			(0.070)	(0.244)
$\Delta^{R-}\mathcal{F}_{t-1,0}$			−0.360*	−0.609**
			(0.206)	(0.256)
$\mathcal{R}_t \times \Delta^{R+}\mathcal{F}_{t-1,0}$			−1.085**	−1.034**
			(0.512)	(0.520)
$\mathcal{R}_t \times \Delta^{R-}\mathcal{F}_{t-1,0}$			−0.298	−0.155
			(0.369)	(0.340)
Debt (-1)				−0.047
				(0.050)
Output Gap (-1)				0.029
				(0.134)
Openness				−4.106
				(6.366)
Dependency Ratio				−4.890
				(10.207)
Population				0.001***
				(0.000)
Ideology				0.571***
				(0.183)
Idological Range				0.131
				(0.326)
Parl. Fragmentation				−2.789*
				(1.448)
Delegation				2.088**
				(1.002)
Contract				−1.287
				(4.760)
District Magnt.				0.137
				(0.188)
SGP				2.083**
				(1.010)
N	105	91	91	85
R^2 (within)	0.396	0.656	0.699	0.791

Source: Author's calculations
Notes: Estimation results for Equations 3 to 4); time and country fixed effects are included in all regressions but not reported; dependent variable is the change of the difference of the constrained variable to its numerical constraint from year to year $\Delta^t(\Delta^R F_{i,t,0})$, explanatory variables are the difference between constrained variable and numerical limit $(\Delta^R F_{t-1,0})$ for the previous year, also split into positive $(\Delta^{R+}F_{t-1,0})$ *and negat*ive $(\Delta^{R-}F_{t-1,0})$ values, a dummy variable being one if this difference is positive (N_{t-1}), i.e. the rule is not complied with, and a dummy variable being one if the fiscal rule is in force in the respective years R_t . *Het*eroscedasticity robust standard errors are in parentheses. * indicate significance at 10% level, ** at 5% level and *** at 1% level.

Section 4.1.5.1 showed the reaction of fiscal policy variables to (non-)compliance with their expenditure rules in previous years. Expenditure rules might also have a strong effect in the reaction of policy makers to forecasts of fiscal variables and especially to forecast (non-)compliance. Columns (1) to (4) of Table IV.1.5 show the same estimations as Table IV.1.4, but instead of looking at the change from year to year the change from one forecast to the next is used.

Overall the main results are confirmed. When expenditure rules are actually introduced in national legislation and the country did not comply with the rule in the previous forecast, then the constrained variable is decreased twice as fast as without such a rule in force. Nevertheless, two main differences emerge when comparing the results to the annual differences: First, the dummy variable of having an

expenditure rule in force in national legislation or not (R_t) becomes significant. Usually countries also strengthen their other fiscal institutions for forecasting, monitoring and auditing when introducing fiscal rules. These changes have effects on the fiscal variables which are independently of the current stance of fiscal policy or the compliance or non-compliance of the policy makers with the expenditure rule. Thus, the significant level effect in the regressions of Table IV.1.5 could be an indication that those strengthened institutions do in fact have an effect, but only on the forecast (non-)compliance with expenditure rules e.g. through improved forecasts. Table IV.1.8 in Section 4.1.9 (Appendix B) shows robustness checks regarding the time period used for the estimations. Overall the results remain qualitatively the same. But smaller differences regarding the size of the fixed level effect can be observed. After the financial crisis the level effect is still highly significant but much smaller than before. This would correspond to the effect being driven by an improvement of the quality of the forecasts.

Second, the increase of the constrained variables in times of compliance with the expenditure rule is much stronger than for the annual differences. In fact, the effect is even stronger than the decrease of the variable in times of non- compliance. This is independent of the fiscal rule being actually in force or not. I.e. governments strongly use the "space" towards the numerical limit and increase the constrained variable, if they see compliance with the rules in the forecasts.

4.1.6. Conclusions

This paper analyses the reaction of policy makers to (non-)compliance with statutory expenditures rules in the EU28. For this purpose it calculates the exact variables and numerical limits as set out in the legal documents for the actual values and forecasts from 2000-2014.

Descriptive statistics show that countries only comply with their expenditure rules in around 60% of the years. But the data already show a tendency of policy makers to change non-compliance with their rules into compliance over the medium-term. On the other hand non-compliance after years of compliance emerges only in the short-term. Furthermore, countries seem to comply with their expenditure rules more often if they constrain the central government, only smaller fractions of the general government finances, and are enforced with sanctions or automatic correction mechanisms.

Three main result stands out in the empirical exercises of this paper: First, there is a general tendency of the constrained variables towards the numerical limit from above (in times of non-compliance) and from below (in times of compliance). With actual values the change from above is stronger and with forecasts from below. Second, this general tendency is independent of actually introducing the expenditure rules in national legislation. But after doing so the adjustment in years of non-compliance is twice as strong as without. Third, only in the forecasts also a level effect of improved fiscal institutions can be observed.

While this paper presents a first look on the reaction of policy makers on (non-)compliance with expenditure rules, more research is needed to under- stand the mechanisms at work. First of all more observations would increase the statistical significance and allow more experiments with sub-samples of the expenditure rules to analyze the effects of their various characteristics. Further- more, the combination of various fiscal rules and the interplay with medium term expenditure (budgetary) frameworks would be interesting research topics.

Table IV.1.5.: **Regression results: Forecast change of difference between constrained variable and numerical limit (Dep. Var: $\Delta^{\tau}(\Delta^{R+}F_{t-1,0})$)**

	(1)	(2)	(3)	(4)
$\mathcal{R}_t$	−1.042*	−1.697***	−2.201***	−1.723**
	(0.625)	(0.738)	(0.763)	(0.723)
$\mathcal{N}_{t,\tau-1}$	−2.935***			
	(1.109)			
$\mathcal{R} \times \mathcal{N}_{t,\tau-1}$	−2.815***			
	(1.002)			
$\Delta^{R}\mathcal{F}_{t,\tau-1}$		−0.936***		
		(0.108)		
$\mathcal{R}_t \times \Delta^{R}\mathcal{F}_{t,\tau-1}$		−0.160*		
		(0.103)		
$\Delta^{R+}\mathcal{F}_{t,\tau-1}$			−0.664**	−0.912***
			(0.278)	(0.336)
$\Delta^{R-}\mathcal{F}_{t,\tau-1}$			−0.939***	−1.030***
			(0.091)	(0.106)
$\mathcal{R}_t \times \Delta^{R+}\mathcal{F}_{t,\tau-1}$			−0.585***	−0.617**
			(0.219)	(0.270)
$\mathcal{R}_t \times \Delta^{R-}\mathcal{F}_{t,\tau-1}$			−0.030	0.067
			(0.094)	(0.119)
Debt (-1)				−0.058**
				(0.029)
Output Gap (-1)				0.243***
				(0.094)
Openness				3.594
				(3.408)
Dependency Ratio				54.900
				(67.710)
Population				0.001*
				(0.001)
Ideology				0.274**
				(0.138)
Ideological Range				−4.463*
				(2.338)
Parl. Fragmentation				1.363
				(2.391)
Delegation				−0.790
				(0.869)
Contract				−0.351
				(2.847)
District Magnt.				0.017
				(0.036)
SGP				−0.438
				(1.449)
N	333	333	333	317
R^2 (within)	0.076	0.542	0.540	0.552

Source: Author's calculations
Notes: Estimation results for Equations \ref34) with forecast differences instead of annual differences; time and country fixed effects are included in all regressions but not reported; dependent variable is the change of the difference of the constrained variable to its numerical constraint from forecast to forecast $\Delta^{t}(\Delta^{R}F_{i,t,0})$, explanatory variables are the difference between constrained variable and numerical limit $(\Delta^{R}F_{t-1,0})$ for the previous year, also split into positive $(\Delta^{R+}F_{t-1,0})$ *and negati*ve $(\Delta^{R-}F_{t-1,0})$ values, a dummy variable being one if this difference is positive (N_{t-1}), i.e. the rule is not complied with, and a dummy variable being one if the fiscal rule is in force in the respective years R_t . Heteroscedasticity robust standard errors are in parentheses. * indicate significance at 10% level, ** at 5% level and *** at 1% level.

4.1.7 References

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4.1.8. Appendix A

Table IV.1.6: **Data and Control Variables**

Variable	Source
Economic variables	
(lagged) Debt level	AMECO, European Commission
(lagged) Output gap	AMECO, European Commission
Dependency ratio	Population structure and ageing, EC
Population	Population structure and ageing, EC
Openness	(Imports + Exports) / GDP, AMECO, European Commission
Political variables	
Ideology of government	World Bank Political Database
Ideol. dist. of parties in government	World Bank Political Database
Fragmentation of parliament	World Bank Political Database
District magnitude	World Bank Political Database
Institutional variables	
Contract or delegation approach	Hallerberg et al. (2009), Ylaoutlinen (2004)
Stability and growth pact	authors input

Source: Author's calculations

4.1.9. Appendix B: Robustness checks

Table IV.1.7: **Robustness regarding the use of fixed effects**

	(1)	(2)	(3)	(4)
$\mathcal{R}_t$	0.541	0.098	0.537	0.239
	(1.113)	(0.863)	(1.346)	(1.012)
$\Delta^{R+}\mathcal{F}_{t-1,0}$	−1.079***	−1.199***	−0.983***	−1.096***
	(0.070)	(0.133)	(0.114)	(0.137)
$\Delta^{R-}\mathcal{F}_{t-1,0}$	−0.360*	−0.407***	−0.019	−0.083
	(0.206)	(0.121)	(0.106)	(0.088)
$\mathcal{R}_t \times \Delta^{R+}\mathcal{F}_{t-1,0}$	−1.085**	−1.017***	−1.092**	−1.043***
	(0.512)	(0.344)	(0.502)	(0.355)
$\mathcal{R}_t \times \Delta^{R-}\mathcal{F}_{t-1,0}$	−0.298	−0.232	−0.480	−0.389
	(0.369)	(0.302)	(0.374)	(0.333)
Country fixed effects	Yes	Yes	No	No
Time fixed effects	Yes	No	Yes	No
N	91	91	91	91
R^2 (within)	0.699	0.631	0.688	0.622

Notes: Estimation results for Equation 4; fixed effects are included in according to middle panel; dependent variable is the change of the difference of the constrained variable to its numerical constraint from year to year $\Delta^t(\Delta^R\mathcal{F}_{i,t,0})$, explanatory variables are the difference between constrained variable and numerical limit $(\Delta^R\mathcal{F}_{t-1,0})$ for the previous year, also split into positive $(\Delta^{R+}\mathcal{F}_{t-1,0})$ and negative $(\Delta^{R+}\mathcal{F}_{t-1,0})$ values, and a dummy variable being one if the fiscal rule is in force in the respective years $\mathcal{R}_t$. Heteroscedasticity robust standard errors are in parentheses. * indicate significance at 10% level, ** at 5% level and *** at 1% level.

Source: Author's calculations

Table IV.1.8: **Robustness regarding the time period**

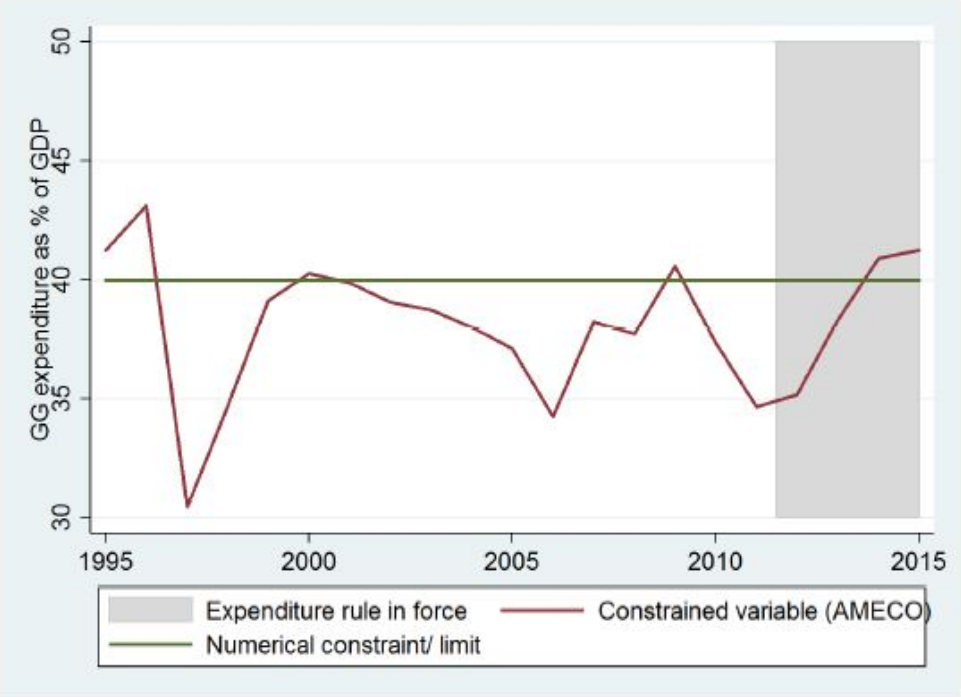
	(1) 2000-2014	(2) 2000-2009	(3) 2008-2014	(4) 2005-2011
$\mathcal{R}_t$	−2.201***	−4.175***	−0.954**	−1.950***
	(0.763)	(1.544)	(0.417)	(0.761)
$\Delta^{R+}\mathcal{F}_{t,\tau-1}$	−0.664**	−1.078***	−0.286***	−0.716**
	(0.278)	(0.397)	(0.077)	(0.297)
$\Delta^{R-}\mathcal{F}_{t,\tau-1}$	−0.939***	−0.988***	−0.724***	−0.867***
	(0.091)	(0.086)	(0.123)	(0.143)
$\mathcal{R}_t \times \Delta^{R+}\mathcal{F}_{t,\tau-1}$	−0.585***	−1.489***	−0.420**	−0.571**
	(0.219)	(0.519)	(0.193)	(0.286)
$\mathcal{R}_t \times \Delta^{R-}\mathcal{F}_{t,\tau-1}$	−0.030	0.500	−0.044	−0.013
	(0.094)	(0.307)	(0.126)	(0.123)
N	333	221	179	217
R^2 (within)	0.540	0.583	0.365	0.515

Notes: Estimation results for Equations 4; Sample period used for calculations incdicated in header; time and country fixed effects are included in all regressions but not reported; dependent variable is the change of the difference of the constrained variable to its numerical constraint from forecast to forecast $\Delta^t(\Delta^R\mathcal{F}_{i,t,\tau})$, explanatory variables are the difference between constrained variable and numerical limit $(\Delta^R\mathcal{F}_{t,\tau-1})$ for the previous forecast, also split into positive $(\Delta^{R+}\mathcal{F}_{t,\tau-1})$ and negative $(\Delta^{R+}\mathcal{F}_{t,\tau-1})$ values, a dummy variable being one if the fiscal rule is in force in the respective years $\mathcal{R}_t$. Heteroscedasticity robust standard errors are in parentheses. * indicate significance at 10% level, ** at 5% level and *** at 1% level.

Source: Author's calculations

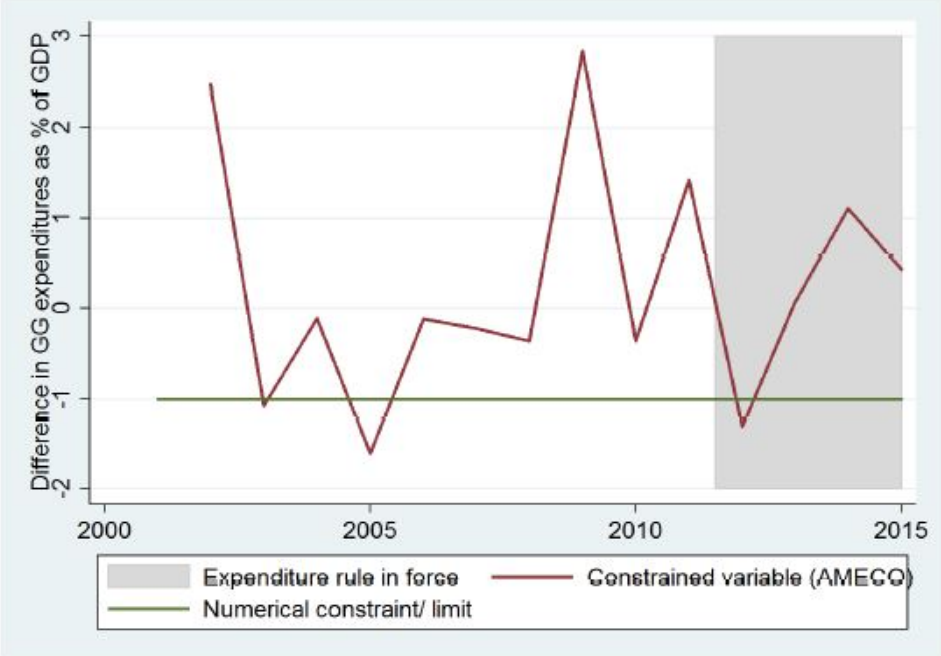
4.1.10. Appendix C: Constrained variables and numerical limits

Graph IV.1.3: **Variables of Expenditure Rule (since 2012), Bulgaria (General Government)**



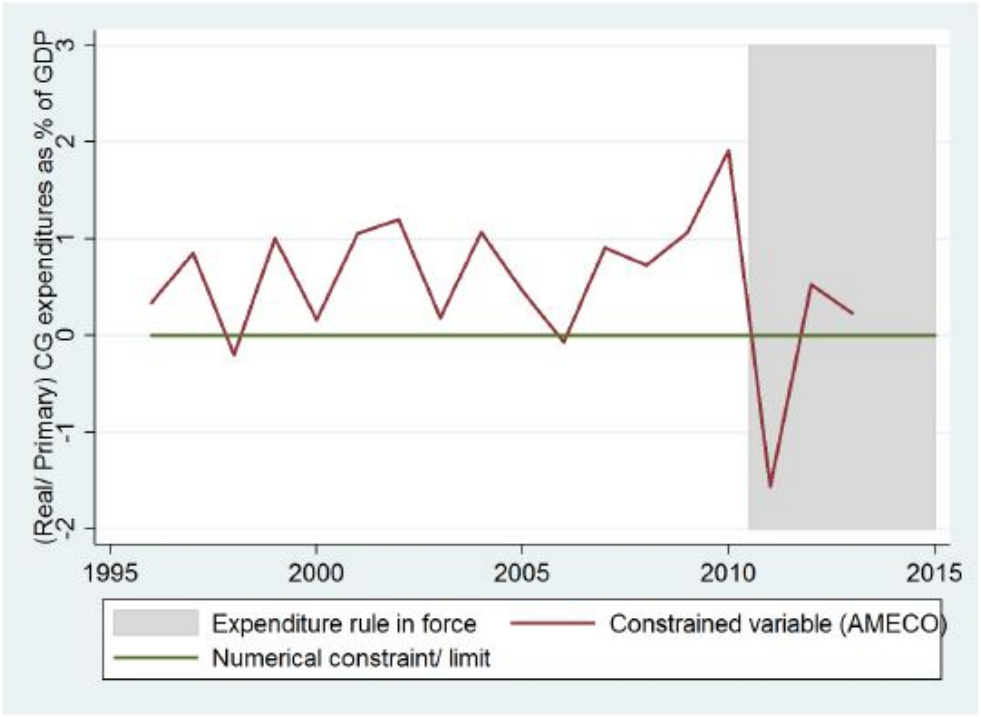
Source: Author, AMECO

Graph IV.1.4: **Variables of Expenditure Rule (since 2012), Croatia (General Government)**



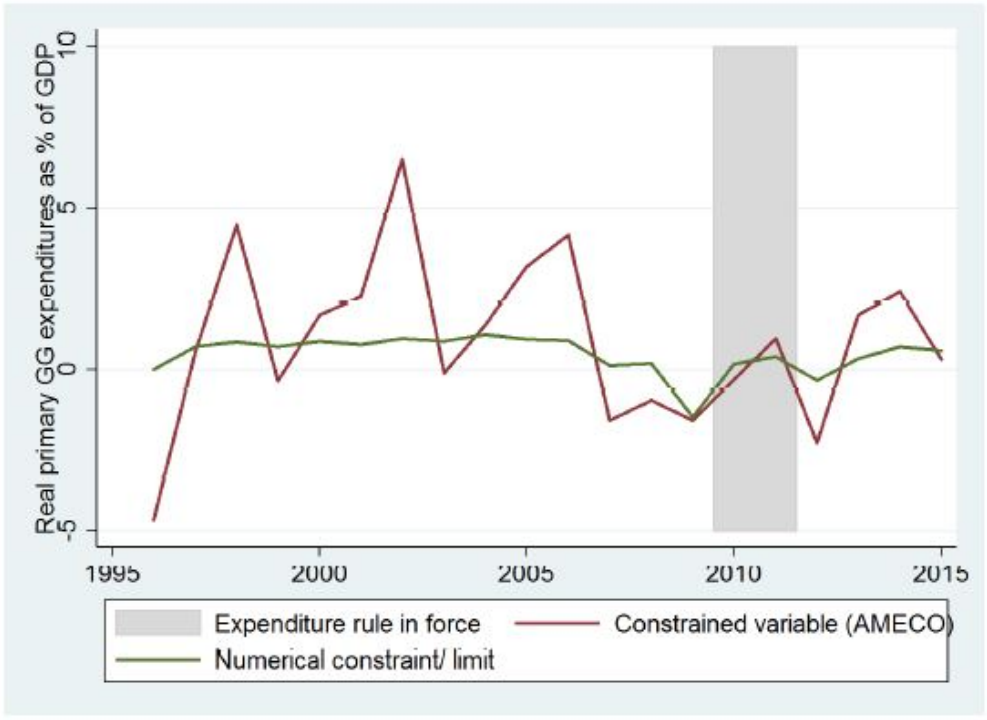
Source: Author, AMECO

Graph IV.1.5: **Variables of Expenditure Rule (since 2011), France (Central Government)**



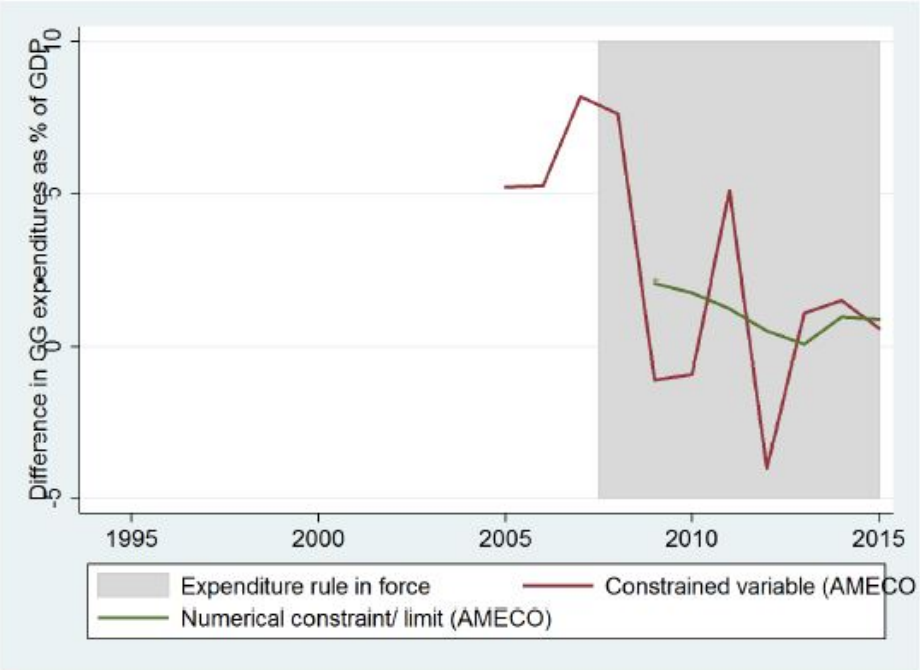
Source: Author, AMECO

Graph IV1.6: **Variables of Expenditure Rule (2010-2011), Hungary (General Government)**



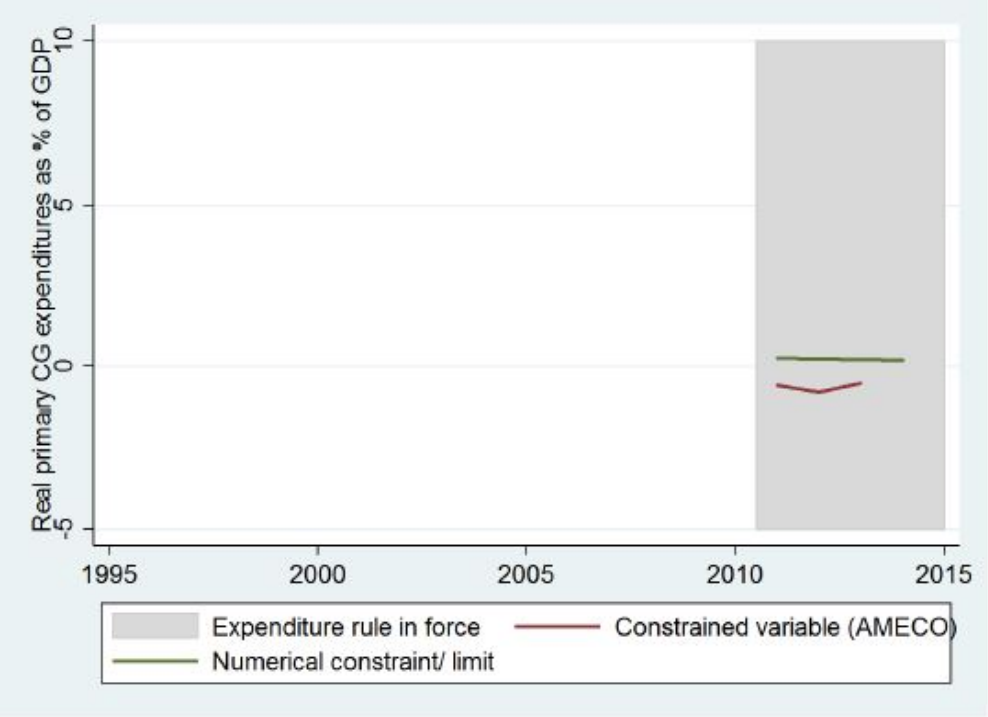
Source: Author, AMECO

Graph IV..1.7: **Variables of Expenditure Rule (since 2008), Lithuania (General Government)**



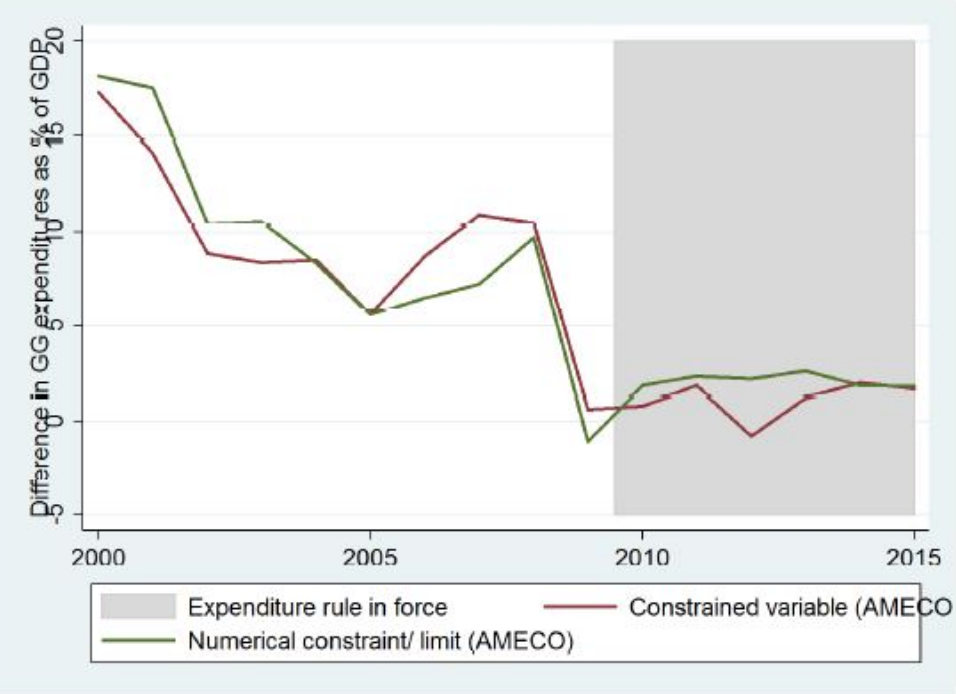
Source: Author, AMECO

Graph IV.1.8: **Variables of Expenditure Rule (since 2011), Poland (Central Government)**



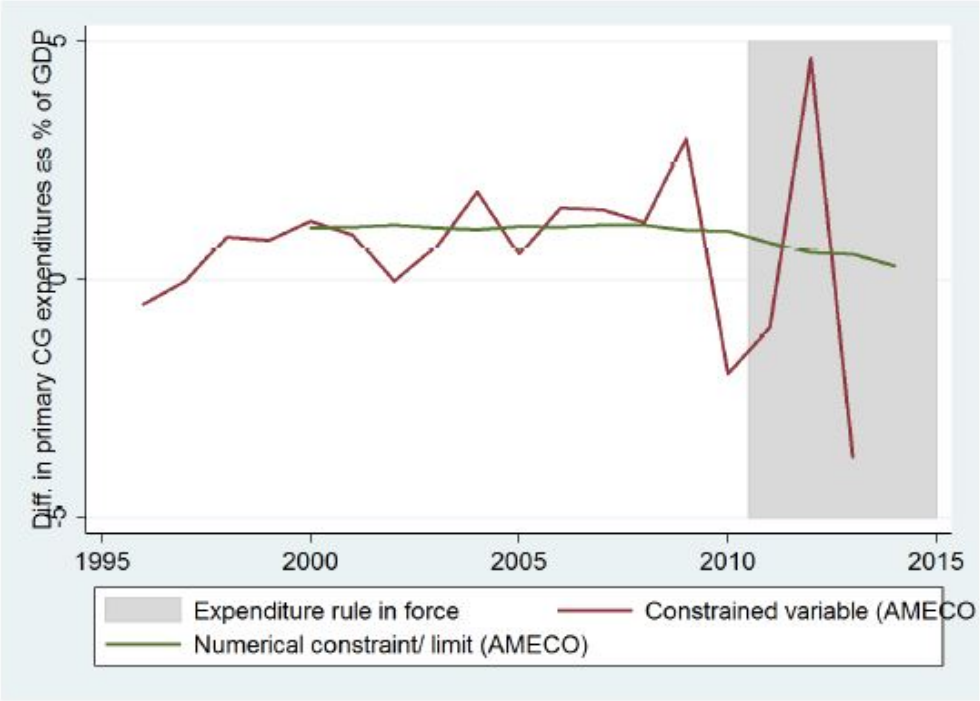
Source: Author, AMECO

Graph IV.1.9: **Variables of Expenditure Rule (since 2010), Romania (General Government)**



Source: Author, AMECO

Graph IV.1.10: **Variables of Expenditure Rule (since 2011), Spain (Central Government)**



Source: Author, AMECO

4.2 THE EFFECT OF UK WELFARE REFORMS ON THE DISTRIBUTION OF INCOME AND WORK INCENTIVES

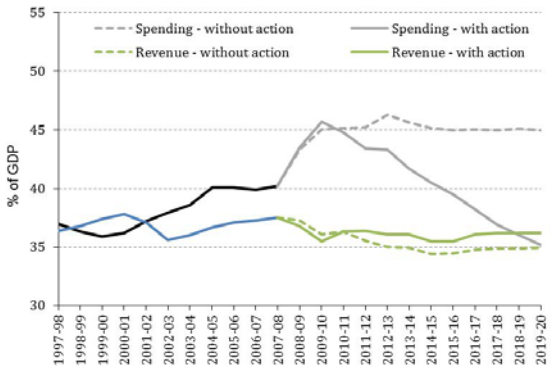
By Stuart Adam ([1]) and James Brown ([2])([3])

4.2.1. Introduction

Like many countries in the EU and elsewhere, the UK faced a large structural budget deficit in the wake of the financial crisis of 2008 and is responding by implementing a fiscal consolidation package.

The UK had a budget deficit even before the 2008 financial crisis, with spending exceeding revenue by around 3 per cent of GDP in the mid-2000s. ([4]) But the deficit grew sharply after the onset of the financial crisis and the subsequent 'Great Recession'. The dashed lines in IV.2.1 show that, if the fiscal impact of new discretionary measures implemented after 2007–08 is stripped out (but ignoring any consequences their absence would have had for the economy), official figures imply that the budget deficit would have grown to over 11 per cent of GDP by 2012–13 and remained above 10 per cent for the rest of the decade. Part of this increase is the result of falling real GDP reducing tax revenues and increasing benefit expenditure. But the biggest contributor is spending on public services and administration: the government chose to stick to pre-announced cash spending totals which represented a much larger share of GDP than originally intended when GDP fell.

Graph IV.2.1: **UK government revenue and spending**



Source: Solid lines from Office for Budget Responsibility (2014); dashed lines calculated from Figure 1.2.
Note: 'Without action' lines simply add the officially estimated net budgetary impacts of policy announcements to the latest estimates/forecasts of actual spending and receipts, ignoring any difference that the presence or absence of these measures would make to the economy and the resulting indirect impact on the public finances.

Clearly a budget deficit of that size was not sustainable, and while discretionary measures acted to provide further fiscal stimulus in 2008–09 and 2009–10, the government began a programme of concerted fiscal consolidation in 2010–11. Currently part-way through this consolidation, the UK still has a substantial budget deficit – forecast at 5 per cent of GDP in 2014–15, down from 10 per cent in 2009–10 – but current government plans are that further fiscal tightening through the second half of this decade will eliminate the deficit and in fact lead to a budget surplus of 1 per cent of GDP by the

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([3]) This research was funded by the ESRC Centre for the Microeconomic Analysis of Public Policy at the Institute for Fiscal Studies (RES-544-28-5001). The Family Resources Survey was collected by the Department for Work and Pensions and made available through the Economic and Social Data Service (ESDS), which bears no responsibility for the interpretation of the data in this Working Paper. Living Costs and Food Survey data are collected by the Office for National Statistics and distributed by the Economic and Social Data Service. Crown copyright material is reproduced with the permission of the Controller of HMSO and the Queen's Printer for Scotland. The authors thank Nicolas Carnot and Javier Perez for their discussions of a draft of this paper at the ECFIN workshop on expenditure-based consolidation and thank Carl Emmerson, Paul Johnson and participants at the 2014 Work, Pensions and Labour Economics Study Group annual conference for comments on an earlier version. Any errors and omissions are the responsibility of the authors.
([4]) The UK's Office for Budget Responsibility, the IMF and the OECD now estimate that the structural deficit was bigger than this 'raw' deficit, at around 4–5 per cent of GDP in 2007, though estimates at the time did not suggest this. See Box 1.1 of Emmerson and Tetlow (2015) for a discussion.

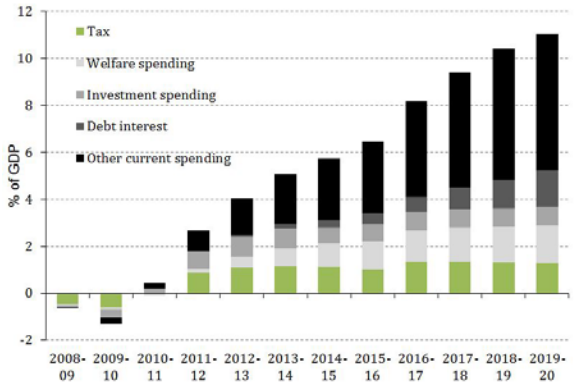
end of the decade (the gap between the solid lines in Graph IV.2.1). With a 1 per cent surplus rather than a 10 per cent deficit, discretionary measures thus amount to a net fiscal tightening of 11 per cent of GDP in 2019–20.

Graph IV.2.2 shows the net impact of these discretionary measures on each year's fiscal position (that is, the different between the solid and dashed lines in Graph IV.2.1), from the small loosening in 2008–09 and 2009–10 to the 11 per cent of GDP tightening in 2019–20, and breaks it down into net tax increases and net reductions in various categories of government spending.

The coalition government that came to office in 2010–11 chose to implement most of the fiscal tightening on the spending side. By 2019–20 only 12 per cent of the fiscal tightening will come from tax rises; 53 per cent is accounted for by cuts to spending on public services and administration ('other current spending' in Graph IV.2.2), 7 per cent by cuts to investment spending and 15 per cent by cuts to welfare spending, with the remainder being the reduced cost of servicing a smaller debt. However, the tax rises and investment cuts have almost all been implemented already. While some additional welfare cuts (and reductions in debt interest) are pencilled in, most of the remaining consolidation is due to involve cutting other current spending. Where these future cuts will be made is so far largely unspecified.

The focus of this paper is on cuts to welfare spending, which have so far been a major component of the fiscal consolidation. Specifically, we examine discretionary changes in welfare policy implemented between May 2010 and May 2015, the coalition government's term of office. The empirical analysis in this paper was conducted in autumn 2014, and so excludes reforms announced in the Autumn Statement of December 2014 or the Budget of March 2015. ([5])

Graph IV.2.2: **Composition of the discretionary fiscal tightening**



Source: IFS calculations based on HM Treasury and Office for Budget Responsibility figures.

The most direct way in which welfare changes can reduce government spending is simply by reducing entitlements, making affected households worse off. In this paper we show what types of households have seen their entitlements cut and by how much. But as well as reducing expenditure directly, the UK government hopes that its welfare reforms will encourage work. The most important of its structural reforms is to introduce a 'universal credit', which will combine six means-tested benefits for those of working age into a single payment. However, other benefit cuts and tax rises that form part of the fiscal consolidation package will also affect work incentives. And falling real wages over the period when these changes are being introduced will tend to make work less attractive, other things being equal. We use micro-simulation techniques to investigate whether financial work incentives will indeed be stronger in 2015–16 than they were in 2010–11 and to separate out the impact of changes to taxes, benefit cuts and the introduction of universal credit from the impact of wider economic changes. We do not, however, attempt to quantify people's responses to those work incentive changes, or therefore the second-round effects the reforms have on the budget deficit.

([5]) In practice those announcements were minor compared to those discussed in this paper. Updated analysis – but in much less depth than this paper, particularly as regards work incentives – is available at http://election2015.ifs.org.uk.

The paper proceeds as follows. In Section 4.2.2 we explain how we measure financial work incentives and discuss the implications of abstracting from behavioural responses to reforms. The focus of this paper is on welfare reforms; but to put that discussion into context, in Section 4.2.3 we look at changes in financial work incentives that are not directly caused by tax and benefit reforms at all but by changes in wider economic variables (notably falls in real earnings). Section 4.2.4 then describes the tax and benefit reforms being introduced in the UK between 2010 and 2015. Using the IFS's tax and benefit micro-simulation model, TAXBEN, Section 4.2.5 shows the distributional impact of these reforms, while Section 4.2.6 quantifies their impact on financial work incentives across the population. This is done separately excluding and including universal credit, both to allow us to assess the impact of this important reform on its own and because the introduction of universal credit has been severely delayed such that it will not affect most claimants until well after 2015. Section 4.2.7 concludes.

4.2.2. Measurement and policy analysis

4.2.2.1. Measuring financial work incentives

Financial work incentives depend on the relationship between hours of work and net income (that is, income after taxes and benefits). Thus, they will depend on both the gross wage rate an individual can command and the taxes and benefits payable from/to them at different levels of earnings.

Graph IV.2.3 shows the budget constraint for one example low-wage lone parent under the 2014–15 tax and benefit system and the role of different benefits and tax credits in creating it. One striking feature is the sheer number of different benefits involved, demonstrating one of the government's arguments in favour of the introduction of universal credit, which will combine most of these benefits into a single payment. At low levels of hours worked, the budget constraint is completely flat because means-tested out-of-work benefits (income support (IS), income-based jobseeker's allowance (JSA) or employment and support allowance (ESA)), which top up claimants' income to a minimum level, are reduced pound-for-pound as private income rises until that minimum level is reached. Working tax credit (WTC) provides support for those who are in work but have a low income and gives a strong incentive for this lone parent to work at least 16 hours per week; but once over the 16-hour threshold they receive little gain from increasing their earnings, as they face withdrawal of multiple benefits over the same range of income (namely tax credits, housing benefit (HB), which provides support towards rental costs, and council tax support, which gives low-income families assistance with their local tax liabilities). ([6])

To understand fully the financial work incentives facing any given individual, one would ideally look at their full budget constraint. But to make analysis of the whole population tractable, we use summary measures of work incentives. We distinguish between the incentive an individual faces to do paid work at all (as opposed to not working) and the incentive for someone in work to increase their earnings slightly – whether by working more hours, seeking promotion, or moving to a better-paid job. We measure the incentive to work at all by the replacement rate (RR), an individual's income if they did not work as a percentage of their in-work income, and the participation tax rate (PTR), the proportion of total earnings taken in tax and withdrawn benefits. ([7]) That is:

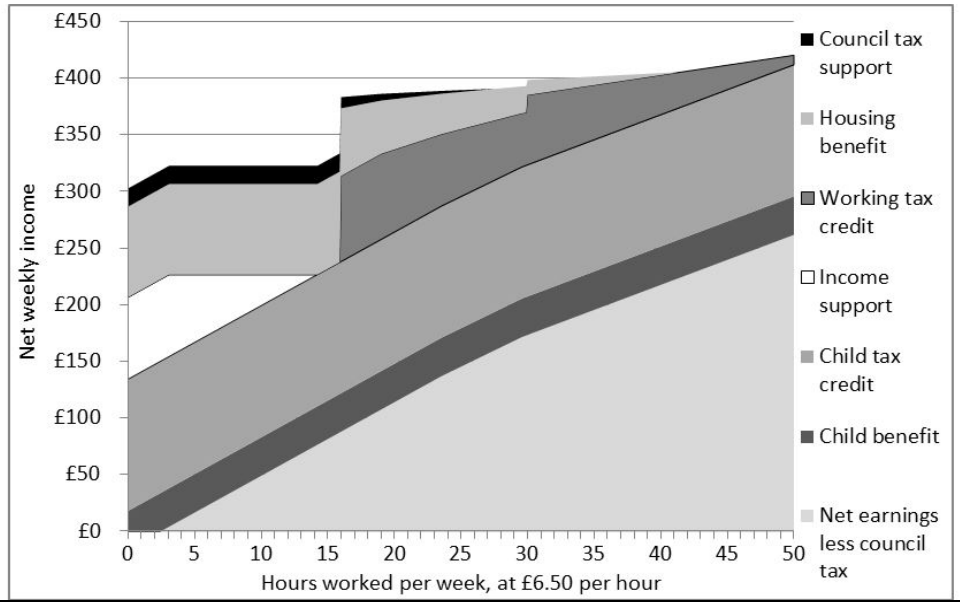
$$\text{RR} = \frac{\text{Net income out of work}}{\text{Net income in work}}$$

$$\text{PTR} = 1 - \frac{\text{Net income in work} - \text{Net income out of work}}{\text{Gross earnings}}$$

([6]) Council tax is a banded property-based tax, the level of which is set by local authorities. See Pope and Roantree (2014) for more details.

([7]) All references to 'work' in this paper refer to paid work: people not in paid work are not necessarily living a life of leisure.

Graph IV.2.3: **Composition of an example budget constraint in 2014–15**



Source: Authors' calculations using TAXBEN.

We measure the incentive for those in work to increase their earnings by the effective marginal tax rate (EMTR), the proportion of a small increase in earnings taken in tax and withdrawn benefits. In this paper, we calculate EMTRs by increasing individuals' earnings by one penny a week, but leaving their hours of work unchanged. ([8]) In all cases, higher numbers mean weaker work incentives.

When calculating these measures, we include employer National Insurance contributions (NICs) (so our measure of 'gross earnings' might more accurately be termed 'employer cost'), and we include indirect taxes by imputing an indirect tax rate for each household and assuming that this rate would apply to any change in their household's net income.

When looking at work incentives for members of couples, we focus on the relationship between an individual's working behaviour and their family's net income. This implicitly assumes that couples fully pool their income between them – not a wholly realistic assumption, but alternative extreme scenarios seem even less plausible and modelling truly realistic within-household allocations would be too difficult.

The fact that the PTR is based on the *difference* between in-work and out-of-work income, while the RR is based on the *ratio* between them gives them significantly different properties:

something that changes in-work and out-of-work incomes by the same proportion – such as a uniform VAT – will affect PTRs but have no effect on RRs;

something that changes in-work and out-of-work incomes by the same cash amount – such as a non-means-tested benefit – will affect RRs but have no effect on PTRs (that is, PTRs do not reflect income effects). Note that, given how we measure these for couples, something that changes the income brought in by one member of a couple irrespective of their partner's income (a change in their income

([8]) An alternative would have been to increase hours of work slightly and leave the hourly wage unchanged. This can yield different results because entitlements to some benefits and tax credits depend on hours of work as well as on income. It is debatable which is the more relevant measure of work incentives: traditional labour supply analysis has focused on how hours of work respond to incentives, but more recent literature has found that the overall responsiveness of taxable income is much greater than that of labour supply – implying that much of the overall response of taxable income comprises other aspects of behaviour – and that responses often take other forms, such as intensity of effort per hour, moving jobs, etc. (see, for example, Saez, Slemrod and Giertz (2012) for a review). In practice, however, we have found in previous (unpublished) analysis that estimates of the distribution of EMTRs, and the effect of reforms on it, are not very sensitive to whether it is hours or the hourly wage that are increased (or indeed to the size of the increase used).

tax when the family is not subject to a means test, for example) will therefore change their partner's RR but not their PTR.

Arguably, the RR is a better measure of the financial incentive to be in work, while the PTR is a better measure of how far the tax and benefit system weakens the financial incentive to be in work.

When measuring work incentives, we examine the long-term impact of an individual moving into work or increasing their earnings on their family's disposable income, ignoring features of the tax and benefit system that provide support only temporarily or after a certain waiting period.

Examining how individual reforms affect example people can be informative. But there is a limit to what can be achieved by looking at individual examples when circumstances vary so widely it is hard to be sure how representative a particular person is. And when we wish to assess the combined effect of a large number of reforms that interact with household characteristics in complicated ways, a micro-simulation model of the tax and benefit system is indispensable. In this paper we use the IFS's tax and benefit micro-simulation model, TAXBEN, to calculate how actual and alternative tax and benefit systems would affect the incomes of a representative sample of the UK population, and how those same tax and benefit systems would affect their incomes if they stopped working, increased their earnings, etc. TAXBEN is an extremely detailed model which allows us to incorporate the main indirect taxes (VAT and excise duties) as well as income tax, employee and employer National Insurance contributions, local (council) tax and all the main benefits and tax credits. It excludes business most business taxes (corporation tax and business rates, a tax on business property) and capital taxes (capital gains tax, inheritance tax and stamp duties on property and share transactions). It is a model of entitlements and liabilities rather than actual payments, so it does not incorporate tax evasion, benefit fraud or non-take-up of entitlements. It also does not model behavioural responses to taxes and benefits. ([9])

4.2.2.2. Behavioural responses and policy analysis

The analysis in this paper is essentially a complicated arithmetical exercise, using TAXBEN to apply the rules of different tax and benefit systems to data on a given set of people, with given gross incomes and other characteristics, and calculating how their net household incomes (in and out of work) are affected.

In reality, people's gross incomes and other characteristics may well respond to tax and benefit changes. Indeed, looking at the effect of reforms on work incentives is interesting precisely because people may respond to those incentives. In this paper we do not attempt to quantify these behavioural responses, merely to quantify the changes in the incentives themselves and in household incomes holding behaviour fixed.

For the distributional analysis in section 4.2.5, measuring changes in household incomes after behavioural responses (rather than before, as we do) would not necessarily be preferable even if it were straightforward. For example, suppose a benefit cut induced someone to work more. In that case the person's net income might rise, yet the person would still be worse off as a result of the reform (their income at any hours choice would be the same as or lower than before). The ideal might be to estimate a structural model of behavior centered on a utility function and directly assess the effect of the reform on the person's well-being, taking into account both the value of income and the value of leisure. But short of estimating the effect of reforms on well-being across the population, a no-behavioural-response distributional analysis may be preferable to an analysis of the distribution of incomes after behavioural responses.

When analyzing work incentives, in effect we decompose the overall change in work incentives from 2010 to 2015 into the effect of changes in pre-tax incomes etc. (section 4.2.3) and the effect of changes in tax and benefit policy (section 4.2.6). But some of the changes in gross earnings will be the result of behavioural responses to the tax and benefit reforms. We should therefore recognise that, in our

([9]) An older version of TAXBEN is described in Giles and McCrae (1995). The model has been developed since then, but its basic structure and function is little changed.

decomposition, the changes in pre-tax incomes etc. in section 4.2.3 incorporate indirect effects of tax and benefit reforms, while section 4.2.6 quantifies only the direct effect of tax and benefit reforms.

Behavioral responses to reforms also feed back into revenue. Cutting means-tested benefits saves money directly, but if it also induces people to work (or work more) then that will further reduce benefit spending and increase tax revenue. Increasing tax rates raises revenue, but if it discourages work then part of the revenue gain will be lost. ([10]) Thus the more the reforms strengthen (or weaken) work incentives – and the more the affected groups respond to work incentive changes – the more (less) effectively they will contribute to reducing the budget deficit. Our estimates of the effects on work incentives provide some pointers as to the direction of these reinforcements/offsets for different population groups, but since in this paper we say nothing about different groups' responsiveness to those incentives, we do not quantify the feedback effects on revenue.

There is, of course, a large literature estimating responses to work incentives. ([11]) We know, for example, that the employment decisions of women with school-age children and of people around retirement age are relatively responsive, whereas the hours of work of 25-50-year-old men barely respond to financial incentives at all.

We might therefore think it is particularly important to minimise disincentives to work for those groups that are most responsive to them. ([12]) At the same time we must also bear in mind the government's social preferences. Consider, for example, work incentives for first versus second earners in couples (as we will see, assessing entitlements based on couples' joint incomes can create a trade-off between the two). One the one hand, the labour supply decisions of (actual or potential) second earners are generally more responsive to financial incentives than those of the first earner, suggesting that we should put more emphasis on incentives for those with working partners. On the other hand, for a variety of reasons governments might simply care more about minimising the number of workless households than about enabling households to have two earners rather than one, which would suggest putting more emphasis on incentives for those without working partners. Moreover, financial work incentives may already be stronger for more responsive groups, ([13]) in which case strengthen their incentives further is not necessarily more important than strengthening incentives for those (perhaps less responsive) groups whose incentives are currently weaker.

Balancing these delicate considerations to reach policy conclusions is the subject of optimal tax analysis, such as that in Brewer, Saez and Shephard (2010) and Mirrlees et al (2011). Our goal in this paper is a less ambitious one: to quantify the direct impact of reforms on households' incomes and individuals' work incentives, taking people's characteristics and behaviour as given. This does not allow us to draw normative conclusions, but provides an important part of the evidence needed for an informed debate about policy.

4.2.3. The impact of wider economic and demographic changes on work incentives

Falling real earnings since the start of the recession have reduced household incomes in the UK. ([14]) They are also changing people's incentives to work.

RRs, PTRs and EMTRs depend on, among other things, how people's (actual or potential) earnings and other private income compare to rates and thresholds in the tax and benefit system. If individuals' earnings grow at different rates from tax thresholds or from benefit rates and thresholds, then the work incentives they face will change.

([10]) The loss due to behavioural response can even exceed the 'mechanical' revenue gain, leading to a net revenue reduction, if tax rates are increased above the point where the Laffer curve peaks.
([11]) See, for example, Meghir and Phillips (2010), Blundell and Macurdy (1999), Bargain, Orsini and Peichl (2011) and Keane (2011) for reviews.
([12]) As argued in Section 4.4 of Mirrlees et al. (2011), for example.
([13]) Section 4.1.3 of Mirrlees et al. (2011) provides qualified evidence of this for the UK.
([14]) See Brewer *et al.* (2013) for analysis of how household incomes are likely to change over this period.

Prior to 2010, in the absence of discretionary reforms, most rates and thresholds affecting those of working age increased in line with Retail Prices Index (RPI) inflation. ([15]) Earnings have been growing much less quickly than this: the Office for Budget Responsibility suggest that they will fall by 6.2% between 2010–11 and 2015–16 relative to the RPI figures used for uprating. ([16])

We can model the consequences for work incentives of these changes in real earnings – along with changes in other (e.g. demographic) characteristics of the working-age population. ([17]) As noted in the previous section, some of these changes in real earnings and other characteristics may themselves be responses to the reforms discussed later in this paper.

4.2.3.1. Methodology

Our approach in this section is to compare the pattern of work incentives in 2010–11 with what the pattern would be in 2015–16 excluding the impact of policy reforms. To estimate the distribution of financial work incentives in 2010–11, we run data from the 2010–11 Family Resources Survey (FRS) through a 2010–11 tax and benefit system in TAXBEN. Estimating work incentives in 2015–16 requires us to simulate a 2015–16 population and a 2015–16 tax and benefit system. The tax and benefit system is obtained by taking the actual 2010–11 tax and benefit system and applying default indexation rules (as they stood in 2010) to create a 'no reform' 2015–16 system in 2015–16 prices.

Simulating a 2015–16 population is more complicated; our methodology is very similar to that of Brewer *et al.* (2013) and more detail is available in that paper. We start with FRS data from 2012–13 and first uprate financial variables in the data (most importantly for our purposes, gross earnings) in line with observed or forecast changes. Earnings are increased with actual average earnings growth as reported by the ONS between 2012–13 and 2013–14, and then in line with Office for Budget Responsibility forecasts of average earnings growth from 2013–14 to 2015–16 (Office for Budget Responsibility, 2014). In each case, earnings growth is allowed to vary by industry according to projections from Oxford Economics. The data are then reweighted (using the algorithm set out in Gomulka (1992), implemented in Stata by the reweight2 command (Browne, 2012)) to account for forecast changes to employment and other socio-demographic variables: loosely speaking, this increases the relative weights given to types of people and households forecast to become relatively more common. ([18]) Our analysis of work incentives focuses only on those aged between 19 and the State Pension Age in 2010 (in other words, women aged 19–59 and men aged 19–64). ([19]) This gives us 24,578 observations.

Work incentive measures for those in paid work are calculated at their actual level of hours and earnings. For those not in paid work, financial incentives to move into work depend on what their earnings and hours would be if they were to work. For each non-working individual, we calculate RRs and PTRs at four different hours points, using predicted earnings based on an Ordinary Least Squares regression of log weekly earnings of individuals observed employed in the relevant hours category on various characteristics including age, sex, region, ethnicity, education, housing tenure, number and ages of children, partnership status, and any partner's employment status and earnings. Once we have calculated four PTRs and RRs for each non-worker, these are weighted according to estimated probabilities of that individual choosing to work that number of hours were they to enter paid work.

([15]) This was not true of all rates and thresholds, however: means-tested benefit rates were increased in line with Rossi, a slightly different inflation measure, and a few benefit rates and thresholds were frozen by default. As we discuss in Section 4, the government has since switched to using CPI inflation to uprate most benefit rates and direct tax thresholds.

([16]) See Table 4.1 of Office for Budget Responsibility (2013, 2014). The figures in the text compare nominal earnings growth in each fiscal year to RPI inflation in the September of the *previous* fiscal year, since that is what was used for uprating most tax and benefit parameters.

([17]) In this section, we take wider economic changes as given though if the government had not introduced any tax and benefit reforms, earnings (and other characteristics) might have evolved in different ways. Modelling how behavioural responses to tax and benefit changes affect the wider economy goes beyond the scope of this paper.

([18]) Specifically, we control for changes in the total population by age and sex, by region and by ethnicity, household type by region, employment by industry and by region. The sources of the population and household control totals we use for future years are Office for National Statistics (2013, 2014), Northern Ireland Statistics and Research Agency (2010), Department for Communities and Local Government (2013), Welsh Assembly Government (2014), General Register Office for Scotland (2012). We control for changes in total employment using forecasts from the Office of Budget Responsibility (2014). Within that total, changes in employment are allowed to vary by constituent nation and English region, and by industry, according to forecasts provided by Oxford Economics.

([19]) The female State Pension Age is in the process of being increased from 60 to 65 between April 2010 and November 2018.

Probabilities are calculated using a multinomial logit model, again estimated using the behaviour of individuals in paid work in our data with the same set of explanatory variables. ([20]) As the FRS does not contain information on spending patterns for each household, we give each household an average consumption tax rate for their household type (single without children, lone parent, couple without children, couple with children) and income decile calculated using TAXBEN run on the 2012 Living Costs and Food Survey (LCFS).

4.2.3.2. Results

When we compare our measures of financial work incentives for our 2015–16 synthetic population under an unreformed 2010–11 tax and benefit system (one where all benefit rates and tax thresholds are increased in line with default indexation) with those from the actual 2010–11 population, we find that the RR, the ratio of out-of-work income to in-work income, increases, as we would expect when earnings increase less quickly than benefits. The mean RR rises from 55.6% to 56.9%, and the median RR from 57.0% to 58.5%.

The effect of lower real earnings on PTRs is theoretically ambiguous and will depend on whether the extra earnings would have been subject to a higher or lower effective tax rate (including benefit withdrawal) than their overall earnings – in other words (for small changes in earnings) whether an individual's EMTR is higher or lower than their PTR. In practice we find that, in the absence of reforms, PTRs would have increased on average, but by less than RRs, with the mean PTR rising from 52.0% to 52.8%, and the median from 50.5% to 51.7%.

Similarly, the impact of lower real earnings on EMTRs depends on whether an individual's EMTR would be lower or higher if their earnings were slightly lower. Again we find that, in the absence of reforms, EMTRs of those in work would have slightly increased on average: the mean EMTR rises from 53.5% to 54.3%, and the median from 49.6% to 50.6%. Lower earnings mean that some workers fall into a lower tax bracket, but also that more workers face withdrawal of means-tested benefits.

In the absence of discretionary reforms, then (and abstracting from their effects on people's behaviour), changes in population characteristics from 2010 to 2015 – in particular real earnings growing less quickly than taxes and benefits were due to be uprated – would have weakened average work incentives on all of our measures.

In the remainder of this paper we look at how tax and benefit reforms are due to change the outlook for work incentives in 2015 relative to this no-reform baseline.

4.2.4. Tax and benefit reforms from 2010 to 2015

The reforms we consider in this paper are those that have been implemented, or are due to be implemented, from when the UK's coalition government took office in May 2010 until the scheduled end of its term of office in May 2015; in other words, comparing the tax and benefit system it inherited from its predecessor with the one it will bequeath to its successor. That is not the same as examining reforms *announced* by the coalition. The present government has chosen to go ahead with certain changes announced by its Labour predecessor but not others. It has also announced some reforms that are due to be implemented after May 2015, and as some of the reforms introduced by the present government affect the way that benefit and tax credit rates are increased year on year, they will have an increasing effect over time. The full set of tax and benefit reforms that we model is listed in section 4.2.8 (Appendix A). ([21])

The main tax changes that affect work incentives are the following.

([20]) This methodology is the same as that used in Adam and Phillips (2012): a fuller description is given in Appendix A of that paper.

([21]) Note that there are some reforms that we do not model here, including most changes to business taxes (including corporation tax and business rates, though not employer NICs), most changes to capital taxes (including capital gains tax, inheritance tax and stamp duty) and some changes to benefits, including changes to the way in which in-year changes in income affect tax credit awards.

Changes in tax rates: The government has raised significant revenue by increasing employer, employee and self-employed NIC rates by 1 ppt each, and by increasing the main rate of VAT from 17.5% to 20%, partly offset by substantial real reductions in fuel duties. These rises in tax rates straightforwardly increase EMTRs and PTRs. But the effect on RRs is different: NIC rises do increase RRs for people without working partners but have ambiguous effects on RRs for people with working partners (since both in-work and out-of-work income fall, by amounts that depend on the two partners' earnings), while changes to indirect tax rates do not affect RRs at all (since in-work and out-of-work income are reduced by the same fraction).

Changes in tax thresholds: The government has announced big increases in the point at which income tax starts to be paid (and much smaller increases in the points at which employer and employee NICs start to be paid) while reducing the point at which higher-rate income-tax (but a reduced rate of employee NICs) starts to be paid. These reforms reduce EMTRs for those low earners taken out of income tax and increase EMTRs for those higher earners brought into higher-rate tax. In terms of the incentive to be in work at all, the reforms increase PTRs for higher-rate taxpayers and reduce them for everyone else; the same is true of RRs, except for people with working partners, for whom the effects are again ambiguous.

Welfare reforms that affect financial work incentives can be divided into three main groups: changes in the generosity of 'safety-net' benefits; cuts to in-work support; and means-testing more aggressively. ([22])

Changes in the generosity of safety-net benefits: The majority of the welfare reforms involve changing the maximum amount of means-tested support that can be received by those with no other income. This includes (amongst others) cuts to HB and council tax support. ([23]) These cuts straightforwardly strengthen work incentives, reducing out-of-work income, meaning there is less to lose from moving into work, and reducing the number of people on means-tested benefit tapers. In some cases the government has increased the generosity of safety-net benefits, notably increasing the child element of child tax credit (CTC), which has the opposite effect, weakening work incentives for those affected.

Cuts to in-work support: WTC provides support to low-income working families. The coalition government has introduced real-terms cuts to the maximum value of WTC and increased the weekly hours that couples with children must work to qualify from 16 to 24.These cuts to WTC weaken the incentive for families to have someone in low-paid work. However, with less generous in-work support, those already receiving WTC before the reforms have less to lose from increasing their family earnings. One way in which a couple can increase their earnings is, of course, for both partners to work instead of one. Thus, for couples, cuts to WTC weaken the incentive for the first partner to be in work, but strengthen the incentive for both members of a couple to work rather than just one. Being a one-earner couple is being made less attractive, both relative to being a no-earner couple and relative to being a two-earner couple. ([24])

Means-testing more aggressively: As well as changing the maximum amount of means-tested benefits and tax credits that can be received, the government's welfare reforms also involve means-testing tax credits more aggressively and means-testing child benefit for the first time. These cuts affect only those in work, so they weaken the incentive for families to have someone in work. In the case of tax credits, the effect for couples will often be similar to that of cutting WTC: while the incentive to have a first earner in work is weakened, the reduced support for one-earner couples can mean that there is less to

([22]) A fourth group – changes to non-means-tested benefits – includes fewer reforms affecting the working-age households that are the subject of this paper, and in any case typically has much less effect on work incentives.

([23]) Since council tax support has been localised, its generosity (in England) is now a decision for individual local authorities. In this report we assume that all local authorities in England adopt a scheme which mirrors the old council tax benefit, but reduces the maximum amount of support that can be claimed to 89.6% of the household's council tax liability, the average reduction local authorities in England have made in 2013–14, in response to the cut in funding from central government.

([24]) This is not true, however, of the reduction in the childcare element of WTC. To qualify for childcare support, both members of the couple must be in paid work, so reducing it has no effect on the incentive for the first partner to be in work (since the presence of a non-working partner disqualifies them from the childcare support anyway) but weakens the incentive for a second earner to be in work (since working entitles them to less childcare support than before the reforms).

be lost by – and thus a stronger incentive for – the second member of the couple entering work. ([25]) Turning to incentives for those in work to increase their earnings, the means-testing of child benefit clearly reduces the incentive for those in work to increase their earnings through the £50,000 to £60,000 range over which the benefit will be withdrawn. The effect of reforms to the means-testing of tax credits on the incentive for those in work to increase their earnings is more complicated, with higher and lower EMTRs applying to people in different income ranges.

By far the biggest cut to welfare introduced by the coalition government is the switch to uprating most working-age benefit rates annually in line with the CPI measure of inflation, rather than the RPI and Rossi measures used previously (reform 4 in Table IV.2.6). ([26]) Since CPI inflation is usually lower than the measures it was replacing, this change leads to steadily falling benefit rates relative to what they would otherwise have been. Five years of this lower indexation starting from April 2011 was expected at the time to be saving the Exchequer £10.6 billion a year by 2015–16, a figure that will keep rising thereafter. ([27]) Furthermore, most benefit and tax credit rates are being increased by only 1% in nominal terms in April 2013, 2014 and 2015 (less than CPI inflation), saving a further £2.3 billion a year by 2015–16 (reforms 29, 30 and 31). Since changes to uprating policy affect rates of both in-work and out-of-work benefits, its effects combine the features of both.

The government has made a number of changes to the benefits system that affect ***non-financial work incentives*** **–** that is, they do not directly affect the relationship between hours of work and net income but might nevertheless have an effect on people's work behaviour.

The introduction of the Work Programme, in which welfare-to-work services are delivered by a mix of private, voluntary and public-sector organisations, which are then paid according to their success in returning claimants to work. The intention is that the Work Programme should give providers greater flexibility to innovate and stronger incentives to get claimants into work. After disappointing initial results, outcomes from the Work Programme have somewhat improved to be comparable to those of previous programmes but remain well below the government's initial expectations. ([28])

Lone parents with children aged 5 or over now have to claim JSA rather than IS. This does not affect their monetary entitlements in most cases, but does place additional work search requirements on these claimants.

Tougher medical tests for disability benefits are reducing benefit entitlements and/or increasing work search requirements for some of those who would previously have qualified for disability benefits.

Overall, one would expect these changes to have a positive impact on the likelihood of people entering work, though the magnitude of this effect is unclear.

4.2.4.1. Universal credit

The introduction of universal credit is perhaps the most radical restructuring of the working-age benefits system since the 1940s. Universal credit is a new benefit, which will replace six of the seven main existing means-tested benefits and tax credits for those of working age: IS, income-based JSA, income-related ESA, HB, CTC and WTC. The seventh main means-tested benefit for those of working

([25]) However, that is not always the case: if the couple's combined income would still leave them entitled to tax credits in the absence of the reforms (perfectly possible given that entitlement extended up to family income of more than £58,000), it is possible that the reforms can reduce the couple's entitlement by more if both partners work than if only one does, in which case the incentive to have a second partner in work is also weaker. In the case of Child Benefit, all that is relevant is the income of the higher-income parent: the reform weakens the incentive for the higher-income parent to stay in (or move into) work if their income would be more than £50,000 (unless both partners have income above £60,000).

([26]) Rossi had been used to uprate IS, ESA and JSA (and consequently the threshold for withdrawing HB and council tax benefit, which were set at that same level), while the RPI was used to uprate most other benefits and tax credits.

([27]) Note that this revenue effect also includes the effect of a shift to CPI-uprating of public service pensions, which we do not discuss further in this paper. The actual saving will depend on the size of the difference between RPI and CPI inflation, which has been revised downwards since Budget 2011, meaning that the actual saving will likely be much lower than this.

([28]) See Comptroller and Auditor General (2012, 2014) and Public Accounts Committee (2013, 2014).

age, council tax benefit, is not being brought within universal credit, though it has also been reformed. ([29])

The first claims to universal credit were made in April 2013 and it is gradually being extended to more areas and more claimant groups. However, the roll-out is running several years behind the government's original schedule and on current plans some claimants will still be receiving the existing means-tested benefits and tax credits into the next decade. Furthermore, there will be transitional protection for existing claimants of means-tested benefits and tax credits who would otherwise receive less in universal credit than they currently receive in benefits and tax credits when they are moved across. The combination of a long phase-in period and transitional protection for existing claimants means that it will be a long time before universal credit rates apply to everyone. Because of this we model the two extreme scenarios: one that ignores universal credit completely, and one that treats it as being fully implemented in 2015–16 with no transitional protection. The actual position will be somewhere in between these two extremes for some years.

4.2.4.2. The impact of universal credit on benefit entitlements and work incentives

The budget constraint in Graph IV.2.4 shows the impact of universal credit on the financial work incentives faced by the example lone parent we encountered in Section 2 in 2015–16. This illustrates some of the key features of universal credit; in particular: ([30])

Entitlements for those with no other income or assets are the same as under the current benefit system. This is because each of the components of universal credit is set equal to the equivalent benefit under the current system. ([31])

There is a 'work allowance' before entitlement starts to be withdrawn, the size of which varies by family type and by whether a family is claiming the housing component. The work allowance is much larger in universal credit than in the existing out-of-work benefits.

Earnings (net of income tax and NICs) above the work allowance are subject to a taper rate of 65%. The 100% taper rates on earnings associated with IS, JSA and ESA will no longer exist, and by combining several overlapping means tests into a single one, universal credit reduces the maximum EMTR an individual can face below that created by tax credits and HB together. However, special rules are used to impute income from savings, which place a very high effective tax rate on savings in certain ranges, and other unearned income reduces entitlement pound-for-pound.

There are no longer any jumps in the budget constraint when an individual works a certain number of hours each week and qualifies for WTC (16 in this case, but 24 or 30 in others). ([32]) Graph IV.2.4 ignores council tax and associated rebates. Although universal credit by itself leads to a reduction in the highest overall EMTRs, the fact that council tax support will remain separate from universal credit still leads to the possibility that two strands of support will be withdrawn simultaneously, creating EMTRs that are nearly as high as under the current system. How the new council tax support schemes designed by local authorities interact with universal credit will have significant implications for work incentives. In this paper we assume that local authorities follow the central government's default scheme in

([29]) The reform of council tax benefit is discussed in Adam and Browne (2012).
([30]) This section gives brief details on universal credit, focusing on its impacts on financial work incentives. A fuller description and analysis of its impacts are available in Browne and Roantree (2013).
([31]) That is, a family's 'personal amount' will be set equal to their maximum entitlement to JSA or IS, additional amounts for children will be set equal to the child element of CTC and the housing component will be similar to HB in that it will cover the full amount of rent for those in the social rented sector (unless they are deemed to be under-occupying their property) and private sector rents up to a 'local reference rent' level.
([32]) Note that as we assume hours worked remain constant when calculating EMTRs, we are perhaps overestimating how much universal credit strengthens individuals' incentives to increase their earnings, since in reality some individuals will increase their earnings by increasing their hours worked, which may qualify them for WTC under the current system. Such effects are not captured by our measure of EMTRs, and are no longer relevant under universal credit, which does not have hours rules.

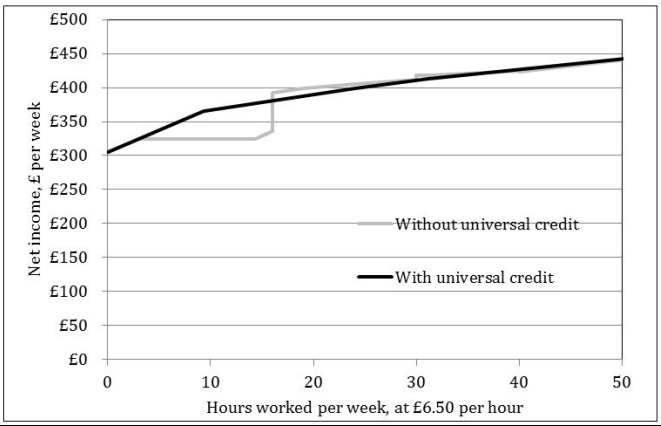
counting universal credit as income for the purposes of the means test and that the withdrawal rate is 20%. ([33])

This would involve a maximum EMTR of 80.96%, which is higher than the maximum 76.2% EMTR if council tax support were not being withdrawn in parallel to universal credit, but still lower than the highest EMTRs that can arise under the current system.

4.2.4.3. Simplicity, transparency and salience

Many of the hoped-for advantages of universal credit could arise not because of changes in financial incentives but because it is a simpler and more integrated programme. One consequence of the plethora of programmes that currently exist is that people often do not know what they are entitled to, let alone what they would be entitled to if their circumstances were different. Many out-of-work families are unaware that they could continue to claim HB and/or council tax support if they moved into low-paid work. ([34]) People might therefore be discouraged from working by a perception that PTRs are higher

Graph IV.2.4: **Budget constraint for a lone parent with two children before and after the introduction of universal credit, 2015–16**



Source: Authors' calculations
Note: Figures in 2015–16 prices. Assumes lone parent with two children who can choose how many hours to work at a given wage rate, £6.50 per hour, and has rent of £80 per week, no childcare costs, no disabled family members, and no other income. Ignores council tax and associated rebates, employer NICs and indirect taxes. 'Without universal credit' line includes all other tax and benefit changes considered in this paper.

than they actually are. Similarly, many people do not realise that WTC can be claimed by those without children, and indeed HMRC estimate that take-up of WTC by this group was only 34% of those eligible in 2012–13 (HMRC, 2014).

Under universal credit, it will be clear that the same benefit will be providing support for low-income families (albeit not at the same level) throughout their working-age lives regardless of their particular circumstances or changes therein. Since a single programme will cover a wide variety of circumstances, it is more likely that people will continue to claim the support to which they are entitled when their circumstances change. People should be aware of a simple equation: the first slice of earnings they get to keep; after that they lose 65p in the pound.

On the other hand, as complicated as the current system is, there is an argument for saying that WTC does at least provide a clear signal that if you work the requisite hours, support is available. Universal credit may lack that kind of salient and easily understood focal point: whatever the true effect on net incomes, it may not be perceived as providing such a reward to moving into work.

([33]) A 20% withdrawal rate is a standard feature of council tax support schemes in England: more than 90% of local authorities in England had this withdrawal rate in 2013–14 (Adam et al. (2014). The schemes in Scotland, Wales and Northern Ireland also have this feature.
([34]) Turley and Thomas (2006).

If people overestimate the return to work (rather than underestimate it), a simpler, more transparent system might actually weaken perceived work incentives. Changes in perception may, therefore, not be unambiguously positive.

4.2.4.4. Changes in conditionality

As well as significantly changing benefit withdrawal rates and work allowances, universal credit in principle involves a significant change in the job-search conditions for those in receipt of means-tested benefits. In the pre-universal credit system, only those claiming JSA (who cannot work for more than 16 hours a week) are subject to conditionality. Under universal credit, all claimants with total family earnings below a particular threshold will be subject to work-search requirements. If the threshold were set at the maximum level allowed by legislation, this would impose conditionality on many more people. Importantly, for couples the work-search requirements may (with some exceptions) apply to any partner not working full time if the couple's *combined* earnings are below the relevant threshold. ([35]) However, these new powers are so far not being used; currently, during the initial phases of the rollout of universal credit, the earnings threshold has been set at a lower level such that full conditionality is only applying to 'groups roughly equivalent to those subject to the current JSA conditionality regime'. The option of increasing the threshold to extend conditionality to those with slightly higher earnings has been maintained, but it is unclear at the time of writing exactly what will happen in the longer run (Department of Work and Pensions, 2013).

Although one may expect increased job-search requirements to increase the likelihood of moving in to work and increasing one's earnings, existing evidence tells us little about the impact of such requirements on those already in work.

4.2.5. The distributional impact of tax and benefit reforms

In this section we look at the distribution of gains and losses from the different reforms. This analysis is done on the synthetic 2015–16 population described in Section 4.2.3, for whom we compare incomes (and, in the next section, work incentives) in the 'no-reform' tax and benefit system considered in Section 4.2.3 with alternative 2015 tax and benefit systems which in turn include the tax reforms only, all reforms excluding universal credit, and finally all reforms including universal credit. ([36])

Official estimates suggest that the tax measures we consider in this paper will raise a net £8.2 billion, and welfare reforms a net £23.4 billion, in 2015–16. The total 'takeaway' of £31.6 billion per year is equivalent to a little over £1,100 per household in the UK. As with our analysis of work incentives, the analysis below only considers non-pensioner households. It shows that the average loss for non-pensioner households is nearly £1,300 per year: this is higher because pensioner households lose less from tax and benefit changes than other groups, and because of differences in our modelling approach from the government's.

Graphs IV.2.5 and 6 show how these losses vary across the income distribution, in cash terms and as a percentage of income respectively. Tax changes predominantly affect the richest tenth of households: this group loses out from higher NICs and VAT rates, reductions in the point at which the 40% income tax rate starts to be applied, and restrictions on pension contributions, though the loss from these measures is slightly offset by the lower top income tax rate and increases in direct tax thresholds. For those in the middle of the income distribution, though, higher direct tax thresholds more than offset increases in NICs and VAT. However, the very lowest-income households, whose incomes were already below the thresholds for paying income tax and NICs, do not benefit from the higher thresholds, but do lose out from higher VAT. The coalition government's welfare reforms (excluding universal credit) are mainly cuts that take money predominantly from the bottom half of the income

([35]) The self-employed will automatically be assumed to be meeting these conditions (and will be paid a commensurate amount of universal credit, i.e. their earned income for the purposes of the universal credit means test will be taken to be this level if it is below).

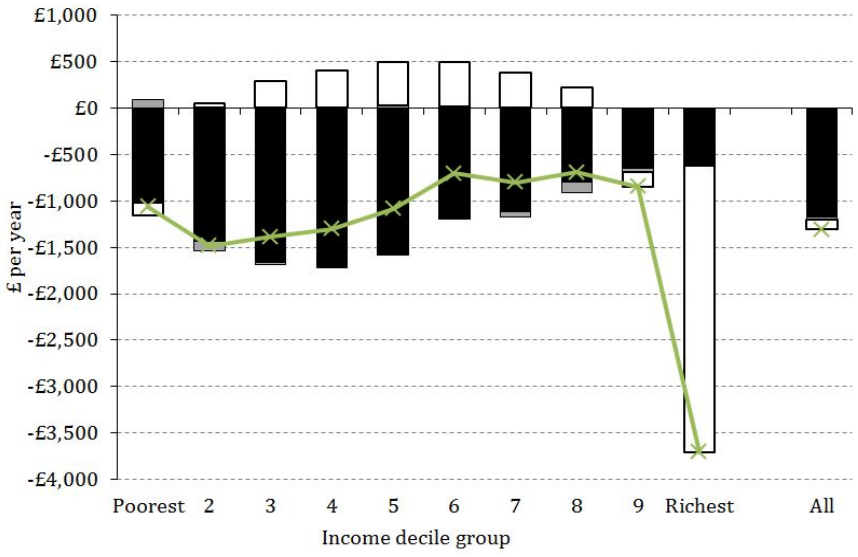
([36]) As the reforms interact with each other, the impact of a particular reform depends on whether it is implemented with or without other reforms. It is possible that changing the order in which we examine the reforms would affect our results slightly.

distribution, though better-off households also lose out from some cuts to 'middle-class welfare' such as the freeze in child benefit, the withdrawal of child benefit from those with incomes of more than £50,000 and the withdrawal of the family element of child tax credit at lower income than before. The welfare reforms take a bigger share of income from lower-income households, though in cash terms the biggest losses are in the lower-middle of the income distribution rather than the very bottom. Universal credit does not significantly affect average benefit entitlements at any point in the income distribution, though as we shall see later, the impact varies significantly by household type. Overall, the line in Graph IV.2.6 shows that the impact of reforms is regressive across the bottom 90% of the income distribution, and the richest decile still loses less as a percentage of income than the bottom 40%

Graphs IV.2.7 and 8 show losses by household type, in cash terms and as a percentage of income respectively. We saw above that the tax reforms led to the largest average losses for the highest-income households: as these are disproportionately single-earner couples with children, this group sees the largest average cash loss from the tax changes. Benefit changes, as we would expect, have least effect on those groups that receive little state support to start with, in particular single people without children who are in paid work and two-earner couples without children. Universal credit increases benefit entitlements for one-earner couples, but reduces benefit entitlements on average for workless households and lone parents: although maximum benefit entitlement will remain the same in most cases for those with no other income sources or assets, the treatment of unearned income and capital will be much harsher under universal credit than under the existing set of means-tested benefits and tax credits, meaning that some workless households lose out significantly. ([37])

Overall, the largest losses from the reforms as a percentage of income are for workless households, and these are largely driven by the changes to benefits that are being introduced over the period 2010 to 2015.

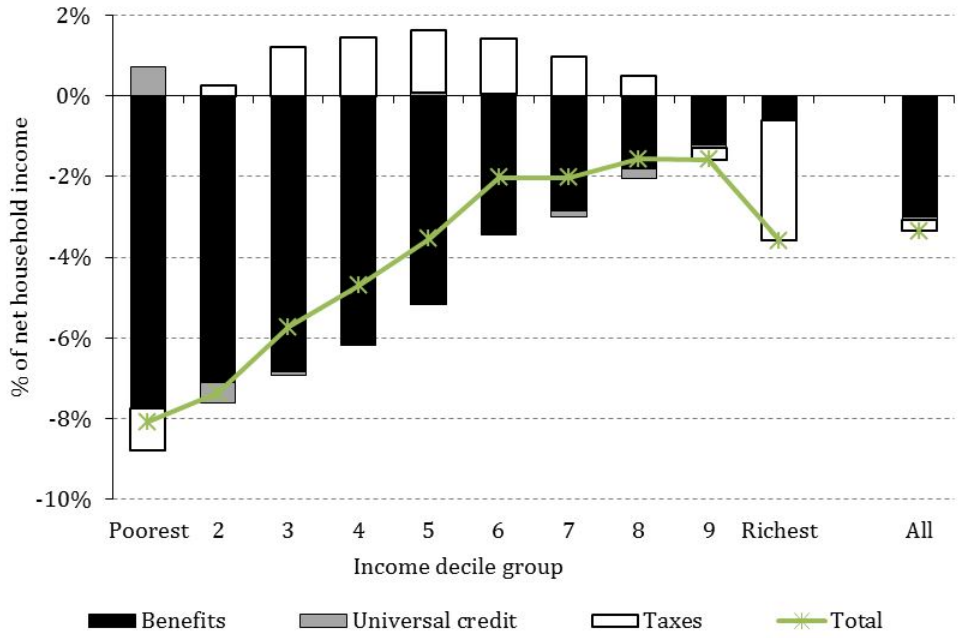
Graph IV.2.5: **Cash losses across the income distribution from the reforms**



Source: Authors' calculations using TAXBEN run on uprated data from the 2012–13 FRS and 2012 LCFS.
Note: Income decile groups are derived by dividing all non-pensioner households into 10 equal-sized groups according to income adjusted for household size using the McClements equivalence scale.

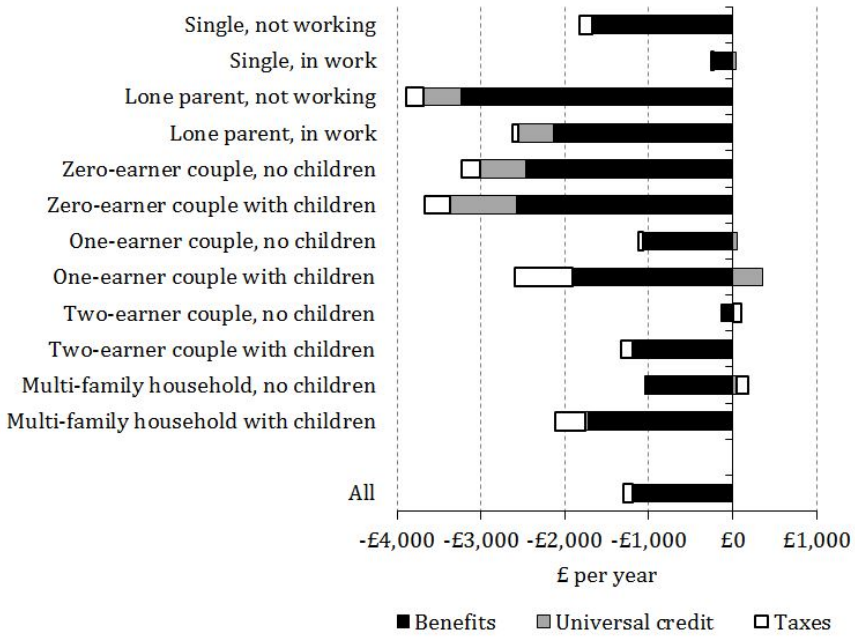
([37]) See Brewer, Browne and Jin (2012) for a fuller description of how the universal credit means test will work.

Graph IV.2.6: **Losses as a share of income across the income distribution from the reforms**



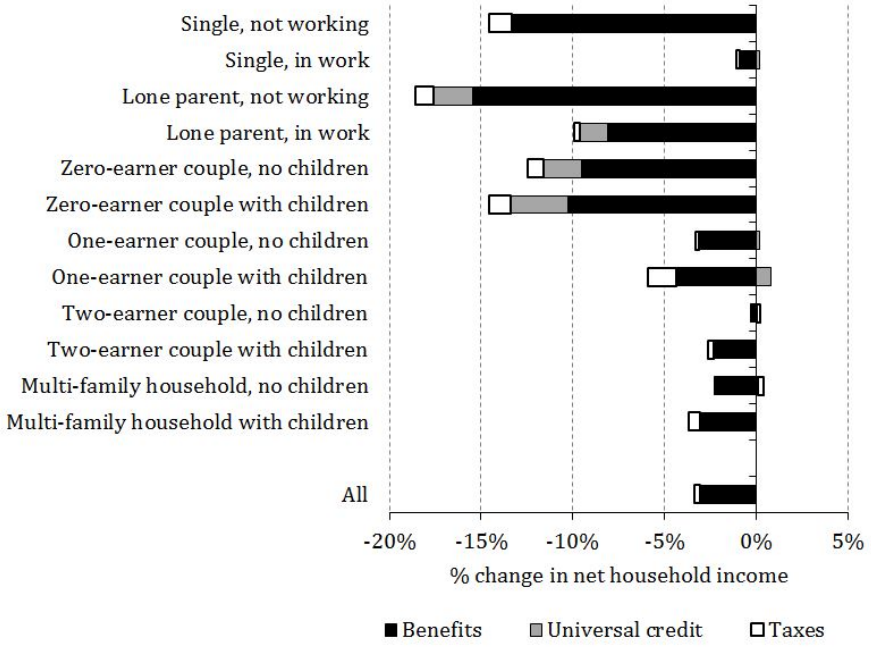
Source: Authors' calculations using TAXBEN run on uprated data from the 2012–13 FRS and 2012 LCFS.
Note: Income decile groups are derived by dividing all non-pensioner households into 10 equal-sized groups according to income adjusted for household size using the McClements equivalence scale.

Graph IV.2.7: **Cash gains and losses from the reforms for different household types**



Source: Authors' calculations using TAXBEN run on uprated data from the 2012–13 FRS and 2012 LCFS.

Graph IV.2.8: **Percentage gains and losses from the reforms for different household types**



Source: Authors' calculations using TAXBEN run on uprated data from the 2012–13 FRS and 2012 LCFS.

4.2.6. The effect of tax and benefit reforms on work incentives

In this section, we present our results showing the impact of tax and benefit reforms on the work incentives facing our synthetic 2015 population.

4.2.6.1. Incentives to be in work at all

Tax and benefit reforms from 2010 to 2015 strengthen incentives for people to be in work, on average, reducing the mean RR by 2.9 ppts excluding universal credit and 3.7 ppts including it, and the mean PTR by 3.0 ppts excluding universal credit and 3.7 ppts including it.

While the changes in overall average RRs and PTRs are almost identical, Tables IV.2.1 and IV.2.2 show that the reduction in the average RR is driven mostly by benefit reforms whereas the contributions of tax and benefit reforms are much more equal in the case of the PTR. ([38]) This difference arises because RRs depend on the ratio of in-work to out-of-work income, whereas PTRs depend on the difference. This means that RRs are particularly sensitive to out-of-work benefit rates, since a relatively small cash change in benefits can change out-of-work incomes, and hence RRs, by a significant amount in percentage terms. A tax cut that increases in-work incomes by the same amount will have much less of an impact. With PTRs, however, a £1 increase in in-work income caused by a tax cut has the same impact as a £1 reduction in out-of-work income caused by a benefit cut.

These modest changes in average incentives conceal far greater variation across the population, however. Table IV.2.3 shows that, for example, 30% of working-age adults (11 million people) see their PTR change by more than 5 ppts, 17% by more than 10 ppts and 7% by more than 20 ppts as a result of the benefit reforms (including universal credit). Many more people see big falls in their RRs and PTRs than see big rises. By contrast, tax reforms have a much more uniform effect.

([38]) These tables show mean RRs and PTRs, but the same is true of medians.

Tables IV.2.1 and 2 show how the reforms affect mean RRs and PTRs for different groups, while Graphs IV.2.9 and 10 show how they affect RRs and PTRs at different levels of earnings (or rather, employer cost – that is, earnings plus employer NICs – in order to capture the effect of employer NICs changes).

Tax changes in isolation slightly reduce average RRs and PTRs for virtually all family types, and average RRs for almost all family types – RRs increase very slightly on average for those in couples without children whose partner is in paid work as the partners of these individuals are likely to have benefited from increases to direct tax thresholds, which increases their out-of-work incomes. The main variation is by earnings level: the higher income tax allowance and NICs thresholds reduce total income tax and NICs payments – and therefore RRs and PTRs – at lower earnings levels, but at higher levels of earnings these are outweighed by higher NIC rates and the reduction in the point at which the 40% income tax rate applies, increasing RRs and PTRs.

Benefit changes excluding universal credit reduce RRs most for single people without children and those in couples without children whose partner does not work. These are the groups who would generally receive benefits if not in work, but not if they are in work. Thus when both out-of-work and in-work benefits are reduced these groups see falls in their out-of-work incomes but not in their in-work incomes. In contrast, those who have children and a non-working partner see their RRs fall least as a result of benefit changes. This is because for this group, some elements of out-of-work benefits (namely the child element of CTC) have been increased and in-work benefits have been particularly severely cut, with WTC rates being frozen and the minimum number of hours required to receive WTC increased from 16 to 24. These effects are most important at low earnings, where individuals are most likely to receive benefits if they are in work as well as if they are not in work. Individuals whose partner works are less affected by benefit changes as they are less likely to receive benefits whether or not they are working themselves.

Benefit changes also particularly reduce PTRs for single people and those in couples without children whose partner does not work. However, benefit changes increase PTRs for those in couples with children whose partner does not work and lone parents as a result of cuts to in-work support for these groups.

Universal credit reduces the mean RR and the mean PTR. But its most dramatic effect is to eliminate the extremely high RRs and PTRs that exist under the current tax and benefit system. Universal credit reduces the number of individuals with RRs of 75% or more by 500,000 and reduces the number with PTRs of 75% or more by nearly half (1.6 million) relative to the situation where it is not introduced (see Graphs IV.2.11 and IV.2.12 in section 4.2.9 - Appendix B). Since (perhaps understandably) most of the individuals who face such weak incentives to do paid work do not do so, universal credit reduces the mean RRs and PTRs of non-workers by more than those of workers.

Universal credit also has significant differences in its impact between different types of individual. It strengthens the incentive for couples to have one person in work rather than none, but also weakens the incentive for both members of a couple to work rather than just one – reflecting the findings of the distributional analysis in Section 4.2.4 that the main gainers from the introduction of universal credit are single-earner couples with children, increasing the attractiveness of being a single-earner couple relative to being a zero-earner or a two-earner couple. The reduction of 8ppts in the mean PTR of parents with non-working partners is particularly striking.

Universal credit does not significantly lower average RRs or PTRs at any earnings level: its impact on average RRs and PTRs is at most small. Since there are individuals with and without working partners at all income levels, the incentive-weakening effects for second earners are balanced out by the incentive-strengthening effects for first earners.

Table IV.2.1: **Impact of tax and benefit reforms on RRs of different groups**

	2010 level	2015 without reforms	Change in mean RR (ppts) from:			2015 excluding UC	2015 including UC	Number of people (millions)
			Tax changes	Benefit changes	UC			
Single, no children	38.9%	41.8%	–0.9	–3.8	–0.8	37.1%	36.3%	10.5
Lone parent	70.9%	72.3%	–0.7	–2.2	–0.2	69.5%	69.3%	2.0
Partner not working, no children	59.2%	60.9%	–0.5	–4.5	–3.4	55.9%	52.4%	2.7
Partner not working, children	70.7%	70.3%	–0.6	–0.8	–5.4	68.9%	63.5%	2.7
Partner working, no children	55.2%	56.1%	+0.0	–1.5	–0.0	54.6%	54.6%	9.5
Partner working, children	65.8%	66.8%	–0.4	–1.9	+0.4	64.6%	65.0%	9.3
Without children	48.4%	50.0%	–0.5	–2.9	–0.8	46.6%	45.8%	22.7
With children	67.5%	68.3%	–0.5	–1.7	–0.8	66.1%	65.3%	13.9
Non-workers	60.6%	62.8%	–0.6	–2.7	–1.0	59.5%	58.5%	9.8
Workers	53.7%	54.8%	–0.4	–2.4	–0.7	52.0%	51.3%	26.8
Total	55.6%	57.0%	–0.5	–2.5	–0.8	54.0%	53.2%	36.6

Source: Authors' calculations using TAXBEN run on the 2010–11 and 2012–13 Family Resources Survey and 2012 Living Costs and Food Survey.

Table IV.2.2: **Impact of tax and benefit reforms on PTRs of different groups**

	2010 level	2015 without reforms	Change in mean PTR (ppts) from:			2015 excluding UC	2015 including UC	Number of people (millions)
			Tax changes	Benefit changes	UC			
Single, no children	54.0%	55.6%	–1.7	–2.2	–1.3	51.7%	50.4%	10.5
Lone parent	53.7%	53.4%	–1.3	+0.7	+2.6	52.7%	55.3%	2.0
Partner not working, no children	61.1%	62.6%	–1.1	–2.8	–3.7	58.7%	55.0%	2.7
Partner not working, children	71.4%	71.2%	–1.0	+2.2	–8.0	72.4%	64.4%	2.7
Partner working, no children	43.3%	44.0%	–1.5	–1.7	+0.0	40.8%	40.8%	9.5
Partner working, children	49.3%	50.4%	–1.8	–1.6	+1.4	47.0%	48.5%	9.3
Without children	50.5%	51.6%	–1.6	–2.0	–1.0	48.0%	46.9%	22.7
With children	54.3%	54.8%	–1.5	–0.6	–0.2	52.7%	52.5%	13.9
Non-workers	53.6%	54.6%	–1.5	–1.4	–1.0	51.6%	50.6%	9.8
Workers	51.3%	52.2%	–1.6	–1.5	–0.6	49.1%	48.5%	26.8
Total	52.0%	52.8%	–1.6	–1.5	–0.7	49.8%	49.1%	36.6

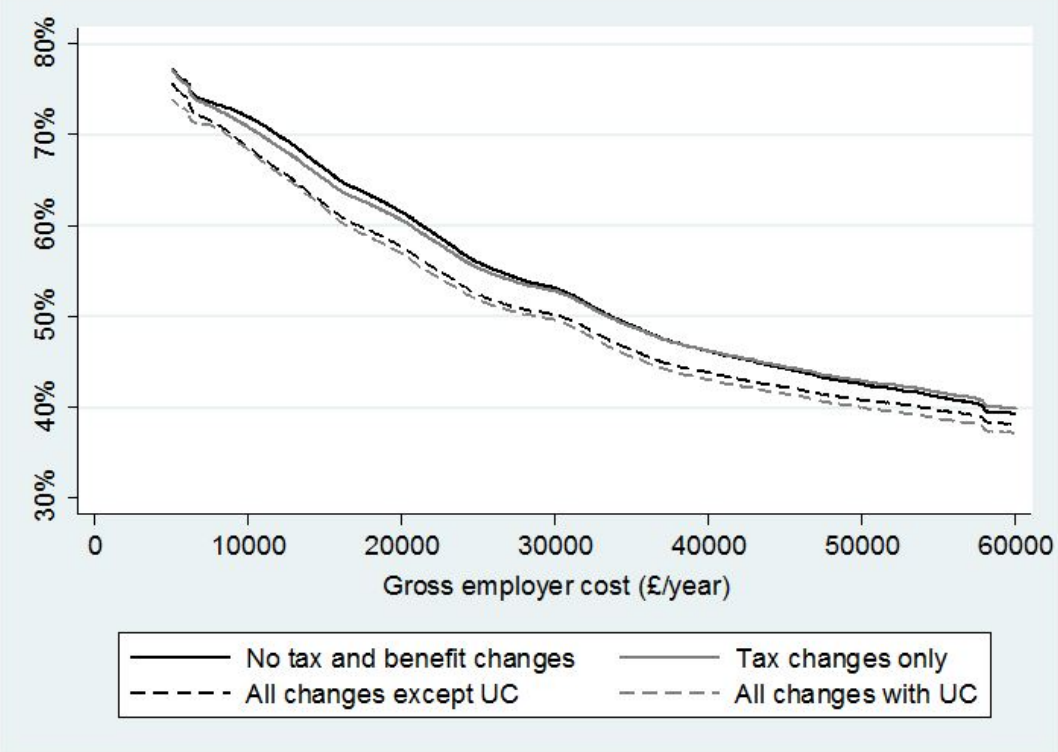
Source: Authors' calculations using TAXBEN run on the 2010–11 and 2012–13 Family Resources Survey and 2012 Living Costs and Food Survey.

Table IV.2.3: **Number of people seeing changes in RRs and PTRs of different magnitudes as a result of tax and benefit reforms**

Number of individuals (millions) whose rate:	*Tax reforms*		*Benefit reforms excluding UC*		*Benefit reforms including UC*	
	RRs	*PTRs*	*RRs*	*PTRs*	*RRs*	*PTRs*
Falls more than 20 ppts	<0.05	<0.05	0.6	0.7	1.3	1.6
Falls 10–20 ppts	<0.05	0.1	1.6	1.2	3	2.6
Falls 5–10 ppts	0.1	1.6	2.5	2.2	3.7	3.5
Stays within ±5 ppts	36.5	34.7	31.6	31.2	27.2	25.8
Rises 5–10 ppts	<0.05	0.2	0.2	0.8	0.8	1.2
Rises 10–20 ppts	<0.05	<0.05	0.1	0.3	0.4	1.1
Rises more than 20 ppts	<0.05	<0.05	<0.05	0.2	0.1	0.8
Total	36.6	36.6	36.6	36.6	36.6	36.6

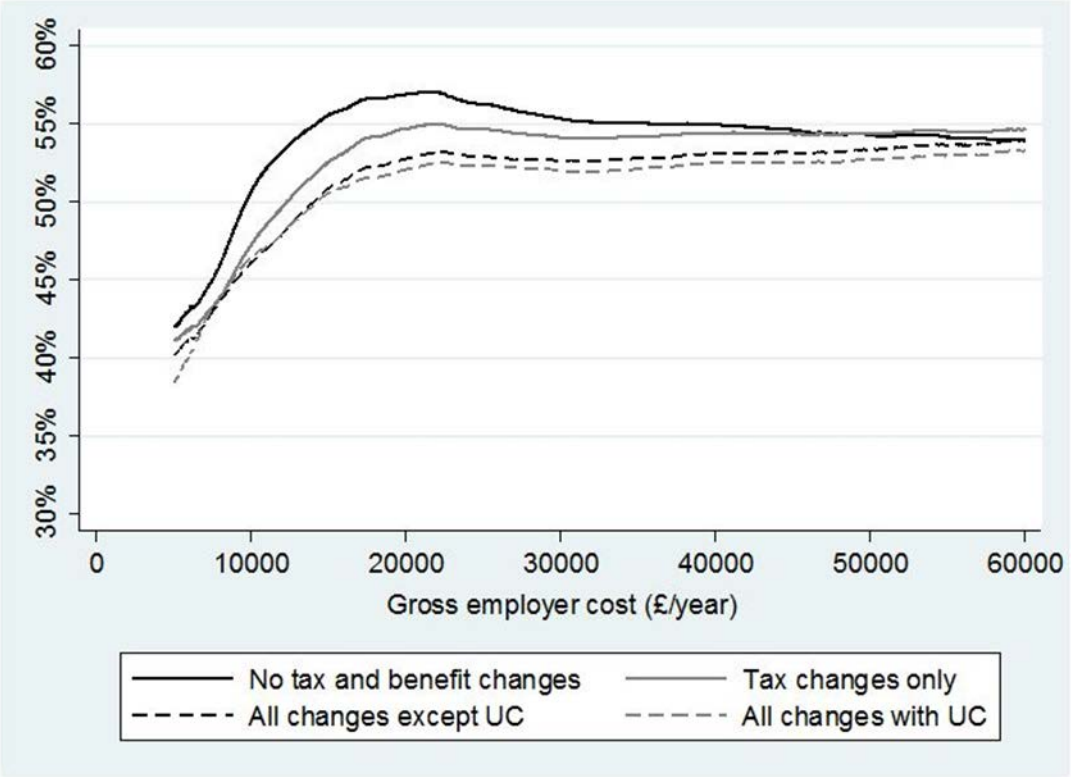
Source: Authors' calculations using TAXBEN run on uprated data from the 2012–13 FRS and 2012 LCFS.
Note: Figures may not sum to totals because of rounding.

Graph IV.2.9: **Impact of tax and benefit reforms from 2010 to 2015 on mean RRs by employer cost**



Source: Authors' calculations using TAXBEN run on uprated data from the 2012–13 FRS and 2012 LCFS.

Graph IV.2.10: **Impact of tax and benefit reforms from 2010 to 2015 on mean PTRs by employer cost**



Source: Authors' calculations using TAXBEN run on uprated data from the 2012–13 FRS and 2012 LCFS.

4.2.6.2. Incentives for those in work to increase their earnings

Table IV.2.5 and Graph IV.2.11 show how the tax and benefit reforms affect average EMTRs for workers with different family circumstances and at different earnings levels. The mean EMTR is reduced by benefit changes and universal credit and essentially unaffected by tax changes, though there are differences between family types and (particularly) earnings levels.

Tax changes barely affect the mean EMTR among workers, but increase the median EMTR by 1.2ppts. The median is increased because most workers face slightly higher EMTRs as a result of higher NICs and VAT rates; in calculating the mean this is offset by a small number of workers at low levels of earnings who see their EMTRs fall significantly as a result of increases in the thresholds at which income tax and NICs start to be paid. As lone parents are the group that is most likely to have such low levels of earnings, tax changes reduce average EMTRs among lone parents. And as those with children are more likely to work part-time, tax changes reduce average EMTRs for those in couples with children, but increase them for those in couples without children.

Benefit changes excluding universal credit reduce average EMTRs for all groups and at all earnings levels below £50,000, the point where child benefit now starts to be withdrawn. This reduction in EMTRs arises because cuts to the generosity of means-tested benefits mean that fewer workers are on a means-tested benefit taper and face losing support if they increase their earnings slightly. These effects are less relevant for people with working partners and no children, who are less likely to be entitled to means-tested benefits and are not affected by the new means test for child benefit either. Conversely these changes increase the mean EMTR most for those with children and a non-working partner because this is the group that is most likely to have lost entitlement to one or more means-tested benefits or tax credits as a result of these changes – for example this group is now required to work for 24 hours a week to be entitled to WTC rather than 16, meaning that those working between 16 and 24 hours a week lose their entitlement to WTC.

The most dramatic impact of universal credit is to reduce average EMTRs for lone parents by 6.4 ppts. As described earlier, by combining several overlapping means tests into a single one, universal credit removes the extremely high EMTRs that exist under the current benefits system. Lone parents are particularly likely to face these extremely high EMTRs. In contrast, EMTRs increase for those in couples with children whose partner is not in paid work, for three main reasons. First, this group is less likely to be on multiple means-tested benefit tapers than are lone parents and thus are less likely to face extremely high EMTRs in the first place. They are more likely to be receiving only tax credits, which have a lower taper rate than universal credit. Second, those in couples with children who work between 16 and 24 hours a week are not entitled to either out-of-work benefits or WTC at the moment, but will be entitled to universal credit, which increases their income but also their EMTR as they will then be on to a means-tested benefit taper. Finally, the increased generosity of universal credit to this group means that entitlement to means-tested benefits extends further up the income distribution, increasing the number of parents without a working partner who face withdrawal of means-tested benefits if they increase their earnings slightly.

Overall, universal credit increases EMTRs at very low earnings levels (mostly because people earning so little are often working too many hours to qualify for out-of-work benefits but earning too little to face withdrawal of HB or council tax support, yet they can still earn enough to face withdrawal of universal credit), but reduces them at slightly higher earnings levels where the highest EMTRs exist under the current system. The rationalisation of means-testing effectively makes average EMTRs more equal across different earnings levels.

Again, there is much more variation at the individual level than might be suggested by looking at overall averages. Table IV.2.4 shows that nearly one in five working adults sees their EMTR change by more than 5ppts as a result of the benefit reforms (including universal credit) and one in ten – 2.8 million people – see a change of more than 20ppts, and around one in six sees their EMTR change by at least 5ppts, and one in ten by at least 10ppts, as a result of tax changes.

Table IV.2.4: **Number of people seeing changes in EMTRs of different magnitudes as a result of tax and benefit reforms**

Number of individuals (millions) whose rate:	*Tax reforms*	*Benefit reforms excluding UC*	*Benefit reforms including UC*
Falls more than 20 ppts	0.3	1.0	2.0
Falls 10–20 ppts	1.8	0.2	0.8
Falls 5–10 ppts	0.6	0.2	0.6
Stay within ± 5 ppts	22.2	24.9	21.9
Rises 5–10 ppts	1.2	0.2	0.3
Rises 10–20 ppts	0.6	0.2	0.4
Rises more than 20 ppts	0	0.1	0.8
Total	26.8	26.8	26.8

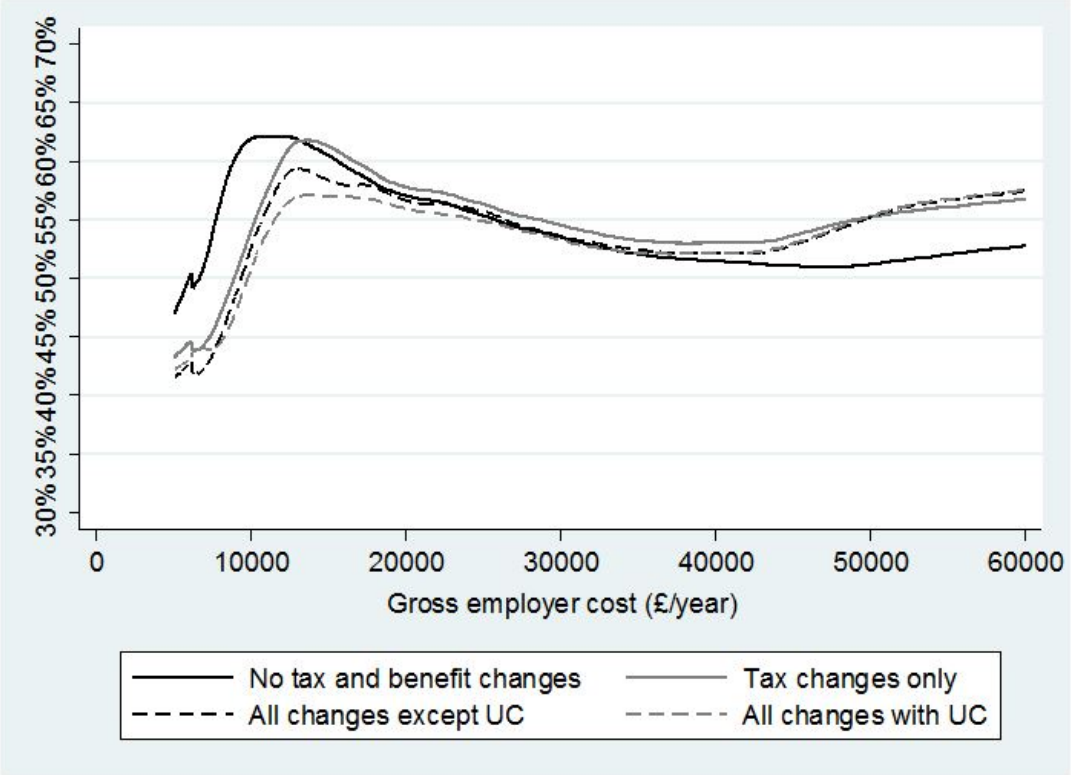
Source: Authors' calculations using TAXBEN run on uprated data from the 2012–13 FRS and 2012 LCFS.
Note: Figures may not sum to total due to rounding.

Table IV.2.5: **Impact of tax and benefit reforms on EMTRs of different groups of workers**

	2010 level	2015 without reforms	Change in mean EMTR (ppts) from: Tax changes	Benefit changes	UC	2015 excluding UC	2015 including UC	Number of people (million)
Single, no children	51.3%	51.6%	–0.2	–1.4	+0.4	50.0%	50.4%	6.6
Lone parent	74.4%	75.6%	–1.1	–1.0	–6.4	73.5%	67.1%	1.1
Partner not working, no children	55.9%	56.3%	+0.4	–1.2	–0.4	55.4%	55.0%	1.4
Partner not working, children	67.9%	69.7%	–0.2	–1.7	+0.1	67.8%	67.9%	1.8
Partner working, no children	49.0%	49.8%	+0.4	–0.7	–0.2	49.5%	49.3%	8.3
Partner working, children	53.2%	54.3%	+0.0	–1.0	–0.4	53.2%	52.8%	7.5
Without children	50.6%	51.1%	+0.1	–1.0	+0.0	50.2%	50.2%	16.4
With children	58.1%	59.2%	–0.2	–1.1	–1.0	57.9%	57.0%	10.4
Total	53.5%	54.3%	+0.0	–1.1	–0.4	53.2%	52.8%	26.8

Source: Authors' calculations using TAXBEN run on uprated data from the 2012–13 FRS and 2012 LCFS.
Note: Workers only.

Graph IV.2.11: **Impact of tax and benefit reforms from 2010 to 2015 on mean EMTRs by employer cost**



Source: Authors' calculations using TAXBEN run on uprated data from the 2012–13 FRS and 2012 LCFS.
Note: Workers only.

4.2.7. Conclusion

As in many EU countries, the recent recession has led to significant falls in real earnings levels in the UK and created a large structural budget deficit, which has led to the UK government introducing a fiscal consolidation package consisting chiefly of reductions in government expenditure, though also involving tax rises. As part of this there has been series of tax and benefit measures which, taken as a whole, will reduce the incomes of non-pensioner households by £1,300 per year on average by 2015–16, equivalent to about 3.3% of their net income. The impact of these measures varies both by income and across different demographic groups. Working-age households where no one is in work lose the most as a percentage of their income as a result of reforms (though tax rises for the highest-income tenth overshadow them in cash terms), with the upper-middle income group and childless households where all adults work being less affected.

Both changes in gross earnings and tax and benefit reforms can be expected to have an impact on individuals' work incentives. In this paper, we have shown how work incentives would have evolved between 2010–11 and 2015–16 in the absence of tax and benefit changes (but ignoring any consequences their absence would have had for the economy), and then analysed the direct impact of tax and benefit changes on work incentives.

In the absence of any new announcements, benefit rates would have increased more quickly than earnings between 2010–11 and 2015–16. Thus, in the absence of reforms, we find that RRs would increase, as we would expect when earnings increase less quickly than benefits. The mean RR rises from 55.6% to 57.0%, and the median RR from 57.0% to 58.5%. PTRs and EMTRs would also increase on average, but by less.

However, these effects are more than offset by the impact of tax and benefit changes that strengthen average incentives for individuals to be in work. Taking tax and benefit reforms together, they reduce

the mean RR by 2.9 ppts excluding universal credit and 3.7 ppts including it, and reduce the mean PTR by 3.0 ppts excluding universal credit and 3.7 ppts including it. Benefit changes other than universal credit are responsible for the bulk of the reduction in the mean RR, though tax and benefit changes have roughly equal impacts on the mean PTR.

Yet while these changes to average RRs and PTRs are far from negligible, they are relatively modest considering the sheer scale of the reforms in question. Although the impact of tax changes is fairly uniform, for benefit changes the averages conceal far bigger changes at the individual level, and differences between different groups of people. For example, 30% of working-age adults (nearly 11 million people) see their PTR change by more than 5ppts (7.7 million down by at least 5ppts and 3.1 million up by at least 5ppts), 17% by more than 10ppts (4.2 million down by at least 10ppts and 1.9 million up by at least 10ppts) and 7% by more than 20ppts (1.6 million down by at least 20ppts and 0.8 million up by at least 20ppts), as a result of the benefit reforms (including universal credit). The relatively modest averages reflect strengthening of incentives for some being offset by weakening for others.

For those without a working partner (i.e. single people and people with non-working partners), the effect of the benefit changes on incentives to be in work is in principle ambiguous: it depends whether in-work support or out-of-work support is cut by more. In practice, relatively few of those without children are entitled to tax credits if they work, so cuts to out-of-work benefits dominate and these groups see the biggest increases in their average RRs and PTRs. For those with children, however, reductions in the tax credits they receive if they work are significant while tax credits (though not benefits) for non-working families have actually been increased. Lone parents and parents with non-working partners – particularly those who earn little if they work – thus see smaller reductions in their mean RRs, and indeed see their mean PTRs increased by benefit changes excluding universal credit. For those with a working partner – about half the working-age population – the strengthening of incentives is largely unambiguous. Benefit cuts mean less (if any) support with one partner in work, and so less to lose by a second partner working.

Universal credit also has different effects on different groups. Since the main gainers from the introduction of universal credit are one-earner couples with children, it increases the attractiveness of being a one-earner couple relative to being a zero-earner or a two-earner couple. Thus it strengthens the incentive for couples to have one person in work rather than none, but also weakens the incentive for both members of a couple to work rather than just one, unlike the other benefit reforms. Another notable effect of universal credit is to remove most of the very highest RRs and PTRs that exist under the current tax and benefit system: it reduces the number of individuals with RRs of 75% or more by 500,000 and reduces the number of individuals with PTRs of 75% or more by nearly half (or 1.6 million).

Turning to the incentive for those in work to increase their earnings, we again see dramatic effects at the individual level. Nearly one in five working adults (4.9 million people) see their EMTR change by more than 5 ppts as a result of the benefit reforms (including universal credit, 3.4 million down by at least 5 ppts and 1.5 million up by at least 5 ppts) and one in ten (2.8 million) see a change of more than 20 ppts (2 million down by at least 20 ppts and 0.8 million up by at least 20 ppts). Furthermore, tax changes see around one in six working adults (4.5 million people) having their EMTR change by at least 5ppts and around one in ten (2.7 million) having their EMTR change by at least 10ppts.

Big changes at the individual level largely offset each other for the population as a whole: the mean EMTR falls by only 1.1ppts without universal credit and 1.4ppts including universal credit. Universal credit reduces EMTRs for those who face the very highest EMTRs under the current system, significantly reducing the average EMTR for lone parents in particular, but increases EMTRs for many others. Reductions in the generosity of means-tested benefits mean that fewer workers face the high EMTRs associated with benefit tapers. Some tax changes, in particular increases in rates of NICs and VAT, tend to increase EMTRs slightly for the majority of workers, but others, namely increases in thresholds for paying income tax and NICs, have taken a smaller number of workers out of income tax and NICs altogether, significantly reducing their EMTRs. Taking all tax reforms together, it turns out that the mean EMTR across all workers barely changes at all, but the median EMTR increases by 1.2ppts.

To summarise: the government's welfare reforms strengthen financial incentives to be in work, on average, more than offsetting the weakening caused by falling real wages. The patterns vary across the population, however, and particularly between first and second earners in couples. Universal credit contributes to this strengthening of incentives to be in work – a notable achievement given that it is broadly revenue and distributionally neutral. Reductions in the generosity of means-tested benefits are a key factor behind this strengthening in incentives, though reductions in average RRs and PTRs are perhaps less dramatic than might be expected given the scale of the cuts, in part because of the way the government has reduced in-work support for families with children. Benefit cuts also reduce the number of people on means-tested benefit tapers, reducing average EMTRs. However, while these changes are true on average, it is worth emphasising the huge amount of variation there is at the individual level, with large numbers of people seeing large rises or falls in effective tax rates. And one unambiguously welcome aspect of the reforms is how universal credit reduces the number of people facing the very weakest work incentives.

Although this paper focuses on financial work incentives, changes in non-financial incentives and in the perception of how the tax and benefit system works are also likely to be important. While universal credit will change the overall entitlements of people in different circumstances, arguably just as important is the way it integrates different strands of support into a single benefit. This offers the prospect of greater simplicity and more transparent work incentives – though perhaps with a less visible and salient incentive to work than working tax credit provides, and with much depending on how successful the practical implementation proves to be. Universal credit may also extend work search requirements to many more low earners, especially in couples, than are subject to them now. Universal credit is not the only benefit reform being introduced that will affect non-financial work incentives. The Work Programme involves a significant reorganisation of welfare-to-work; and work search requirements are being imposed for the first time on many lone parents and previous claimants of disability benefits. While these changes might be expected to increase moves from non-employment to employment in principle, in practice it is not clear how large the impact will be.

Finally, we should remember that labour market outcomes do not depend only on incentives and preferences: the state of labour demand will also be a key determinant of total employment in the years to come.

4.2.8. Appendix A: List of reforms considered in this paper

Table IV.2.6: **Benefit and tax credit changes considered in this paper (excluding universal credit)**

	Reform	Announced	Effective	Revenue effect in 2015–16 (£m)[b]
1	Expiry of temporary increase in winter fuel payments so rate falls back from £250 to £200 (from £400 to £300 for those aged 80 or over)	2010 March Budget	Winter 2011–12	+600
2	Reduce hours of work required for WTC from 30 to 16 for those aged 60 or over or with a partner aged 60 or over	2010 March Budget	April 2011	–20
3	Change local housing allowance so that cannot claim more than the amount of rent actually paid (previously, could keep up to £15 per week if rent paid was less than the LHA rate)	2009 Budget/ 2010 March Budget	April 2011	+195
4	Switch to uprating most benefits with CPI inflation (instead of RPI or Rossi)	2010 June Budget	April 2011	+10,595[a]
5	'Triple lock' for basic state pension (highest of CPI, average earnings or 2.5%) from April 2012, after increase in line with RPI in April 2011 (higher than triple lock would have been that year)	2010 Spending Review	April 2011/ April 2012	–1,620[a]
6	Increase pension credit guarantee credit by same cash amount as state pension in April 2011 and April 2012	2010 June Budget/ 2011 Autumn Statement	April 2011/ April 2012	–850
7	Cash freeze in the pension credit savings credit for 4 years from April 2011, with a reduction in April 2012	2010 Spending Review/ 2011 Autumn Statement	April 2011/ April 2012	+615
8	Cash freeze in the basic and 30-hour elements of WTC for 3 years from April 2011, and in the couple and lone parent element in April 2012	2010 Spending Review/ 2011 Autumn Statement	April 2011/ April 2012	+1,320
9	Increase the hours requirements for WTC from 16 to 24 for couples with children	2010 Spending Review	April 2012	+550
10	Reduce the proportion of eligible childcare costs covered by tax credits from 80% to 70%	2010 Spending Review	April 2011	+405
11	Withdraw the family element of CTC immediately after withdrawing other elements of tax credits (previously withdrawn only once income exceeded £50,000)	2010 June Budget	April 2011/ April 2012	+545
12	Increase the rate at which tax credits are withdrawn from 39% to 41%	2010 June Budget	April 2011	+780

(Continued on the next page)

Table (continued)

13	Increase the child element of CTC by £180 above inflation	2010 June Budget/ 2010 Spending Review	April 2011	–1,625
14	Remove the baby element of CTC	2010 June Budget	April 2011	+270
15	Freeze child benefit in cash terms for 3 years	2010 June Budget	April 2011	+1,335
16	Taper child benefit away from families containing someone earning more than £50,000	2010 Spending Review/ 2012 Budget	January 2013	+1,895
17	Restrict Sure Start maternity grant to the first birth	2010 June Budget	April 2011	+75
18	Set LHA rates at 30th instead of 50th percentile of local rents	2010 March Budget/ 2010 June Budget	April 2011	+505
19	Increase housing benefit deductions for resident non-dependants in April 2011 and uprate them with CPI thereafter	2010 June Budget	April 2011	+215[a]
20	Cap total rent claimable for a given family composition under LHA (irrespective of local rents) and abolish rates above the 4-bedroom rate	2010 June Budget	April 2011	+185
21	Increase LHA rates in line with CPI rather than actual rents	2010 June Budget	April 2013	+465[a]
22	Cut LHA (to the 'shared room rate') for single adults aged 25–34 without children	2010 Spending Review	January 2012	+205
23	Cut housing benefit for people under-occupying socially rented properties	2010 June Budget	April 2013	+490
24	Time-limit contributory ESA to 1 year except for the most severely disabled	2010 Spending Review	April 2012	+1,475
25	Introduce a benefit cap, £500 per week in 2013–14 (£350 for single adults), for working-age adults, excluding recipients of WTC or disability living allowance and the most severely disabled recipients of ESA	2010 Spending Review	April 2013	+185
26	Replace council tax benefit with local council tax rebate schemes and reduce the funding provided for it. The is assumed to work like the current CTB system but with a reduction in the maximum proportion of council tax one can claim for from 100% to 90%	2010 Spending Review	April 2013	+475
27	Move existing claimants of incapacity benefits onto employment and support allowance, reassessing their health condition in the process	2008 Budget	October 2010	—[d]

(Continued on the next page)

Table (continued)

28	Replace disability living allowance with personal independence payment, reassessing claimants' health condition in the process	2010 June Budget	April 2013	+1,190
29	Increase most working-age benefits by 1% in April 2013, April 2014 and April 2015	2012 Autumn Statement	April 2013	+2,680
30	Increase child benefit by 1% in April 2014 and April 2015	2012 Autumn Statement	April 2014	+270
31	Increase LHA rates by 1% in April 2014 and April 2015 with provision for high rent areas	2012 Autumn Statement	April 2014	+40

Source: Various HM Treasury Budgets.
a These numbers will rise year-on-year because these reforms change the speed at which benefit rates increase over time.
b The revenue effects of some reforms depend on whether others have happened; the costings here are taken from Budget documents, which assume that those listed higher up in the Budget costings table (or in a previous Budget) are already in place and those listed lower down (or in a subsequent Budget) are not.
c Funded within the Department for Work and Pensions' overall Department Expenditure Limit as announced in the 2010 Spending Review.
d We have been unable to find a revenue estimate for this.

Table IV.2.7: **Tax reforms considered in this report**

	Reform	Announced	Effective	Revenue effect in 2015–16 (£m)[b]
1	Real reductions in income tax higher-rate threshold	2009 Pre-Budget Report/2010 June Budget/2012 Autumn Statement	April 2012/April 2013/April 2014/April 2015	+2,950
2	Increase in threshold at which employee NICs becomes payable	2009 Pre-Budget Report	April 2011	–1,660
3	Increases in employee NIC rates	2009 Pre-Budget Report	April 2011	+5,040
4	Increases in employer NIC rates	2009 Pre-Budget Report	April 2011	+5,490
5	Increases in self-employed NIC rates	2009 Pre-Budget Report	April 2011	+230
6	Restrictions to income tax relief on pension contributions (then reductions in contribution limits instead)	2010 March Budget/2012 Autumn Statement	April 2011/April 2014	+4,805
7	Increases in alcohol duties	2010 March Budget	April 2013/April 2014	+210
8	Increase main VAT rate from 17.5% to 20%	2010 June Budget	January 2011	+13,450
9	Increase insurance premium tax from 5% to 6%	2010 June Budget	January 2011	+455
10	Increase threshold at which employer NICs becomes payable	2010 June Budget	April 2011	–3,890
11	Increases in income tax personal allowance and associated adjustments to higher-rate threshold	2010 June Budget/2011 Budget/2012 Budget/2012 Autumn Statement/2013 Budget/2014 Budget	April 2011/April 2012/April 2013/April 2014/April 2015	–12,215
12	Council tax freezes	2010 June Budget/2011 Autumn Statement/2012 Autumn Statement/2013 Spending Review	April 2011/April 2012/April 2013/April 2014/April 2015	–1,578
13	Switch to uprating direct tax thresholds in line with CPI (instead of RPI) inflation	2011 Budget	April 2012	+390[a]

(Continued on the next page)

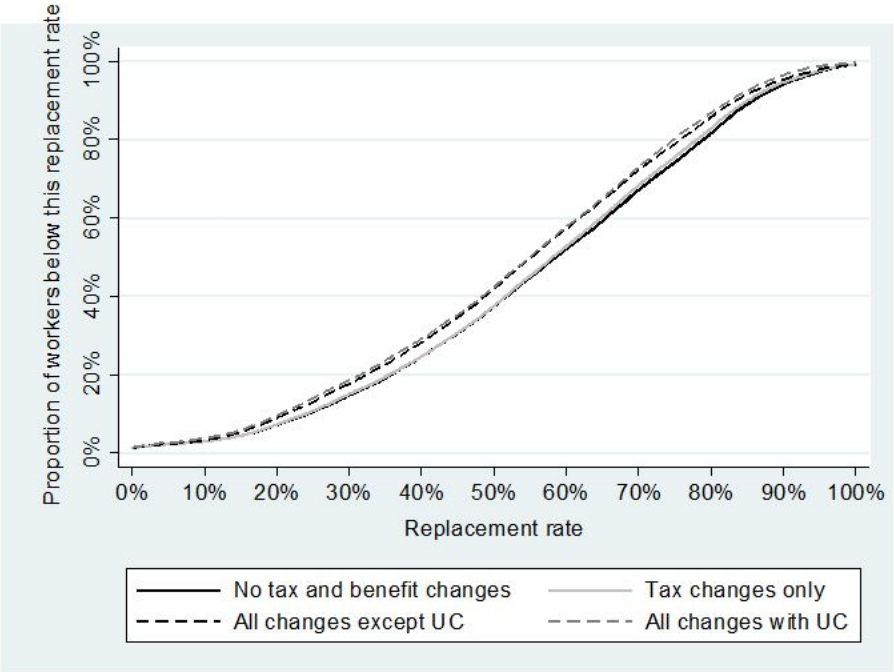
Table (continued)

14	Reduce NICs contracted-out rebates	2011 Budget	April 2012	+610
15	Reduce fuel duties in real terms	2011 Budget/2011 Autumn Statement/2012 Autumn Statement/2013 Budget/2013 Autumn Statement	April 2011/January 2012/August 2012/January 2013/September 2013/September 2014	–6,145
16	Increase tobacco duties	2010 March Budget/2012 Budget/2014 Budget	March 2011/March 2012/March 2013/March 2014/March 2015	+240
17	Reduce top rate of income tax from 50% to 45%	2012 Budget	April 2013	–110
18	Freeze income tax personal allowances for those aged 65 and over and restrict to existing claimants	2012 Budget	April 2013	+1,040
19	Reduce beer duty	2013 Budget/2014 Budget	March 2013/March 2014	–320
20	Introduce transferable allowance in income tax for some married couples	2013 Autumn Statement/2014 Budget	April 2015	–515
21	Abolish income tax on interest income in the first £5,000 of taxable income	2014 Budget	April 2015	–135
22	Reduce duty on wine and spirits	2014 Budget	March 2014	–185

Source: Various Budgets.
a These numbers will rise year-on-year because these reforms change the speed at which tax thresholds increase over time.
b Note: The revenue effects of some reforms depend on whether others have happened; the costings here are taken from Budget documents, which assume that those arbitrarily listed higher up in the Budget costings table (or in a previous Budget) are already in place and those listed lower down (or in a subsequent Budget) are not.

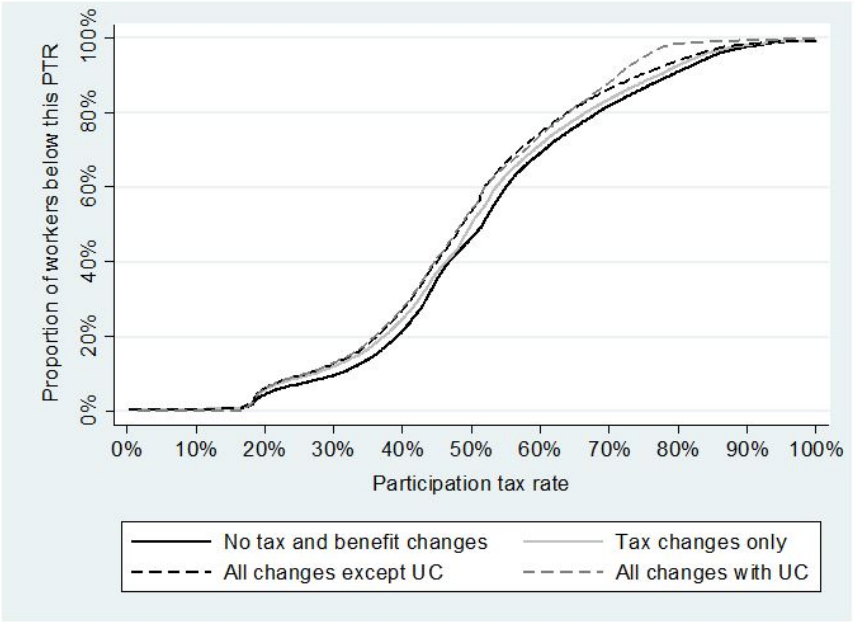
4.2.9. Appendix B: Distribution of RRs, PTRs and EMTRs under different tax and benefit systems

Graph IV.2.12: **Effect of tax and benefit reforms on the distribution of replacement rates**



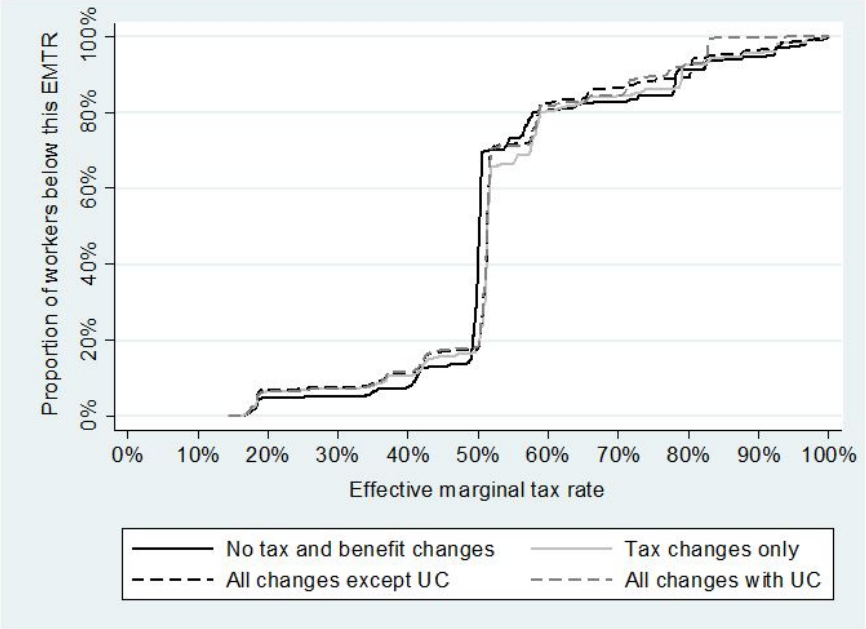
Source: Authors' calculations using TAXBEN run on the 2010–11 Family Resources Survey and the 2010 Living Costs and Food Survey.
Note: Earnings for non-workers calculated as described in Section 2.

Graph IV.2.13: **Effect of tax and benefit reforms on the distribution of participation tax rates**



Source: Authors' calculations using TAXBEN run on the 2010–11 Family Resources Survey and the 2010 Living Costs and Food Survey.
Note: Earnings for non-workers calculated as described in Section 2.

Graph IV.2.14: **Effect of tax and benefit reforms on the distribution of workers' effective marginal tax rates**



Source: Authors' calculations using TAXBEN run on the 2010–11 Family Resources Survey and the 2010 Living Costs and Food Survey.
Note: Workers only.

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