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Discretionary Fiscal Policies over the Cycle: New Evidence based on the ESCB Disaggregated Approach

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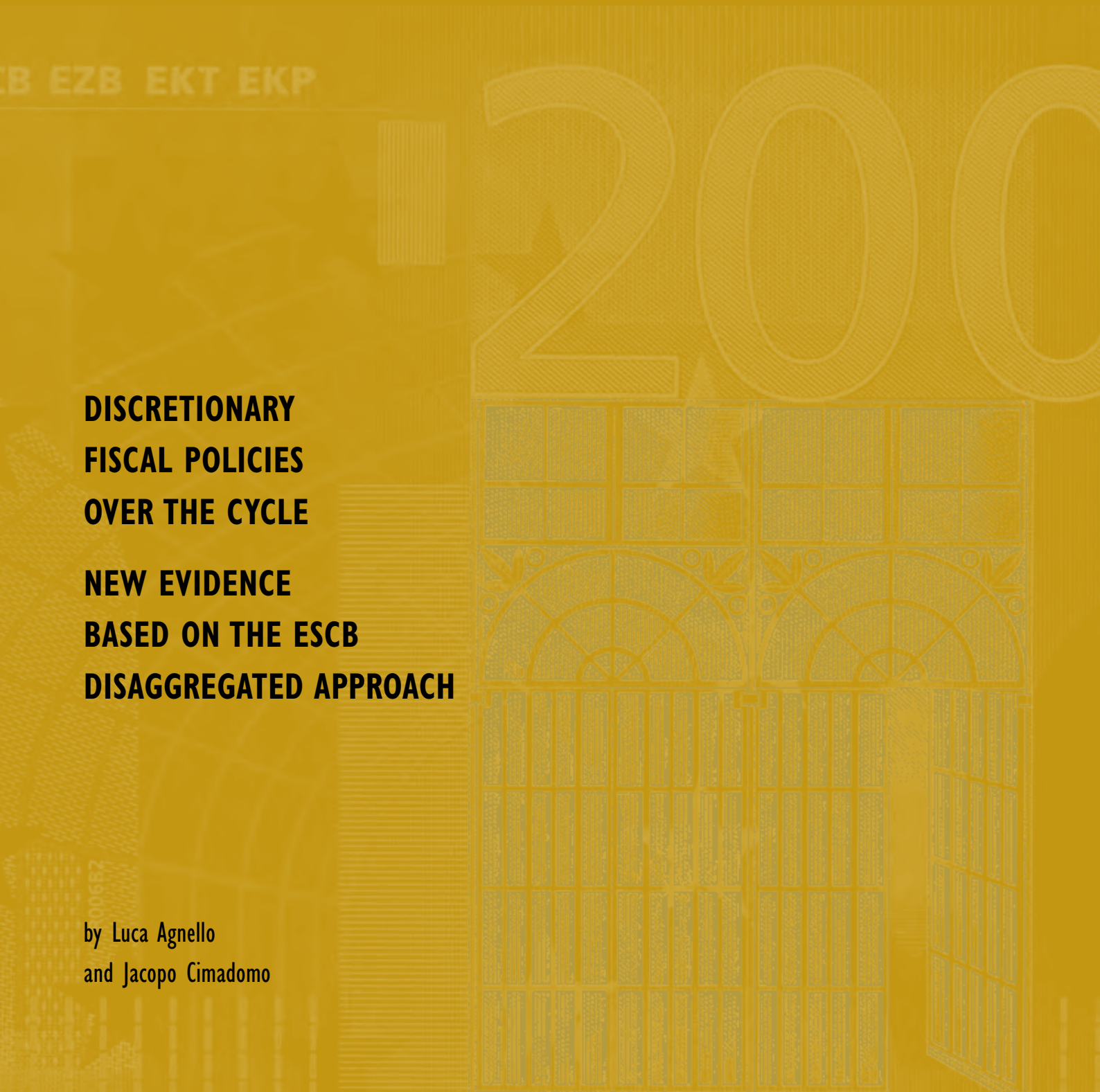

DISCRETIONARY FISCAL POLICIES OVER THE CYCLE

NEW EVIDENCE BASED ON THE ESCB DISAGGREGATED APPROACH

by Luca Agnello
and Jacopo Cimadomo

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Abstract

This paper explores how discretionary fiscal policies on the revenue side of the government budget have reacted to economic fluctuations in European Union countries. For this purpose, it uses data on legislated revenue changes and structural indicators provided twice per year by National Central Banks of European Union countries in the ESCB framework for analysing fiscal policy. The analysis is based on the estimation of fiscal policy rules linking these measures of legislated fiscal policy changes to the output gap and other control variables. Then, baseline results are compared with regression estimates where variations of cyclically-adjusted indicators are used as proxy for discretionary fiscal policies, as conventionally proposed in the empirical literature on fiscal policy. Results suggest that, overall, legislated changes in taxes and social security contributions have responded in a strongly pro-cyclical way to the business cycle, while commonly-used cyclical-adjustment methods point to a-cyclicality.

Keywords: Discretionary fiscal policies, government revenues, cyclical sensitivity, legislation changes, narrative approach, ESCB disaggregated framework.

JEL Classification: E62, E65, H20.

Non-technical summary

This paper re-assesses how *discretionary* fiscal policies on the *revenue side* of the government budget balance have reacted to economic fluctuations in EU countries, over the period 1998 through 2008. The analysis is based on a dataset of *legislated changes* in taxes and social security contributions, collected within the European System of Central Banks (ESCB).

When the discretionary component of fiscal policy is under investigation, indicators that have been 'cyclically-adjusted' through statistical methods are generally employed. Based on cyclically-adjusted fiscal variables, a number of papers have argued that discretionary fiscal policies tend to be *a-cyclical* (i.e. disconnected from the economic cycle) in the European Union, in particular after the entry into force of the Maastricht Treaty (see e.g. Ballabriga and Martinez-Mongay, 2002; European Commission, 2006, Wyplosz, 2006). As regards in particular the cyclical behaviour of structural *government revenues*, while some authors have suggested that they are predominantly a-cyclical (see e.g. Galí and Perotti, 2003), some other have found evidence of counter-cyclicality (see in particular Turrini, 2008, Fatás and Mihov, 2009).

While cyclically-adjusted indicators represent a useful benchmark to evaluate the fiscal policy stance, especially in the absence of more detailed information on changes in legislation passed by parliaments, they are clearly subject to a number of limitations. These latter are notably related to the high degree of uncertainty intrinsic in statistical smoothing techniques used to extract the cyclical component of budgetary categories (see e.g. Canova, 1998, Jaeger and Schuknecht (2004), Darby and Melitz, 2008).

Against this background, the present paper uses a dataset that includes *legislated* government revenue changes for 27 EU countries, as reported by National Central Banks (NCBs) according to the ESCB framework for fiscal analysis. In fact, changes in *laws* that have a budgetary impact should reflect discretionary fiscal actions more appropriately than (changes in) fiscal cyclically-adjusted indicators, which might vary depending on factors not specifically related to discretionary actions, as highlighted in Kremer et al (2006).

Changes in legislation for overall taxes and social contributions are used, together with their breakdown into direct taxes payable by households, direct taxes payable by enterprises, indirect taxes and social security contributions. For each of these categories, the dataset employed here records the estimated budgetary impact of legislative changes, in terms of (nominal) size and duration. It can be argued that this approach is close in spirit

to the 'narrative' one proposed by Romer and Romer (2007a, 2007b, 2008) for the analysis of the impact of legislated tax changes on the US economic growth. However, these authors have also identified the motivation behind legislated policy decisions, while our sources do not allow such a classification.

This novel dataset is used for the estimation of fiscal policy rules linking revenue legislation changes to the output gap and a set of control variables. In addition, as a comparison, panel regressions where the dependent variable is the (change of) cyclically adjusted indicators are also estimated, as conventionally proposed in the empirical literature on fiscal policy. Our results show that, in line with existing studies, changes in cyclically-adjusted taxes and social security contributions seem to be disconnected from the economic cycle in EU countries, over the last ten years. However, when legislated measures are used instead of cyclical-adjusted indicators, it is found that, overall, permanent revenue changes respond in a strongly *pro-cyclical* way to the business cycle. In particular, this result appears to be the outcome of a significant pro-cyclical reaction of direct taxes payable by households and of social security contributions. More specifically, there is evidence that direct taxes paid by households have been significantly reduced during economic expansions. As for indirect taxes, while estimates based on cyclically-adjusted indicators suggest pro-cyclicality, changes in indirect tax legislation seem to be a-cyclical. In addition, and interestingly, indirect taxes are the only revenue subcomponent that appears to have been used to stabilize the government debt-to-GDP ratio.

While an extension of this analysis to cover the ongoing economic crisis will be certainly of interest, our findings already suggest that a sound identification of the discretionary component of fiscal policy is of key importance to appropriately assess how fiscal policies are implemented over the economic cycle. This is particularly relevant in the context of the EU fiscal framework and the implementation of the Stability and Growth Pact, that recommends more ambitious fiscal consolidation efforts during buoyant economic times.

1. Introduction

This paper aims to provide new evidence on the cyclical stance of fiscal policy in European Union (EU) countries, over the period 1998 through 2008. In particular, it is explored whether EU governments have adopted counter-cyclical revenue-based fiscal policies that helped to smooth the business cycle, or whether they have acted in a pro-cyclical way, for instance by raising taxes during slowdowns while implementing expansionary policies in booming times, thereby exacerbating swings of the cycle.

The paper focuses on *legislated changes* in taxes and social security contributions, as defined by the ESCB disaggregated approach (see Kremer et. al, 2006). In fact, as stressed in this framework, changes in laws that have a budgetary impact should reflect the discretionary component of fiscal policy more effectively than commonly used cyclically-adjusted fiscal indicators. The latter might be affected by a number of limitations, mostly related to the filtering techniques applied to net out the automatic impact of the cycle from headline fiscal figures (see e.g. Canova, 1998, Jaeger and Schuknecht (2004), Darby and Melitz, 2008).

Measures of legislated changes in taxes and social security contributions are based on the information collected within the ESCB.

The cyclical stance of revenue-based discretionary fiscal policies in the EU is assessed by estimating fiscal policy rules linking these measures of legislated changes to the output gap and other control variables. In particular, the cyclical reaction of discretionary changes in overall taxes and social security contributions is analyzed, together with the cyclical behaviour of four sub-categories of government revenues (direct taxes paid by households, direct taxes paid by enterprises, indirect taxes and social security contributions). Finally, results from these baseline regressions are compared to what is obtained using fiscal indicators which are cyclically-adjusted according to the ESCB disaggregated approach.

Based on this analysis it emerges that, in line with existing studies, changes in cyclically-adjusted taxes and social security contributions seem to be disconnected from the economic cycle in EU countries, over the last ten years. However, when legislated measures are used instead of cyclical-adjusted indicators, it is found that, overall, permanent revenue changes have responded in a *strongly pro-cyclical* way to the business cycle. In particular, this result appears to be the outcome of a significant pro-cyclical reaction of direct taxes payable by households and of social security contributions. More specifically, there is evidence that direct taxes paid by households have been significantly

reduced during economic expansions. As for indirect taxes, while estimates based on cyclically-adjusted indicators suggest pro-cyclicality, changes in indirect tax legislation seem to be a-cyclical. In addition, indirect taxes are the only revenue subcomponent that appears to have been used to stabilize the government debt-to-GDP ratio.

The rest of this paper is organized as follows. In Section 2, a review the empirical literature that explores the cyclical sensitivity of discretionary fiscal policies, based on cyclically-adjusted indicators, and *ex-post* data, is provided. Section 3 describes how the dataset used in this analysis is constructed using information provided by NCBs. In section 4, the fiscal policy reaction functions used in the analysis are described. In section 5, the main results from the analysis are shown and commented. Section 6 is devoted to a series of robustness check and section 7 concludes.

2. Review of the literature based on cyclically-adjusted indicators

The bulk of the macroeconomic literature typically employs (changes of) "cyclically-adjusted" indicators as a proxy for the discretionary component of fiscal policy. Based on cyclically-adjusted indicators regularly published by the main international institutions, a number of policy and academic papers have investigated issues related to discretionary fiscal policies (see, for example, Alesina and Perotti, 1995; Giavazzi and Pagano, 1996).

In particular, as regards the issue of the policy responsiveness to economic fluctuations (which is often referred to as 'cyclical sensitivity'), the standard approach in the fiscal policy literature is to estimate fiscal policy rules linking (levels or changes of) cyclically-adjusted fiscal variables, as measures of the discretionary component of fiscal policy, to business cycle indicators (generally, the output gap) and other explanatory variables, such as, in particular, the public debt (see e.g. Taylor, 2000; Auerbach, 2002). Within this literature, most papers employ "ex-post" data, i.e. observations in a revised form taken from the latest available vintage, to study "actual" or "realized" policies.[1]

[1] Recently, a new strand of literature focuses on fiscal policy plans, or "intentions", rather than actual policies. In particular, Cimadomo (2007) proposes to estimate fiscal policy rules based on an information set which closely mimic the one available to fiscal policy makers at the time of budgeting. Budget plans reported at the time of budgetary decisions, and other real-time macro indicators, are used in this framework. It is found that *ex-ante* fiscal plans are counter-cyclical, especially in expasions, whereas ex-post data point to a-cyclicality (See Beetsma and Giuliodori (2008) and Giuliodori and Beetsma (2007) for related studies). At the same time, other papers focus on actual policies, and incorporate revised information as regards fiscal indicators and real-time data for the output gap and other explanatory variables (see Forni and Momigliano (2005) and Golinelli and Momigliano (2006)).

While the empirical evidence from this literature is quite mixed, a relatively large consensus has emerged on the fact that (ex-post) discretionary fiscal policies seem to be substantially *a-cyclical* in EU countries, especially as far as *government revenues* are concerned. In particular, Galì and Perotti (2003) estimate fiscal policy rules for a panel of euro area countries and find that cyclically-adjusted budget balances have not reacted to the business cycle in the period that followed the entry into force of the Maastricht Treaty in 1992. When they focus on the breakdown between (cyclically-adjusted) spending and revenue, they show that both these components seem to have been a-cyclical over the period considered. Similar results are found by Turrini (2008), who however highlights that the substantial neutrality of the cyclically-adjusted budget balance over the cycle is likely to stem from the combined effect of a significant counter-cyclical response of revenue compensated by a pro-cyclical reaction of expenditure. More recently, Fatás and Mihov (2009) have shown that cyclically-adjusted spending has become more pro-cyclical in euro area countries, after the adoption of the single currency, whereas cyclically-adjusted taxes have become more counter-cyclical. Many other studies employing cyclically-adjusted budget balances, and revised data, tend to confirm that discretionary fiscal policies are a-cyclical in EU and euro area countries (see e.g. Ballabriga and Martinez-Mongay, 2002; OECD, 2003; European Commission, 2006, Wyplosz, 2006).

While structural indicators represent a useful benchmark to evaluate the fiscal policy stance, especially in the absence of more detailed information on changes in legislation passed by parliaments, they are clearly subject to a number of limitations. These latter are notably related to the substantial uncertainty inherent in the cyclical adjustment procedure. In particular, there is a certain degree of arbitrariness in the selection of the statistical smoothing technique used to extract the cyclical component from the unadjusted level of the budget and budgetary categories. In addition, while standard methods imply that elasticities of budgetary components with respect to output are treated as constant, empirical evidence suggest that they can vary over time and that they might be characterized by high volatility (see Jaeger and Schuknecht (2004), Eschenbach and Schuknecht (2004)). Moreover, additional difficulties may stem from the (un-consensual) definition of temporary measures, as long as structural indicators are considered. Finally, it cannot be excluded that not only unemployment benefits react to the cycle (as generally assumed), but also other categories of social spending, such as for example age- and health-related expenditure as well as incapacity and sick benefits, move in response to cyclical fluctuations (on this point, see in particular Darby and Melitz, 2008). Therefore, as

discussed by some authors (see, for example, Chalk, 2002; Larch and Salto, 2005) commonly-used cyclically-adjusted fiscal indicators may provide inaccurate measures of discretionary policies, and empirical results based on these indicators should be interpreted cautiously. Against this background, as also suggested by Kremer et. al (2006), data on legislated policy changes should reflect better the discretionary stance of fiscal policy.

3. A dataset for discretionary fiscal policies in the EU

The starting point of this study is the identification of legislated revenue changes as measures of the discretionary component of fiscal policy. To that aim, data from the ESCB's disaggregated approach are used. Data include discretionary measures that have been approved by the respective national parliament. These data may differ from official government estimates, as NCBs' fiscal experts apply their own judgement regarding the composition, the duration, and the size of approved fiscal packages. All in all, information has been combined to compile two complementary datasets. The first one (based on the so-called 'disaggregated' approach' (*DA*) tables, as described below) incorporates data on legislated revenue changes and structural indicators (including cyclical adjusted indicators and other fiscal indicators) for 19 EU countries. The second (compiled on the basis of *DA* tables and on further complementary information from NCBs) comprises only legislated revenue changes, but for the larger set of 27-EU countries.

Two facts should be stressed. First, while the spending-side is also covered in *DA* tables, legislative acts on expenditure are usually numerous and the assessment of their effects often involves a number of arbitrary assumptions (see also Kremer et al., 2006). Second, *DA* tables do not provide information on temporary measures affecting revenue subcomponents, therefore the analysis will focus on *permanent* (legislated) discretionary measures on the *revenue side* of the government budget.

In the following, an overview of the information provided in *DA* tables, and the construction of the dataset, is described in more detail.[2]

[2] It is interesting to note that the data on legislated changes in the EU countries collected in the framework of the ESCB disaggregated approach are to some extent similar to the data gathered by Romer and Romer (2007a, 2007b, 2008) for their studies on the effects of legislated tax changes on US economic activity and on public spending developments in that country. Romer and Romer use a 'narrative record' of presidential speeches, executive-branch documents, Congressional reports and budget laws, to identify the size, timing, and principal *motivation* for all major postwar tax policy actions. Based on this data, they uncover that tax increases are highly contractionary in the US. The data reported in tables from the ESCB disaggregated approach also provide a description of the size, timing and nature of legislated revenue changes that took place in EU countries. On the other hand, at the current juncture, these data do not allow to identify also the motivation behind each policy decision (e.g. cyclical stabilization, deficit control, or other 'exogenous' reasons) as in the dataset of Romer and Romer.

3.1. The 'disaggregated approach' tables

DA tables are complied in a standardized form according to 'ESCB disaggregated approach'.[3] These tables report changes in cyclically-adjusted total expenditure and revenue, along with the breakdown of the latter into its four main categories (see Table A1 for an example of a *DA* table for Italy, as reported in Kremer et al. (2006)). In particular, structural ratios are computed for a) *Direct taxes payable by corporations* (ΔR^{dte}); b) *Direct taxes payable by households* (ΔR^{dth}); c) *Indirect taxes* (ΔR^{itx}); and d) *social contributions* (ΔR^{sct}). The sum of these four categories is defined as o*verall taxes and social contributions*, simply labelled as *overall revenue* (ΔR^{txs}) in this paper.[4]

As regards the cyclical-adjustment procedure, the approach developed by Bouthevillain et al. (2001) is followed. In particular, cyclically-adjusted revenue and expenditure categories are adjusted individually by applying specific elasticitites to the deviation of their respective macroeconomic bases from an estimated trend. Specifically, for each budgetary category considered, labelled as *j*, the structural level X^j is computed as:

$$X^j = x_u^j - x_c^j - x_T^j \qquad (1)$$

where x_u^j is the unadjusted level of the budget item *j*, x_c^j is its cyclical component and x_T^j the temporary measures. In this context, all variables are expressed as ratios of nominal trend GDP, as estimated through the Hodrick-Prescott methodology. *DA* tables span a period typically ranging from *t-8* until *t+2*. For example, the Spring 2008 vintage include data from 2000 through 2010.

Importantly, *DA* tables also incorporate data on legislated changes, which defined as $\Delta\ell^j$ hereafter, for each budgetary category *j*.[5] The impact of legislated changes in *DA* tables is expressed as a ratio of trend GDP. To be noted, in this context the difference between

[3] See Kremer et al. (2006) for a detailed escription of this methodology.

[4] Overall taxes and social contributions might differ from total revenue as the former do not included non-tax-related revenue, as for example revenue from EU funds.

[5] The "first-difference" notation $\Delta\ell^j$ to indicate the fiscal impact of legislated changes is a simple convention, as in reality "levels" of legislation (and their implied budgetary effects) are unobversed. On the other hand, the budgetary impact of a change in legislation can be estimated.

changes in cyclically-adjusted indicators and legislated changes for each revenue category j is accounted for by three separate factors: i) *fiscal drag* (fd^j), ii) *decoupling of the tax base from GDP* (de^j), iii) a *residual component* (re^j).[6]

3.2. Data availability and data construction

Two complementary datasets have been constructed, based on DA tables and on other information from NCBs:

1. The first dataset incorporates an unbalanced panel for 19 EU countries, over the period 1998-2008, including *both* changes in structural indicators (ΔR^j) and legislated measures ($\Delta \ell^j$). Sources of this dataset are only *DA* tables;
2. The second datasets comprises an (unbalanced) panel covering 27-EU countries, where only data on legislated measures are incorporated. This dataset is constructed based on *DA* tables and other complementary information from NCBs.

The analysis is based on the Spring 2008 vintage of DA tables, but information from earlier vintages has also been used, in case of missing values. Table A2 reports the time and country coverage of these two datasets. To be noted, the first dataset does not include 8 EU countries (Bulgaria, Denmark, Estonia, Hungary, Romania, Slovakia, Sweden, the United Kingdom) based on the fact that only legislated changes, but not cyclically-adjusted revenue indicators, are available for these countries.

The sample used in the empirical analysis ends in 2008 given that in projection years actual output tends to converge to the potential one for the majority of countries considered (as it typically occurs at the end of the forecast horizon of projection exercises). Therefore, an analysis which focuses on the cyclical stance of fiscal policy for these projection years would not make much sense, given that the output gap tends to shrink over these years.

[6] These three factors, that account for changes in structural revenue ratios (ΔR) beyond the ones explained by legislation changes, are defined as follows: *i)* the '*fiscal drag*' refers to the increase in average tax rates in a progressive income tax scheme that stems from an increase in nominal income, due to inflation or real growth. As such, the fiscal drag may affect structural revenues, even in the absence of legislation changes; *ii)* the so-called '*decoupling of the tax base form GDP*' refers to the possibility that revenue ratios to nominal (trend) GDP might change even when the elasticity with respect to the macroeconomic base amounts to unity, and even when legislation is unmodified. This may occur when the (trend) growth rate of the tax base deviates from the (trend) growth rate of nominal GDP; *iii)* changes in the structural revenue ratios not explained by the two factors decribed above, and by legislation changes, are denoted as '*residuals*'. A more thorough description of these components and details concerning their computation can be found in Kremer et al. (2006).

From a preliminary descriptive analysis of data on legislated changes collected as documented above, some interesting evidence emerges. In particular, focusing on observations averaged over all countries considered, Table 1a presents the correlation matrix of cyclical-adjusted changes of total taxes and social contributions (ΔR^{txs}) and its driving factors as defined by disaggregated approach. We note that unsystematic events, as captured by the residual component rs^{txs}, seem to have been important in explaining structural developments of taxes and social contributions. Looking at the impact of the other three factors, it turns out that legislated changes seem to be only weakly correlated with changes in structural revenues.

Table 1b reports the variance-covariance matrix across legislated changes relative to each revenue category *j*. Two facts are worth noticing. First, legislated changes display low cross-correlations. Second, the bulk of the variability of the total change in legislation is due to changes of direct taxes payable by households, whereas changes in direct taxes payable by corporations, indirect taxes and social security contributions explain less (as documented by a lower cross-correlation of these items with the aggregate variable). This suggests that the former policy instrument seem to have been predominantly used by European fiscal policymakers in setting their revenue policies.

4. Empirical strategy

In order to assess the cyclical sensitivity of legislated changes in the EU, during the period 1998-2008, and to compare results from regressions based on cyclically-adjusted indicators as obtained from the disaggregated approach (for the restricted set of 19 EU countries), we run separately the following panel regressions:

$$\Delta R_{i,t}^{j} = \beta\, Y_{i,t} + \gamma\, \widetilde{R}_{i,t-1}^{j} + \phi\, B_{i,t-1} + \mathbf{Z}_{i,t}^{'}\boldsymbol{\delta} + \alpha_i + \varepsilon_{i,t} \qquad (2)$$

$$\Delta \ell_{i,t}^{j} = \beta\, Y_{i,t} + \gamma\, \widetilde{R}_{i,t-1}^{j} + \phi\, B_{i,t-1} + \mathbf{Z}_{i,t}^{'}\boldsymbol{\delta} + \alpha_i + \varepsilon_{i,t} \qquad (3)$$

for $i = 1,\ldots N$ and $t = 1,\ldots,T_i$ where N is the number of countries included in our sample while T_i is the number of observations available for each country.

We estimate model (2) and (3) for the aggregate series of overall taxes and social contributions, and for each individual revenue-side budgetary category *j*. As discussed

above, both the two discretionary fiscal policy indicators considered, $\Delta R_{i,t}^{j}$ and $\Delta \ell_{i,t}^{j}$, are expressed as percentage of nominal trend GDP.

The explanatory variable $\widetilde{R}_{i,t-1}^{j}$ measures the level of the *cyclically-adjusted* component of each budgetary category *j*. It is computed as the difference between the unadjusted volume of each budgetary item *j* and its cyclical component divided by the nominal trend GDP (as estimated by NCBs). To be noted, $\widetilde{R}_{i,t-1}^{j}$ includes temporary measures while $R_{i,t-1}^{j}$ does not.[7]

The regressor $\widetilde{R}_{i,t-1}^{j}$ captures persistence of budgetary policy decisions. In fact, it is reasonable to assume that the initial level of each revenue categories affects the way discretionary policies for that item are set for the following year. For example, it can be expected that the higher the initial level of taxation (in structural terms) the higher the size of the downward adjustment implemented. According to this hypothesis, we expect that the coefficient γ ranges between minus one and zero (i.e. $-1 < \gamma < 0$). $\widetilde{R}_{i,t-1}^{j}$ is also used a proxy to capture persistence in equation (3) since, clearly, it is not possible to reconstruct levels of 'legislation'.[8] In addition, the inclusion of $\widetilde{R}_{i,t-1}^{j}$ in equation (3) facilitates comparisons with model (2), as the set of control variables is exactly the same in the two equations.

The economic cycle is represented by the output gap, labelled as $Y_{i,t}$. This is the key variable used to measure the systematic response of fiscal discretionary measures to cyclical conditions. $Y_{i,t}$ is computed by NCBs as the difference between nominal GDP and nominal trend GDP (estimated through the Hodrick and Prescott filter), over trend GDP. A positive value of β indicates counter-cyclicality, i.e. taxes or social contributions increase during economic booms and decrease during slowdowns. On the other hand, negative value of β points to pro-cyclicality given that discretionary fiscal policies become looser during expansions and tighter during downturns.

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[7] In principle, levels of the structural ratio indicators as computed in equation (1) should be used as regressors. Unfortunately, the lack of information concerning temporary measures adopted by national governments and impacting on each budgetary item makes it impossible to re-construct levels of the variable $R_{i,t}^{j}$. For this reason, the variable $\widetilde{R}_{i,t}^{j}$ is used as a proxy. This variable is computed without netting out the temporary measures.

[8] An experiment based on the inclusion of lagged values of $\Delta \ell$ has also been carried out. Unfortunately, however, these controls enter insignificantly in the regression equations. In addition, empirical fiscal policy rules are generally specified such that the initial state of public finances, as represented by fiscal variables included on the right-hand-side of the regression equation, are expressed in levels rather than in differences (see e.g. Galí and Perotti (2003)). This is consistent with the idea that fiscal policymakers are more concerned about levels of deficits, revenues and expenditure, rather than their growth rates.

Following several other papers (See e.g. Bohn (1998), Ballabriga and Martinez-Mongay (2002), Wyplosz (2002), Favero (2003)), we also incorporate a "debt stabilization" motive by adding as a regressor the general government debt (relative to nominal trend GDP) outstanding at the time of the budget decision, denoted as $B_{i,t-1}$ [9] A positive sign of ϕ is expected because more indebtedness may lead to more concern about fiscal sustainability and induce the governments to adopt more stringent discretionary measures.

The vector $\mathbf{Z}_{i,t}$ includes the following set of additional variables: a) $NONACTIVE_{i,t}$, which accounts for "*population ageing*" effects on fiscal policy making process (see e.g. Beetsma and Giuliodori, 2008). This variable is computed as the share of the population that is not of working age (i.e. the number of 15 year or younger plus the number of 65 or older); [10] b) $ELECT_{i,t}$, acts as a control for the possible influence of electoral cycle, and takes a value of one (zero) if year *t* is (not) an election year[11]; c) $EMU15_i$, is a dummy variable which equals one for years in which EMU countries have joined the European Monetary Union, and zero otherwise. The idea is to check whether the fiscal policy stance differs between countries belonging to EMU area and others EU countries. In particular, we expect that accession countries have incentives to pursue tighter fiscal policies in order to consolidate public finances, meet the convergence criteria and benefit from joining the single currency; d) T_i, is a linear trend that is intended to capture common third factors driving discretionary fiscal behaviour of all countries that are unlikely due to common economic circumstances. In practice, we account for the possibility that both $\Delta R_{i,t}$ and $\Delta \ell_{i,t}$ might evolve according to a deterministic trend (see e.g. Afonso, Agnello and Furceri, 2008; Fatàs and Mihov, 2003). Finally, α_i denote the country-specific effects, and $\varepsilon_{i,t}$ are the error terms.

A problem related to estimation of model (2)-(3) concerns the potential reverse causality between $Y_{i,t}$ and our dependent variables. Therefore, this issue is tackled by estimating the panel regressions through instrumental variables (IV/2SLS) method (see e.g. Jaimovich and Panizza (2007)). In particular, we instrument $Y_{i,t}$ by using its lagged value, $Y_{i,t-1}$, and the lagged value of the output gap of the United States (see e.g. and Galì and Perotti

9 Data on nominal debt are taken from World Economic Outlook (WEO).
10 Source: Ameco dataset.
11 Recent work show that elections may play a role in explaining the fiscal stance in euro-area countries in the past decades (see e.g. Golinelli and Momigliano (2008) and Debrun et al. (2008)). Data on election years are taken from the website of the International Institute for Democracy and Electoral Assistance (htpp://www.idea.int) and from the Election Resources on the Internet website http://electionresource.org.

(2003)).[12] In addition, we will estimate our models also using the fixed-effects OLS estimator. In fact, although OLS estimates are in principle biased if the output gap reacts to fiscal policy actions, it cannot be discarded that the reversal causality is weak given that we are considering sub-components of the budget balance, whose influence on the economic activity might be feeble. In addition, OLS estimates serve as a useful benchmark, given that they are not affected by the choice of instruments.

5. Baseline results

First, results for the aggregate indicator, as represented by overall taxes and social contributions, and panel regressions (2)-(3), are reported in Table 2. Column 1 and 2 of that Table presents IV/2SLS and OLS estimates of regression (2), which include as dependent variable structural taxes and social contribution, for the panel of 19 EU countries. The estimated coefficient on output gap, $\hat{\beta}$, is not statistically significant suggesting that changes in revenue items have behaved in a-cyclical way.

When legislated changes are considered, results on cyclical sensitivity turn out to be remarkably different. In fact, as shown in columns 3 and 4 (for the 19-countries sample), and columns 5 and 6 (for the 27-countries sample), it is found that changes in taxes and social contribution laws are highly responsive to cyclical conditions. In particular, the negative sign of the parameter $\hat{\beta}$ indicates that changes in legislation have been implemented in a *pro-cyclical way, i.e. governments have tended to reduce tax pressure and cut social contributions during booms while increase revenues in recessions*. The effects are sizeable: an increase of one percentage point in $Y_{i,t}$ induces policymakers to cut taxes and social contributions by about 0.17-0.16 percent (of nominal trend GDP).

Regarding the other parameters, the estimated coefficients $\hat{\gamma}$ are significant and have the expected negative sign in each specification. This implies that regardless the measure considered, discretionary fiscal policy actions are driven by a "permanent" component, $\widetilde{R}_{i,t}^{txs}$. The coefficients on debt, $\hat{\phi}$, are not statistically significant. Nevertheless, this result does not necessarily imply that fiscal decisions are not sensitive to debt developments, as it cannot be excluded that debt stabilization is achieved mainly through expenditure-based policies. Analyzing the significance of controls $\mathbf{Z}_{i,t}$, it is found that the variable *EMU15* is

12 The U.S. output gap is used as instrument given that a business cycle variable which is likely to be correlated (for reasons other than the existence of coordinated fiscal policies) with EU countries-specific output gap is needed.

always significant and has negative sign, in line with the possible interpretation proposed above. In particular, it is likely that the incentives to join the monetary union have induced accession countries to increase taxation and consolidate public finances with a view of joining the EMU. The demographic variable *NONACTIVE* seems to play a role only for $\Delta R_{i,t}^{txs}$ while it is never statistically significant when legislated changes are considered. Finally, it is found that the electoral cycle does not seem to be relevant in determining discretionary fiscal decisions.[13]

As an additional set of results, Table 3 presents estimates for EMU countries. By comparing results to those obtained using the full sample (and reported in Table 2), previous conclusions remain quantitatively and qualitatively unaltered. In fact, there seems to be no sizeable differences, between EU-19, EU-27 and EMU countries, in the responsiveness of legislated changes to the economic cycle.

5.1 Estimating the cyclical sensitivity of revenue-side categories

This section is devoted to examine whether the cyclical sensitivity varies across revenue categories and to investigate to what extent each of these budgetary items determine the pro-cyclical nature of revenue-side discretionary fiscal policies. To that end, panel regressions (2)-(3) are re-estimated for each of the four revenue budgetary items considered. Results are reported in Tables (4)-(7). As in Table 2 and 3, both IV and OLS estimates are provided.

Focusing on the cyclical sensitivity parameter, it is found that results for direct taxes payable by households and social contributions are qualitatively the same of those obtained for overall taxes and social contributions. In fact, from Table (4) and (7), it can be noticed that while their cyclically-adjusted components ($\Delta R_{i,t}^{dth}$ and $\Delta R_{i,t}^{sct}$) are not responsive to the economic cycle, legislation changes ($\Delta \ell_{i,t}^{dth}$ and $\Delta \ell_{i,t}^{sct}$) behave in a *pro-cyclical way*. However, some differences emerge as regards the size of the coefficients $\hat{\beta}$. As shown in columns 3 through 6 of Table 4, it seems that legislated changes impacting on *taxes payable by households are highly pro-cyclical*. In particular, an increase of one percentage point in the output gap induces policymakers to cut these taxes by about 0.10-0.11% of nominal trend GDP. On the other side, the degree of pro-cyclicality of legislated changes associated to social contributions is lower, as suggested by results in columns 3

13 See also Turrini (2008) for similar results on the electoral cycle.

through 5 of Table 7). In fact, an increase of one percentage point in the output gap reduces social contributions by around 0.04%. This effect, although rather small, is still statistically significant.

Results from regression estimated based on taxes by corporations and indirect taxes point to different conclusions. In particular, while results on fiscal rules estimated using $\Delta R_{i,t}^{dte}$ point clearly towards counter-cyclicality (see Columns 1 and 2 of Table 5), estimates based on legislated changes on taxes payable by enterprises indicate always a-cyclicality.

Turning to indirect taxes, results from Table 6 show that changes in cyclically-adjusted indirect taxes respond in a pro-cyclical way to the cycle while, when legislated changes are considered, results indicate that there are not responsive to economic developments.

Overall, these findings suggest that the observed a-cyclicality of the changes in the cyclically-adjusted overall taxes and social contributions seems to be explained by a-cyclicality of both taxes payable by households and social contributions and, on the other hand, by the possibility that the counter-cyclicality found for taxes payable by corporations offsets the pro-cyclical behaviour of changes in indirect taxes. At the same time, as regards legislated revenue changes, *their pro-cyclical behaviour can be interpreted as driven by a significant pro-cyclicality of changes in taxes payable by households and (though to a minor extent) social contributions*.

Finally, by analyzing the statistical significance of the other explanatory variables in each specification, it emerges that, with the exception of legislated changes in indirect taxes, the coefficient $\hat{\gamma}$ is always significant and with the expected negative sign. On the contrary, the parameter $\hat{\phi}$ has been found to be significant and with the expected positive sign only in the regressions of legislated changes on indirect taxes. This suggests that, *indirect taxes are the only revenue subcomponent that seems to have been used to stabilize the debt-output ratio*.

Regarding the importance of control variables, $\mathbf{Z}_{i,t}$, it is found that only for indirect taxes, and in the equation of cyclically-adjusted taxes payable by households, the dummy *EMU15* is statistically significant.

5.2 Testing for asymmetries

In this section the possible presence of non-linearity in the way discretionary fiscal policies react to the evolution of the economic cycle and to debt accumulation is explored.

In order to test whether there is a significant difference in the policymaker's response along the business cycle, the notion of "*good times*" as periods of positive output gap, and "*bad*" ones as years in which the output gap is negative, is used.[14] Asymmetries in the discretionary fiscal response may also be at play as regards the level of government debt. In the framework of the European Monetary Union (EMU) and the Stability Growth Pact (SGP), for instance, fiscal authorities may pursue more sustainable policies, attempting to reduce government debt, when the 60% ceiling is approached or exceeded. More generally, it can be expected that governments are more concerned about the sustainability of public finances when the government debt is high rather that when it is low.

In order to account for asymmetric effects the following panel regressions are estimated:

$$\Delta R_{i,t}^{j} = \beta^{+} Y_{i,t} d_1 + \beta^{-} Y_{i,t}(1-d_1) + \gamma\ \widetilde{R}_{i,t-1}^{j} + \phi^{+} B_{i,t-1} d_2 + \phi^{-} B_{i,t-1}(1-d_2) + \mathbf{Z}_{i,t}^{'}\boldsymbol{\delta} + \alpha_i + \varepsilon_{i,t} \quad (4)$$

$$\Delta \ell_{i,t}^{j} = \beta^{+} Y_{i,t} d_1 + \beta^{-} Y_{i,t}(1-d_1) + \gamma\ \widetilde{R}_{i,t-1}^{j} + \phi^{+} B_{i,t-1} d_2 + \phi^{-} B_{i,t-1}(1-d_2) + \mathbf{Z}_{i,t}^{'}\boldsymbol{\delta} + \alpha_i + \varepsilon_{i,t} \quad (5)$$

where:

$$d_1 = \begin{cases} 1 \text{ if } Y_{i,t} > 0 \\ 0 \text{ if } Y_{i,t} \le 0 \end{cases} \qquad d_2 = \begin{cases} 1 \text{ if } B_{i,t} > 60 \\ 0 \text{ if } B_{i,t} \le 60 \end{cases}$$

The variables $Y_{i,t}$ and $B_{i,t-1}$ from the baseline model (3) have been replaced in equations (4)-(5) with two sets of regressors. The first set of regressors is constructed by interacting $Y_{i,t}$ with a dummy indicator which equals one (zero) if the output gap is positive (negative) and their associated coefficients are β^{+} and β^{-}, respectively. The second one is computed by interacting $B_{i,t-1}$ with a dummy indicator which equals one (zero) when the debt at time *t-1* is above (below) the 60% ceiling. The coefficients associated to these regressors are denoted as ϕ^{+} and ϕ^{-}.

Tables 8a and 8b report estimates of the panel models (4) and (5) respectively, when we use the sample of nineteen EU countries. In addition, Table 8c shows results from model (5) when we consider the group of twenty-seven EU countries. Specifically, for each

[14] The same approach is followed by many other papers on fiscal policy rules (see e.g. Gavin and Perotti, 1997; European Commission, 2004; Turrini, 2008; OECD, 2003)

budget category, we report the estimates from three possible nested specifications of our models. In particular, the first column shows estimates accounting only for asymmetric responses of discretionary fiscal policy indicators to the economic cycle. The second one considers the possibility of asymmetries linking discretionary measures to debt developments. Finally, the third column reports estimates from the nested model, where the reaction to both the output gap and debt development can be characterized by two regimes.

To formally test for asymmetric effects in these models, some Wald tests are proposed. The first one tests the null hypothesis $\beta^+ = \beta^-$, i.e. equality of coefficients associated with positive and negative output gaps. The second one tests the linear restriction $\beta^+ = \beta^- = 0$, i.e. equal coefficients, and jointly not statistically different from zero. These two tests are also carried out for the parameters ϕ^+ and ϕ^-, which measure the reaction of dicretionary fiscal policies to dept developments when the debt ratio is respectively above and below the 60% threshold. Results are reported at the bottom of each table.

Table 8a indicates that, when we consider cyclically-adjusted indicators as a measure of discretionary fiscal policy, changes in taxes and social contributions seem to be disconnected from the economic cycle, and do not behave in an asymmetric way (in fact, both the parameter estimates $\hat{\beta}^+$ and $\hat{\beta}^-$ are not statistically significant, and the Wald test reject the null that $\hat{\beta}^+ = \hat{\beta}^-$). Analyzing the behaviour of the revenue-side budgetary subcomponents, we find that changes in direct taxes by households and social contributions remain a-cyclical in each phase of the cycle. At the same time, changes in taxes payable by enterprises have responded in a counter-cyclical way, especially during bad times ($\hat{\beta}^-$=0.15) rather than good times ($\hat{\beta}^+$=0.08). However, the hypothesis than these two coefficients are statistically different is rejected by the reported Wald statistic. Finally, asymmetric effects due to debt development do not seem to exist.

Table 8b and 8c show that legislated changes in taxes and social contributions occur in a strongly pro-cyclical way in “good times” and in an a-cyclical way during “bad times”. This evidence holds in particular for the sample of 19 countries, for which the Wald test rejects (at the 10% level) the null hypothesis that $\beta^+ = \beta^-$. At the same time, as regards the panel of 27-EU countries, while the coefficient associated with positive output gaps is again negative and significant at the 99% level, and $\hat{\beta}^-$ is not significantly different from

zero, there is no strong statistical evidence that the two parameters are different from each other (although the Wald statistic associated is very close to the 10% critical level).

As regards the legislation process related to each single revenue category, changes in taxes payable by households seem to be strongly pro-cyclical when the output gap is positive. In particular, while the parameter $\hat{\beta}^{+}$ is equal to -0.10 for the sub-group of 19 countries, it decreases to -0.07 for the overall country sample. A possible interpretation of this result is that the fiscal position of governments tends to improve during economic upswings, at least partially on account of the fiscal drag which operates in progressive tax systems (e.g. in European ones). As a consequence, EU governments may have reacted to these developments by lowering personal income taxes, as a compensation of losses in disposable income due to the fiscal drag.

Our results also indicate that asymmetries related to the reaction of legislative changes to debt developments do not seem to be at play. In fact, although the coefficients ϕ^{+} and ϕ^{-}, in the equation of legislated change in indirect taxes are both significant and positive (as expected), their difference is not statistically different from zero.

Finally, estimates indicate that asymmetries due to economic and debt development do not seem to occur simultaneously.

6. Robustness checks

The robustness of the empirical findings presented above is explored in different directions. First, we test whether our results are robust to various alternative business cycle indicators. In particular, we re-estimate our baseline models (2)-(3) by replacing the output gap as reported by NCBs with the one published by the European Commission in its AMECO database. In addition, we check the sensitivity of our results by using the simple growth rate of real GDP as an alternative measure of the cycle. In fact, it cannot be excluded that fiscal policy makers do not base their decisions on the output gap, due for example to the unreliability of potential output estimates, and might use simply real GDP growth as a proxy for the state of the economy. Estimates of models (2)-(3) for overall taxes and social contributions obtained by these alternative measures of cyclical conditions are reported in Table 9, along with our baseline estimates. Results from the use of the AMECO output gap clearly point to results in line with the baseline: overall taxes and social contributions appear to be more pro-cyclical when legislated changes are

considered, while a-cyclical when structural indicators are used (Columns 2, 5 and 8). When GDP growth is used instead, regressions based on structural indicators yield to a statistically insignificant $\hat{\beta}$ .However, when legislated revenue changes are incorporated, $\hat{\beta}$ becomes negative, indicating again pro-cyclicality, as in the baseline case (Columns 3, 6 and 9).

A further robustness test consists of examining the effects of including in equations (2) and (3) additional control variables. Specifically, we are interested in testing whether the omission of variables potentially correlated to ΔR^{txs} or $\Delta \ell^{txs}$, may impact significantly on the relation between discretionary fiscal policy behaviour and economic fluctuations. In particular, we control for changes in total and primary government spending and changes in the inflation rate. In addition, we check whether the ideology behind national political parties in power influence the degree of fiscal policy discretion.

By controlling for changes in government spending we account for the possibility that changes in taxes and social contributions may be driven by changes in expenditures.[15] In order to test for such hypothesis, we use two measures of spending changes: the change in the total expenditure and the changes in the primary expenditure (i.e. total expenditure less interest payments). Both series are taken from the AMECO database, and are divided by nominal trend GDP. Lagged values of these series are used since a reverse causality (expenditure are adjusted to respond to revenue dynamics) cannot be a priori excluded.

In addition, experiments based on the inclusion of changes in the inflation rate are carried out. This may reflect the possibility that taxes, especially the indirect ones (VAT), may be lowered to mitigate the impact of increases in prices on consumption goods. Similarly to spending, lagged values of inflation changes are used, given that taxes may impact on prices in the same period.

Finally, the possibility that the 'political orientation' of coalitions in power in the countries considered, may affect the way discretionary fiscal policies are decided, is tested. To that aim, the information from the Dataset of Political Indicators (DPI) provided by the World Bank is used. In particular, the variable EXECRCL distinguishes between right, center and left parties according to the government orientation with respect to economic policy. Based on this information, for each of the 27 countries, the succession of political parties in charge since 1998 is reconstructed. Specifically, three dummy variables which enter as

[15] As an alternative, one may also want to include the government deficit, instead of spending, as an additional control variable. However, the deficit clearly incorporates revenues, therefore problems related to endogeneity are very likely to arise.

regressors in the baseline model are introduced, namely: i) *Right* takes value of one during the years in which parties in charge can be defined as 'conservative', Christian democratic, or right-wing, and zero otherwise; ii) *Center* takes value of one when the parties can best be described as 'centrist', zero otherwise; and finally iii) *Left* takes value of one for parties that are defined as communist, socialist, social democratic, or left-wing, and zero otherwise.

As Table 10 shows, none of these additional alter significantly the baseline results. In particular, spending developments do not seem to be associated with revenue decisions. Inflation appears to be mildly significant in the regression for ΔR^{txs}, but it has no explanatory power for $\Delta \ell^{txs}$. Finally, the political orientation of ruling parties plays no role in accounting for revenue developments. In all these experiments, the core findings related to the coefficient on the output gap are unaffected, pointing to the fact the baseline model seems to be well-specified.

7. Conclusion

This paper proposes a new approach to study the cyclical sensitivity of discretionary revenue policies in EU countries, based on measures of legislated revenue changes as provided by EU National Central Banks in the framework of the 'ESCB disaggregated approach'. The findings from this analysis, which focuses on the period 1998-2008, can be summarized as follows.

First, it emerges that, *ex-post*, legislated changes on the revenue side of the government budget seem to have been used in a strongly pro-cyclical way, in contrast to what emerges based on cyclically-adjusted indicators, which point to a-cyclicality. This result holds for the whole set of EU countries, but also when countries belonging to the EMU are analysed separately.

Second, the observed pro-cyclicality of discretionary revenue appears to be mainly driven by direct taxes paid by households and social security contributions. In particular, the former have been significantly reduced during booming economic times, thus probably contributing to overheating economies which were already in an expansionary phase. These developments might be driven by deliberate decisions of governments to lower personal income taxes in booming times, as a (at least partial) compensation of losses in disposable income generated by the fiscal drag, in progressive tax systems.

Finally, indirect taxes are the only revenue item that seems to react to the government debt-to-GDP ratio.

These findings suggest that a sound identification of the discretionary component of fiscal policy is of key importance to appropriately assess how fiscal policies have been implemented over the economic cycle.

Looking ahead, and in the spirit of Romer and Romer (2007a), a natural extension of this work would be to study the effects of legislated revenue changes on the economic activity in the European Union.

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Tables:

Table 1a. Correlation matrix of overall taxes and social contributions, and four sub-components computed according to the ESCB's disaggregated approach

	ΔR^{txs}	fd^{txs}	de^{txs}	$\Delta \ell^{txs}$	rs^{txs}
ΔR^{txs}	1.00				
fd^{txs}	-0.10	1.00			
de^{txs}	0.12	0.26	1.00		
$\Delta \ell^{txs}$	0.37	-0.23	-0.32	1.00	
rs^{txs}	0.75	-0.19	-0.06	-0.05	1.00

Notes: Variables refer to overall taxes and social security contributions, net of temporary measures (*txs*). ΔR are changes in cyclically-adjusted values, net of temporary measures; *fd*: fiscal drag; *de*: decoupling of the tax base from GDP;: legislated changes; *rs:* residual component. Values reported are the simple average of single countries' variance-covariance matrix, for the panel EU-19 over the period 1998-2008.

Table 1b: Correlation matrix of legislated changes

	$\Delta \ell^{txs}$	$\Delta \ell^{dth}$	$\Delta \ell^{dte}$	$\Delta \ell^{itx}$	$\Delta \ell^{sct}$
$\Delta \ell^{txs}$	1.00				
$\Delta \ell^{dth}$	0.69	1.00			
$\Delta \ell^{dte}$	0.40	0.27	1.00		
$\Delta \ell^{itx}$	0.33	-0.02	0.02	1.00	
$\Delta \ell^{sct}$	0.32	0.17	-0.03	-0.21	1.00

Notes. Variables refer to legislated changes $\Delta \ell$ in: overall taxes and social security contributions (*txs*); direct taxes paid by households (*dth*); direct taxes paid by enterprises (dte); indirect taxes (itx); social security contributions (sct). Sample: 27-EU countries over the period 1998-2008.

Table 2. Estimates for overall taxes and social contributions (*txs*): EU-19 and EU-27

Dependent variable:	ΔR^{txs}		$\Delta \ell^{txs}$		$\Delta \ell^{txs27}$	
	(1)	(2)	(3)	(4)	(5)	(6)
	IV/2SLS	*OLS*	*IV/2SLS*	*OLS*	*IV/2SLS*	*OLS*
Output gap$_t$	-0.086	0.036	-0.172***	-0.107***	-0.156***	-0.094***
	[0.072]	[0.048]	[0.038]	[0.025]	[0.034]	[0.022]
Permanent$_{t-1}$	-0.271***	-0.294***	-0.045	-0.058**	-0.054*	-0.064**
	[0.058]	[0.056]	[0.030]	[0.029]	[0.028]	[0.027]
Debt$_{t-1}$	0.007	0.009	0.001	0.002	-0.001	0.000
	[0.013]	[0.013]	[0.007]	[0.007]	[0.006]	[0.006]
EMU-15	-1.379***	-1.451***	-0.454*	-0.492**	-0.458**	-0.496**
	[0.462]	[0.452]	[0.241]	[0.235]	[0.229]	[0.224]
T_i,	0.062**	0.068***	0.012	0.015	0.012	0.015
	[0.025]	[0.025]	[0.013]	[0.013]	[0.012]	[0.012]
NONACTIVE$_{i,t}$	-0.310***	-0.288**	0.034	0.046	0.026	0.042
	[0.118]	[0.115]	[0.061]	[0.060]	[0.058]	[0.056]
ELECT$_{i,t}$	-0.021	-0.012	0.084	0.088	0.079	0.082
	[0.149]	[0.146]	[0.078]	[0.076]	[0.069]	[0.068]
Obs.	189	189	189	189	222	222
Number of countries	19	19	19	19	27	27
R-squared	0.23	0.26	0.18	0.22	0.17	0.20
Sargan Statistic$^{(\circ)}$	3.23		0.00		0.03	
(P-value)	(0.07)		(0.99)		(0.85)	

Notes: *, ***, ***, significant at respectively 10, 5, and 1 per cent. Standard error in square brackets. $^{(\circ)}$ Overidentifying restrictions test and p-value in brackets.

Table 3. Estimates for overall taxes and social contributions: EMU countries

Dependent variable:	ΔR^{txs}		$\Delta \ell^{txs}$	
	(1)	(2)	(3)	(4)
	IV/2SLS	*OLS*	*IV/2SLS*	*OLS*
Output gap$_t$	-0.068	0.072	-0.178***	-0.093**
	[0.104]	[0.071]	[0.064]	[0.044]
Permanent$_{t-1}$	-0.227***	-0.281***	-0.111**	-0.143***
	[0.080]	[0.073]	[0.049]	[0.045]
Debt$_{t-1}$	-0.002	0.004	-0.002	0.002
	[0.016]	[0.015]	[0.010]	[0.009]
T_i,	0.038	0.064*	0.008	0.023
	[0.037]	[0.034]	[0.023]	[0.021]
NONACTIVE$_{i,t}$	0.036	-0.085	-0.004	-0.077
	[0.230]	[0.217]	[0.142]	[0.134]
ELECT$_{i,t}$	-0.210	-0.196	-0.007	0.001
	[0.166]	[0.162]	[0.102]	[0.100]
Obs.	125	127	125	127
Number of countries	13	15	13	15
R-squared	0.16	0.19	0.19	0.22
Sargan Statistic$^{(\circ)}$	9.86		1.14	
(P-value)	(0.00)		(0.29)	

Notes: *, ***, ***, significant at respectively 10, 5, and 1 per cent. Standard error in square brackets. $^{(\circ)}$ Overidentifying restrictions test and p-value in brackets.

Table 4: Estimates for direct taxes payable by households (*dth*)

Dependent variable:	ΔR^{dth}		$\Delta \ell^{dth}$		$\Delta \ell^{dth27}$	
	(1)	(2)	(3)	(4)	(5)	(6)
	IV/2SLS	*OLS*	*IV/2SLS*	*OLS*	*IV/2SLS*	*OLS*
Output gap$_t$	-0.036	-0.025	-0.115***	-0.060***	-0.107***	-0.050***
	[0.034]	[0.023]	[0.024]	[0.016]	[0.022]	[0.014]
Permanent$_{t-1}$	-0.366***	-0.372***	-0.106**	-0.136***	-0.116**	-0.142***
	[0.076]	[0.074]	[0.053]	[0.050]	[0.048]	[0.046]
Debt$_{t-1}$	-0.002	-0.002	-0.004	-0.003	-0.005	-0.003
	[0.006]	[0.006]	[0.004]	[0.004]	[0.004]	[0.004]
EMU-15	-0.394*	-0.402*	0.020	-0.018	0.017	-0.023
	[0.217]	[0.217]	[0.152]	[0.146]	[0.148]	[0.142]
T_i,	0.004	0.005	-0.017**	-0.016*	-0.017**	-0.015*
	[0.012]	[0.012]	[0.008]	[0.008]	[0.008]	[0.008]
NONACTIVE$_{i,t}$	-0.106**	-0.102*	-0.014	0.003	-0.017	0.003
	[0.053]	[0.052]	[0.037]	[0.035]	[0.036]	[0.034]
ELECT$_{i,t}$	-0.011	-0.01	-0.014	-0.012	0.001	0.002
	[0.072]	[0.071]	[0.050]	[0.048]	[0.046]	[0.044]
Obs.	189	189	190	190	222	222
Number of countries	19	19	19	19	27	27
R-squared	0.20	0.21	0.10	0.16	0.07	0.14
Sargan Statistic(°)	8.22		1.23		0.99	
(P-value)	(0.00)		(0.27)		(0.32)	

Notes: *, ***, ***, significant at respectively 10, 5, and 1 per cent. Standard error in square brackets. (°) Overidentifying restrictions test and p-value in brackets.

Table 5: Estimates for direct taxes payable by corporations (*dte*)

Dependent variable:	ΔR^{dte}		$\Delta \ell^{dte}$		$\Delta \ell^{dte27}$	
	(1)	(2)	(3)	(4)	(5)	(6)
	IV/2SLS	*OLS*	*IV/2SLS*	*OLS*	*IV/2SLS*	*OLS*
Output gap$_t$	0.095**	0.111***	0.005	0.008	0.005	0.008
	[0.039]	[0.025]	[0.016]	[0.011]	[0.015]	[0.009]
Permanent$_{t-1}$	-0.327***	-0.339***	-0.085***	-0.087***	-0.085***	-0.086***
	[0.064]	[0.060]	[0.027]	[0.025]	[0.025]	[0.023]
Debt$_{t-1}$	0.000	0.000	-0.004	-0.004	-0.004	-0.004
	[0.006]	[0.006]	[0.003]	[0.003]	[0.002]	[0.002]
EMU-15	-0.144	-0.15	-0.108	-0.109	-0.111	-0.111
	[0.223]	[0.223]	[0.094]	[0.094]	[0.089]	[0.089]
T_i,	0.029**	0.030**	0.004	0.004	0.004	0.004
	[0.012]	[0.012]	[0.005]	[0.005]	[0.005]	[0.005]
NONACTIVE$_{i,t}$	-0.053	-0.05	0.005	0.006	0.006	0.006
	[0.054]	[0.054]	[0.023]	[0.023]	[0.022]	[0.021]
ELECT$_{i,t}$	-0.066	-0.064	0.000	0.000	-0.004	-0.004
	[0.073]	[0.073]	[0.031]	[0.031]	[0.028]	[0.028]
Obs.	189	189	190	190	222	222
Number of countries	19	19	19	19	27	27
R-squared	0.22	0.22	0.10	0.10	0.10	0.10
Sargan Statistic(°)	1.04		0.13		0.15	
(P-value)	(0.31)		(0.72)		(0.70)	

Notes: *, ***, ***, significant at respectively 10, 5, and 1 per cent. Standard error in square brackets. (°) Overidentifying restrictions test and p-value in brackets.

Table 6: Estimates for indirect taxes (*itx*)

Dependent variable:	ΔR^{itx}		$\Delta \ell^{itx}$		$\Delta \ell^{itx27}$	
	(1)	(2)	(3)	(4)	(5)	(6)
	IV/2SLS	*OLS*	*IV/2SLS*	*OLS*	*IV/2SLS*	*OLS*
Output gap$_t$	-0.122***	-0.049*	0.001	-0.012	-0.003	-0.014
	[0.043]	[0.029]	[0.023]	[0.016]	[0.021]	[0.014]
Permanent$_{t-1}$	-0.301***	-0.289***	-0.032	-0.035	-0.034	-0.036
	[0.048]	[0.047]	[0.026]	[0.026]	[0.024]	[0.024]
Debt$_{t-1}$	0.008	0.009	0.009**	0.009**	0.008**	0.008**
	[0.008]	[0.008]	[0.004]	[0.004]	[0.004]	[0.004]
EMU-15	-0.639**	-0.720***	-0.364**	-0.350**	-0.359**	-0.346**
	[0.276]	[0.269]	[0.152]	[0.150]	[0.143]	[0.142]
T_i,	0.007	0.011	0.009	0.009	0.009	0.008
	[0.015]	[0.015]	[0.008]	[0.008]	[0.008]	[0.008]
NONACTIVE$_{i,t}$	-0.234***	-0.204***	-0.049	-0.054	-0.051	-0.056
	[0.071]	[0.068]	[0.039]	[0.038]	[0.036]	[0.036]
ELECT$_{i,t}$	-0.041	-0.035	-0.009	-0.01	-0.015	-0.016
	[0.091]	[0.089]	[0.050]	[0.050]	[0.044]	[0.044]
Obs.	189	189	190	190	222	222
Number of countries	19	19	19	19	27	27
R-squared	0.22	0.25	0.08	0.08	0.08	0.08
Sargan Statistic(°)	0.27		5.88		6.08	
(P-value)	(0.61)		(0.02)		(0.01)	

Notes: *, ***, ***, significant at respectively 10, 5, and 1 per cent. Standard error in square brackets. (°) Overidentifying restrictions test and p-value in brackets.

Table 7: Social contribution (*sct*)

Dependent variable:	ΔR^{sct}		$\Delta \ell^{sct}$		$\Delta \ell^{sct27}$	
	(1)	(2)	(3)	(4)	(5)	(6)
	IV/2SLS	*OLS*	*IV/2SLS*	*OLS*	*IV/2SLS*	*OLS*
Output gap$_t$	-0.002	0.012	-0.046**	-0.030*	-0.044**	-0.028**
	[0.033]	[0.023]	[0.022]	[0.015]	[0.021]	[0.014]
Permanent$_{t-1}$	-0.518***	-0.519***	-0.269***	-0.272***	-0.269***	-0.269***
	[0.074]	[0.074]	[0.051]	[0.051]	[0.047]	[0.047]
Debt$_{t-1}$	0.006	0.006	0.003	0.003	0.003	0.003
	[0.006]	[0.006]	[0.004]	[0.004]	[0.004]	[0.004]
EMU-15	-0.041	-0.055	0.09	0.074	0.086	0.071
	[0.210]	[0.208]	[0.144]	[0.143]	[0.139]	[0.138]
T_i,	0.016	0.017	0.013*	0.014*	0.013*	0.014*
	[0.012]	[0.012]	[0.008]	[0.008]	[0.008]	[0.008]
NONACTIVE$_{i,t}$	0.017	0.022	0.053	0.058	0.053	0.059*
	[0.053]	[0.052]	[0.036]	[0.036]	[0.035]	[0.034]
ELECT$_{i,t}$	0.083	0.084	0.097**	0.098**	0.086**	0.087**
	[0.069]	[0.069]	[0.048]	[0.048]	[0.043]	[0.043]
Obs.	189	189	190	190	222	222
Number of countries	19	19	19	19	27	27
R-squared	0.27	0.27	0.24	0.25	0.23	0.23
Sargan Statistic(°)	0.25		1.05		1.09	
(P-value)	(0.62)		(0.31)		(0.30)	

Notes: *, ***, ***, significant at respectively 10, 5, and 1 per cent. Standard error in square brackets. (°) Overidentifying restrictions test and p-value in brackets.

Table 8a: Asymmetric behaviour of cyclically-adjusted measures (19 countries)

Dependent variable:	ΔR^{txs}			ΔR^{dth}			ΔR^{dte}			ΔR^{itx}			ΔR^{sct}		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Output gap$_t$ (β)	-	0.041	-	-	-0.025	-	-	0.112***	-	-	-0.048	-	-	0.014	-
	-	[0.048]	-	-	[0.024]	-	-	[0.025]	-	-	[0.029]	-	-	[0.022]	-
Output gap$_t^+$ (β^+)	-0.027	-	-0.012	-0.022	-	-0.023	0.081*	-	0.084*	-0.093*	-	-0.086	0.015	-	0.022
	[0.089]	-	[0.089]	[0.044]	-	[0.044]	[0.046]	-	[0.047]	[0.055]	-	[0.055]	[0.042]	-	[0.042]
Output gap$_t^-$ (β^-)	0.128	-	0.117	-0.029	-	-0.028	0.152**	-	0.149**	0.012	-	0.007	0.007	-	0.002
	[0.118]	-	[0.118]	[0.058]	-	[0.058]	[0.059]	-	[0.059]	[0.072]	-	[0.072]	[0.056]	-	[0.056]
Permanent$_{t-1}$	-0.296***	-0.304***	-0.305***	-0.372***	-0.372***	-0.372***	-0.334***	-0.340***	-0.336***	-0.294***	-0.293***	-0.297***	-0.519***	-0.537***	-0.536***
	[0.056]	[0.056]	[0.056]	[0.075]	[0.075]	[0.075]	[0.060]	[0.060]	[0.060]	[0.047]	[0.046]	[0.047]	[0.075]	[0.074]	[0.075]
Debt$_{t-1}$ (Φ)	0.009	-	-	-0.002	-	-	0.001	-	-	0.009	-	-	0.006	-	-
	[0.013]	-	-	[0.006]	-	-	[0.006]	-	-	[0.008]	-	-	[0.006]	-	-
Debt$_{t-1}^+$ (Φ^+)	-	0.000	0.001	-	-0.001	-0.001	-	-0.001	-0.001	-	0.004	0.005	-	0.002	0.002
	-	[0.014]	[0.014]	-	[0.007]	[0.007]	-	[0.007]	[0.007]	-	[0.008]	[0.008]	-	[0.006]	[0.006]
Debt$_{t-1}^-$ (Φ^-)	-	-0.008	-0.007	-	-0.001	-0.001	-	-0.003	-0.003	-	0.000	0.001	-	-0.002	-0.002
	-	[0.016]	[0.016]	-	[0.008]	[0.008]	-	[0.008]	[0.008]	-	[0.010]	[0.010]	-	[0.007]	[0.008]
EMU-15	-1.456***	-1.336***	-1.344***	-0.402*	-0.409*	-0.408*	-0.157	-0.129	-0.137	-0.723***	-0.669**	-0.674**	-0.055	-0.003	-0.002
	[0.452]	[0.453]	[0.454]	[0.217]	[0.219]	[0.220]	[0.223]	[0.225]	[0.225]	[0.269]	[0.270]	[0.271]	[0.209]	[0.209]	[0.209]
T_i,	0.064**	0.055**	0.053**	0.005	0.005	0.005	0.028**	0.028**	0.026**	0.008	0.005	0.003	0.017	0.011	0.011
	[0.025]	[0.025]	[0.026]	[0.012]	[0.013]	[0.013]	[0.013]	[0.013]	[0.013]	[0.015]	[0.016]	[0.016]	[0.012]	[0.012]	[0.012]
NONACTIVE$_{i,t}$	-0.280**	-0.307***	-0.300**	-0.103*	-0.102*	-0.102*	-0.045	-0.053	-0.048	-0.200***	-0.212***	-0.207***	0.022	0.013	0.012
	[0.116]	[0.115]	[0.115]	[0.053]	[0.052]	[0.053]	[0.054]	[0.054]	[0.055]	[0.068]	[0.068]	[0.068]	[0.053]	[0.052]	[0.052]
ELECT$_{i,t}$	-0.02	0.007	0.000	-0.01	-0.012	-0.012	-0.068	-0.06	-0.064	-0.04	-0.025	-0.03	0.084	0.093	0.094
	[0.146]	[0.145]	[0.146]	[0.072]	[0.072]	[0.072]	[0.074]	[0.074]	[0.074]	[0.090]	[0.089]	[0.090]	[0.070]	[0.069]	[0.069]
H_0: $\beta^+ = \beta^-$	0.71	-	0.50	0.01	-	0.00	0.58	-	0.49	0.86	-	0.67	0.01	-	0.06
H_0: $\beta^+ = \beta^- = 0$	0.64	-	0.62	0.55	-	0.55	9.94***	-	9.99***	1.85	-	1.67	0.14	-	0.22
H_0: $\Phi^+ = \Phi^-$	-	3.26*	3.30*	-	0.06	0.06	-	0.57	0.48	-	2.21	2.00	-	3.59*	3.62*
H_0: $\Phi^+ = \Phi^- = 0$	-	1.89	1.80	-	0.08	0.07	-	0.29	0.24	-	1.77	1.72	-	2.33	2.33
Obs.	189	189	189	189	189	189	189	189	189	189	189	189	189	189	189
Centered R-squared	0.26	0.28	0.28	0.21	0.21	0.21	0.23	0.23	0.23	0.25	0.26	0.26	0.27	0.28	0.28

Notes: *, ***, ***, significant at respectively 10, 5, and 1 per cent. Standard error in square bracket. OLS estimates

Table 8b: Asymmetric behaviour of legislated revenue changes (19 countries)

Dependent variable:	$\Delta \ell^{txs}$			$\Delta \ell^{dth}$			$\Delta \ell^{dte}$			$\Delta \ell^{itx}$			$\Delta \ell^{sct}$		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Output gap$_t$ (β)	-	-0.109***	-	-	-0.060***	-	-	0.008	-	-	-0.013	-	-	-0.029*	-
	-	[0.025]	-	-	[0.016]	-	-	[0.011]	-	-	[0.016]	-	-	[0.015]	-
Output gap$_t^+$ (β^+)	-0.176***	-	-0.181***	-0.097***	-	-0.100***	-0.009	-	-0.01	-0.024	-	-0.027	-0.034	-	-0.031
	[0.046]	-	[0.046]	[0.029]	-	[0.029]	[0.020]	-	[0.020]	[0.031]	-	[0.031]	[0.029]	-	[0.029]
Output gap$_t^-$ (β^-)	-0.008	-	-0.005	-0.007	-	-0.005	0.031	-	0.031	0.005	-	0.008	-0.026	-	-0.027
	[0.061]	-	[0.061]	[0.038]	-	[0.038]	[0.025]	-	[0.025]	[0.040]	-	[0.040]	[0.039]	-	[0.039]
Permanent$_{t-1}$	-0.059**	-0.055*	-0.056*	-0.132***	-0.136***	-0.133***	-0.084***	-0.087***	-0.084***	-0.036	-0.033	-0.034	-0.272***	-0.278***	-0.278***
	[0.029]	[0.029]	[0.029]	[0.050]	[0.050]	[0.050]	[0.025]	[0.025]	[0.025]	[0.026]	[0.026]	[0.026]	[0.051]	[0.051]	[0.051]
Debt$_{t-1}$ (Φ)	0.003	-	-	-0.003	-	-	-0.003	-	-	0.009**	-	-	0.003	-	-
	[0.007]	-	-	[0.004]	-	-	[0.003]	-	-	[0.004]	-	-	[0.004]	-	-
Debt$_{t-1}^+$ (Φ^+)	-	0.004	0.005	-	-0.002	-0.002	-	-0.003	-0.003	-	0.011**	0.011**	-	0.002	0.002
	-	[0.007]	[0.007]	-	[0.004]	[0.004]	-	[0.003]	[0.003]	-	[0.005]	[0.005]	-	[0.004]	[0.004]
Debt$_{t-1}^-$ (Φ^-)	-	0.006	0.008	-	-0.001	0.000	-	-0.003	-0.003	-	0.013**	0.013**	-	0.000	0.000
	-	[0.008]	[0.008]	-	[0.005]	[0.005]	-	[0.003]	[0.003]	-	[0.005]	[0.005]	-	[0.005]	[0.005]
EMU-15	-0.498**	-0.521**	-0.532**	-0.024	-0.031	-0.04	-0.113	-0.109	-0.114	-0.351**	-0.371**	-0.373**	0.074	0.094	0.093
	[0.234]	[0.238]	[0.236]	[0.145]	[0.147]	[0.146]	[0.094]	[0.095]	[0.095]	[0.151]	[0.151]	[0.152]	[0.143]	[0.144]	[0.144]
T_i,	0.01	0.018	0.014	-0.018**	-0.014	-0.016*	0.003	0.004	0.003	0.008	0.011	0.01	0.014*	0.012	0.012
	[0.013]	[0.013]	[0.013]	[0.008]	[0.008]	[0.008]	[0.005]	[0.005]	[0.005]	[0.009]	[0.009]	[0.009]	[0.008]	[0.008]	[0.008]
NONACTIVE$_{i,t}$	0.054	0.05	0.061	0.009	0.005	0.011	0.008	0.006	0.009	-0.053	-0.051	-0.049	0.059	0.055	0.055
	[0.060]	[0.060]	[0.060]	[0.035]	[0.035]	[0.035]	[0.023]	[0.023]	[0.023]	[0.038]	[0.038]	[0.038]	[0.036]	[0.036]	[0.036]
ELECT$_{i,t}$	0.08	0.083	0.074	-0.016	-0.014	-0.019	-0.002	0.000	-0.002	-0.012	-0.014	-0.016	0.098**	0.102**	0.102**
	[0.076]	[0.076]	[0.076]	[0.048]	[0.048]	[0.048]	[0.031]	[0.031]	[0.031]	[0.050]	[0.050]	[0.050]	[0.048]	[0.048]	[0.048]
H_0: $\beta^+ = \beta^-$	3.15*	-	3.34*	2.29	-	2.50	1.07	-	1.08	0.21	-	0.30	0.02	-	0.00
H_0: $\beta^+ = \beta^- = 0$	10.90***	-	11.23***	8.37***	-	8.61***	0.69	-	0.79	0.37	-	0.44	1.93	-	1.81
H_0: $\Phi^+ = \Phi^-$	-	0.77	1.07	-	0.71	0.93	-	0.00	0.01	-	1.31	1.39	-	1.16	1.14
H_0: $\Phi^+ = \Phi^- = 0$	-	0.44	0.61	-	0.67	0.75	-	0.88	0.83	-	2.83**	2.89**	-	0.91	0.91
Obs.	189	189	189	190	190	190	190	190	190	190	190	190	190	190	190
Centered R-squared	0.23	0.22	0.24	0.17	0.17	0.18	0.11	0.10	0.11	0.08	0.09	0.09	0.25	0.25	0.25

Notes: *, ***, ***, significant at respectively 10, 5, and 1 per cent. Standard error in square bracket. OLS estimates.

Table 8c: Asymmetric behaviour of legislated revenue changes (overall sample)

Dependent variable:	$\Delta\ell^{txs27}$			$\Delta\ell^{dth27}$			$\Delta\ell^{dte27}$			$\Delta\ell^{itx27}$			$\Delta\ell^{sct27}$		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Output gap$_t$	-	-0.094***	-	-	-0.050***	-	-	0.008	-	-	-0.015	-	-	-0.028**	-
	-	[0.022]	-	-	[0.014]	-	-	[0.009]	-	-	[0.014]	-	-	[0.014]	-
Output gap$_t^+$	-0.143***	-	-0.145***	-0.068***	-	-0.070***	-0.005	-	-0.005	-0.037	-	-0.038	-0.027	-	-0.025
	[0.040]	-	[0.040]	[0.026]	-	[0.026]	[0.017]	-	[0.017]	[0.026]	-	[0.026]	[0.025]	-	[0.025]
Output gap$_t^-$	-0.017	-	-0.015	-0.023	-	-0.021	0.027	-	0.027	0.02	-	0.022	-0.031	-	-0.033
	[0.055]	-	[0.056]	[0.036]	-	[0.036]	[0.022]	-	[0.023]	[0.036]	-	[0.036]	[0.035]	-	[0.035]
Permanent$_{t-1}$	-0.066**	-0.063**	-0.064**	-0.142***	-0.143***	-0.143***	-0.085***	-0.086***	-0.085***	-0.038	-0.034	-0.036	-0.269***	-0.273***	-0.273***
	[0.027]	[0.027]	[0.027]	[0.046]	[0.046]	[0.046]	[0.023]	[0.023]	[0.023]	[0.024]	[0.024]	[0.024]	[0.047]	[0.047]	[0.047]
Debt$_{t-1}$	0.001	-	-	-0.003	-	-	-0.003	-	-	0.008**	-	-	0.003	-	-
	[0.006]	-	-	[0.004]	-	-	[0.002]	-	-	[0.004]	-	-	[0.004]	-	-
Debt$_{t-1}^+$	-	0.002	0.003	-	-0.002	-0.002	-	-0.004	-0.003	-	0.010**	0.010**	-	0.002	0.002
	-	[0.006]	[0.006]	-	[0.004]	[0.004]	-	[0.003]	[0.003]	-	[0.004]	[0.004]	-	[0.004]	[0.004]
Debt$_{t-1}^-$	-	0.003	0.004	-	-0.001	-0.001	-	-0.004	-0.003	-	0.011**	0.012**	-	0.000	0.000
	-	[0.007]	[0.007]	-	[0.005]	[0.005]	-	[0.003]	[0.003]	-	[0.005]	[0.005]	-	[0.005]	[0.005]
EMU-15	-0.501**	-0.517**	-0.525**	-0.026	-0.035	-0.04	-0.114	-0.111	-0.115	-0.349**	-0.366**	-0.370**	0.071	0.089	0.089
	[0.223]	[0.226]	[0.225]	[0.142]	[0.143]	[0.143]	[0.089]	[0.090]	[0.090]	[0.142]	[0.143]	[0.143]	[0.138]	[0.139]	[0.139]
T_i,	0.012	0.017	0.014	-0.016**	-0.014*	-0.015*	0.004	0.004	0.004	0.007	0.01	0.009	0.014*	0.012	0.012
	[0.012]	[0.012]	[0.013]	[0.008]	[0.008]	[0.008]	[0.005]	[0.005]	[0.005]	[0.008]	[0.008]	[0.008]	[0.008]	[0.008]	[0.008]
NONACTIVE$_{i,t}$	0.049	0.045	0.053	0.006	0.005	0.008	0.008	0.006	0.009	-0.053	-0.053	-0.05	0.059*	0.056	0.056
	[0.056]	[0.057]	[0.057]	[0.034]	[0.034]	[0.034]	[0.022]	[0.022]	[0.022]	[0.036]	[0.036]	[0.036]	[0.034]	[0.034]	[0.035]
ELECT$_{i,t}$	0.079	0.079	0.076	0.001	0.000	-0.002	-0.004	-0.004	-0.005	-0.017	-0.019	-0.02	0.087**	0.089**	0.090**
	[0.068]	[0.068]	[0.068]	[0.044]	[0.044]	[0.044]	[0.028]	[0.028]	[0.028]	[0.044]	[0.044]	[0.044]	[0.043]	[0.043]	[0.043]
H_0: $\beta^+ = \beta^-$	2.25	-	2.40	0.72	-	0.81	0.90	-	0.90	1.05	-	1.20	0.01	-	0.02
H_0: $\beta^+ = \beta^- = 0$	10.00***	-	10.12***	6.47***	-	6.54***	0.78	-	0.78	1.02	-	1.11	2.06	-	2.03
H_0: $\Phi^+ = \Phi^-$	-	0.48	0.63	-	0.60	0.69	-	0.00	0.00	-	1.22	1.38	-	1.06	1.07
H_0: $\Phi^+ = \Phi^- = 0$	-	0.24	0.33	-	0.64	0.66	-	1.07	1.00	-	2.80*	2.98**	-	0.83	0.83
Obs.	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222
Centered R-squared	0.212	0.20	0.22	0.15	0.15	0.15	0.11	0.10	0.11	0.09	0.09	0.09	0.23	0.24	0.24

Notes: *, ***, ***, significant at respectively 10, 5, and 1 per cent. Standard error in square bracket. OLS estimates

Table 9: Estimates using different measure of business cycle

	ΔR^{txs}			$\Delta \ell^{txs}$			$\Delta \ell^{txs\,27}$		
	$Outgap_t$		$Growth_t$	$Outgap_t$		$Growth_t$	$Outgap_t$		$Growth_t$
	BASELINE	*AMECO*		*BASELINE*	*AMECO*		*BASELINE*	*AMECO*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
β	-0.086	-0.076	0.151	-0.172***	-0.122***	-0.113*	-0.156***	-0.112***	-0.088*
	[0.072]	[0.051]	[0.103]	[0.038]	[0.026]	[0.059]	[0.034]	[0.024]	[0.052]
$Permanent_{t-1}$	-0.271***	-0.276***	-0.272***	-0.045	-0.060**	-0.090***	-0.054*	-0.067**	-0.089***
	[0.058]	[0.057]	[0.055]	[0.030]	[0.029]	[0.032]	[0.028]	[0.027]	[0.029]
$Debt_{t-1}$	0.007	0.006	-0.003	0.001	0.000	0.012	-0.001	-0.001	0.009
	[0.013]	[0.013]	[0.015]	[0.007]	[0.007]	[0.008]	[0.006]	[0.006]	[0.007]
EMU-15	-1.379***	-1.352***	-1.447***	-0.454*	-0.431*	-0.542**	-0.458**	-0.438*	-0.536**
	[0.462]	[0.463]	[0.445]	[0.241]	[0.237]	[0.255]	[0.229]	[0.225]	[0.239]
T_i,	0.062**	0.064**	0.059**	0.012	0.016	0.025*	0.012	0.017	0.021
	[0.025]	[0.025]	[0.025]	[0.013]	[0.013]	[0.014]	[0.012]	[0.012]	[0.013]
$NONACTIVE_{i,t}$	-0.310***	-0.332***	-0.191	0.034	0.005	-0.013	0.026	-0.001	0.002
	[0.118]	[0.120]	[0.133]	[0.061]	[0.061]	[0.077]	[0.058]	[0.058]	[0.071]
$ELECT_{i,t}$	-0.021	-0.023	0.02	0.084	0.082	0.07	0.079	0.076	0.069
	[0.149]	[0.149]	[0.146]	[0.078]	[0.076]	[0.084]	[0.069]	[0.068]	[0.073]
Obs.	189	189	189	189	189	189	222	222	222
Number of countries	19	19	19	19	19	19	27	27	27
Centered R-squared	0.23	0.23	0.28	0.18	0.21	0.07	0.17	0.20	0.09
Sargan Statistic(°)	3.23	2.34	2.00	0.00	0.71	11.38	0.03	0.90	12.89
(P-value)	(0.07)	(0.13)	(0.16)	(0.99)	(0.40)	(0.00)	(0.85)	(0.34)	(0.00)

Notes: *, ***, ***, significant at respectively 10, 5, and 1 per cent. Standard error in square brackets. (°) Overidentifying restrictions test and p-value in brackets. Growth rate instrumented using its own lagged values.

Table 10: Testing for omitted controls

Dependent variable:	ΔR^{txs}	$\Delta \ell^{txs}$	ΔR^{txs}	$\Delta \ell^{txs}$	ΔR^{txs}	$\Delta \ell^{txs}$	ΔR^{txs}	$\Delta \ell^{txs}$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Output gap$_t$	-0.087	-0.173***	-0.086	-0.172***	-0.076	-0.175***	-0.092	-0.176***
	[0.072]	[0.037]	[0.072]	[0.038]	[0.073]	[0.038]	[0.073]	[0.038]
Permanent$_{t-1}$	-0.275***	-0.046	-0.275***	-0.044	-0.290***	-0.04	-0.285***	-0.064**
	[0.058]	[0.030]	[0.058]	[0.030]	[0.059]	[0.031]	[0.060]	[0.031]
Debt$_{t-1}$	0.006	0.001	0.005	0.001	0.009	0.000	0.008	0.002
	[0.013]	[0.007]	[0.013]	[0.007]	[0.013]	[0.007]	[0.013]	[0.007]
EMU-15	-1.403***	-0.457*	-1.408***	-0.449*	-1.319***	-0.467*	-1.273***	-0.325
	[0.464]	[0.242]	[0.464]	[0.242]	[0.458]	[0.242]	[0.477]	[0.244]
T_i,	0.063**	0.012	0.064**	0.011	0.068***	0.01	0.068**	0.019
	[0.025]	[0.013]	[0.025]	[0.013]	[0.025]	[0.013]	[0.027]	[0.014]
NONACTIVE$_{i,t}$	-0.332***	0.03	-0.330***	0.037	-0.368***	0.047	-0.334***	0.001
	[0.122]	[0.064]	[0.121]	[0.063]	[0.121]	[0.064]	[0.123]	[0.063]
ELECT$_{i,t}$	-0.027	0.082	-0.026	0.084	-0.024	0.084	-0.029	0.064
	[0.149]	[0.078]	[0.149]	[0.078]	[0.148]	[0.078]	[0.152]	[0.078]
ΔSpending$_{t-1}^{(1)}$	-0.033	-0.005						
	[0.048]	[0.025]						
ΔSpending$_{t-1}^{(2)}$			-0.036	0.005				
			[0.049]	[0.025]				
ΔInflation$_{t-1}$					-0.060*	0.014		
					[0.036]	[0.019]		
Left							0.024	0.235
							[0.623]	[0.319]
Center							-0.305	-0.198
							[0.655]	[0.335]
Right							-0.057	0.164
							[0.577]	[0.295]
Obs.	189	189	189	189	189	189	189	189
Number of countries	19	19	19	19	19	19	19	19
R-squared	0.23	0.18	0.23	0.18	0.25	0.18	0.23	0.22
Sargan Statistic$^{(*)}$	2.99	0.00	3.03	0.00	4.18	0.01	3.50	0.05
(P-value)	(0.08)	(0.97)	(0.08)	(0.99)	(0.04)	(0.92)	(0.06)	(0.83)

Notes: *, ***, ***, significant at respectively 10, 5, and 1 per cent. Standard error in square brackets. $^{(*)}$ Overidentifying restrictions test and p-value in brackets. $^{(1)}$ excluding interest rates, $^{(2)}$ total expenditure.

Appendix

Table A1. Changes in the structural fiscal components (as percentage of trend GDP) from a 'disaggregated approach' (*DA*) table for Italy, as reported in Kremer et al. (2006)

Increasing +, decreasing -	1998	1999	2000	2001	2002	2003	2004	98-04
Unadjusted balance[1]	**0.3**	**1.4**	**1.5**	**-2.4**	**-1.7**	**-1.2**	**1.1**	**-1.0**
Cyclical component	0.8	0.4	0.6	1.0	-0.2	-1.4	-1.2	0.1
Temporary measures	0.0	0.0	0.6	-0.9	0.3	0.0	0.2	0.2
Balance	**-0.5**	**1.0**	**0.3**	**-2.6**	**-1.8**	**0.3**	**2.0**	**-1.3**
Interest payments	-0.3	-0.3	-0.6	-0.5	-0.4	-0.2	-0.1	-2.4
due to changes in average interest rate	*0.0*	*-0.1*	*-0.2*	*-0.2*	*-0.3*	*-0.2*	*-0.1*	*-1.2*
due to changes in debt level	*-0.2*	*-0.2*	*-0.4*	*-0.3*	*-0.1*	*0.0*	*0.1*	*-1.1*
Primary balance	**-0.8**	**0.7**	**-0.3**	**-3.1**	**-2.2**	**0.1**	**1.9**	**-3.7**
Total revenue	**-0.7**	**1.3**	**-0.2**	**-1.9**	**-1.7**	**0.1**	**1.4**	**-1.7**
Direct taxes payable by corporations	**0.0**	**0.0**	**0.0**	**-0.1**	**-0.6**	**-0.5**	**0.2**	**-1.1**
Fiscal drag	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Decoupling of base from GDP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.2
Legislation changes	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2
Residual	0.0	0.0	0.0	-0.1	-0.6	-0.5	0.0	-1.1
Direct taxes payable by households	**-0.3**	**0.0**	**0.0**	**-0.6**	**0.5**	**0.0**	**-0.1**	**-0.5**
Fiscal drag	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Decoupling of base from GDP	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.4
Legislation changes	-0.2	-0.1	-0.2	-0.6	0.3	-0.2	0.0	-1.1
Residual	-0.2	0.0	0.1	-0.1	0.1	0.1	-0.1	0.0
Memo item: included in expenditure[2]	*0.1*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.2*
Social contributions	**-0.2**	**0.8**	**-0.1**	**-2.4**	**-0.7**	**0.7**	**0.8**	**-1.0**
Fiscal drag	-0.2	-0.2	-0.3	-0.3	-0.2	-0.2	-0.1	-1.4
Decoupling of base from GDP	0.3	0.3	0.1	0.2	0.1	0.0	0.0	0.9
Legislation changes	-0.1	0.2	0.0	-1.8	-0.1	0.8	0.3	-0.8
Residual	-0.2	0.5	0.1	-0.5	-0.4	0.1	0.7	0.3
Memo item: included in expenditure[2]	*0.1*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Indirect taxes	**0.0**	**0.5**	**-0.1**	**0.4**	**-0.4**	**0.1**	**0.4**	**1.0**
Fiscal drag	0.0	0.0	-0.1	-0.1	-0.1	0.0	0.0	-0.3
Decoupling of base from GDP	0.0	0.0	-0.1	-0.1	-0.1	-0.1	0.0	-0.3
Legislation changes	0.0	0.1	0.0	0.6	-0.2	0.3	0.2	0.9
Residual	0.0	0.4	0.0	0.0	0.0	-0.1	0.3	0.7
Taxes and social contributions overall	**-0.4**	**1.4**	**-0.4**	**-2.6**	**-1.3**	**0.3**	**1.4**	**-1.6**
Fiscal drag	-0.2	-0.2	-0.3	-0.4	-0.2	-0.2	-0.1	-1.5
Decoupling of base from GDP	0.4	0.4	0.1	0.1	0.0	-0.1	-0.1	0.8
Legislation changes	-0.3	0.2	-0.2	-1.8	-0.1	0.8	0.6	-0.8
Residual[3]	-0.3	1.0	0.1	-0.6	-0.9	-0.3	1.0	-0.1
Memo item: included in expenditure[2]	*0.1*	*0.1*	*0.0*	*0.0*	*0.1*	*0.0*	*-0.1*	*0.2*
Non-tax-related revenue[4]	**-0.3**	**-0.1**	**0.2**	**0.7**	**-0.4**	**-0.2**	**0.0**	**-0.1**
of which EU[5]								
Total primary expenditure	**0.1**	**0.7**	**0.1**	**1.2**	**0.5**	**0.0**	**-0.6**	**2.0**
Social payments	-0.2	-0.2	-0.1	0.0	0.3	0.2	-0.1	-0.2
of which old-age pensions	*0.0*	*0.0*	*-0.1*	*-0.1*	*0.0*	*0.0*	*0.0*	*-0.1*
of which unemployment benefits	*0.0*	*-0.1*	*-0.1*	*0.0*	*-0.1*	*-0.1*	*-0.1*	*-0.3*
of which social transfers in kind	*0.1*	*0.1*	*0.1*	*0.2*	*0.5*	*0.2*	*0.1*	*1.3*
Subsidies	-0.2	0.1	-0.1	0.0	0.0	-0.1	0.0	-0.2
of which EU[6]	*-0.1*	*0.0*	*0.0*	*-0.1*	*0.0*	*0.0*	*0.0*	*-0.2*
Compensation of employees	0.0	0.2	-0.1	-0.1	0.1	0.1	0.0	0.2
Intermediate consumption	0.1	0.3	0.0	0.8	0.1	0.0	-0.1	1.1
Government investment	0.1	0.1	0.1	0.3	0.2	-0.2	-0.3	0.3
Other[7]	0.3	0.2	0.3	0.2	-0.1	0.1	-0.1	0.8
of which EU[8]	*0.2*	*-0.1*	*0.0*	*-0.1*	*-0.2*	*0.0*	*0.1*	*0.0*
Memorandum items								
Health care[9]	0.0	0.1	0.2	0.2	0.5	0.2	0.1	1.3
Trend growth of real GDP	3.0	2.8	2.4	2.1	1.7	1.6	1.5	
Change in GDP deflator	1.7	1.6	3.9	5.2	3.8	2.5	0.9	
Change in public employees	3.1	0.9	0.8	1.8	2.1	0.4	-0.7	

Table A2: Dataset description (countries and time coverage)

	Dataset 1 (*19-EU countries*)	Dataset 2 (*27-EU countries*)
Variables	$\Delta R^j, \Delta \ell^j$	ΔR^j
Austria	00-08	00-08
Belgium	98-08	98-08
Bulgaria		06-08
Cyprus	00-08	00-08
Czech Rep.	98-07	98-08
Denmark		04-08
Estonia		04-08
Finland	98-08	98-08
France	98-08	98-08
Germany	98-08	98-08
Greece	00-08	00-08
Hungary		04-08
Ireland	00-08	00-08
Italy	00-08	98-08
Latvia	98-08	98-08
Lithuania	98-08	98-08
Luxembourg	00-08	00-08
Malta	04-08	04-08
Netherlands	00-08	98-08
Poland	99-08	99-08
Portugal	00-08	00-08
Romania		06-08
Slovakia		04-08
Slovenia	00-08	00-08
Spain	96-08	96-08
Sweden		04-08
U.K.		04-08

Note: the first dataset also incorporates data on: i) fiscal drag (fd^j), ii) decoupling of the tax base from GDP (de^j), iii) a residual component (re^j)

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