Automatic stabilizers:
A European Union design perspective

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Abstract

This paper aims to investigate the effect of the criteria proposed by the Maastricht Treaty and the Stability and Growth Pact (SGP) on the effectiveness of automatic stabilizers in the European Union (EU) member states. Using balanced panel data from 1960 to 2016, this paper relies on a reduced form model to estimate the effectiveness of the automatic stabilizers, employing a three stage least square model. The cyclical components of the government budget reflect the stabilizing ability, primarily stemming from the expenditure side. The EU design causes the structural breaks in the behaviour of the automatic stabilizers of the member states prior to and after the adoption of the explicit requirements in the Maastricht Treaty, while some EU member members exhibited such a change since the beginning of the European Monetary System (EMS). In addition, the requirements on the government debt-to-GDP ratio limit the use of the automatic stabilizers in the EU member states. Lastly, several theoretical extensions of the automatic stabilizer concept are analyzed in the EU context.

Key words: automatic stabilizers, European Union, panel data, structural break

1. Introduction

The International Monetary Fund (IMF) refers to the Great Recession as the worst global recession since the Great Depression in the 1930s (IMF, WEO 2009). Interestingly, the turmoil of economies around the world could be categorized into two episodes — the original one represented by the intensified financial market catastrophe, accompanied by the collapse of international trade and housing market corrections, and the other being referred to as the European sovereign debt crisis, with the fears surrounding solvency risks in European countries, especially Greece, Ireland, Italy, Portugal, and Spain. The latter episode, the eurozone crisis, however, did not manifest itself concurrently with the global financial crisis, which had preceded the eurozone crisis by approximately two years, when Greece revealed its true indebtedness in late 2009 and triggered general concerns of European sovereign defaults. Given the closeness of the two episodes, the European Commission (EC) discoursed that the former financial crisis led to the latter debt crisis (EC, 2017). Other economists have argued that the former is only the triggering mechanism of the latter (De Grauwe 2011, 2013), or the causal link may not even exist (Seccareccia, 2017). Despite the temporal relationship between the two series of crises, the recent public debate has been focused on fiscal policies in European countries because of the policy responses during the Great Recession and the severe economic consequences in the eurozone.

Prior to the crises, for decades, mainstream economists believed that monetary policy through interest rate management was sufficient to achieve macroeconomic stabilization, whereas fiscal policies were sources of destabilizing forces due to Ricardian equivalence and other forms of crowing-crowd effects. Governments should therefore only target a balanced budget and long-term debt sustainability. As the world witnessed during the crises, monetary policies even extended to unconventional tools like zero interest rate and quantitative easing, which could not well combat the crises and, as a result, governments were “forced” to implement fiscal stimuli, which relied on a Keynesian perspective to boost aggregate demand (Seccareccia, 2011). The anomalous practices received much attention from researchers, ranging from analyses of banking sector structure and policy responses (Laeven and Valencia, 2012; Bouheni and Hasnaoui, 2017) to eurozone supranational fiscal risk-sharing mechanism (Furceri and Zdzienicka, 2013). The majority of the analyses, though, still pinpointed fiscal policies. Many revisited the famous paper by Gali and Perotti (2003) which argued that the discretionary fiscal policy in Europe as a result of the Maastricht Treaty and the Stability and Growth Pact (SGP) was predominately counter-cyclical after the crisis; however, these post-crises studies yielded mixed conclusions, from those confirming the results (Huart, 2013) to those supporting the pro-cyclical criticism (Candelon, et al., 2009; Rahman, 2010; Dobrescu and Salman, 2010; Arsic et al., 2017). Such inconsistency may be explained by the use of real time or forecasting data available to the policy makers versus ex post data (Marinheiro, 2008; Cimadomo, 2012; Frankel and Schreger, 2013). Automatic stabilizers, on the other hand, as the cyclical component of fiscal policies, were also thoroughly analyzed through micro-simulations of the effects of potential output shocks on tax and government spending rules (Dolls et al., 2012a, 2012b; Randelovic, 2013). However, these cross-sectional analyses could only reveal the contribution of automatic stabilizers to overall fiscal expansions. There is limited research that relied on macro data, especially post crises, and that studied the smoothing effects of the automatic stabilizers empirically.

Another popular strand of post crises research concerns the design flaws of fiscal rules in the European Union (EU) system, especially regarding the European Economic and Monetary Union (EMU), which was the successor of the European Monetary System (EMS). There has been a long-lasting opprobrium surrounding the tight fiscal regulations which create a pro-cyclical and deflationary bias (see for example, Seccareccia and Lequain, 2006; De Grauwe, 2013). On the other hand, many arraigned the EC for failing to prevent countries like Greece from accumulating excessive deficits, which eventually ignited the eurozone debt crisis (Collignon, 2012). In addition, while other stand-alone countries are able to issue government debt in their own currency and the central banks can provide the liquidity, the monetary system design is very restricting in the EU member states since the European Central Bank (ECB) could only provide very limited support during booms and busts. Thus, the EU member states are particularly dependent on fiscal policies, especially the automatic stabilization given the Maastricht Treaty and the SGP. Both the restriction on fiscal policy that the government deficit cannot exceed 3% of the GDP and the structural balance should approach balanced position or surplus, and the restrained fiscal space, a threshold of 60% government debt-to-GDP ratio, may still prevent countries from implementing stimulus packages during economic downturns if they have a large size of automatic stabilizers and if they are already approaching the boundary of their public debt level (Buiter et al.,1993; Eichengreen and Wyplosz, 1998).

This paper attempts to analyze empirically the effect of the Maastricht Treaty and the SGP on the automatic stabilizers in the EU member states, in particular regarding the constraint on using discretionary fiscal policy and the restriction on their debt-to-GDP ratio. Using balanced panel data from 1960 to 2016, this paper adopts Keynesian perspectives on the automatic stabilizers and relies on a reduced form model to capture the effectiveness of the automatic stabilizers. To address the endogeneity problem in the regressors, three stage least square (3SLS) estimation are employed in the analysis. This paper also discusses some potential extensions of the definition of the automatic stabilizer beyond the ones used by statistical agencies such as the EU AMECO, in order to better measure the effect of the of the automatic stabilizers on the economy.

The empirical results in regard to the effectiveness of the automatic stabilizers adhere to the guidance of promoting the usage of rule-based fiscal policies. Overall, the automatic stabilizers embrace stabilization forces to smooth out output volatility. A structural break test is included, in order to measure the shift from discretionary policy to automatic stabilizers which originates from the period of the EMU start-up and is enhanced by the Maastricht Treaty and the SGP. However, the restriction of the debt-to-GDP ratio might limit the use of automatic stabilizers.

This paper primarily contributes to the existing literature in the following two aspects. First, this is, to my knowledge, the first study that backtracks the data series to the 1960s to capture any effects resulting from the creation of the EMU (at the time, the EMS). The additional time series data allow the paper to test the effects of the automatic stabilizers that were influenced by the requirement of EU prior to the explicit requirement listed in the Treaty and the SGP. Secondly, this paper quantitatively examines the effect of the limitation of government debt-to-GDP ratio proposed by the Treaty on the size of the automatic stabilizers in the context of the EU member states. The results confirm the literature with respect to the constraining nature of the EMU criteria.

Section 2 introduces the existing literature studying the effect of automatic stabilizers and the impact of the EU design. The conceptual framework and models are presented in Section 3. Sections 4 and 5 provide data and empirical analysis, respectively. Section 6 details a few theoretical analyses that would result in a better understanding of the automatic stabilizers. Section 7 concludes the paper.

2. Literature Review

2.1 Automatic stabilizers

As first recognized by Fisher (1933) and Keynes (1936), the standard view on the automatic stabilizer is based on the idea that a portion of tax revenue and government spending adjusts itself automatically to absorb output fluctuations without government discretionary decisions (Fatas and Mihov, 2001). The built-in automatic stabilization system relies on tax codes and spending rules so that it does not require any political decision to react to economic volatility in a timely counter-cyclical manner. In the periods of economic upturn (downturn), more (less) taxes will be collected and less (more) government spending will be transferred and thus a positive (negative) automatic stabilizer balance will be observed. As many mainstream economists generally view discretionary fiscal policy during bad times, especially those resulting from supply shocks, as being plagued with solvency and inflationary consequences, and because of the widespread existence of potential pro-cyclical fiscal policy practices in the EU member states, enhancing automatic stabilizers seems to be the popular choice across economies at different development stages (IMF, 2009).

Given the well-established concept of automatic stabilizers, its precise statistical definition, however, does not exist due to different approaches used to model the effects. Three main fiscal instruments of automatic stabilizers are widely cited in the literature: tax, direct government purchases, and transfer payments (Reicher, 2014). In addition, Darby and Melitz (2008) suggest that besides unemployment transfer payments, as claimed by earlier researchers (Gali and Perotti, 2003; Auerbach and Feenberg, 2000), other transfer programs, such as health expenditures, pensions, incapacity benefits, and sick pay, also have the potential capacity to automatically smooth cyclicality. For the purpose of this paper, however, only tax revenue and unemployment related expenditure are taken into account as the automatic stabilizers, although there are useful features in including other above-mentioned sources or indictors. Defining automatic stabilizers in such a straightforward way also matches the formal definition of cyclical budget components estimated by the majority of the statistical agencies such as the OECD, the IMF, and, in particular, the EC. The stabilization effects of taxes and unemployment related expenditures are confirmed not only by simulations of RBC models (Jones, 2002; Moldovan, 2010; McKay and Reis, 2016) and New Keynesian models (Muscatelli et al., 2004, 2008; Mattesini and Rossi, 2012), but also micro-simulations based on tax codes and spending rules (Kniesner and Ziliak, 2002; Brunila et al., 2003; Auerbach, 2009; Mabbett and Schelkle, 2007; Dolls, et al., 2012a, 2012b) before and after the crises in the context of most Western advanced economies like the EU and OECD members. Despite the abundance of recent literature stemming from simulations, there are relatively few analyses conducted at the macro level that address the effectiveness of automatic stabilizers, especially for the period of the eurozone crises. There are a number of major studies of the relationship between output volatility and automatic stabilizers usually dated back to the early 2000s (Gali, 1994; Fatas and Mihov, 2001; Auerbach and Hassett, 2002).

The determinants of automatic stabilizers in the majority of the macro level analyses consist of variables describing economic conditions, to which the automatic stabilizers are supposed to respond. In addition, the government size, which is not a direct measure of economic conditions, is also included in the analysis. As suggested by Fatas and Mihov (2010), the systematic positive correlation between the government size and the effects of automatic stabilizers validates the intuition that larger governments generally have more resources to be devoted to the automatic stabilizers, such as unemployment benefit programs, which should have larger stabilization power. The results are empirically robust for both OECD countries and other developing countries (Lee and Sung, 2007), and also theoretically supported by RBC models (Gali, 1994; Andres et al., 2008). Nevertheless, such an effect of the increasing size of the automatic stabilizers faces decreasing return to fiscal stabilization, because of the potential efficiency costs (Buti and Franco, 2005; Debrun et al., 2008; IMF, 2009). These results generally suggest that once the government size approaches 40% of the GDP, an increase in government size does not yield further significant improvement in output stabilization.

2.2 The EU design and the fiscal policy surveillance

It is worthwhile reviewing the requirements of fiscal policy surveillance within the EU system given its complexity and country-specific details. Before everything was consolidated into the present-day EU, various organizations and systems were established to promote economic integration, including the European Economic Community, the EMS, and the EMU. Yet, explicit rules regarding fiscal policy were not imposed on the governments of the member states until the creation of the EMU when the Maastricht Treaty was signed in 1992. The criteria of the EMU were established by the Maastricht Treaty and further refined by the SGP, which required the member states to engage in sound finance, rather than in functional finance. Across the EMU or even the EU, no effective supranational fiscal policy was implemented and the EU system prevented large government spending in the fear of "excessive" deficit which may lead to macroeconomic destabilization (Parguez, 2016; Seccareccia, 2017).

This paper, particularly, focuses on two requirements of the Maastricht Treaty and the SGP, which are the limits to the size of government deficits and the level of the public debt. According to the Maastricht Treaty (European Union, 1992), governments "shall examine compliance with budgetary discipline on the basis of the following criteria:

(a) whether the ratio of the planned or actual government deficit to gross domestic product exceeds … 3% … at market prices…

(b) whether the ratio of government debt to gross domestic product exceeds … 60%… at market prices …"

With further refinement with respect to the government deficit while keeping the same requirement of the debt-to-GDP ratio, the SGP (European Commission, 1997) states that "the medium-term objective of budgetary positions close to balance or in surplus will allow Member States to deal with normal cyclical fluctuations while keeping the government deficit within the 3% GDP reference value". Although these criteria do not apply to the periods when the EU area experiences the downturn as a whole (European Parliament, 2015), the fiscal discipline remains to be tight in the member states, of which the automatic stabilizers are limited to 3% of the GDP in addition to the limited usage of discretionary policy. In addition, although the Maastricht Treaty and the SGP are the foundational documents for the EMU and the eurozone, the institutional design of the EU is set up in a way that all EU member states are subject to the criteria of the Treaty and the SGP, except the United Kingdom which is only required "to endeavour to avoid excessive deficits". For example, Sweden does not use the euro but is obliged to follow the criteria of the Maastricht Treaty and the SGP due to its Treaty of Accession in 1994 when it joined the EU. Denmark, in contrast, opted out from the Maastricht Treaty; however, the SGP requirements are still legally binding for the Danish government.

The theoretical foundation which originated from Mundellian theory suggests that the Maastricht Treaty and the SGP were supposed to maintain public debt sustainability while allowing automatic stabilizers to smooth out economic cycles. However, the empirical results of the (discretionary) fiscal policy of the member states as tools of macroeconomic stabilization essentially diminished because of a pro-cyclical and deflationary bias (Seccareccia and Lequain, 2006; Seccareccia, 2017; Wyplosz, 2006). Under the EMU structure, during recessions, the budget balance will fall due to the effects of automatic stabilizers, which will force the government to cut discretionary spending or raise taxes to meet the fiscal constraints, thereby amplifying the economic downturn. Conversely, whenever an economic boom occurs, countries would face larger "available" funds, because the automatic stabilizers will generate higher tax revenues and lower unemployment-related expenditures. Governments generally seek to reduce the "excess" surpluses given the budgetary requirements. No such pro-cyclical behaviour would be observed with countries that do not suffer from the pressures arising from these rigid institutional designs due to the fixed exchange rate system and common currency arrangements, like these member states prior to joining the EMU or even earlier, the EMS.

3. Conceptual Framework

3.1. The effectiveness of automatic stabilizers

In this paper, a Keynesian approach was adopted regarding the effect of the automatic stabilizers. The tax revenue of the government will increase during booms and decrease during busts; in addition, the mechanism of unemployment-related public expenditure will also get triggered automatically by the economic cycles. Both reactions counter-cyclically adjust the aggregate demand fluctuations. The model, closely following Gali and Perotti (2003) and Darby and Melitz (2008), relies on a reduced form of the structural model, rather than on the original structural model (see for example, Muscatelli, et al., 2004, 2008; Mattesini and Rossi, 2012), to estimate the effect of the automatic stabilizers. In addition, this paper does not attempt to capture the simultaneous relationship between net government fiscal stance and the general economic cycle. One crucial assumption of this model is that relying on the former study by the EC (2004) which underlines significant delays in adjustments of tax codes and spending regulations, there is no influence of contemporaneous discretionary fiscal decisions on the automatic stabilizers.

The basic specification is:

$$as_{it} = \alpha_0 + \alpha_i + \alpha_t + \beta_1 \tilde{Y}_{it} + \beta_2 \pi_{it} + \beta_3 r_{it} + \beta_4 \Delta \tilde{Y}_{i,t-1} + \lambda X_{it} + \varepsilon_{it} \qquad (1)$$

The term *as* here stands for the automatic stabilizer, namely the cyclical components of the government budgets of the EU member states. The formal definition of *as* will be discussed in detail in Section 4 below. The coefficients α_i, α_t are country fixed effect and time fixed effect respectively. In the case of Germany, prior to the unification in 1990, the data is restricted to West Germany and also a dummy is introduced to capture any unobserved time-invariant changes before and after the unification. $\tilde{Y}_{it}$ is for the output gap as percentage of potential GDP, which captures the aggregate demand shocks — in the structural model, coming from consumers and firms — to which the automatic stabilizers respond. π_{it} is the inflation rate and there are two sources of inflation in the underlying New Keynesian structural model. It is the result of the sticky price assumption incorporated in the model as well as of the New Keynesian Phillips Curve. r_{it} is the long term interest rate, which stems from the household utility maximization problem and the monetary policy. $\Delta\tilde{Y}_{i,t-1}$, the lagged change in the output gap, is included to capture the effect of discretionary policy on the general economic environment in the model. X_{it} consists of a few other control variables that may have potential impact on the effectiveness of automatic stabilizers, in order to incorporate the effects of few commonly covered macroeconomic environment, as suggested by Blix (2009), which includes a dummy for asymmetry and the size of the government. The asymmetry dummy is defined as zero when the output gap is below zero and one otherwise. The government size is taken as the current government spending to GDP ratio. The variable of interest is β_1, and the rest may be considered as control variables.

Given the potential endogeneity problem of the output gap, three stage least squares will be applied, following Darby and Melitz (2008). The model will use three instrumental equations for the output gap, the inflation and the long term interest rate, as determined by the underlying structural model. The instruments include contemporaneous oil price inflation, which captures the exogenous supply shocks, lags of the endogenous variables and the growth rates, and unemployment rate and net export. Country fixed effect and time fixed effect are also included in the instrumental equations.

In addition to the estimation of the effectiveness of the automatic stabilizers on smoothing business cycles, potential structural breaks will be estimated with particular interest with respect to the requirements imposed by the Maastricht Treaty and the SGP. Instead of restricting the model to test the known break date when the Maastricht Treaty was in force, a structural break test with an unknown break date is used in order to observe any effect the previous EMS may have had.

3.2. The effect of public debt on automatic stabilizers

The relationship between automatic stabilizers and public debt is theoretically straightforward: the larger the tax revenues, the smaller the public debt; and the smaller the expenditure, the smaller the public debt, and vice versa. However, although many advanced economies put budget balance as their main concerns (Wyplosz, 2002), very few of them have established stipulations of the government debt-to-GDP ratio as rigid as the ones set by the Maastricht Treaty and the SGP. The empirical difficulty to estimate whether such a limit on the debt-to-GDP ratio will restrain the size of automatic stabilizers, and of the fiscal policy in general, comes down to the inherent public debt accumulation process (Alesina and Ardagna, 2010). Given the observations and the complication of constructing a complete structural model, no attempt is made to address the causal relationship. Instead, only simple regressions will be run to investigate whether the size of automatic stabilizers is restrained by the tight fiscal discipline because of the EMU design.

The basic estimation model is an extension of equation (1):

$$as_{it} = \alpha_0 + \alpha_i + \alpha_t + \beta_1 debt60_{i,t-1} + \beta_2 \tilde{Y}_{it} + \beta_3 \pi_{it} + \beta_4 r_{it} + \beta_5 \Delta \tilde{Y}_{i,t-1} + \lambda X_{it} + \varepsilon_{it} \qquad (2)$$

where $debt60_{i,t-1}$ is a dummy to capture the requirement of the explicit criterion of the Maastricht Treaty which has the value of 1 if the public debt level to GDP ratio is above 60% after the reference year of country *i* (see Appendix 1 for the specific year for each country in the sample) and 0 otherwise. This is to estimate the effect of EMU criteria on the public debt. The rest of the notations inherit from equation (1) section 3.1. The variable of interest is β_1 and the rest may be considered as control variables.

The model is purely explanatory and only represents the presumed relationship with respect to the hypotheses that the EU criteria, including the ones of the EMU and the EMS, proposed significant forces that alter the relationship among the discretionary fiscal policy, the automatic stabilizers, and the output gap. The results are mainly suggestive and should be interpreted with caution.

4. Data

The data are primarily taken from the AMECO database in annual frequency, which is the official database used for EU member states. However, instead of covering all EU members, only 14 countries with complete and consistent data coverage are selected in the sample, namely Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden, and United Kingdom. As mentioned in the literature review, although Denmark and Sweden are not in the eurozone, the fiscal criteria are still applicable. The explicit requirements of the Maastricht Treaty and SGP are not legally binding with respect to the UK; however, the British government seemed to have attempted to follow these EMU requirements voluntarily (see, for example, the corporate report of UK Convergence Programme 2012-2013). In addition, when the UK first joined the EMS, there may have been implicit effects. Regarding the effect of the public debt level, the UK is included as a benchmark. The Eastern European countries are not included in the sample because they do not have data coverage prior to the fall of the Iron Curtain in 1989 and the quality of data became consistent only when they joined the EU. See Appendix 2 for the complete list of variables used in the model and the AMECO data coverage. The oil price data is taken from the Federal Reserve Bank of St. Louis. For the interest of this paper to estimate the effect of the EU design including the EMS and the EMU, the data sample is from 1960 to 2016, covering many business cycles and the emergence of the unification of Europe. For certain variables for which AMECO data do not go back to 1960, the IMF historical database is used (Mauro et al., 2013).

The dependent variable, namely the cyclical components of the government budget, including both revenues and expenditures, is manually constructed using the official definition of EU (EC, 2005; Fedelino et al., 2009) because of no historical coverage of AMECO. The method is also consistent with other credible statistical agencies such as the OECD, the IMF and the European System of Central Banks (See, for example, Bezdìk et al. (2003), Girouard and Andre (2006), Symansky and Baunsgaard (2009)). The data series of the cyclical component of the government budget contained by AMECO require a stronger assumption that the government revenue and expenditure to GDP ratios are set to be constant over time. Figure 1 plots the progression of the two series, and one could observe that in the recent decade, the ratios of revenue and expenditure to GDP are relatively stable so that such a restriction will not yield significant differences in the calculation for the periods of which AMECO has coverage. However, if the formula is extended to the earlier periods, such as the 1960s, then there would be a significant difference between the constant used in the AMECO data series and the actual tax revenue and expenditure. Therefore, for this paper, the actual ratios are used in the calculation of the entire sample. The root mean squared error between the calculated size of the automatic stabilizers and the official figures reported by AMECO for the period AMECO has coverage equal to 0.0368 and the difference is nil.

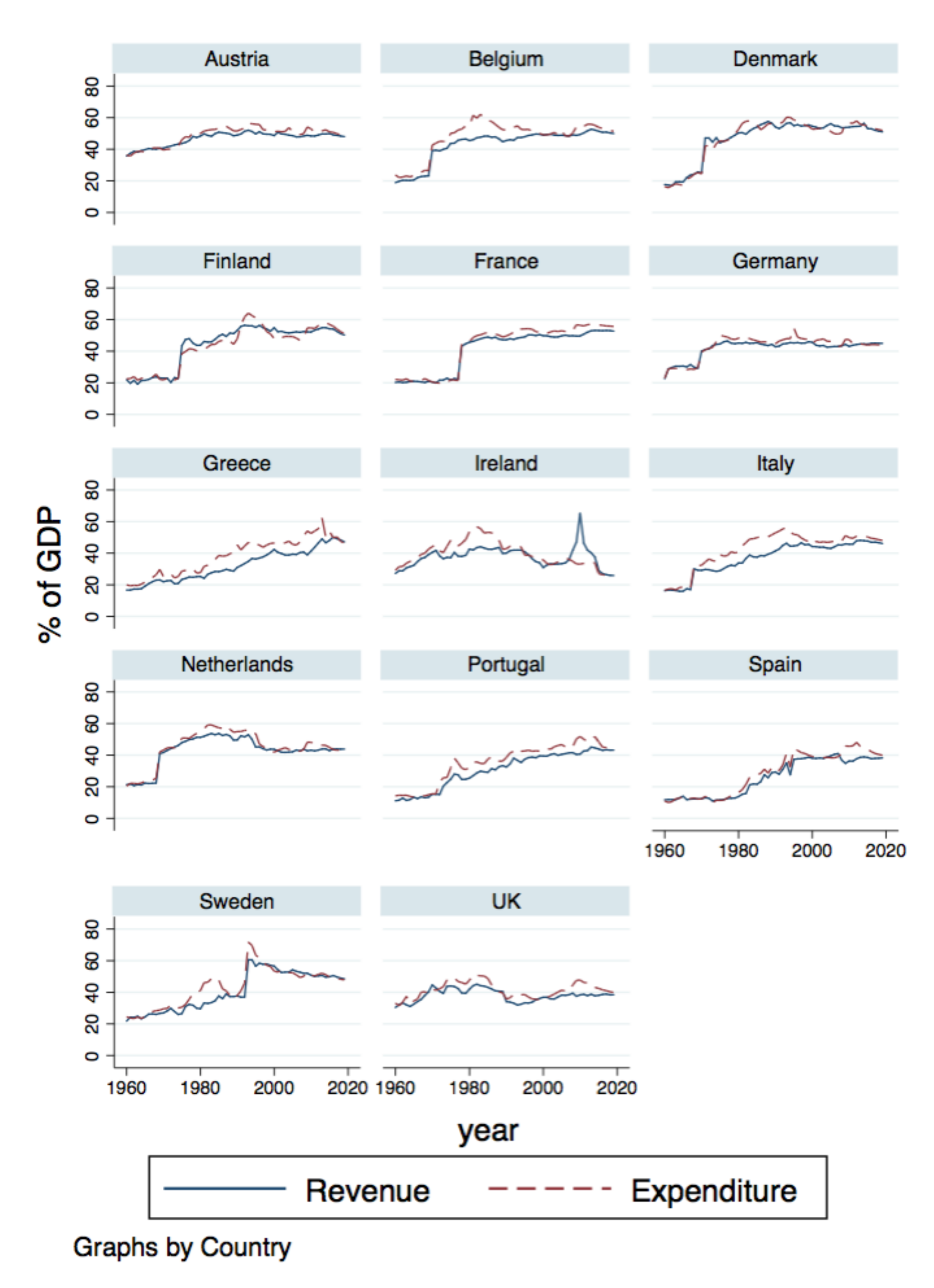

Figure 1. Progression of government revenue and expenditure as percentage of GDP
Source: IMF historical database (Mauro et al., 2013) and AMECO

The starting point is the cyclically-adjusted primary balance (CAPB), defined as:

$$capb = \frac{CAPB}{Y^p} = \frac{R^{CA}}{Y^p} - \frac{G^{CA}}{Y^p} = \frac{R}{Y}(\frac{Y^p}{Y})^{\epsilon_R - 1} - \frac{G}{Y}(\frac{Y^p}{Y})^{\epsilon_G - 1} = r(1+gap)^{-\epsilon_R - 1} - g(1+gap)^{-\epsilon_G - 1}$$

where *capb* denotes the ratio of CAPB to the potential output, Y^p. The superscript CA stands for cyclically-adjusted component. *R* and *G* denote the nominal government tax revenue and expenditure while *r* and *g* stand for the ratios of revenue and expenditure to GDP, respectively. *gap* is the output gap measured in percentage of potential output. ϵ_R and ϵ_G are elasticity of revenue and expenditure with respect to the potential output.

If the output gap is considered to be small, the previous equation could be approximated by:

$$capb = r(1+gap)^{-\epsilon_R - 1} - g(1+gap)^{-\epsilon_G - 1} \approx r(1-(\epsilon_R - 1)gap) - g(1-(\epsilon_G - 1)gap)$$

Thus, the automatic stabilizers, which are the cyclical components of the primary balance out of potential GDP, could be defined as:

$$as = cpb = \frac{PB - CAPB}{Y^p} = r\epsilon_R gap - g\epsilon_G gap = as_R - as_G$$

where cpb stands for the cyclical component of the primary balance to potential GDP ratio, and PB is the nominal public balance. as_R, as_G represent the cyclical components of revenue and expenditure, respectively. The elasticities ϵ_R, ϵ_G are calibrated using the newest EC official estimates (Mourre et al., 2013, 2014), which using the EC methodology, are considered as time-invariant. This remained as a strong assumption in the model.

Figure 2 plots the calculated automatic stabilizers against the output gap. It can be observed that the dynamics of the automatic stabilizers follow the evolution of the output gap closely with lower volatility, as one would expect because of the theoretical foundation of the automatic stabilizers as well as the calculation procedures. For a few countries like Greece, Portugal and, to a lesser extent, Spain, the fluctuations of the automatic stabilizers in the early

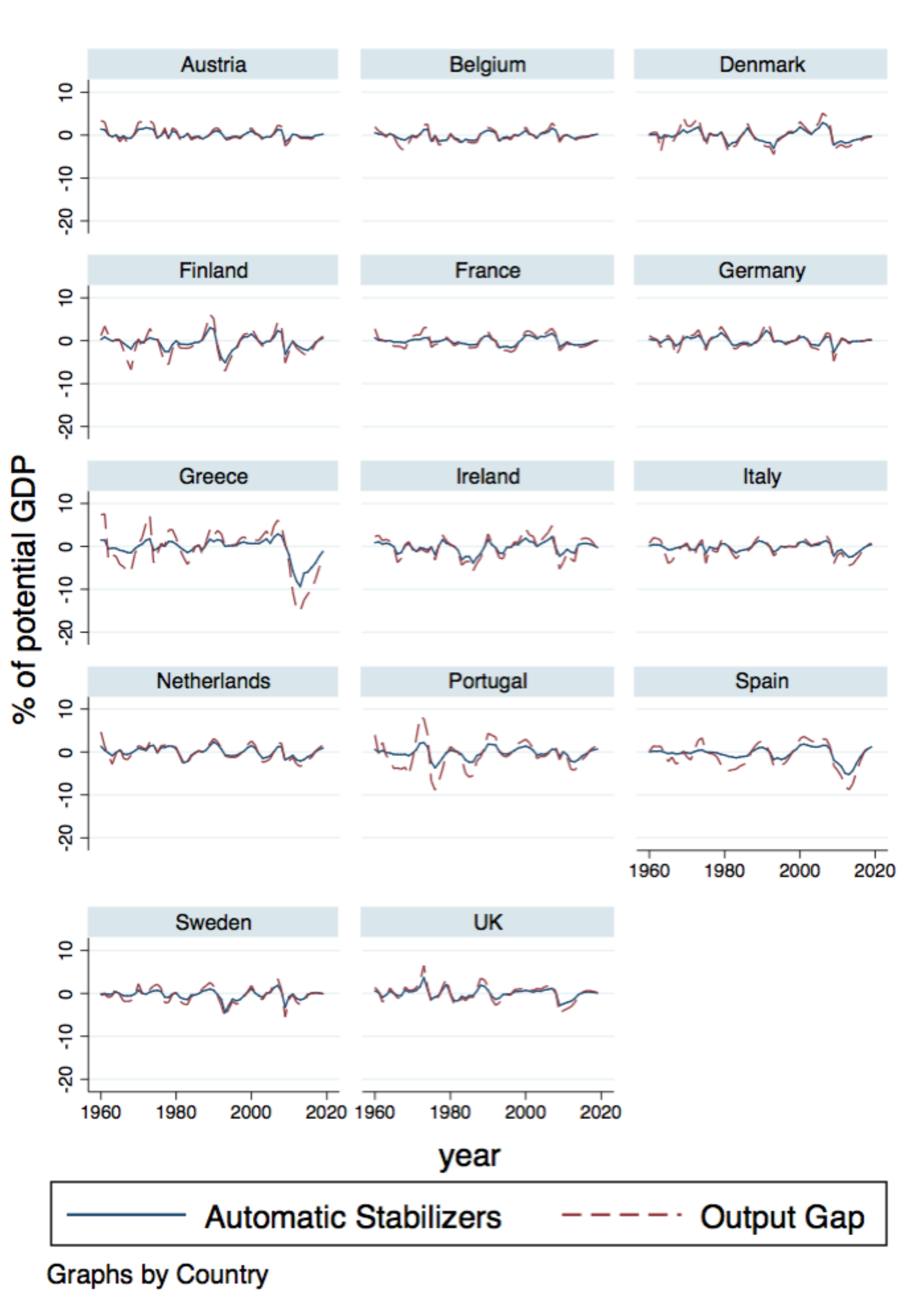

Figure 2. Dynamics of automatic stabilizers and potential output gap as percentage of potential GDP
Source: author's calculation and AMECO

period of the 1960s are much more volatile, while the pattern of the rest of the countries is less noticeable.

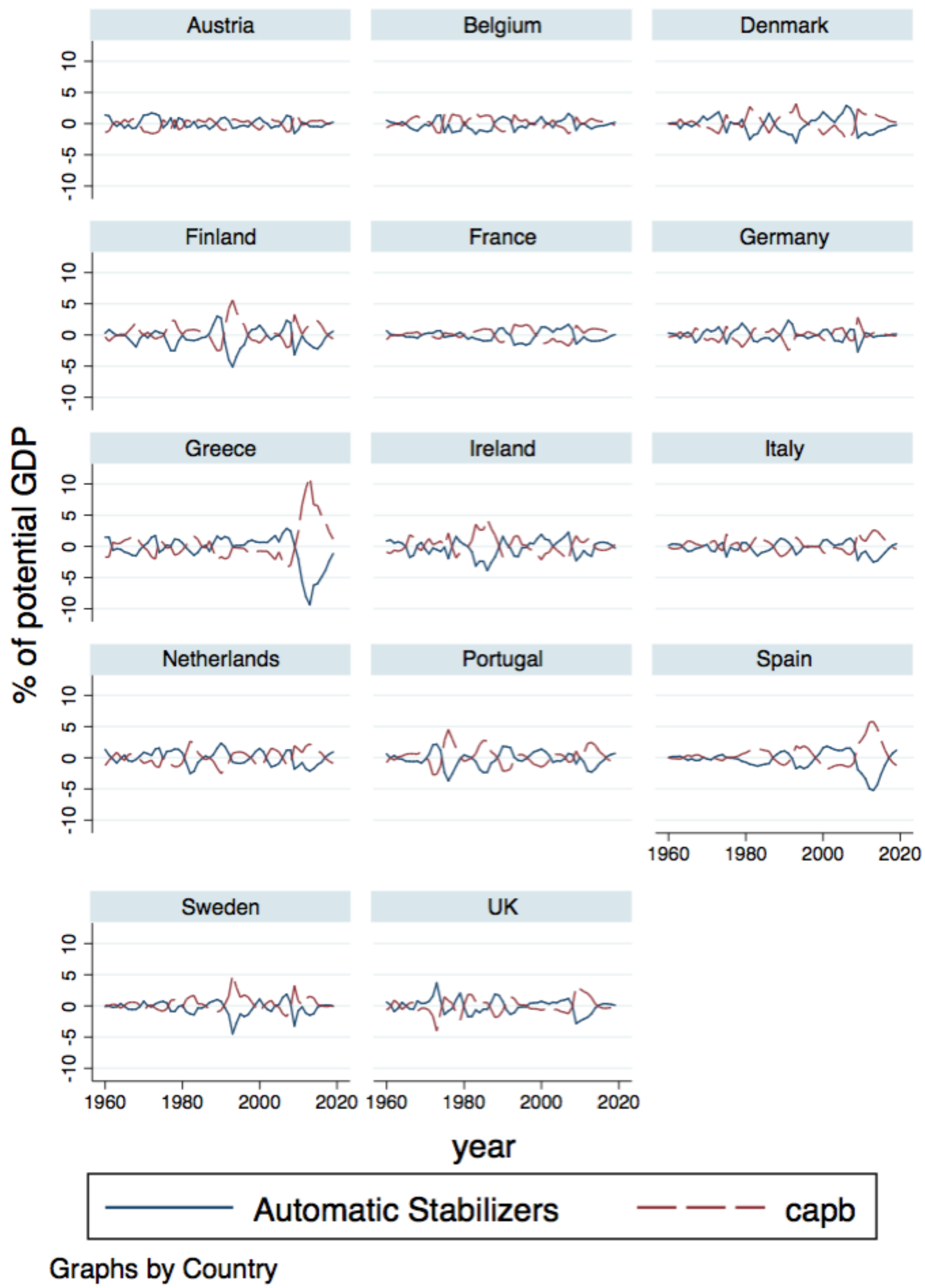

Figure 3. Dynamics of automatic stabilizers and *capb* as percentage of potential GDP
Source: author's own calculation

Figure 3 plots the automatic stabilizers against CAPB. Theoretically, the opposite direction would be expected because of the pro-cyclical bias introduced in the literature review

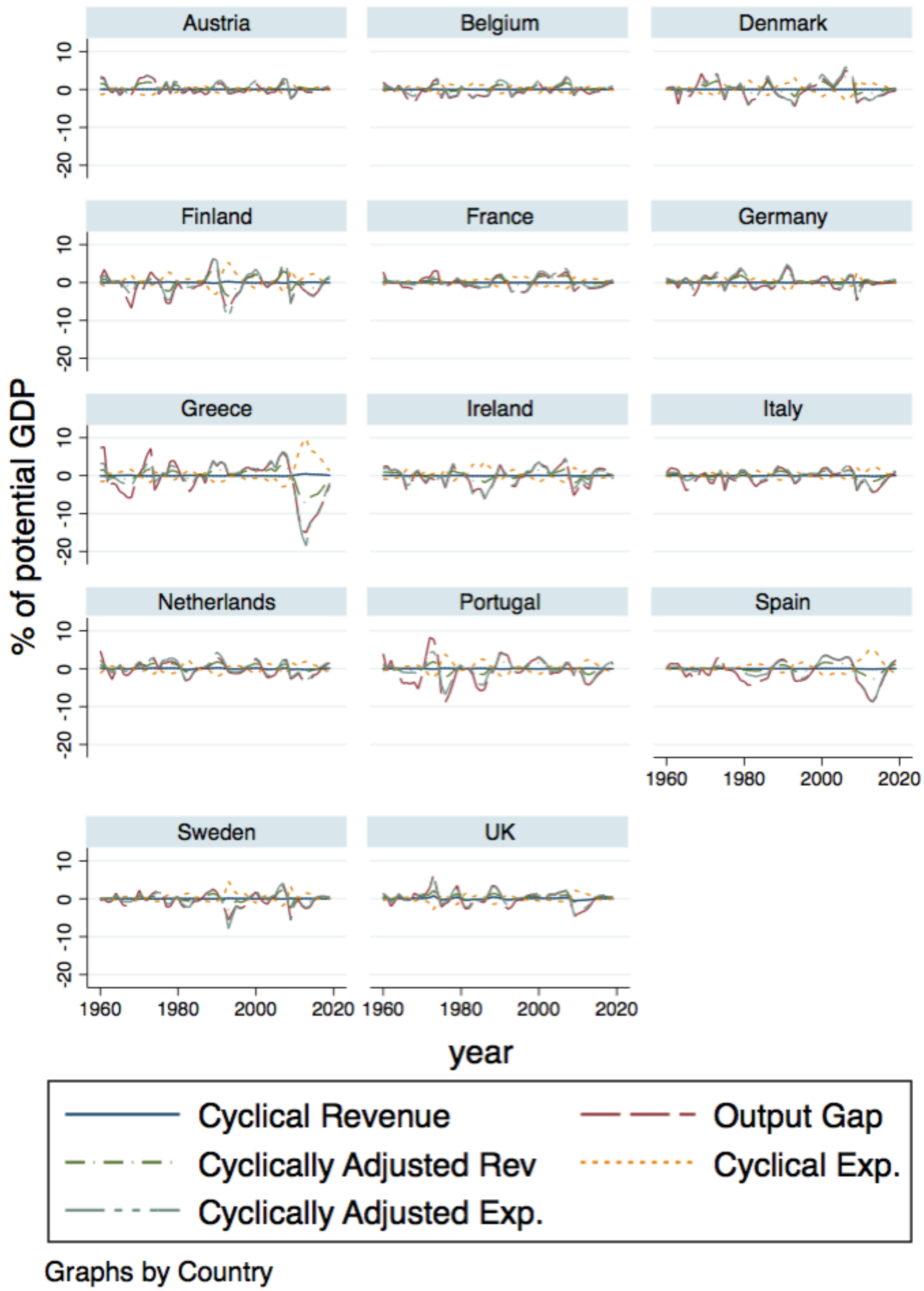

Figure 4. Breakdown of Automatic Stabilizers and *capb* as percentage of potential GDP
Source: author’s own calculation and AMECO

section. However, it is quite surprising that the two series mirror each other, even in the early periods of the 1960s, although such symmetric behaviour in the later periods might be explained by the SGP criteria of targeting a zero structural balance. Regarding the calculation formula, it is also not straightforward to observe such a relationship.

If we rewrite the function for *capb*:

$$capb = (r - g)(1 + gap) - as$$

But the term $(r - g)(1 + gap)$ does not necessarily correlate to *as* (or approach to 0) to an extent that one could observe in Figure 3.

Furthermore, if the automatic stabilizers are broken down by revenue and expenditure, as shown in Figure 4, there are notable differences in the behaviours on the revenue and expenditure sides. The size of the cyclical component of government revenue is much smaller than the size of the cyclically-adjusted revenue while the difference on the spending side is considerably smaller. Indeed, the sizes of cyclical expenditure and cyclically-adjusted expenditure are comparable to the size of the potential output gap. Therefore, it will be useful to look at the revenue and expenditure separately to detect any distinctions. The summary statistics of key variables are displayed in Table 1, together with the Levin-Lin-Chu unit root test result of which the p-value is reported.

5. Results and Analysis

5.1. The effectiveness of automatic stabilizers

Table 2 presents the estimation results of the effect of the automatic stabilizers based on equation (1), including the individual components of the automatic stabilizers, on absorbing the

Table 1. Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Unit Root test
as	784	-0.1962162	1.271691	0.0000
as_R	784	0.0029829	0.0851596	0.0000
as_G	784	0.1991992	1.273014	0.0000
capb	784	0.1999232	1.374536	0.0000
Cyclically adjusted Rev.	784	0.2462334	1.025793	0.0000
Cyclically adjusted Exp.	784	0.0463102	2.379602	0.0000
Debt	784	55.7936	33.18658	0.0150
Government size	784	41.95456	12.15936	0.1836
Output gap	784	-0.3224245	2.534663	0.0000
π	784	5.1124	5.107914	0.0003
Long term interest rate	784	3.085087	3.339505	0.0258
Unemployment rate	784	6.675238	4.439908	0.0000
Growth rate	784	0.028827	0.0290152	0.0000
First-Difference Net Export	784	0.000745	0.0109262	0.0000

Source: author's own calculation

fluctuations of the potential output gap (see Appendix 3 for the full results including the control variables). For comparison purposes, panel OLS fixed effect estimation are also included. The empirical results suggest that overall the automatic stabilizers have the stabilization power at the 1% confidence level both by OLS and 3SLS. In response to an 1% increase in the output gap, the automatic stabilizers go up 0.48% of the potential output. The government size, which is measured by the first difference due to the unit root problem, however, acts in a destabilizing fashion. It could be attributed to the efficiency costs related to the large government size of which the mean, as shown in Table 1, is already above the 40% threshold argued by the previous literature.

Table 2. Estimates of the effectiveness of automatic stabilizers

	Automatic Stabilizers		Cyclical Revenue		Cyclical Expenditure	
	OLS	3SLS	OLS	3SLS	OLS	3SLS
gap	0.4648***	0.4784***	-0.0082	-0.0175***	-0.4731***	-0.4960***
	(0.0287)	(0.0215)	(0.0097)	(0.0048)	(0.0265)	(0.0215)
FD-Gov. size	-0.0156**	-0.0175***	0.0007	0.0015	0.0163*	0.0189***
	(0.0069)	(0.0054)	(0.0009)	(0.0014)	(0.0092)	(0.0053)
R^2	0.9157	0.9267	0.0814	0.1463	0.9178	0.9272

Note: The estimated coefficients are followed by ***, **, and * to denote statistical significance at 1%, 5%, and 10% significance level respectively. Robust standard errors are reported in parentheses. For 3SLS, pseudo R^2 reported. Only variables of interest are shown.
Source: Author's own calculation

If the effect of the automatic stabilizers is broken down into cyclical revenue component and cyclical expenditure component, it could be perceived that the main driver of the stabilization effect of the automatic stabilizers is the cyclical spending. Admittedly, both coefficients of output gap and government size for the cyclical expenditure, despite the opposite direction, matched the ones of the automatic stabilizers well. On the other hand, the cyclical revenue, unexpectedly, shows a destabilizing effect in the sample. Although the magnitude is relatively small, a 1% increase in the output gap will lead to lower tax revenue received by the government by roughly 0.02%, which is counter-intuitive. However, this results matches the initial conclusion drawn by Darby and Melitz (2008).

Further analyses are conducted at the individual country level as the policy decision making process will rely on the national estimates while the panel data coefficients offer a reference point. Table 3 reports the coefficients of output gap estimated from the 56 observations per country from the re-estimation of equation (1) separately for each country in the sample. The

Table 3. Estimates of the country coefficients for output gap

Dependent Variables	Austria	Belgium	Denmark	Finland	France	Germany	Greece	Ireland	Italy	Netherlands	Portugal	Spain	Sweden	UK
as	0.5268***	0.5997***	0.5429***	0.4836***	0.4542***	0.5296***	0.5628***	0.4715***	0.5236***	0.6483***	0.3469***	0.1835	0.5397***	0.5797***
	(0.0190)	(0.0473)	(0.0439)	(0.0410)	(0.0680)	(0.0191)	(0.0544)	(0.0686)	(0.0966)	(0.0356)	(0.0512)	(0.9844)	(0.0592)	(0.0135)
R^2	0.9739	0.7844	0.9431	0.9232	0.7426	0.9775	0.8655	0.9323	0.2641	0.9534	0.5589	-	0.8646	0.9934
Structural break	1994	1973	1973	1989	1978	1975	2004	1991	1974	1991	1992	1986	1993	1975
Test statistics	23.1007	265.1040	54.9451	76.8398	3340.8359	200.9263	77.1112	68.4323	36.1218	5.5459	55.2309	104.9819	73.3985	6.7506
p-value	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0625	0.0000	0.0000	0.0000	0.0342
as_R	0.0090***	0.0133***	-0.0008***	-0.0261***	0.0015***	-0.0084***	-0.0279***	0.0206***	0.0336***	0.0660***	-0.0129***	0.0044	-0.0197***	0.1171***
	(0.0002)	(0.0010)	(0.0001)	(0.0021)	(0.0001)	(0.0002)	(0.0025)	(0.0014)	(0.0080)	(0.0035)	(0.0023)	(0.0157)	(0.0026)	(0.0023)
as_G	-0.5177***	-0.5864***	-0.5438***	-0.5097***	-0.4526***	-0.5380***	-0.5907***	-0.4508***	-0.4900***	-0.5822***	-0.3599***	-0.1790	-0.5588***	-0.4625***
	(0.0187)	(0.0463)	(0.0440)	(0.0431)	(0.4055)	(0.0193)	(0.0569)	(0.0691)	(0.0885)	(0.0321)	(0.0535)	(0.9690)	(0.0618)	(0.0121)

Note: The estimated coefficients are followed by ***, **, and * to denote statistical significance at 1%, 5%, and 10% significance level respectively. Robust standard errors are reported in parentheses. For 3SLS, pseudo R^2 reported. Only variables of interest are shown.
Source: Author's own calculation

R^2, structural break date and the associated statistics are only for the model whose dependent variable is *as*. See Appendix 4 for the full results, including the control variables.

For the majority of the countries in the sample, the automatic stabilizers have statistically significant stabilization power at the 1% confidence level and the coefficients suggest approximately 50% of the output gap could be absorbed by the automatic stabilizers. Spain, yet, did not show a statistically significant effect overall. For Spain, the coefficient is small and the standard error is large, which may hint to structural differences in the system of automatic stabilizer design before and after the structural break. Across the sample, the coefficients of cyclical expenditure follows closely with the entire automatic stabilizers, which is similar to the panel data analysis.

The structural breaks are tested by the Quandt-Andrews test with unknown breakpoint using Wald statistics. The empirical results show, in opposition to the hypothesis that the Maastricht Treaty and the SGP imposed significant restrictions on the fiscal policy behaviour of the EU member states, that the changes occurred much prior to the official introduction of the Maastricht criteria for many EU member states. Ireland, the Netherlands and Portugal, on the other hand, are the only countries for which the empirical data suggest that the Maastricht Treaty led to the statistically significant change in their fiscal policy behaviour. Regarding the break dates for the rest of the countries, it could be argued that they stemmed from the date when they officially accepted the EMS guidelines in 1979, while Austria, Finland, Ireland, and Sweden joined the EU system at a later date, which result in the later break date. The special circumstance for Greece is that, after it joined the eurozone, it admitted in 2004 that the numbers of the entry requirements were fudged and the corresponding adjustments required by the EC

Table 4. Estimates of the country coefficient for output gap prior to and after the structural break date

Dependent Variables		Austria	Belgium	Denmark	Finland	France	Germany	Greece	Ireland	Italy	Netherlands	Portugal	Spain	Sweden	UK
as	Prior	0.4672***	0.3496***	0.0761	0.3536***	0.2359***	0.6972***	0.1784**	0.6175***	0.2996***	0.7457***	0.2154***	-0.1683	0.2915***	0.5613***
		(0.0346)	(0.0880)	(0.3486)	(0.0522)	(0.0083)	(0.1575)	(0.0786)	(0.0468)	(0.094)	(0.0919)	(0.0478)	(0.4617)	(0.0883)	(0.0113)
	After	0.5902***	0.6819***	0.7431***	0.7446***	0.6308***	0.5615***	0.5401***	0.6530***	0.6410***	0.6047***	0.5027***	0.6215***	0.6112***	0.5840***
		(0.0102)	(0.0538)	(0.1871)	(0.1306)	(0.0323)	(0.005)	(0.0429)	(0.1835)	(0.1015)	(0.0344)	(0.0119)	(0.0201)	(0.0406)	(0.0197)
as_R	Prior	0.0085***	0.0077***	-0.0001	-0.0203***	0.0008***	-0.0110***	-0.0081**	0.0201***	0.0182***	0.0758***	-0.0068***	-0.0016	-0.0089***	0.1150***
		(0.0004)	(0.0020)	(0.0006)	(0.0039)	(0.00004)	(0.0019)	(0.0039)	(0.001)	(0.0054)	(0.0088)	(0.0016)	(0.0063)	(0.0025)	(0.0029)
	After	0.0096***	0.0150***	-0.0010***	-0.0330***	0.0021***	-0.0086***	-0.0233***	0.0077	0.0412***	0.0639***	-0.0208***	0.0113***	-0.0210***	0.1144***
		(0.00005)	(0.0473)	(0.0002)	(0.0017)	(0.00009)	(0.0001)	(0.0017)	(0.0125)	(0.0091)	(0.002)	(0.0003)	(0.0002)	(0.001)	(0.0044)
as_G	Prior	-0.4587***	-0.3419***	-0.0762	-0.3739***	-0.2351***	-0.7083***	-0.1866**	0.4715***	-0.2814***	-0.6699***	-0.2222***	0.1666	-0.3005***	-0.4462***
		(0.0341)	(0.086)	(0.3492)	(0.0561)	(0.0084)	(0.1595)	(0.0823)	-(0.0686)	(0.0885)	(0.0832)	(0.0493)	(0.4553)	(0.0909)	(0.0091)
	After	-0.5805***	-0.6668***	-0.7442***	-0.7777***	-0.6286***	-0.5702***	-0.5635***	-0.6452***	-0.5998***	-0.5407***	-0.5236***	-0.6101***	-0.6322***	-0.4695***
		(0.0102)	(0.0531)	(0.1873)	(0.1321)	(0.0322)	(0.0051)	(0.0424)	(0.1926)	(0.0942)	(0.0325)	(0.0123)	(0.02)	(0.0415)	(0.0177)

Note: The estimated coefficients are followed by ***, **, and * to denote statistical significance at 1%, 5%, and 10% significance level respectively. Robust standard errors are reported in parentheses. For 3SLS, pseudo R^2 reported. Only variables of interest are shown.
Source: Author's own calculation

might materially change the fiscal policy decision in Greece.

Another interesting observation comes from the cyclical revenue component. In the panel setting, the results suggest destabilization power, while for the individual countries, the empirical results are mixed. The regressions for Austria, Belgium, France, Ireland, Italy, the Netherlands, and the UK, all have statistically significant positive coefficients which could conclude that the taxes in these countries could smooth out the fluctuations in the economic cycle. In contrast, the estimations for Denmark, Finland, Germany, Greece, Portugal, and Sweden suggest taxes are destabilizing. These country-specific characteristics of the tax systems may explain the negative coefficient in the panel estimation.

To observe the change prior to and after the structural break, the country specific coefficients estimated for the output gap from the subsample periods are reported in Table 4 (see Appendix 5 for the full results including control variables). Generally speaking, the empirical results show that the output stabilization of the EU member states increasingly relied on systematic tax codes and spending rules around the 1980s. This is consistent with the trend when the mainstream economists started to advocate that monetary policy, rather than (discretionary) fiscal policy, should be the main source to smoothing out business cycle fluctuations. The majority of the countries exhibits larger cyclical revenue and expenditure component such as Belgium, Finland, and Italy. The results also match the fiscal strategy promoted by the EU as the mainstream economists had recommended. A few other countries, for instance, Denmark and Spain, have altered their fiscal policies and established consistent systems of automatic stabilizers, represented by shifting statistically insignificant coefficients into significant ones. The Netherlands and Germany, on the other hand, are the only two countries in the sample for

Table 5. First Difference Estimates of the effectiveness of automatic stabilizers

	Automatic Stabilizers		Cyclical Revenue		Cyclical Expenditure	
	OLS	3SLS	OLS	3SLS	OLS	3SLS
FD-gap	0.4386***	0.4099***	0.0044	-0.0005	-0.4342***	-0.4104***
	(0.0323)	(0.0072)	(0.0098)	(0.0018)	(0.0274)	(0.0069)
FD-Gov. size	-0.0393***	-0.0302***	0.0002	0.0014	0.0395***	0.0316***
	(0.0109)	(0.0041)	(0.0012)	(0.0010)	(0.0089)	(0.0040)
R^2	0.8946	0.9175	0.0306	0.0874	0.8982	0.9204

Note: The estimated coefficients are followed by ***, **, and * to denote statistical significance at 1%, 5%, and 10% significance level respectively. Robust standard errors are reported in parentheses. For 3SLS, pseudo R^2 reported. Only variables of interest are shown.
Source: Author's own calculation

which the coefficients from the period after the structural break are smaller in magnitude. Ireland is the other country whose estimates have uncommon behaviour. Its cyclical revenue seems to be insignificant after the structural break, while the standard error is significantly larger than the one for the period before the break.

Some researchers in the panel discussion have argued that the model used by Darly and Melitz suffers from the implicit restrictions on model parameters. Through manipulations of the equation (1) and the underlying structure model, from a theoretical point of view, the relationship between the lagged change in output gap and the level of automatic stabilizers may be ambiguous in the underlying structure model. Instead, the first-difference estimation of equation (1) should be used, according to those critics, and Table 5 presents the results from the first-difference estimation as a robustness check (see Appendix 6 for the full results including control variables). Such a modification of the model does not change the conclusion that the stabilizing effect of the automatic stabilization primarily comes from the cyclical government expenditure.

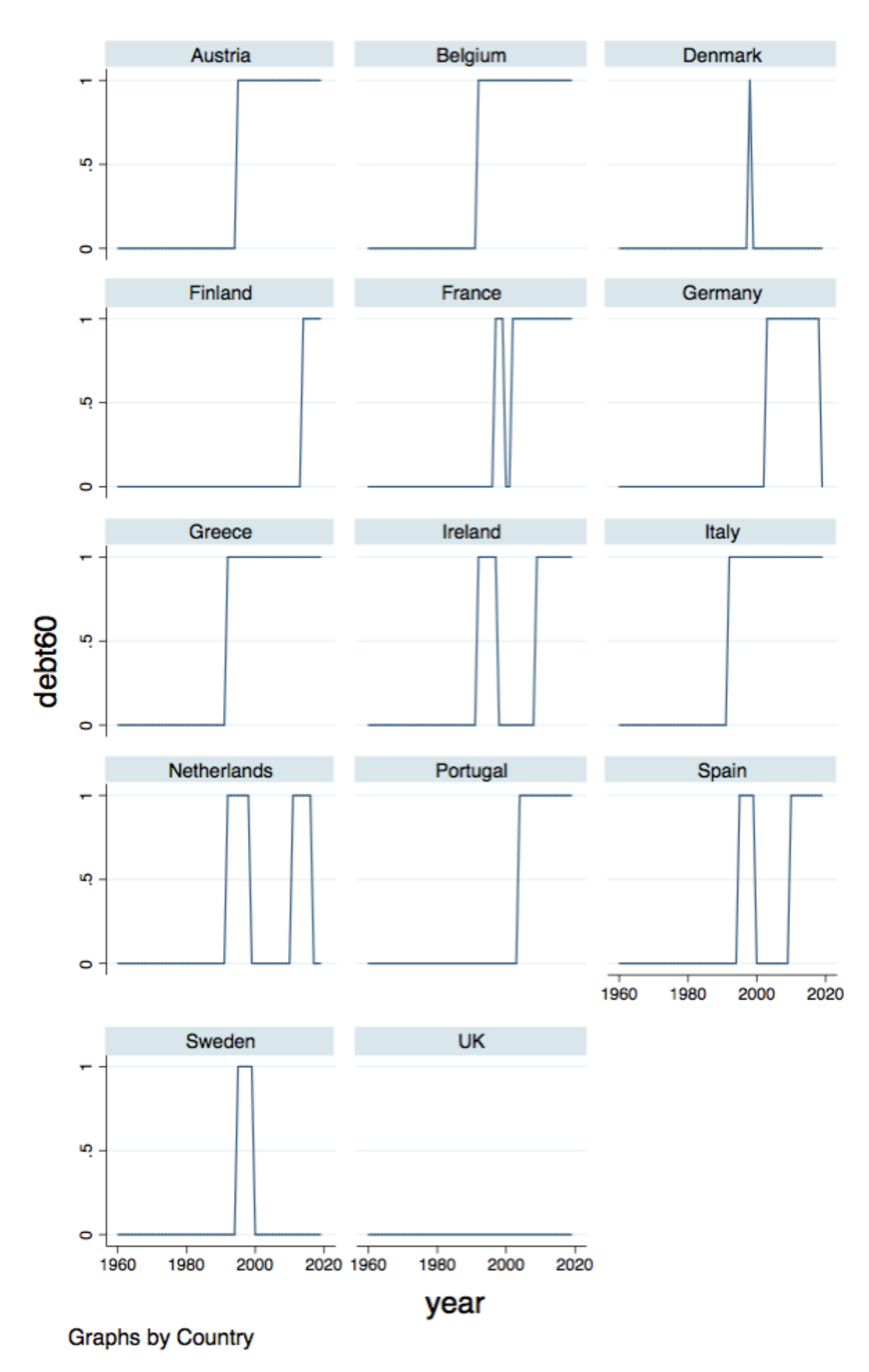

Figure 5. The dynamics of *debt60*
Source: author's own calculation and AMECO

It, nevertheless, does change the inference with respect to the taxes, namely that the taxes are now statistically insignificant in response to the output shocks. The results from the estimation, however, are still far from the general perception that the progressive tax system creates a strong buffer to the business cycles. The difference between the empirical results and the theoretical foundation may be explained by the country specific details, as could be seen from Table 3 and 4.

5.2. The effect of automatic stabilizers on discretionary policy

Figure 5 plots the dummy variable *debt60* for each of the countries in the sample. As one can observe, a few countries technically violated the requirement of the government debt-to-GDP ratio since the late 1990s, such as Austria, Belgium and Italy. The best performing countries are those Scandinavian countries with respect to this particular criterion. Although Germany, one of the best fiscal austerity country around the globe during the post-crisis period, managed its government deficit successfully, it still failed to meet such a tight requirement of the debt-to-GDP ratio during the recent European debt crisis.

Table 6 displays the panel and country specific estimation of the equation (2) (see Appendix 7 for the full results including the control variables). For the panel, both the OLS estimation and the instrumental variable approach yield statistically significant results at the 5% confidence level. The negative sign of the coefficients supports the hypothesis that the constraint of the debt-to-GDP ratio limits the use of automatic stabilizers. In other words, if the member state breached the threshold of the debt-to-GDP ratio in a long duration, the negative coefficients suggest that political decisions might be made to change the tax codes and spending rules, in order to avoid the sanctions from the EC.

Country effects are not significant globally. The OLS results of Denmark, Finland, Greece and Ireland indicate some weak evidence in accordance with the panel results, while the results of Portugal and Spain are significant at the 1% confidence level. Only the estimate of

Table 6. Panel and country estimation of the effect of debt60

	Panel	Austria	Belgium	Denmark	Finland	France	Germany	Greece	Ireland	Italy	Netherlands	Portugal	Spain	Sweden	UK
OLS	-0.1624**	0.0499	-0.0980	-0.1401*	-0.2916*	-0.0615	-0.0939	-0.4929*	-0.2096**	-0.2212	-0.0909	-0.4910***	-0.7127***	-0.1417	N/A
	(0.0718)	(0.0440)	(0.0850)	(0.0726)	(0.1521)	(0.0936)	(0.0587)	(0.2512)	(0.0930)	(0.1471)	(0.0850)	(0.1321)	(0.2415)	(0.1649)	N/A
IV	-0.4610**	0.2152	-0.2027	0.1469	-0.0596	-0.2680	-0.0650	1.8283	0.4844	-0.1783	-0.0801	-0.6289***	-0.7447	-0.4715	N/A
	(0.2024)	(0.2598)	(0.1284)	(0.1273)	(0.2816)	(0.3049)	(0.1333)	(2.0167)	(0.3826)	(0.2086)	(0.0827)	(0.2139)	(0.9805)	(0.3881)	N/A

Note: The estimated coefficients are followed by ***, **, and * to denote statistical significance at 1%, 5%, and 10% significance level respectively. Robust standard errors are reported in parentheses. For 3SLS, pseudo R^2 reported. Only variables of interest are shown.

Portugal, however, is statistically significant. To some extent, this is expected as the variations that could be seen from Figure 5 of the dummy *debt60* are not sufficiently large to produce an efficient estimator at the country level. However, for the majority of the country specific regressions, regardless of OLS or 3SLS approach being taken, the sign of the coefficient for *debt60* is negative, which potentially indicates the constraining relationship between the public debt level and the size of automatic stabilizers in the long term if the EU member state continues to fail to meet the requirement. The results are in accordance with the regulation that the SGP sets the maximum size of the automatic stabilizers to 3% of the GDP in normal times; however, such a restriction might be opposed to the promotion of using rule-based automatic stabilizers in response to negative output shocks because the fiscal discipline is still essentially limited.

6. Discussion on Automatic Stabilizers in the EMU design

From the empirical results, the criteria of the Maastricht Treaty and the SGP have continued the trend of the reform in the fiscal policy system of the EU member states, especially with respect to the automatic stabilizers, first introduced by the EMS. The political elites of these member states followed the guidance of the sound finance and advocated for fiscal inactivism starting in the Great Moderation, which was reinforced by the official administrative rules proposed by the Treaty. The general increase of the size of automatic stabilizers matched the mainstream opinion regarding the rule-based fiscal policy and decreasing reliance on the discretionary policy. The good intentions, however, were overwhelmed by the rigid design of the EU system, in particular, the government deficit objectives proposed by the Maastricht Treaty and the SGP.

The aforementioned case of the change in the government debt-to-GDP ratio confirmed this conception. Inevitably, it is important to ensure government debt sustainability and price stability in the medium term, of which losing control will engender solvency problems; but more active instruments of automatic stabilizers should be introduced to smooth out the business cycles besides the tax system and the unemployment related expenditures documented by the code book (Hiebert et al., 2008), especially during recessions. Based on the current methodology of cyclically-adjusted primary balance, these instruments, including discretionary decision made on the automatic stabilizers (for example, the decision to increase the duration of unemployment benefits), will essentially be classified as discretionary components which is subject to the constraint of the Maastricht Treaty and the SGP, whereas they are supposed to rely on the automatic stabilization mechanism in the nature of business cycles as long as there exists a pre-defined rule to limit the use of discretionary decision. These sources of output stabilization, however, neither are recognized by the stringent fiscal policy objectives in the EU system, nor are in existence at the national or supranational level in the EU member states (Furceri and Zdzienicka, 2013).

In addition, the cyclically-adjusted primary balance, together with the automatic stabilizers, constitutes the primary balance, which is relatively definite figure, while the its breakdown is not. As shown in the data section, such classification relied heavily on the elasticities of revenue and expenditure components. The assumption of elasticities to be time-invariant fails to take into account how income is distributed in different stages of the business cycles, and subsequently affects the aggregate demand stabilization. Furthermore, as Costantini (2017) argued, there are obvious delays in the estimation of the elasticities which might not reflect contemporaneous economic conditions. Hence, both the inherent pitfall in the design of cyclical component methodology and the empirical inaccuracy of the parameters may question the credibility of using the current methodology of the automatic stabilizers to measure the true effect of automatic stabilization power of the government.

7. Conclusion

The recent European solvency crisis encouraged investigation of the fiscal policy practice in the EU member states. This paper studies the automatic stabilizers with respect to the EU design from both empirical and theoretical perspectives. The stabilization role of the automatic stabilizers has generally increased since the beginning of the EMU, despite the explicit restrictions proposed by the Maastricht Treaty and the Stability and Growth Pact. Such movements also complement the advocacy of reliance on rule-based fiscal policy to a larger extent. However, the stabilization effects mostly result from the cyclical expenditure component while, on the cyclical revenue side, the estimated results showed either a-cyclical or even pro-cyclical pattern before and after the EMU criteria were enforced. Moreover, one of the limitations of the Maastricht Treaty, the threshold of the government debt-to-GDP ratio, is also closely related to the constraining fiscal space for the automatic stabilizers in the EU context, which contradicts the promotion of the use of automatic stabilizers. Rigid EU requirements, lack of risk sharing mechanism during business cycles and inherent problems in the methodology of automatic stabilizer calculation further limit the full potential of utilization of automatic stabilizers.

Several directions of further research could be conducted to understand comprehensively the automatic stabilizers and their effects in the EU member states. First, the empirical model for the effectiveness of automatic stabilizers does not consider the reciprocal effects. A complete general equilibrium structural model could be implemented to capture varying effects on both aggregate demand and supply. Similarly, the analysis of the public debt requirement could be extended into more sophisticated models to reach a causal conclusion. Also whether such restriction will impact the effectiveness of the automatic stabilizers would also be worthwhile exploring. Lastly, the theoretical improvements with respect to the automatic stabilizers, on the other hand, would benefit from quantitative supports from model simulation and empirical analyses, if future opportunity arises.

References:

Alesina, A., & Ardagna, S. (2010). Large changes in fiscal policy: taxes versus spending. *Tax Policy and the Economy*, *24*(1), 35-68.

Andrés, J., Doménech, R., & Fatás, A. (2008). The stabilizing role of government size. *Journal of Economic Dynamics and Control*, *32*(2), 571-593.

Arsic, M., Nojkovic, A., & Randjelovic, S. (2017). Determinants of discretionary fiscal policy in Central and Eastern Europe. *Economic Systems*, *41*(3), 367-378.

Auerbach, A. J., & Feenberg, D. R. (2000). The significance of federal taxes as automatic stabilizers. *Journal of Economic Perspectives*, *14*(3), 37-56.

Auerbach, A. J., & Hassett, K. A. (2002). Fiscal policy and uncertainty. *International Finance*, *5*(2), 229-249.

Auerbach, A. J. (2009). Implementing the new fiscal policy activism. *American Economic Review*, *99*(2), 543-49.

Bezdìk, V., Dybzcak, K., & Kreidl, A. (2003). Cyclically Adjusted Fiscal Balance: OECD and ESCB Methods. *Czech Journal of Economics and Finance (Finance a uver)*, *53*(11-12), 477-509.

Blix, M. (2009). *Are automatic stabilisers immune from asymmetries and extreme events*. European Central Bank, mimeo.

Bouheni, F. B., & Hasnaoui, A. (2017). Cyclical behavior of the financial stability of Eurozone commercial banks. *Economic Modelling*, *67*, 392-408.

Brunila, A., Buti, M., & Veld, J. I. T. (2003). Fiscal policy in Europe: how effective are automatic stabilisers?. *Empirica*, *30*(1), 1-24.

Buiter, W., Corsetti, G., & Roubini, N. (1993). Excessive deficits: sense and nonsense in the Treaty of Maastricht. *Economic Policy*, *8*(16), 57-100.

Buti, M., & Franco, D. (2005). *Fiscal policy in Economic and Monetary Union: theory, evidence, and institutions*. Edward Elgar Publishing.

Candelon, B., Muysken, J., & Vermeulen, R. (2009). Fiscal policy and monetary integration in Europe: an update. *Oxford Economic Papers*, *62*(2), 323-349.

Cimadomo, J. (2012). Fiscal policy in real time. *The Scandinavian Journal of Economics*, *114*(2), 440-465.

Collignon, S. (2012). Fiscal policy rules and the sustainability of public debt in Europe. *International Economic Review*, *53*(2), 539-567.

Costantini, O. (2017). Political economy of the Stability and Growth Pact. *European Journal of Economic Policies: Intervention* 14(3), 333-350.

Darby, J., & Melitz, J. (2008). Social spending and automatic stabilizers in the OECD. *Economic Policy*, *23*(56), 716-756.

Debrun, M. X., Pisani-Ferry, J., & Sapir, A. (2008). *Government size and output volatility: should we forsake automatic stabilization?* (No. 8-122). International Monetary Fund.

De Grauwe, P. (2011). Managing a fragile Eurozone. In *CESifo Forum* (Vol. 12, No. 2, p. 40). Institut für Wirtschaftsforschung (Ifo).

De Grauwe, P. (2013). Design Failures in the Eurozone: Can they be fixed? *London School of Economics and Political Science Paper No. 57*

Dobrescu, M. G. & Salman, M. F., (2011). *Fiscal policy during absorption cycles (No. 11-41)*. International Monetary Fund.

Dolls, M., Fuest, C., & Peichl, A. (2012a). Automatic stabilization and discretionary fiscal policy in the financial crisis. *IZA Journal of Labor Policy*, *1*(1), 4.

Dolls, M., Fuest, C., & Peichl, A. (2012b). Automatic stabilizers and economic crisis: US vs. Europe. *Journal of Public Economics*, *96*(3-4), 279-294.

Eichengreen, B., & Wyplosz, C. (1998). The Stability Pact: more than a minor nuisance?. *Economic policy*, *13*(26), 66-113.

European Commission (1997). Council Regulation (EC) No 1466/97: on the strengthening of the surveillance of budgetary positions and the surveillance and coordination of economic policies, 7 July 1997

European Commission (2004). Public finances in EMU, Luxembourg: European Economy No. 3, Directorate-General of Economic and Financial Affairs, Office for Official Publications of the EC.

European Commission (2017): Reflection paper on the deepening of the Economic and Monetary Union, Brussels: European Commission, 31 May

European Parliament (2015), Stability and Growth Pact – An overview of the rules, Briefing notes

European Union, *Treaty on European Union (Consolidated Version), Treaty of Maastricht* , 7 February 1992, Official Journal of the European Communities C 325/5

Fatás, A., & Mihov, I. (2001). Government size and automatic stabilizers: international and intranational evidence. *Journal of International Economics*, *55*(1), 3-28.

Fatás, A., & Mihov, I. (2010). The euro and fiscal policy. In *Europe and the Euro* (pp. 287-324). University of Chicago Press.

Fedelino, M. A., Horton, M. M. A., & Ivanova, A. (2009). *Computing cyclically-adjusted balances and automatic stabilizers*. International Monetary Fund.

Fisher, I. (1933). The debt-deflation theory of great depressions. *Econometrica: Journal of the Econometric Society*, 337-357.

Frankel, J., & Schreger, J. (2013). Over-optimistic official forecasts and fiscal rules in the eurozone. *Review of World Economics*, *149*(2), 247-272.

Furceri, D., & Zdzienicka, M. A. (2013). *The euro area crisis: need for a supranational fiscal risk sharing mechanism?* (No. 13-198). International Monetary Fund.

Gali, J. (1994). Government size and macroeconomic stability. *European Economic Review*, *38*(1), 117-132.

Galí, J., & Perotti, R. (2003). Fiscal policy and monetary integration in Europe. *Economic Policy*, *18*(37), 533-572.

Girouard, N., & André, C. (2006). Measuring cyclically-adjusted budget balances for OECD countries, OECD Working Papers

Government of United Kingdom (2013). 2012-13 Convergence Programme for the United Kingdom: Submitted in line with the Stability and Growth pact. *The National Archives*

Hiebert, P., Pérez, J. J., & Rostagno, M. (2009). The trade-off between public debt reduction and automatic stabilisation. *Economic Modelling*, *26*(2), 464-472.

Huart, F. (2013). Is Fiscal Policy Procyclical in the Euro Area?. *German Economic Review*, *14*(1), 73-88.

IMF. (2009) World Economic Outlook: Crisis and Recovery, International Monetary Fund

Jones, J. B. (2002). Has fiscal policy helped stabilize the postwar US economy?. *Journal of Monetary Economics*, *49*(4), 709-746.

Keynes, J. M. (1936). The general theory of money, interest and employment. *Reprinted in The Collected Writings of John Maynard Keynes*, *7*.

Kniesner, T. J., & Ziliak, J. P. (2002). Tax reform and automatic stabilization. *American Economic Review*, 92(3), 590-612.

Laeven, L., & Valencia, F. (2012). Systemic banking crises database: An update. International Monetary Fund.

Lee, Y., & Sung, T. (2007). Fiscal policy, business cycles and economic stabilisation: Evidence from industrialised and developing countries. *Fiscal Studies*, 28(4), 437-462.

Mabbett, D., & Schelkle, W. (2007). Bringing macroeconomics back into the political economy of reform: the Lisbon Agenda and the 'fiscal philosophy'of EMU. *JCMS: Journal of Common Market Studies*, *45*(1), 81-103.

Marinheiro, C. F. (2008). The stability and growth pact, fiscal policy institutions and stabilization in Europe. *International Economics and Economic Policy*, *5*(1-2), 189-207.

Mattesini, F., & Rossi, L. (2012). Monetary policy and automatic stabilizers: the role of progressive taxation. *Journal of Money, Credit and Banking*, *44*(5), 825-862.

Mauro, P., Romeu, R., Binder, A., and Asad Zaman, 2013, "A Modern History of Fiscal Prudence and Profligacy," IMF Working Paper No. 13/5, International Monetary Fund

McKay, A., & Reis, R. (2016). The role of automatic stabilizers in the US business cycle. *Econometrica*, *84*(1), 141-194.

Moldovan, I. R. (2010). Countercyclical taxes in a monopolistically competitive environment. *European Economic Review*, *54*(5), 692-717.

Mourre, G., Astarita, C., & Princen, S. (2014). *Adjusting the budget balance for the business cycle: the EU methodology*(No. 536). Directorate General Economic and Financial Affairs (DG ECFIN), European Commission.

Mourre, G., Isbasoiu, G. M., Paternoster, D., & Salto, M. (2013). *The cyclically-adjusted budget balance used in the EU fiscal framework: an update*. European Commission, Directorate-General for Economic and Financial Affairs.

Muscatelli, V. A., Tirelli, P., & Trecroci, C. (2004). Fiscal and monetary policy interactions: Empirical evidence and optimal policy using a structural New-Keynesian model. *Journal of Macroeconomics*, *26*(2), 257-280.

Muscatelli, V. A., Tirelli, P., Colciago, A., & Ropele, T. (2008). The role of fiscal policy in a monetary union: are national automatic stabilizers effective?. *Review of International Economics*, *16*(3), 591-610.

Parguez, Alain. (2016) Economic theories of social order and the origins of the euro. *International Journal of Political Economy,* 45(1) 2-16.

Rahman, J. (2010). *Absorption Boom and Fiscal Stance: What Lies Ahead in Eastern Europe?* (No. 10-97). International Monetary Fund.

Ranđelović, S. (2013). The estimation of tax-benefit automatic stabilizers in Serbia: A combined micro-macro approach. *Economic Annals*, *58*(198), 61-87.

Reicher, C. (2014). Systematic fiscal policy and macroeconomic performance: A critical overview of the literature. *Economics*, *8*(38), 0_1.

Seccareccia, M. (2011). The role of public investment as principal macroeconomic tool to promote long-term growth: Keynes's Legacy. *International Journal of Political Economy*, *40*(4), 62-82.

Seccareccia, M. (2017). Is high employment in the Eurozone possible? Some reflections on the institutional structure of the Eurozone and its crisis. *European Journal of Economics and Economic Policies: Intervention*, *14*(3), 351-371.

Seccareccia, M., & Lequain, M. (2006). What can we learn from the EMU model? Lessons for Canada and Britain. *Current Politics and Economics of Europe,* 17(2), 289-315.

Symansky, M. S. A., & Baunsgaard, M. T. (2009). Automatic fiscal stabilizers (No. 2009-2023). *IMF Working Papers,* International Monetary Fund.

Wyplosz, C. (2002). How risky is financial liberalization in the developing countries?. *Comparative Economic Studies*, *44*(2-3), 1-26.

Wyplosz, C. (2005). Fiscal policy: institutions versus rules. *National Institute Economic Review*, *191*(1), 64-78.

Wyplosz, C. (2006). European Monetary Union: the dark sides of a major success. *Economic policy*, *21*(46), 208-261.

Appendix 1. Reference Year for *debt60*

Reference dates for debt60

	Austria	**Belgium**	**Denmark**	**Finland**	**France**	**Germany**	**Greece**
Year	1995	1992	1998	1995	1992	1992	1992
Related document	Treaty of Accession	Maastricht Treaty	SGP	Treaty of Accession	Maastricht Treaty	Maastricht Treaty	Maastricht Treaty
	Ireland	**Italy**	**Netherlands**	**Portugal**	**Spain**	**Sweden**	**UK**
Year	1992	1992	1992	1992	1992	1995	N/A
Related document	Maastricht Treaty	Maastricht Treaty	Maastricht Treaty	Maastricht Treaty	Maastricht Treaty	Treaty of Accession	N/A

Note:
1. Maastricht Treaty was drafted in 1991and signed in February 1992. Therefore, the break year related to the Treaty is assumed to be 1992.
2. For the SGP, which was drafted in 1997, the "preventative arms" which directly related to the two criteria analyzed in the paper were in force in 1998.

Appendix 2. Data Source and Coverage

Data Srouce

	Primary Source		Secondary Source	
	Name	**Duration**	**Name**	**Duration**
GDP	AMECO - OVGD	1960-2017		
Output Gap	AMECO - AVGDGP	1965-2017	HP filter	N/A
Revenue to GDP	AMECO - URTG	1995-2017	IMF historical database	1960-1995
Expenditure to GDP	AMECO - UUTG	1995-2017	IMF historical database	1960-1995
CPI	AMECO - ZCPIN	1960-2017		
Public Debt	AMECO - UDGGL	1970-2017	IMF historical database	1960-1970
Long-term Interest Rate	AMECO - ILRV	1961-2016		
Oil Price	FRED St. Louis - WTISPLC	1960-2017		
Net Export	AMECO - UBGS	1960-2017		
Unemployment	AMECO - ZUTN	1960-2017		
Elasticities	Mourre et al., (2013)	N/A		

Appendix 3. Coefficient Estimation Results for Equation (1)

Coefficient Estimation Results for Equation (1)

	Automatic Stabilizers		Cyclical Revenue		Cyclical Expenditure	
	OLS	3SLS	OLS	3SLS	OLS	3SLS
gap	0.4648***	0.4784***	-0.0082	-0.0175***	-0.4731***	-0.4960***
	(0.0287)	(0.0215)	(0.0097)	(0.0048)	(0.0265)	(0.0215)
FD-Gov. size	-0.0156**	-0.0175***	0.0007	0.0015	0.0163*	0.0189***
	(0.0069)	(0.0054)	(0.0009)	(0.0014)	(0.0092)	(0.0053)
π	0.0056	0.0200	0.0005	-0.0553	-0.0051	-0.0169
	(0.0045)	(0.0209)	(0.0005)	(0.0646)	(0.0045)	(0.1173)
r	-0.0076	-0.0568	0.0021	-0.0627	0.0097*	0.0696
	(0.0052)	(0.0376)	(0.0017)	(0.0825)	(0.0052)	(0.1500)
Lagged gap	0.0160**	0.0011	-0.0023	0.0005	-0.0183**	0.0025
	(0.0069)	(0.0148)	(0.0014)	(0.0064)	(0.0074)	(0.0134)
Asymmetry dummy	0.0278	-0.0172	0.0696**	0.0602***	0.0417	0.0630
	(0.0808)	(0.0434)	(0.0287)	(0.0211)	(0.0891)	(0.0505)
Germany dummy	0.0386*	-0.1985	-0.0187**	-0.0126	-0.0574**	0.1859
	(0.0202)	(0.3332)	(0.0081)	(0.1516)	(0.0213)	(0.2890)
R^2	0.9157	0.9267	0.0814	0.1463	0.9178	0.9272

Note: The estimated coefficients are followed by ***, **, and * to denote statistical significance at 1%, 5%, and 10% significance level respectively. Robust standard errors are reported in parentheses. For 3SLS, pseudo R^2 reported.
Source: Author's own calculation

Appendix 4. Coefficients Estimation Results for Equation (1)

Coefficient Estimation Results for Equation (1)

	Austria	Belgium	Denmark	Finland	France	Germany	Greece	Ireland	Italy	Netherlands	Portugal	Spain	Sweden	UK
Panel A: as														
gap	0.5268***	0.5997***	0.5429***	0.4836***	0.4542***	0.5296***	0.5628***	0.4715***	0.5236***	0.6483***	0.3469***	0.1835	0.5397***	0.5797***
	(0.0190)	(0.0473)	(0.0439)	(0.0410)	(0.0680)	(0.0191)	(0.0544)	(0.0686)	(0.0966)	(0.0356)	(0.0512)	(0.9844)	(0.0592)	(0.0135)
FD-Gov. size	0.0080	0.0246	-0.0128	-0.0603**	0.0158	-0.0113**	-0.0203	-0.0425	0.0279	-0.0095	-0.0923	0.5315	-0.0333	0.0141***
	(0.0136)	(0.0181)	(0.0190)	(0.0295)	(0.0142)	(0.0055)	(0.0352)	(0.0735)	(0.0576)	(0.0190)	(0.0622)	(1.6050)	(0.0217)	(0.0056)
π	0.0140	-0.0683	0.0152	0.0639***	-0.0862	0.0234	0.0303	0.0471	-0.1395	0.0064	0.0601	-0.8858	0.0169	-0.0037
	(0.0140)	(0.0482)	(0.0247)	(0.0224)	(0.0776)	(0.0264)	(0.0233)	(0.0649)	(0.1472)	(0.0505)	(0.0538)	(2.7527)	(0.0191)	(0.0128)
r	-0.0290	-0.1472**	-0.0396	0.0062	-0.1519	-0.0275	-0.0292	-0.0431	-0.1883	-0.0451	-0.1150**	-1.5218	-0.0132	-0.0136
	(0.0428)	(0.0676)	(0.0500)	(0.0440)	(0.1271)	(0.0246)	(0.0288)	(0.0617)	(0.1750)	(0.0288)	(0.0548)	(4.5357)	(0.1340)	(0.0198)
Lagged gap	-0.0415*	-0.1279**	0.0198	0.0228	0.0094	-0.0042	-0.0560	0.0294	0.0472	0.0056	0.0226	-0.6941	0.0450	-0.0034
	(0.0250)	(0.0617)	(0.0261)	(0.0321)	(0.0438)	(0.0207)	(0.0465)	(0.0474)	(0.0848)	(0.0235)	(0.0579)	(2.0071)	(0.0395)	(0.0157)
Asymmetry dummy	0.1462**	0.1557	-0.1613	-0.3511*	-0.0730	-0.1300**	-1.37777***	0.5367	-1.0774	-0.2688	0.1373	-3.5422	-0.4263***	-0.1226
	(0.0587)	(0.1570)	(0.2263)	(0.1959)	(0.2283)	(0.0669)	(0.4594)	(0.6595)	(1.0690)	(0.1893)	(0.3258)	(8.4489)	(0.1196)	(0.0056)
Germany dummy						0.0490								
						(0.0964)								
R^2	0.9862	0.7527	0.9431	0.7767	-	0.9400	0.8797	0.9383	-	0.9499	-	-	0.6338	0.9939

Note: The estimated coefficients are followed by ***, **, and * to denote statistical significance at 1%, 5%, and 10% significance level respectively. Robust standard errors are reported in parentheses. For 3SLS, pseudo R^2 reported.
Source: Author's own calculation

Appendix 4. Coefficients Estimation Results for Equation (1) (cont.)

Coefficient Estimation Results for Equation (1)

	Austria	Belgium	Denmark	Finland	France	Germany	Greece	Ireland	Italy	Netherlands	Portugal	Spain	Sweden	UK
Panel B: as_R														
gap	0.0090***	0.0133***	-0.0008***	-0.0261***	0.0015***	-0.0084***	-0.0279***	0.0206***	0.0336***	0.0660***	-0.0129***	0.0044	-0.0197***	0.1171***
	(0.0002)	(0.0010)	(0.0001)	(0.0021)	(0.0001)	(0.0002)	(0.0025)	(0.0014)	(0.0080)	(0.0035)	(0.0023)	(0.0157)	(0.0026)	(0.0023)
FD-Gov. size	0.0001	0.0004	0.00002	0.0027*	0.00004	0.0001*	-0.0008	0.0020	0.0021	-0.0015	0.0039	0.0111	0.0003	0.0027***
	(0.0001)	(0.0003)	(0.00003)	(0.0015)	(0.00004)	(0.00007)	(0.0015)	(0.0022)	(0.0047)	(0.0019)	(0.0027)	(0.0334)	(0.0008)	(0.0010)
π	0.0002	-0.0011	-0.00002	-0.0022*	-0.0002	-0.0004	-0.0017	-0.0013	-0.0115	0.0025	-0.0027	-0.0187	-0.0010	-0.0001
	(0.0002)	(0.0010)	(0.00003)	(0.0011)	(0.0002)	(0.0004)	(0.0011)	(0.0021)	(0.0122)	(0.0052)	(0.0023)	(0.0572)	(0.0008)	(0.0020)
r	-0.0004	-0.0028**	0.00002	-0.0002	-0.0004	0.0003	0.0006	0.00003	-0.0154	-0.0043	0.0049**	-0.0320	-0.0021	-0.0001
	(0.0005)	(0.0014)	(0.00007)	(0.0020)	(0.0003)	(0.0002)	(0.0014)	(0.0012)	(0.0143)	(0.0028)	(0.0025)	(0.0943)	(0.0043)	(0.0033)
Lagged gap	-0.0005	-0.0025*	-0.00005	-0.0013	0.00004	0.0001	0.0019	-0.0009	0.0050	0.0009	-0.0010	-0.0136	-0.0015	-0.0003
	(0.0003)	(0.0013)	(0.00004)	(0.0016)	(0.0001)	(0.0002)	(0.0021)	(0.0008)	(0.0069)	(0.0025)	(0.0024)	(0.0419)	(0.0012)	(0.0025)
Asymmetry dummy	0.0016**	0.0035	0.00002	0.0092	-0.0002	0.0012	0.0640***	-0.0204	-0.0890	-0.0208	-0.0112	-0.0688	0.0137***	-0.0058
	(0.0007)	(0.0031)	(0.00003)	(0.0077)	(0.0006)	(0.0008)	(0.0206)	(0.0213)	(0.0892)	(0.0197)	(0.0138)	(0.1754)	(0.0043)	(0.0164)
Germany dummy						-0.0001								
						(0.0012)								
R^2	0.9862	0.7527	0.9431	0.7767	-	0.9400	0.8797	0.9383	-	0.9499	-	-	0.6338	0.9939

Note: The estimated coefficients are followed by ***, **, and * to denote statistical significance at 1%, 5%, and 10% significance level respectively. Robust standard errors are reported in parentheses. For 3SLS, pseudo R^2 reported.
Source: Author's own calculation

Appendix 4. Coefficients Estimation Results for Equation (1) (cont.)

Coefficient Estimation Results for Equation (1)

	Austria	Belgium	Denmark	Finland	France	Germany	Greece	Ireland	Italy	Netherlands	Portugal	Spain	Sweden	UK
Panel C: as_G														
gap	-0.5177***	-0.5864***	-0.5438***	-0.5097***	-0.4526***	-0.5380***	-0.5907***	-0.4508***	-0.4900***	-0.5822***	-0.3599***	-0.1790	-0.5588***	-0.4625***
	(0.0187)	(0.0463)	(0.0440)	(0.0431)	(0.4055)	(0.0193)	(0.0569)	(0.0691)	(0.0885)	(0.0321)	(0.0535)	(0.9690)	(0.0618)	(0.0121)
FD-Gov. size	-0.0078	-0.0241	0.0128	0.0630**	-0.0157	0.0115**	0.0194	0.0446	-0.0257	0.0079	0.0962	-0.5203	0.0336	-0.0113**
	(0.0135)	(0.0178)	(0.0190)	(0.0310)	(0.0142)	(0.0055)	0.0366	(0.0749)	(0.0529)	(0.0171)	(0.0649)	(1.5716)	(0.0224)	(0.0049)
π	-0.0138	0.0671	-0.0152	-0.0662***	0.0859	-0.0239	-0.0321	-0.0484	0.1280	-0.0038	-0.0629	0.8670	-0.0180	0.0035
	(0.0138)	(0.0472)	(0.0247)	(0.0236)	(0.0774)	(0.0268)	(0.0245)	(0.0664)	(0.1351)	(0.0454)	(0.0561)	(2.6955)	(0.0198)	(0.0114)
r	0.0286	0.1444**	0.0397	-0.0064	0.1514	0.0279	0.0298	0.0431	0.1729	0.0407	0.1200**	1.4897	0.0111	0.0134
	(0.0422)	(0.0661)	(0.0500)	(0.0460)	(0.1268)	(0.0249)	(0.0302)	(0.0623)	(0.1608)	(0.0260)	(0.0573)	(4.4414)	(0.1377)	(0.0171)
Lagged gap	0.0410*	0.1254**	-0.0199	-0.0242	-0.0094	0.0043	0.0579	-0.0303	-0.0421	-0.0047	-0.0236	0.6805	-0.0465	0.0031
	(0.0247)	(0.0604)	(0.0261)	(0.0337)	(0.0437)	(0.0210)	(0.0486)	(0.0479)	(0.0779)	(0.0210)	(0.0604)	(1.9652)	(0.0407)	(0.0144)
Asymmetry dummy	-0.1445**	-0.1521	0.1615	0.3603*	(0.0727)	0.1313**	1.4417***	-0.5572	0.9883	0.2479	-0.1485	3.4733	0.4400***	0.1167
	(0.0580)	(0.1539)	(0.2267)	(0.2031)	(0.2276)	(0.0676)	(0.4797)	(0.6748)	(0.9804)	(0.1703)	(0.3395)	(8.2735)	(0.1235)	(0.1005)
Germany dummy						-0.0492								
						(0.0976)								
R^2	0.9862	0.7527	0.9431	0.7767	-	0.9400	0.8797	0.9383	-	0.9499	-	-	0.6338	0.9939

Note: The estimated coefficients are followed by ***, **, and * to denote statistical significance at 1%, 5%, and 10% significance level respectively. Robust standard errors are reported in parentheses. For 3SLS, pseudo R^2 reported.
Source: Author's own calculation

Appendix 5. Estimates of the Country Coefficient for Output Gap prior to and after the Structural Break Date

Estimates of the Country Coefficient for Output Gap prior to and after the Structural Break Date

	Panel A: as prior to Structural Break Date													
	Austria	**Belgium**	**Denmark**	**Finland**	**France**	**Germany**	**Greece**	**Ireland**	**Italy**	**Netherlands**	**Portugal**	**Spain**	**Sweden**	**UK**
gap	0.4672***	0.3496***	0.0761	0.3536***	0.2359***	0.6972***	0.1784**	0.6175***	0.2996***	0.7457***	0.2154***	-0.1683	0.2915***	0.5613***
	(0.0346)	(0.0880)	(0.3486)	(0.0522)	(0.0083)	(0.1575)	(0.0786)	(0.0468)	(0.094)	(0.0919)	(0.0478)	(0.4617)	(0.0883)	(0.0113)
FD-Gov. size	0.0174	-0.0361	-0.0210	0.0198	0.0029***	-0.0502	0.0362	0.0060	-0.0145	-0.0167	-0.0807***	-0.0099	-0.0948***	0.0105
	(0.0214)	(0.0280)	(0.0460)	(0.0220)	(0.0005)	(0.0318)	(0.0405)	(0.0273)	(0.0158)	(0.0192)	(0.0299)	(0.1263)	(0.0184)	(0.0107)
π	0.0279	0.0489	-0.0662	-0.0667*	-0.0003	0.0167	-0.0172**	-0.0033	0.1336	-0.0123	-0.0337***	-0.1708	-0.0210	0.0029
	(0.0240)	(0.0669)	(0.1668)	(0.0413)	(0.004)	(0.0613)	(0.0077)	(0.0204)	(0.0887)	(0.0299)	(0.0105)	(0.1795)	(0.0446)	(0.0282)
r	0.0021	0.2374	0.3813	-0.0255	0.0053	0.3394	-0.004	-0.0582*	0.1576	-0.0641*	0.0198	-0.3422	-0.0599	0.0347
	(0.0423)	(0.1693)	(0.6118)	(0.0454)	(0.0107)	(0.2191)	(0.0165)	(0.0355)	(0.1191)	(0.0347)	(0.0302)	(0.3998)	(0.041)	(0.0696)
Lagged gap	-0.0460***	0.0753	0.1607	0.0302	-0.0001	0.1631*	0.0345*	-0.0356	-0.0795*	-0.0055	0.0690**	-0.0113	0.0733	0.0327***
	(0.0176)	(0.0885)	(0.1367)	(0.0280)	(0.0043)	(0.0989)	(0.0214)	(0.0327)	(0.043)	(0.0451)	(0.0293)	(0.3009)	(0.0641)	(0.0108)
Asymmetry dummy	0.1874***	-0.1263	0.3781	-0.0376	-0.0064	-0.8809*	0.5777	-0.0512	0.0277	-0.3745	0.4390	0.9066	0	-0.1337*
	(0.0626)	(0.2860)	(0.9883)	(0.1902)	(0.0213)	(0.503)	(0.4267)	(0.1546)	(0.2815)	(0.2368)	(0.3021)	(1.2191)	(0.2013)	(0.0806)
Germany dummy						N/A								
						N/A								
R^2	0.9896	0.8805	0.5765	0.9216	0.9982	0.8805	0.9263	0.9757	0.9059	0.9201	0.9300	-	0.9643	0.9979

Note: The estimated coefficients are followed by ***, **, and * to denote statistical significance at 1%, 5%, and 10% significance level respectively. Robust standard errors are reported in parentheses. For 3SLS, pseudo R^2 reported.
Source: Author's own calculation

Appendix 5. Estimates of the Country Coefficient for Output Gap prior to and after the Structural Break Date (cont.)

Estimates of the Country Coefficient for Output Gap prior to and after the Structural Break Date

	Panel B: as after Structural Break Date													
	Austria	**Belgium**	**Denmark**	**Finland**	**France**	**Germany**	**Greece**	**Ireland**	**Italy**	**Netherlands**	**Portugal**	**Spain**	**Sweden**	**UK**
gap	0.5902***	0.6819***	0.7431***	0.7446***	0.6308***	0.5615***	0.5401***	0.6530***	0.6410***	0.6047***	0.5027***	0.6215***	0.6112***	0.5840***
	(0.0102)	(0.0538)	(0.1871)	(0.1306)	(0.0323)	(0.005)	(0.0429)	(0.1835)	(0.1015)	(0.0344)	(0.0119)	(0.0201)	(0.0406)	(0.0197)
FD-Gov. size	-0.0043**	0.0393	0.1004	0.1029	0.0245	0.0004	-0.0203	0.0327	0.0833	-0.0128*	0.00006	-0.0098	0.0301	0.0051
	(0.0018)	(0.0253)	(0.1556)	(0.1588)	(0.0297)	(0.0014)	-(0.0352)	(0.037)	(0.0808)	(0.0078)	(0.0087)	(0.0122)	(0.0457)	(0.0098)
π	-0.0054	-0.0443**	-0.0238	-0.2812	0.0008	-0.0009	0.0303	-0.0633	-0.0207	-0.0592	0.0310	0.0197	0.0697	0.0020
	(0.0106)	(0.0217)	(0.0415)	(0.2698)	(0.0043)	(0.0168)	-(0.0233)	(0.1345)	(0.0273)	(0.0693)	(0.022)	(0.0224)	(0.06)	(0.0082)
r	-0.0009	-0.0444*	-0.0514	-0.0077	-0.0031	-0.0053***	-0.0292	0.1743	-0.0306	-0.0136	-0.0104	-0.0064	-0.0272	0.0011
	(0.0022)	(0.0264)	(0.0560)	(0.0178)	(0.0069)	(0.0015)	-(0.0288)	(0.1717)	(0.0346)	(0.0185)	(0.0065)	(0.016)	(0.0417)	(0.0098)
Lagged gap	-0.0046	-0.0585*	-0.0839	-0.0354	-0.0266	0.0006	-0.0560	0.0123	-0.0344	0.0284	-0.0066	-0.0190	-0.0044	-0.0066
	(0.0042)	(0.0339)	(0.1159)	(0.096)	(0.0266)	(0.0058)	-(0.0465)	(0.0612)	(0.0478)	(0.0331)	(0.0197)	(0.0166)	(0.0324)	(0.0121)
Asymmetry dummy	-0.0009	-0.0514	-0.1636	-0.0160	-0.0597	-0.0167	-1.093***	0.0000	-0.2467	0.0401	-0.0383	-0.4184***	-0.0476	-0.0494
	(0.0119)	(0.0950)	(0.2760)	(0.4173)	(0.0414)	(0.0109)	(0.3957)	(0.3562)	(0.2278)	(0.1197)	(0.0417)	(0.1181)	(0.1416)	(0.0808)
Germany dummy						0.0252								
						(0.0231)								
R^2	0.9993	0.9707	0.9713	0.9883	0.9984	0.9994	0.9978	0.9098	0.9825	0.9952	0.9973	0.9959	0.9834	0.9940

Note: The estimated coefficients are followed by ***, **, and * to denote statistical significance at 1%, 5%, and 10% significance level respectively. Robust standard errors are reported in parentheses. For 3SLS, pseudo R^2 reported.
Source: Author's own calculation

Appendix 5. Estimates of the Country Coefficient for Output Gap prior to and after the Structural Break Date (cont.)

Estimates of the Country Coefficient for Output Gap prior to and after the Structural Break Date

	Panel C: as_R prior to Structural Break Date													
	Austria	**Belgium**	**Denmark**	**Finland**	**France**	**Germany**	**Greece**	**Ireland**	**Italy**	**Netherlands**	**Portugal**	**Spain**	**Sweden**	**UK**
gap	0.0085***	0.0077***	-0.0001	-0.0203***	0.0008***	-0.0110***	-0.0081**	0.0201***	0.0182***	0.0758***	-0.0068***	-0.0016	-0.0089***	0.1150***
	(0.0004)	(0.0020)	(0.0006)	(0.0039)	(0.00004)	(0.0019)	(0.0039)	(0.001)	(0.0054)	(0.0088)	(0.0016)	(0.0063)	(0.0025)	(0.0029)
FD-Gov. size	0.0002	-0.0008	0.00003	-0.0015	0.000008**	0.0006*	-0.0014	-0.0425	-0.0008	-0.0018	0.0032***	-0.0002	0.0028	0.0018
	(0.0002)	(0.0006)	(0.00008)	(0.0015)	(0)	(0.0003)	(0.0018)	-(0.0735)	(0.0009)	(0.0019)	(0.0007)	(0.0017)	(0.0005)	(0.0023)
π	0.0004	0.001	0.0001	0.0045	-0.00004*	-0.0004	0.0009**	0.0001	0.0074	-0.0005	0.0011***	-0.0023	0.0003	0.0068
	(0.0003)	(0.0015)	(0.0003)	(0.0029)	(0.00002)	(0.0007)	(0.0003)	(0.0004)	(0.0051)	(0.0028)	(0.0003)	(0.0025)	(0.0012)	(0.0063)
r	0.00008	0.0054	-0.0006	0.0015	-0.0001*	-0.0045*	0.0001	-0.0009	0.0089	-0.0063*	-0.0009	-0.0048	0.0012	0.0192
	(0.0005)	(0.0040)	(0.0011)	(0.0031)	(0.00006)	(0.0027)	(0.0008)	(0.0008)	(0.0068)	(0.0034)	(0.0011)	(0.0057)	(0.001)	(0.0151)
Lagged gap	-0.0006**	0.0016	-0.0002	-0.0018	-0.00003	-0.0020*	-0.0020**	-0.0007	-0.0041*	-0.0006	-0.0028***	0.0001	-0.0022	0.0027
	(0.0002)	(0.0020)	(0.0002)	(0.0019)	(0.00002)	(0.0012)	(0.001)	(0.0007)	(0.0025)	(0.0045)	(0.001)	(0.0041)	(0.0018)	(0.0027)
Asymmetry dummy	0.0018**	-0.0028	-0.0006	0.0027	0.00005	0.0127**	-0.0314	0.5367	0.0033	-0.0356	-0.0236**	0.0147	0	-0.0146
	(0.0008)	(0.0066)	(0.0018)	(0.0134)	(0.0001)	(0.0063)	(0.0221)	-(0.6595)	(0.0164)	(0.0235)	(0.0105)	(0.0169)	(0.0213)	(0.0174)
Germany dummy						N/A								
						N/A								
R^2	0.9939	0.8655	0.5310	0.8791	0.9959	0.9273	0.9272	0.9383	0.9243	0.9266	0.9316	0.2347	0.9693	0.9967

Note: The estimated coefficients are followed by ***, **, and * to denote statistical significance at 1%, 5%, and 10% significance level respectively. Robust standard errors are reported in parentheses. For 3SLS, pseudo R^2 reported.
Source: Author's own calculation

Appendix 5. Estimates of the Country Coefficient for Output Gap prior to and after the Structural Break Date (cont.)

Estimates of the Country Coefficient for Output Gap prior to and after the Structural Break Date

	Panel D: as_R after Structural Break Date													
	Austria	**Belgium**	**Denmark**	**Finland**	**France**	**Germany**	**Greece**	**Ireland**	**Italy**	**Netherlands**	**Portugal**	**Spain**	**Sweden**	**UK**
gap	0.0096***	0.0150***	-0.0010***	-0.0330***	0.0021***	-0.0086***	-0.0233***	0.0077	0.0412***	0.0639***	-0.0208***	0.0113***	-0.0210***	0.1144***
	(0.00005)	(0.0473)	(0.0002)	(0.0017)	(0.00009)	(0.0001)	(0.0017)	(0.0125)	(0.0091)	(0.002)	(0.0003)	(0.0002)	(0.001)	(0.0044)
FD-Gov. size	0.00001	0.0007*	-0.0001	-0.0002	0.0001*	0.0000	0.0011**	-0.0009	0.0044	-0.0002	-0.0002	-0.0001	-0.0001	0.0002
	(0.00001)	(0.0004)	(0.0001)	(0.0022)	(0.00008)	(0.00003)	(0.0004)	(0.0023)	(0.0068)	(0.0006)	(0.0002)	(0.0002)	(0.0012)	(0.0002)
π	0.00008	-0.0006**	0.00002	0.0017	0.0000	-0.0005	0.0011	0.0037	-0.0011	-0.0045	-0.0010	0.0002	-0.0027	0.0022
	(0.00006)	(0.0003)	(0.00004)	(0.0037)	(0.00001)	(0.0005)	(0.002)	(0.008)	(0.0023)	(0.005)	(0.0008)	(0.0004)	(0.0018)	(0.0018)
r	0.00001	-0.0004	0.00003	0.0003*	-0.00001	0.00007	0.0011	-0.0107	-0.0029	-0.0009	0.0002	-0.0006**	0.0011	0.0006
	(0.00001)	(0.0004)	(0.00006)	(0.0002)	(0.00001)	(0.00005)	(0.0012)	(0.0114)	(0.0029)	0.0012	(0.0002)	(0.0003)	(0.0011)	(0.002)
Lagged gap	-0.00001	-0.0008	0.00006	-0.0002	-0.0001	0.0001	-0.0044***	-0.00003	-0.0004	0.0023	0.00003	0.0003	0.0001	0.0006
	(0.00002)	(0.0006)	(0.0001)	(0.0013)	(0.00008)	(0.0002)	(0.0009)	(0.0037)	(0.004)	(0.002)	(0.0008)	(0.0003)	(0.0007)	(0.0021)
Asymmetry dummy	0.0001*	-0.0010	0.0002	0.0018	-0.0001	-0.00005	0.0116	0.0000	-0.0214	0.0039	0.0024	-0.0050**	-0.0003	0.0020
	(0.00008)	(0.0013)	(0.0002)	(0.0055)	(0.0001)	(0.0003)	(0.0127)	(0.0034)	(0.0209)	(0.0079)	(0.0016)	(0.0023)	(0.0032)	(0.0179)
Germany dummy						0.0005								
						(0.0008)								
R^2	0.9999	0.9858	0.9893	0.9995	0.9986	0.9981	0.9991	0.8409	0.9719	0.9977	0.9975	0.9965	0.9912	0.9940

Note: The estimated coefficients are followed by ***, **, and * to denote statistical significance at 1%, 5%, and 10% significance level respectively. Robust standard errors are reported in parentheses. For 3SLS, pseudo R^2 reported.
Source: Author's own calculation

Appendix 5. Estimates of the Country Coefficient for Output Gap prior to and after the Structural Break Date (cont.)

Estimates of the Country Coefficient for Output Gap prior to and after the Structural Break Date

	Austria	Belgium	Denmark	Finland	France	Germany	Greece	Ireland	Italy	Netherlands	Portugal	Spain	Sweden	UK
						Panel E: as_G prior to Structural Break Date								
gap	-0.4587***	-0.3419***	-0.0762	-0.3739***	-0.2351***	-0.7083***	-0.1866**	0.4715***	-0.2814***	-0.6699***	-0.2222***	0.1666	-0.3005***	-0.4462***
	(0.0341)	(0.086)	(0.3492)	(0.0561)	(0.0084)	(0.1595)	(0.0823)	-(0.0686)	(0.0885)	(0.0832)	(0.0493)	(0.4553)	(0.0909)	(0.0091)
FD-Gov. size	-0.0172	0.0353	0.0210	-0.0214	-0.0029***	0.0508	-0.0376	-0.0425	0.0136	0.0148	0.0839***	0.0096	0.0976***	-0.0087
	(0.0211)	(0.0274)	(0.0461)	(0.0235)	(0.0005)	(0.0322)	(0.0423)	-(0.0735)	(0.0149)	(0.0173)	(0.0306)	(0.1245)	(0.019)	(0.0089)
π	-0.0274	-0.0479	0.0663	0.0713	0.0003	-0.0172	0.0181**	0.0471	-0.1261	0.0117	0.0349***	0.1684	0.0213	0.0039
	(0.0237)	(0.0653)	(0.1671)	(0.0442)	(0.004)	(0.0621)	(0.0081)	-(0.0649)	(0.0836)	(0.0271)	(0.0109)	(0.177)	(0.0458)	(0.0234)
r	-0.0020	-0.2320	-0.3820	0.0271	-0.0054	-0.3440	0.0046	-0.0431	-0.1487	0.0578*	-0.0208	0.3374	0.0611	-0.0154
	(0.0418)	(0.1653)	(0.6129)	(0.0485)	(0.0107)	(0.2218)	(0.0173)	-(0.0617)	(0.1122)	(0.0314)	(0.0313)	(0.3941)	(0.042)	(0.0577)
Lagged gap	0.0454***	-0.0736	-0.1610	-0.0320	0.0001	-0.1652*	-0.0366*	0.0294	0.0754*	0.0049	-0.0718**	0.0115	-0.0756	-0.0300***
	(0.0173)	(0.0864)	(0.1370)	(0.0298)	(0.0043)	(0.1001)	(0.0224)	-(0.0474)	(0.0405)	(0.0405)	(0.0304)	(0.2968)	(0.0659)	(0.0085)
Asymmetry dummy	-0.1856***	0.1235	-0.3787	0.0403	0.0064	0.8936*	-0.6091	0.0508	-0.0243	0.3389	-0.4626	-0.8919	0	0.1190*
	(0.0619)	(0.2793)	(0.9901)	(0.2035)	(0.0214)	(0.5094)	(0.4476)	(0.1512)	(0.2651)	(0.2134)	(0.3121)	(1.2022)	(0.4128)	(0.0651)
Germany dummy						N/A								
						N/A								
R^2	0.9895	0.8808	0.5764	0.9195	0.9981	0.8813	0.9266	0.9753	0.9045	0.9193	0.9302	-	0.9646	0.9980

Note: The estimated coefficients are followed by ***, **, and * to denote statistical significance at 1%, 5%, and 10% significance level respectively. Robust standard errors are reported in parentheses. For 3SLS, pseudo R^2 reported.
Source: Author's own calculation

Appendix 5. Estimates of the Country Coefficient for Output Gap prior to and after the Structural Break Date (cont.)

Estimates of the Country Coefficient for Output Gap prior to and after the Structural Break Date

	Panel F: as_G after Structural Break Date													
	Austria	**Belgium**	**Denmark**	**Finland**	**France**	**Germany**	**Greece**	**Ireland**	**Italy**	**Netherlands**	**Portugal**	**Spain**	**Sweden**	**UK**
gap	-0.5805***	-0.6668***	-0.7442***	-0.7777***	-0.6286***	-0.5702***	-0.5635***	-0.6452***	-0.5998***	-0.5407***	-0.5236***	-0.6101***	-0.6322***	-0.4695***
	(0.0102)	(0.0531)	(0.1873)	(0.1321)	(0.0322)	(0.0051)	(0.0424)	(0.1926)	(0.0942)	(0.0325)	(0.0123)	(0.02)	(0.0415)	(0.0177)
FD-Gov. size	0.0043**	-0.0385	-0.1005	-0.1032	-0.0244	0.0166	0.0825***	-0.0336	-0.0788	0.0126*	-0.0002	0.0097	-0.0302	-0.0049
	(0.0018)	(0.0249)	(0.1558)	(0.1608)	(0.0296)	(0.011)	(0.0174)	(0.0389)	(0.0753)	(0.0075)	(0.009)	(0.0119)	(0.0469)	(0.0078)
π	0.0055	0.0436**	0.0239	0.2830	-0.0008	0.0004	0.2466***	0.0671	0.0195	0.0546	-0.0320	-0.0194	-0.0724	-0.0021
	(0.0105)	(0.0214)	(0.0415)	(0.2732)	(0.0042)	(0.017)	(0.074)	(0.1421)	(0.0254)	(0.0653)	(0.0228)	(0.0221)	(0.0617)	(0.0077)
r	0.0009	0.0439*	0.0515	0.0081	0.0031	0.0053***	-0.0154	-0.1850	0.0276	0.0126	0.0107	0.0057	0.0283	-0.0004
	(0.0022)	(0.0260)	(0.0561)	(0.018)	(0.0069)	(0.0016)	(0.0339)	(0.1801)	(0.0322)	(0.0175)	(0.0068)	(0.0157)	(0.0428)	(0.0082)
Lagged gap	0.0046	0.0577*	0.0839	0.0351	0.0265	-0.0004	-0.1360***	-0.0123	0.0340	-0.0260	0.0067	0.0194	0.0046	0.0072
	(0.0042)	(0.0334)	(0.1160)	(0.0972)	(0.0265)	(0.0059)	(0.0352)	(0.0647)	(0.0447)	(0.0316)	(0.0205)	(0.0163)	(0.033)	(0.0112)
Asymmetry dummy	0.0010	0.0504	0.1638	0.0178	0.0596	-0.0004	1.1047***	0.0002	0.2252	-0.0361	0.0408	0.4133***	0.0472	0.0514
	(0.0118)	(0.0939)	(0.2763)	(0.4223)	(0.0413)	(0.0014)	(0.3988)	(0.3055)	(0.2102)	(0.1122)	(0.0432)	(0.1162)	(0.1447)	(0.0737)
Germany dummy						-0.0247								
						(0.0233)								
R^2	0.9993	0.9702	0.9713	0.9893	0.9983	0.9994	0.9979	0.8907	0.9828	0.9947	0.9974	0.9958	0.9838	0.9930

Note: The estimated coefficients are followed by ***, **, and * to denote statistical significance at 1%, 5%, and 10% significance level respectively. Robust standard errors are reported in parentheses. For 3SLS, pseudo R^2 reported.
Source: Author's own calculation

Appendix 6. First Difference Estimation of Equation (1)

First Difference Estimation of Equation (1)

	Automatic Stabilizers		Cyclical Revenue		Cyclical Expenditure	
	OLS	3SLS	OLS	3SLS	OLS	3SLS
FD-gap	0.4386***	0.4099***	0.0044	-0.0005	-0.4342***	-0.4104***
	(0.0323)	(0.0072)	(0.0098)	(0.0018)	(0.0274)	(0.0069)
FD-Gov. size	-0.0393***	-0.0302***	0.0002	0.0014	0.0395***	0.0316***
	(0.0109)	(0.0041)	(0.0012)	(0.0010)	(0.0089)	(0.0040)
FD-π	0.0078	-0.0083	-0.0026	-0.0031**	-0.0105	0.0052
	(0.0084)	(0.0060)	(0.0034)	(0.0014)	(0.0084)	(0.0058)
FD-r	-0.0006	-0.0008	-0.0005	-0.0004	0.0001	0.0004
	(0.0089)	(0.0057)	(0.0016)	(0.0014)	(0.0103)	(0.0056)
FD-Lagged gap	0.0094	0.0252***	-0.00003	0.0007	-0.0094	-0.026***
	(0.0073)	(0.0067)	(0.0016)	(0.0016)	(0.0077)	(0.0065)
FD-Asymmetry dummy	0.0135	0.0288	0.0201**	0.0184***	0.0066	-0.0104
	(0.0435)	(0.0258)	(0.0089)	(0.0063)	(0.0411)	(0.0250)
FD-Germany dummy	-0.3028***	-0.4829*	0.0197	-0.0147	0.3225***	0.4679*
	(0.0754)	(0.2804)	(0.0204)	(0.0686)	(0.0646)	(0.2722)
R^2	0.8946	0.9175	0.0306	0.0874	0.8982	0.9204

Note: The estimated coefficients are followed by ***, **, and * to denote statistical significance at 1%, 5%, and 10% significance level respectively. Robust standard errors are reported in parentheses. For 3SLS, pseudo R^2 reported.
Source: Author's own calculation

Appendix 7. Coefficients Estimation Results for Equation (2)

Coefficient Estimation for Equation (2)

	Panel	Austria	Belgium	Denmark	Finland	France	Germany	Greece	Ireland	Italy	Netherlands	Portugal	Spain	Sweden	UK
Panel A: OLS															
debt60	-0.1624**	0.0499	-0.0980	-0.1401*	-0.2916*	-0.0615	-0.0939	-0.4929*	-0.2096**	-0.2212	-0.0909	-0.4910***	-0.7127***	-0.1417	N/A
	(0.0718)	(0.0440)	(0.0850)	(0.0726)	(0.1521)	(0.0936)	(0.0587)	(0.2512)	(0.0930)	(0.1471)	(0.0850)	(0.1321)	(0.2415)	(0.1649)	N/A
gap	0.4606***	0.4829***	0.4975***	0.5187***	0.4957***	0.5119***	0.5184***	0.4460***	0.5597***	0.4552***	0.6423***	0.3003***	0.5881***	0.5520***	N/A
	(0.0297)	(0.0187)	(0.0521)	(0.0574)	(0.1521)	(0.0626)	(0.0297)	(0.0463)	(0.0381)	(0.0483)	(0.0578)	(0.0254)	(0.0458)	(0.0386)	N/A
FD-Gov. size	-0.0179*	0.0019	0.0087*	-0.0174	-0.0603**	0.0070	-0.0127**	-0.0171	0.0332**	-0.0079	-0.0104	-0.0545***	0.0014	-0.0397***	N/A
	(0.0093)	(0.0108)	(0.0052)	(0.0170)	(0.0288)	(0.0051)	(0.0061)	(0.0405)	(0.0157)	(0.0126)	(0.0105)	(0.0199)	(0.0152)	(0.0145)	N/A
π	-0.0008	0.0165	-0.0260*	0.0055	0.0347***	-0.0159	-0.0133	-0.0299*	-0.0030	-0.0115	-0.0056	-0.0187***	0.0069	-0.0024	N/A
	(0.0050)	(0.0104)	(0.0140)	(0.0113)	(0.0123)	(0.0124)	(0.0117)	(0.0154)	(0.0094)	(0.0123)	(0.0175)	(0.0057)	(0.0183)	(0.0085)	N/A
r	-0.0127*	0.0117	-0.0280*	-0.0144	-0.0095	-0.0019	-0.0090	-0.0496***	-0.0004	-0.0024	-0.0168	-0.0076	0.0196	-0.0278	N/A
	(0.0067)	(0.0076)	(0.0147)	(0.0152)	(0.0218)	(0.0184)	(0.0117)	(0.0188)	(0.0177)	(0.0104)	(0.0204)	(0.0092)	(0.0137)	(0.0188)	N/A
Lagged gap	0.0158**	-0.0242*	-0.0327	0.0420	0.0384	0.0293	0.0136	0.0586***	-0.0001	0.0179	0.0141	0.0220	-0.0581*	0.0559**	N/A
	(0.0075)	(0.0125)	(0.0249)	(0.0353)	(0.0330)	(0.0339)	(0.0180)	(0.0231)	(0.0222)	(0.0280)	(0.0317)	(0.0185)	(0.0342)	(0.0252)	N/A
Asymmetry dummy	0.0320	0.1491***	0.2046*	-0.0337	-0.2042	-0.1220	-0.0238	-0.6088*	-0.1425	-0.0350	-0.0952	0.1944	-0.7772***	-0.3449***	N/A
	(0.0784)	(0.0343)	(0.1109)	(0.1233)	(0.1823)	(0.1195)	(0.0463)	(0.3257)	(0.1216)	(0.0945)	(0.1096)	(0.1230)	(0.1957)	(0.1098)	N/A
Germany dummy	-0.0314						0.0293								
	(0.0280)						(0.0405)								
R^2	0.9165	0.9881	0.9365	0.9488	0.9288	0.9105	0.9805	0.9806	0.9455	0.9727	0.9188	0.9616	0.9298	0.9589	

Note: The estimated coefficients are followed by ***, **, and * to denote statistical significance at 1%, 5%, and 10% significance level respectively. Robust standard errors are reported in parentheses. For 3SLS, pseudo R^2 reported.
Source: Author's own calculation

Appendix 7. Coefficients Estimation Results for Equation (2) (cont.)

Coefficient Estimation for Equation (2)

	Panel	Austria	Belgium	Denmark	Finland	France	Germany	Greece	Ireland	Italy	Netherlands	Portugal	Spain	Sweden	UK
Panel B: 3SLS															
debt60	-0.4610**	0.2152	-0.2027	0.1469	-0.0596	-0.2680	-0.0650	1.8283	0.4844	-0.1783	-0.0801	-0.6289***	-0.7447	-0.4715	N/A
	(0.2024)	(0.2598)	(0.1284)	(0.1273)	(0.2816)	(0.3049)	(0.1333)	(2.0167)	(0.3826)	(0.2086)	(0.0827)	(0.2139)	(0.9805)	(0.3881)	N/A
gap	0.5043***	0.5297***	0.5108***	0.5670***	0.5265***	0.4789***	0.5362***	0.9520***	0.3129***	0.4915***	0.7207***	0.2776***	0.6216***	0.5870***	N/A
	(0.0284)	(0.0200)	(0.0485)	(0.0667)	(0.0648)	(0.0873)	(0.0282)	(0.2605)	(0.0408)	(0.0368)	(0.0675)	(0.0434)	(0.0748)	(0.0391)	N/A
FD-Gov. size	-0.0116	0.0004	0.0093*	-0.0135	-0.0650**	0.0103	-0.0108*	-0.0003	-0.0101	-0.0035	-0.0059	-0.0543***	0.01941	0.0133**	N/A
	(0.0288)	(0.0181)	(0.0056)	(0.0193)	(0.0320)	(0.0086)	(0.0058)	(0.0636)	(0.1272)	(0.0140)	(0.0173)	(0.0186)	(0.0334)	(0.0170)	N/A
π	-0.0522*	0.0502	-0.0380	0.0186	0.0723***	-0.0582	0.0231	0.1613	0.0164	-0.0157	-0.0140	-0.0386**	-0.0041	0.0133	N/A
	(0.0308)	(0.0441)	(0.0244)	(0.0260)	(0.0269)	(0.0622)	(0.0256)	(0.1272)	(0.1097)	(0.0268)	(0.0507)	(0.0180)	(0.0966)	(0.0108)	N/A
r	-0.1702***	0.0724	-0.0866***	-0.0380	0.0229	-0.0599	-0.0445	0.1391	-0.1084	-0.0307	-0.0466*	-0.0218	-0.0452	-0.0159	N/A
	(0.0653)	(0.1211)	(0.0277)	(0.0501)	(0.0477)	(0.0530)	(0.0359)	(0.1529)	(0.1576)	(0.0264)	(0.0287)	(0.0344)	(0.0966)	(0.1173)	N/A
Lagged gap	-0.0354	-0.0233	-0.0660**	0.0205	0.0300	0.0368	-0.0134	-0.1976	0.0447	-0.1764	0.0047	0.0229	-0.1102	0.0430	N/A
	(0.0291)	(0.0297)	(0.0313)	(0.0261)	(0.0338)	(0.0383)	(0.02059)	(0.1663)	(0.0911)	(0.2070)	(0.0240)	(0.0243)	(0.0872)	(0.0341)	N/A
Asymmetry dummy	-0.1145	0.0954	0.2081*	-0.1763	-0.3141	-0.0825	-0.0933*	-3.411**	0.6558	-0.1672	-0.3058	0.2822	-0.7410*	-0.4169***	N/A
	(0.1221)	(0.0973)	(0.1176)	(0.2269)	(0.2048)	(0.1522)	(0.0544)	(1.3871)	(1.5167)	(0.1183)	(0.1947)	(0.1769)	(0.4254)	(0.1110)	N/A
Germany dummy	0.1101*						-0.0290								
	(0.0602)						(0.0588)								
R^2	0.7977	0.9470	0.9141	0.9452	0.9216	0.8923	0.9737	0.9738	0.7309	0.8709	0.9107	0.9564	0.9172	0.9549	

Note: The estimated coefficients are followed by ***, **, and * to denote statistical significance at 1%, 5%, and 10% significance level respectively. Robust standard errors are reported in parentheses. For 3SLS, pseudo R^2 reported.
Source: Author's own calculation