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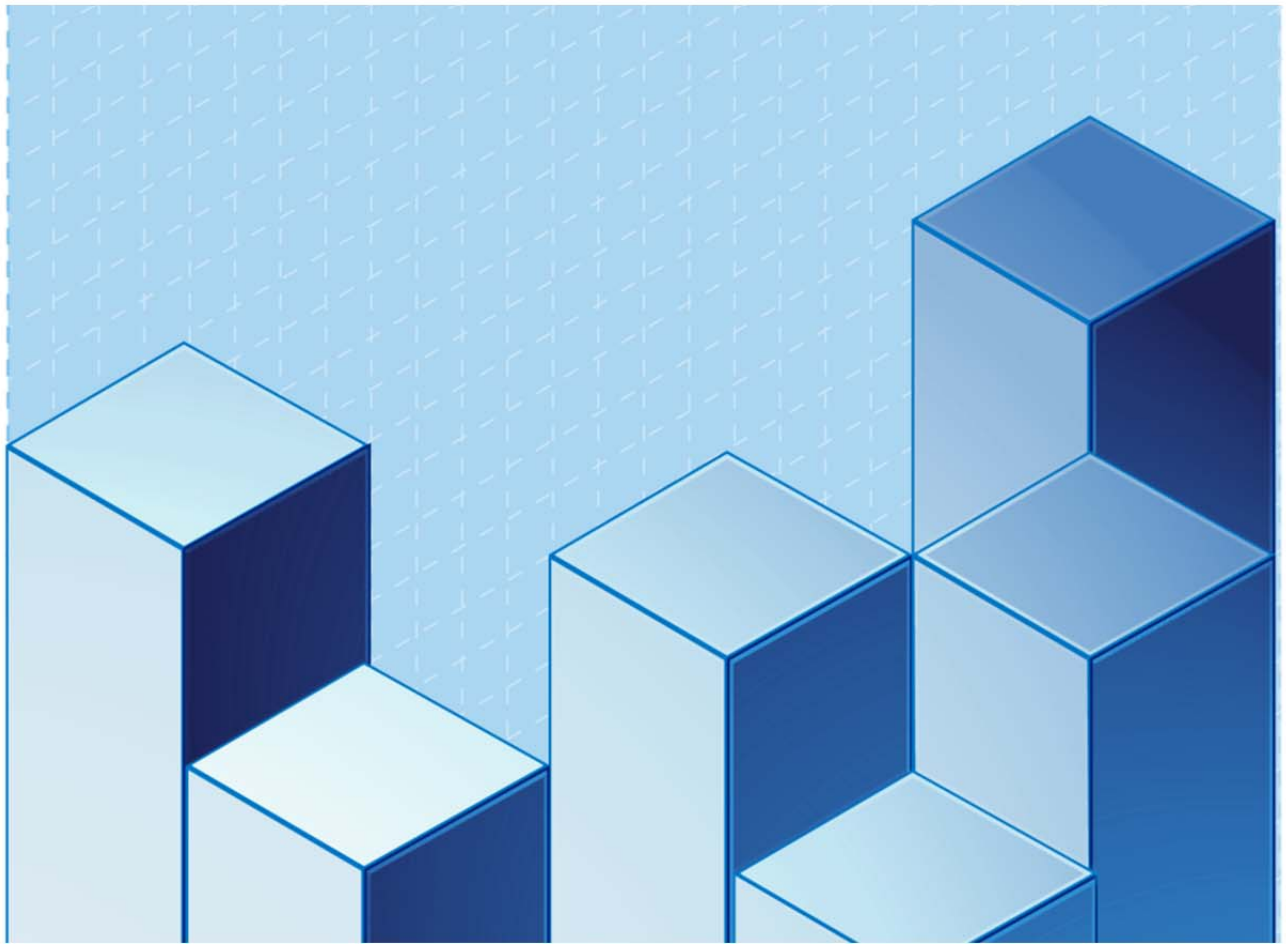

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THE LONG-RUN EFFECT OF FISCAL CONSOLIDATION ON ECONOMIC GROWTH: EVIDENCE FROM QUANTITATIVE CASE STUDIES*

Mischa Kleis
Marc-Daniel Moessinger **

Abstract

We contribute to the literature on the long-run effect of fiscal consolidation on economic growth by applying a novel method for quantitative case studies. Relying on a qualitative (narrative) definition of fiscal consolidations based on an examination of historical policy documents and using the synthetic control method (SCM), we investigate the evolution of post-consolidation trajectories of economic growth in six case studies of OECD countries. In contrast to recent studies that reject the hypothesis of non-Keynesian effects, our results do not offer clear-cut evidence on the long-run effect of fiscal consolidation on economic growth. Half of the case studies point to a positive effect with the other half indicating a negative effect on economic growth trajectories. We further do not find a specific effect of the strength of the fiscal adjustment and the type of consolidation, i.e., whether the consolidation is rather based on expenditure cuts or revenue increases.

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1. Introduction

The budgetary problems in many European countries which emerged as a consequence of the financial and economic crisis directly point towards the need of fiscal consolidation. However, due to the economic recession, also the implementation of growth enhancing (or, at least, growth preserving policies) looms large. Given this trade-off, the austerity debate centers around the question whether fiscal consolidation undermines the prospects for (long-run) economic growth (see, for instance, the most recent contributions by Alesina et al. (2015), Bilbao-Ubillos and Fernandez-Sainz (2014), Guajardo et al. (2014), Hernández de Cos and Moral-Benito (2013), and Yang et al. (2015)).

In order to understand the long-run effects of fiscal consolidation on economic growth, one strategy is to compare economic growth in several consolidation episodes with economic growth in those episodes without consolidation. This investigation, however, would not deliver credible insights since the approach could suffer from a selection and/or reverse causality bias. The timing of a consolidation may not be exogenous to economic growth, i.e., it might be the case that a country shifts necessary consolidation policies from a recession to a boom period which would result in a potentially false conclusion of a growth enhancing effect of fiscal consolidation. The opposite effect might be prevalent as well if a deep recession forces a government to consolidate its budget.

To cope with these problems, we ideally need to identify what would have happened in a consolidating country in the absence of a fiscal consolidation. In this setting, the endogenous decision to consolidate is of minor importance because we would compare trajectories of economic growth in the post-consolidation period with and without an implemented fiscal consolidation in the *same* country.

While this comparison is not possible using standard panel estimators without relying on strong and in most cases implausible assumptions, the synthetic control method (SCM) introduced and applied by Abadie and Gardeazabal (2003) and further developed by Abadie et al. (2010, 2015) offers the chance to make this comparison. In a nutshell, this method uses information from other untreated units to construct the exact counterfactual situation. The economic growth trajectory of the estimated synthetic control unit is comparable to the economic growth trajectory of the consolidating country in the pre-treatment period (i.e., before the implementation of a fiscal consolidation) and thus allows for a comparison of the post-consolidation growth effects for the *same* unit of observation.

We apply this method to investigate the long-run effect of fiscal consolidation on economic growth in six case studies of OECD countries during the 1978–2009 period. To qualify for the investigation, each case study country is featured with a sufficient number of pre- as well as post-consolidation periods without consolidation and an adequate donor pool of countries without any fiscal consolidations in the complete period. The fiscal consolidations

in Austria (1996), Belgium (1992), Portugal (1983), Spain (1994), Sweden (1984), and the United Kingdom (1994) fulfill these criteria.

To identify fiscal consolidation periods, we rely on the qualitative definition of fiscal consolidation periods by Devries et al. (2011). The authors use historical policy documents such as budget speeches or budget reports and examine policymakers' intentions at the timing of the implementation of fiscal consolidations to ensure that changes in fiscal variables were primarily motivated by a deficit reduction instead of a response to cyclical or discretionary economic fluctuations. Using this definition, we solve the problem of potential endogeneity and co-treatments of fiscal variables inherent in rather quantitative definitions (see the discussion in section 4.1).

In contrast to recent studies that reject the hypothesis of non-Keynesian effects, our results do not offer clear-cut evidence on the long-run effect of fiscal consolidation on economic growth. Three case studies point to rather positive effects while two case studies indicate a negative effect on economic growth trajectories. The result of the case study in Sweden is not robust and must be discarded. We further do not find an exact pattern concerning the type of fiscal consolidation, i.e., whether the consolidation is primarily revenue or primarily spending based, or concerning the strength of the fiscal adjustment.

Our analysis is organised as follows: In Section 2, we present a brief review of the literature on measuring fiscal adjustments and its effect on economic growth. In Section 3, we explain the synthetic control method and present an overview of possible applications. The procedure of our analysis is explained in Section 4. In Section 5 we present the results of our case studies with a discussion and sensitivity checks being presented in Section 6. Section 7 concludes.

2. Fiscal consolidations and economic growth

2.1. Growth-consolidation theoretical nexus

According to the traditional Keynesian view, fiscal consolidations are expected to depress economic growth. The validity of this implication, however, was early challenged by Feldstein (1982), who provides evidence for a potential reverse and positive impact of spending cuts and tax increases on economic output. Accordingly, fiscal consolidations must not necessarily hamper economic growth but may boost the economy – at least in the short run.

Theoretically, there are two potential channels for these so-called 'expansionary effects' of fiscal consolidations: On the demand side, in particular consumers' expectations and the effect of the consolidation on interest rates are important. Concerning the former, a regime change in fiscal policy today "eliminates the need for larger, maybe much more

disruptive adjustments in the future" (Giavazzi and Pagano, 1990, p. 111). If present tax increases imply that consumers' originally perceived future tax increases will be smaller than expected, current private consumption can increase. The second channel ascribes a reducing effect on sovereigns' risk premia, i.e., if fiscal adjustments are perceived as permanent and successful, real interest rates of government bonds should decrease (Alesina et al., 1998a). If this reduction transfers to a decrease of private consumers ' and firms' real interest rates, private demand components that are sensitive to interest rates can increase (Alesina and Ardagna, 2010).

On the supply side, the channel for expansionary effects is through the labour market in combination with labour unions. The effects, however, are ambiguous and depend on the fiscal adjustment's configuration. On the one hand, if tax revenue is increased, lower net wages induce unions to negotiate on higher pre-tax wages which in the end may squeeze employers' profits and investments. On the other hand, if spending is cut, e.g., through a decrease in government employment, the lower reservation wage may induce union members to demand lower wage increases which may foster firms' profits and private investment (Alesina and Ardagna, 2010).

Starting with Giavazzi and Pagano (1990), who attribute a short-term growth promoting effect to a decrease in government spending by focusing on fiscal adjustments in Ireland and Denmark, economists have been increasingly studying the arisen contradiction of "Keynesian" and "non-Keynesian" effects of fiscal adjustments (for early studies see, inter alia, Giavazzi and Pagano, 1995; McDermott and Wescott, 1996; Alesina and Perotti, 1997; Alesina et al., 1998a). Looking at the effect of the composition of fiscal adjustments on economic output, Alesina et al. (1998b) show that fiscal adjustments positively affect growth if implemented by spending cuts rather than by tax increases. This conclusion is reproduced by the subsequent empirical analyses of Ardagna (2004) and Alesina and Ardagna (2010).

While these studies are primarily based on descriptive and standard regression analyses, another strand of research investigates the impact of fiscal policy shocks on the macroeconomic environment in vector autoregression (VAR) models. Examining panel data of OECD countries, Perotti (1999) finds support in favor of "non-Keynesian" effects for expenditure shocks occurring in times of high government debt or deficit. Results in a similar vein are presented by Alesina et al. (2002). In contrast, Yang et al. (2015) do not find evidence for expansionary effects of fiscal adjustments in a sample of 20 OECD countries. The same pertains for VAR analyses of fiscal indicators in the U.S. by Blanchard and Perotti (2002) and Mountford and Uhlig (2009). Cimadomo et al. (2011) stresses the importance of consumers' expectations for output effects of fiscal adjustments (also see Hebous (2011) for a review on VAR literature on the topic at hand).

2.2. Measuring fiscal consolidation

The literature is further divided by the definition of fiscal adjustment. Two main approaches exist: 1) a quantitative definition based on changes in fiscal indicators and 2) a qualitative definition based on the evaluation of policymakers' intentions and actions (e.g., described in policy documents, the so-called narrative approach). Concerning the former, definitions of fiscal adjustments differ in various dimensions, which we summarise in Table 1. First, thresholds are chosen rather arbitrary. For instance, fiscal consolidations are defined as a 1% or 1.5% improvement of the fiscal indicator in a specific year. Further definitions account for longer lasting consolidation periods, e.g., a 1% improvement in two consecutive years with at least 0.5% improvements per year, a cumulated two year improvement of at least 2% with improvements in each individual year, or an improvement of at least 1.5% in three years with yearly improvements of at least 0.5%. Second, the underlying fiscal indicators differ. While some authors refer to the cyclically adjusted primary balance, other authors focus on the primary balance or base their analysis on unadjusted budget balance data and debt reductions (see Table 1).

In contrast, the qualitative (narrative) approach of identifying fiscal consolidation periods rests on a careful evaluation of policymakers' intentions and actions described in policy documents that are primarily motivated by a deficit reduction. The method was first applied by Romer and Romer in the context of monetary policy (identification of changes in the U.S. federal funds rate, see Romer and Romer, 1989, 2004) and tax policy (identification of size, timing, and motivation of major tax changes, Romer and Romer, 2010).[1] Devries et al. (2011) have compiled a comprehensive dataset on fiscal adjustment episodes. The authors use historical policy documents such as budget speeches or budget reports and examine policymakers' intentions at the timing of the implementation of fiscal consolidations to ensure that changes in fiscal variables were primarily motivated by a deficit reduction instead of a response to cyclical or discretionary economic fluctuations.

While most of the above mentioned studies rely on a quantitative definition of fiscal adjustment, more recent studies increasingly adopt the qualitative (narrative) definition. The majority of these studies discard the hypothesis of 'non-Keynesian' effects. In a descriptive case study of four small, open European economies (Denmark, Ireland, Finland, and Sweden), Perotti (2013, p.351) finds that expansionary effects were primarily driven by depreciations fostering exports whereas his "results cast doubt on some versions of the 'expansionary fiscal consolidations' hypothesis, and on its applicability to many countries in the present circumstances". Applying a VAR model framework, Guajardo et al. (2014) investigate short-term effects of fiscal consolidation on economic activity and find that fiscal consolidation has contractionary effects on economic growth. A similar result is found by

[1] Ramey and Shapiro (1998) also use a narrative approach based on historical accounts and *Business Week* articles to detect policy events that led to military buildups.

Table 1: Overview quantitative definitions of fiscal adjustments

Indicator	Definition and Source
Debt (% GDP)	• reduction in at least 2 consecutive years (Baldacci et al., 2013) • below debt-to-GDP ratio in the last identified period of adjustment after 2 consecutive years (Alesina and Ardagna, 2013) • cumulative reduction larger 4.5% after 3 consecutive years (Alesina and Ardagna, 2010; Bi et al., 2013) • on average 5% below initial level in 3 consecutive years (Alesina et al., 1998a,b; Alesina and Perotti, 1995; Tavares, 2004; Barrios et al., 2010)
Deficit (% GDP)	• on average 2% below initial level in 3 consecutive years (Alesina et al., 1998a,b; Alesina and Perotti, 1995)
Primary balance (% GDP)	• all years of uninterrupted improvement of at least 6.3% (Tsibouris et al., 2006)
Cyclically adjusted primary balance (CAPB, % GDP)	*Individual improvement of* • 0.8% in at least 2 consecutive years (Zaghini, 2001; Feld and Schaltegger, 2009) • 1% in 1 year (Illera and Mulas-Granados, 2008; Feld and Schaltegger, 2009) • 1.2% in 2 consecutive years (Schaltegger and Weder, 2014) • 1.5% in 1 year (Alesina and Perotti, 1997; Alesina et al., 1998b; Gupta et al., 2005; Tavares, 2004; Lambertini and Tavares, 2005; Tagkalakis, 2009; Alesina and Ardagna, 2010; Hernández de Cos and Moral-Benito, 2013; Schaltegger and Weder, 2014) • 1.5% in 2 consecutive years (Alesina et al., 1998a) • 1.6% in 1 year (Zaghini, 2001) • 2% in 1 year (Alesina et al., 1998a) • the average (μ) + standard deviation (σ) of CAPB and no identical deterioration in the following year (Yang et al., 2015) *Cumulative improvement of* • 1% in 3 years (Tavares, 2004) • 2% in 2 years (Alesina and Ardagna, 2013) • 3% in at least 3 years (Alesina and Ardagna, 2013) • non–negative average change after 3 years (Lambertini and Tavares, 2005; Tagkalakis, 2009) • μ (average) + $1/3\sigma$ (standard deviation) of CAPB in the first year and cumulative change is $\mu + 4/3\sigma$ over 2 years or $\mu + 2\sigma$ over 3 or more years (Yang et al., 2015)
CAPB (% potential GDP)	*Individual improvement of* • 1% in 1 year (Ahrend et al., 2006; Guichard et al., 2007) • 1.5% in 1 year (European Commission, 2007; Barrios et al., 2010) *Cumulative improvement of* • 1% in 2 consecutive years with at least 0.5% in the first year (Ahrend et al., 2006) • 1.5% in 3 consecutive years with at least no deterioration in individual years (European Commission, 2007; Barrios et al., 2010) • 2% in 2 consecutive years with at least 0.25% reduction in the first year and overall reduction in debt-to-GDP ratio over the whole adjustment period (Heylen and Everaert, 2000) • 2% in 2 consecutive years with at least 0.25% reduction in the first year (Mierau et al., 2007)
CAPB (% cyclically adjusted GDP)	*Individual improvement of* • 1.25% in 2 consecutive years (von Hagen and Strauch, 2001; von Hagen et al., 2002; Mierau et al., 2007) • 1.5% in 2 consecutive years, surplus in the preceding and in subsequent years (von Hagen and Strauch, 2001; von Hagen et al., 2002; Mierau et al., 2007)

Notes: The table presents an overview of quantitative definitions of fiscal adjustments for various fiscal indicators.

Alesina et al. (2015) who confirm the absence of 'non-Keynesian' effects applying a seemingly unrelated regression model (SUR). The authors emphasise a milder negative effect of fiscal adjustments that are based on spending cuts rather than on revenue increases. Furthermore, the narrative approach serves Jordà and Taylor (2013) to obtain the average treatment effect of fiscal adjustments with a propensity score estimator. The results highlight the importance of economic conditions prior to a fiscal adjustment, suggesting that austerity always depresses economic growth and that the negative effect is even more pronounced if the fiscal adjustment is introduced in an economy facing a recession. Hernández de Cos and Moral-Benito (2013) employ a panel IV estimator and find a negative impact of fiscal adjustments on short-run economic growth independent of the employed definition for fiscal adjustments.

3. Synthetic control method

3.1. Approach description

A major problem when investigating the long-run effects of fiscal consolidation on economic growth is the potential endogeneity of the adjustment decision. It might be the case that governments postpone consolidation efforts into boom phases of the economy, which would result in the potentially false conclusion of a growth enhancing effect of fiscal consolidations. In contrast, if a government starts a fiscal adjustment at the beginning of a recession period, the perceived effect of the adjustment would be negative. To cope with this problem, we ideally should know what would have happened in the consolidating country in the absence of a consolidation, i.e., we are interested in the exact counterfactual situation. In this setting, the timing of the fiscal adjustment with respect to the state of the economy is of minor importance because we compare post-consolidation trajectories of economic growth in the *same* country with and without a fiscal consolidation, i.e., the surrounding circumstances are identical and do not affect the outcome. Put it differently, the only factor that changes in such a setting (i.e., the treatment) is the fiscal adjustment on either the revenue side and/or the expenditure side.

While it is impossible to observe both statuses (treated and untreated) in parallel in reality, a standard approach from quantitative research is to apply the difference-in-difference method, which in a nutshell compares the treated unit with a single untreated but highly comparable unit. The crucial condition of this approach is a common trend of the outcome measure in the pre-treatment period for the treated unit and the control unit. Furthermore, the control unit should not be affected by a treatment itself. The major challenge, however, is the identification of such an adequate control unit. In particular when looking at the effects of fiscal adjustments on economic growth, it is nearly impossible to detect a single country with a more or less comparable economic growth trajectory in the pre-treatment

period, which additionally does not adjust its budget balance over the complete period itself.

The synthetic control method (SCM), which was first introduced and applied by Abadie and Gardeazabal (2003) and further developed by Abadie et al. (2010, 2015), offers a solution to this problem. It does not rely on a single control unit only but bases the comparison on a weighted combination of several control units and predictor variables of the outcome measure that ideally perfectly matches the trajectory of the outcome variable in the pre-treatment period. With respect to the selection of both predictor variables and comparison units, the donor pool should be restricted "to units with outcomes that are thought to be driven by the same structural process as the unit representing the case of interest" (Abadie et al., 2015, p. 497). Furthermore, donor pool units should not be affected by the treatment itself or by similar structural shocks.[2]

The procedure of the SCM comprises two optimisations (Kaul et al., 2015). In the inner optimisation, non-negative weights (summing up to unity) of the control units are chosen. In the outer optimisation, predictor weights are selected such that the pre-treatment predictor characteristics of the treated unit are highly comparable to the predictor characteristics of the synthetic control. Formally, we minimise the distance

$$\|X_1 - X_0 W\|_V = \sqrt{(X_1 - X_0 W)' V (X_1 - X_0 W)} \tag{1}$$

with X_1 being the $(k \times 1)$ vector of the pre-treatment predictor characteristics of the treated unit. X_0 is the $(k \times J)$ matrix of the same predictors for the units in the donor pool, W is the $(J \times 1)$ vector of weights of the synthetic control (i.e., donor pool country weights), and V is a $(k \times k)$ symmetric and positive semidefinite matrix containing predictor weights. We then select W^* and V to solve the two optimisation problems

$$\min_W \sqrt{(X_1 - X_0 W)' V (X_1 - X_0 W)} \tag{2}$$

for the inner optimisation (i.e., the selection of non-negative control unit weights; the solution to this problem is denoted $W^*(V)$) and

$$\min_V \sqrt{(Z_1 - Z_0 W^*(V))' (Z_1 - Z_0 W^*(V))} \tag{3}$$

for the outer optimisation problem (i.e., the selection of predictor weights, see Kaul et al., 2015). Thereby, V is chosen to minimise the root mean squared prediction error (RMSPE) of the outcome variable in the pre-treatment period. For the sake of simplicity, this subset is denoted with Z_1 in case of the treated unit and Z_0 for control units. For further technical

[2] In a recent paper, Kaul et al. (2015) point to biases if all pre-intervention outcomes are used as predictor variables. In our applications, we do not include pre-treatment outcome measures as predictors.

details regarding the method see the formal descriptions by Abadie et al. (2010, 2015) and Billmeier and Nannicini (2013).

3.2. Applications

With respect to applications, since the introduction of the SCM by Abadie and Gardeazabal (2003) in their analysis of the economic consequences of the terrorist conflict in the Basque country, the approach has been applied in various disciplines of economic research, including public economics (see Bauhoff, 2014; Campos and Kinoshita, 2010), financial economics (see Acemoglu et al., 2013), international economics and finance (see Jinjarak et al., 2013; Jorra, 2011; Sanso-Navarro, 2011), environmental economics (see Coffman and Noy, 2012), labour and demographic economics (see Liu, 2015), monetary economics (see Lee, 2010) as well as law and economics (see Pinotti, 2012).

This broad scope of applications brings along a range of distinct events and policy interventions constituting the investigated treatments. While Abadie et al. (2010) address the implementation of the Californian tobacco control program in 1988 and its impact on cigarette sales, Abadie et al. (2015) study the effects of the German reunification on West Germany's economic development. An investigation of the consequences of the Legal Arizona Workers Act of 2007 on the unauthorised immigrant population of Arizona is provided by Bohn et al. (2014). Furthermore, Köhler and König (2015) investigate whether the introduction of the Stability and Growth Pact in the European Union in 1999 has limited public debt. Hinrichs (2012) defines an affirmative action ban in California as the treatment to study in how far the ban affects educational and demographical outcomes on the university level. The impact of preferential tax rates for foreigners on international mobility is the focus of Kleven et al. (2013), while Moser (2005) considers the effects of patent laws on innovation. Further applications referring to policy interventions are Billmeier and Nannicini (2013) and Nannicini and Billmeier (2011), who study the economic consequences of liberalisation and trade openness. In contrast, Cavallo et al. (2013) do not utilise a policy intervention but investigate the effect of a catastrophic natural disaster on economic development. In a similar manner, Montalvo (2011) examines how terrorist attacks affect election outcomes.

4. Procedure

4.1. Definition of fiscal consolidation episodes

In order to identify events for our case studies, we need to define fiscal consolidation episodes. As discussed in section 2.2, the literature distinguishes between a quantitative definition based on changes in fiscal indicators and a qualitative (narrative) definition based on the

evaluation of policy documents.

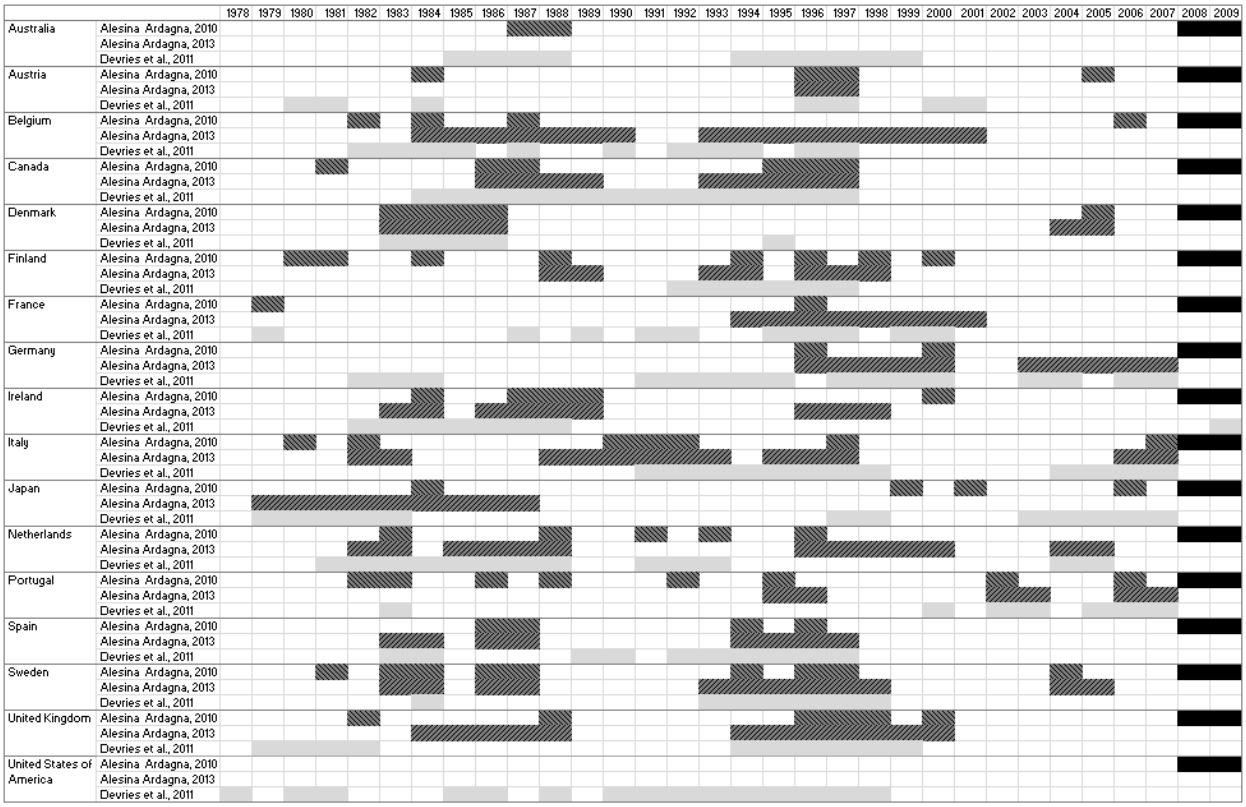
While both definitions come to rather comparable conclusions regarding the magnitude of identified fiscal consolidations in an adequate number of cases (see the comparison by Guajardo et al., 2014, p. 956), large differences occur for the length and the timing of fiscal consolidation periods in particular countries. As an example, in Figure 1, we compare the identified periods for both the quantitative definitions by Alesina and Ardagna (2010) and Alesina and Ardagna (2013)[3] and the qualitative definition by Devries et al. (2011) for various OECD countries in the 1978–2009 period. While there are perfect overlaps in identified periods between the two approaches, e.g., in Denmark (1983–1986) or Austria (1996–1997), identified periods, e.g., in Japan, the United Kingdom, and Finland are highly diverse. This also pertains within quantitative definitions, see, for instance, differences in quantitatively defined periods in Belgium, France, and Portugal. Taken together, due to arbitrarily defined thresholds, the length and the start of quantitatively defined fiscal consolidations differ enormously.

Another caveat when defining fiscal consolidation episodes with the quantitative approach concerns potential endogeneity and potential co-treatments of fiscal variables. For instance, tax increases or spending cuts might be the result of a government's discretionary decision because of the risk of an overheating of the economy. However, defining these adjustments as fiscal consolidation episodes would result in a reverse causality bias implying expansionary effects of fiscal consolidation. Furthermore, changes in fiscal variables might be driven by other economic developments that affect economic output such as a boom in the stock market, which may lead to tax increases that are not the result of fiscal consolidation efforts (Guajardo et al., 2014).

Nonetheless, it is important to note that the qualitative approach may also suffer from problems. Using Granger causality tests, Hernández de Cos and Moral-Benito (2015, p. 7) point to the caveat "that narrative adjustments based on spending cuts can indeed be predicted from past realizations of GDP growth, investment, and consumer confidence indicators." Their results suggest that fiscal consolidations are implemented after a period of weak economic growth. Narratively defined revenue based consolidations, in contrast, seem to be exogenous. However, compared to the caveat of a potential misspecification of fiscal consolidations (see above), this caveat seems to be of minor importance (especially regarding the application of the SCM, which compares the post-consolidation economic growth

[3] These definitions are most commonly used by other authors, see Table 1. Fiscal consolidations are either defined as a "*year in which the cyclically adjusted primary balance improves (deteriorates) by at least 1.5 percent of GDP*" (Alesina and Ardagna, 2010, p. 8) or "*1) a two year period in which the cyclically adjusted primary balance/GDP improves in each year and the cumulative improvement is at least two points of the balance/GDP ratio; 2) a three or more year period in which the cyclically adjusted primary balance over GDP improves in each year and the cumulative improvement is at least three points of the balance/GDP ratio*" (Alesina and Ardagna, 2013, p. 5f).

Figure 1: Overview of fiscal consolidation periods: quantitative vs. qualitative definitions



Notes: The figure contrasts fiscal consolidation episodes based on the quantitative definition by Alesina and Ardagna (2010, i.e., cyclically adjusted primary balance improves by at least 1.5 percent of GDP) and Alesina and Ardagna (2013, i.e., either a two year period in which the cyclically adjusted primary balance/GDP improves in each year and the cumulative improvement is at least two points of the balance/GDP ratio or a three or more year period in which the cyclically adjusted primary balance over GDP improves in each year and the cumulative improvement is at least three points of the balance/GDP ratio) with fiscal consolidation periods based on the qualitative (narrative) definition by Devries et al. (2011). Dark grey coloured and lined (light grey coloured) squares mark fiscal consolidations based on the quantitative (qualitative) approach; black coloured squares indicate that no information is available.

trajectories for the consolidating country and its exact counterfactual).[4] We therefore base our investigation on the qualitative definition of fiscal consolidation periods by Devries et al. (2011).

The dataset comprises information on 173 consolidation episodes for 17 OECD countries in the 1978–2009 period. The authors use historical policy documents such as budget speeches or budget reports and examine the policymakers' intentions at the timing of the implementation of fiscal consolidations to ensure that changes in fiscal variables were primarily motivated by a deficit reduction instead of a response to cyclical or discretionary economic fluctuations. All policy actions that aim at a reduction of the budget deficit are recorded. However, if the fiscal consolidation "is offset by fiscal actions not primarily motivated by cyclical fluctuations, such as a tax cut motivated by long-run supply-side considerations" (Devries et al., 2011, p. 5), the authors compute the sum of both actions and only include

[4] Furthermore, the results by Riera-Crichton et al. (forthcoming) speak in favor of the application of the narrative approach to identify true exogenous shocks compared to SVAR estimates.

the episode if the overall effect reduces the deficit. In contrast, if a fiscal consolidation effort is offset by an adverse shock that hits the economy, the period is included in the database. Taken together, while there must be an overall deficit reducing effect without controlling for policy measures aimed at cyclical fluctuations, the implemented policy action must not necessarily be effective in case of adverse shocks. Furthermore, if policy actions were announced but not implemented, the respective periods were not included in the database (see Devries et al., 2011, p. 4ff).

4.2. Selection of case studies and of the donor pool

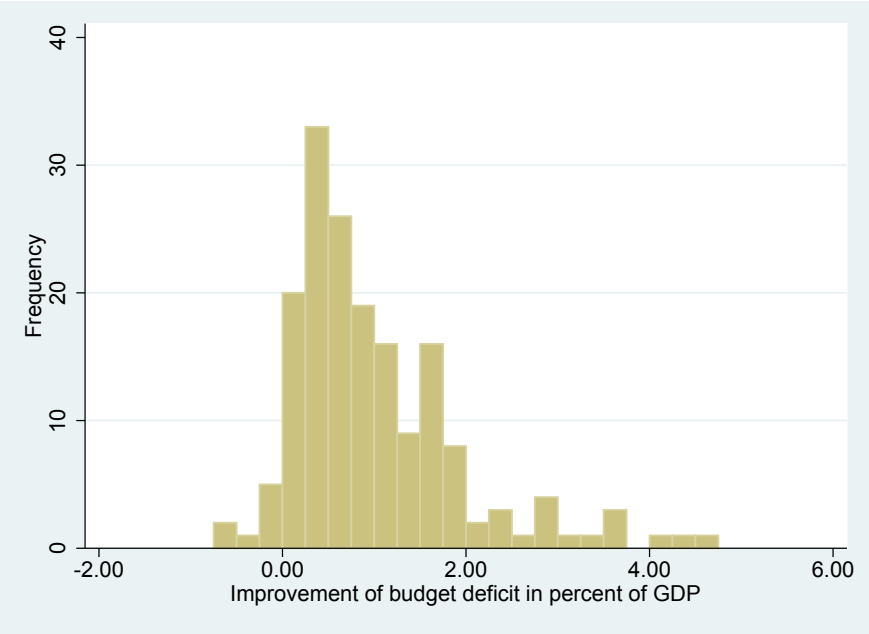
The selection of suitable case study countries for the application of the SCM is guided by two principles: 1) the consolidating country is featured with a sufficient number of pre- as well as post-treatment periods without consolidation and 2) there is an adequate donor pool of countries without fiscal consolidations in the complete period. Taking account of these presets, the full set of qualitatively identified fiscal consolidation periods renders the application of the SCM infeasible, i.e., the donor pool for each possible case study country is too small.[5] However, consolidation efforts are not equally distributed within and across countries. While there are only minor improvements in the budget deficit to GDP ratio in Japan and the USA, Italy (1993, improvement of 4.49 percent of GDP) as well as Belgium (1987) and Ireland (1987, both with a budgetary improvement of 2.8 percent of GDP) heavily engaged in tax hikes and expenditure cuts, respectively (see the qualitative definitions by Devries et al. (2011) in Figure 1).

Figure 2 shows the complete distribution of consolidation efforts in percent of GDP. The median improvement of the budget deficit is 0.74 percent of GDP with the threshold for the 75%-quartile being equal to 1.47. Taken together, the sample is characterised with many but rather small consolidation policies. As a result, we concentrate our analysis on large fiscal adjustments and adjust the sample to the top 50% or the top 25% of the distribution of fiscal consolidation efforts. The identified consolidation episodes of this adjusted sample are presented in Figure 3.

Using this sample, we identify those fiscal consolidation episodes that principally qualify for deeper analyses, i.e., the consolidating countries are denoted by a sufficient number of pre- as well as post-treatment periods without consolidation and an adequate number of countries to construct the synthetic control group. Based on the top 50% sample we detected Australia (1986), France (1996), Germany (1982), Japan (1997), the Netherlands (2004), Portugal (1983), Sweden (1984), Spain (1983, 1989), the United Kingdom (1981, 1994), and the USA (1988, 1994). The top 25% sample additionally includes Austria (1996),

[5] For instance, in the case of the fiscal consolidation in Portugal 1983, only Italy and Denmark would qualify as possible control units because these two countries are the only countries without any fiscal consolidation in the first years before and after 1983 (see Figure 1).

Figure 2: Distribution of fiscal consolidation efforts



Notes: The figure presents the distribution of fiscal consolidation efforts (expressed as an improvement of the budget deficit in percent of GDP) of the qualitative definition by Devries et al. (2011) on a yearly basis. The median improvement is 0.74 percent of GDP; the threshold for the 75%-quartile is 1.47.

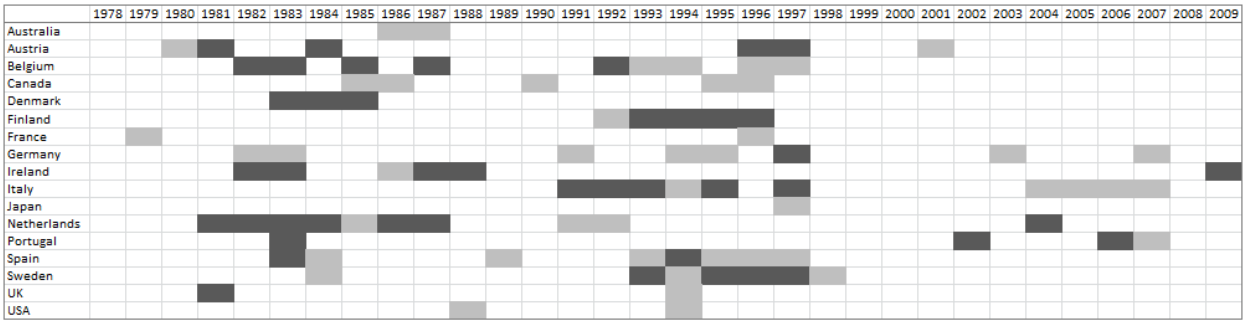
Belgium (1992), Denmark (1983), Finland (1993), Germany (1997), Ireland (1982, 1987), and Spain (1994).

However, some of these fiscal consolidations cannot be used for a quantitative case study either. While the application of the SCM in combination with the narrative definition of fiscal consolidation episodes resolves potential reverse causality and selection biases, the analyses still could be flawed due to parallel confounding events. As Abadie et al. (2015, p. 497) state, the donor pool should be restricted to countries "that were not subject to structural shocks to the outcome variable during the sample period of the study". However, the German reunification in line with the fall of the Iron Curtain in 1989 can be assumed as such a structural shock. Accordingly, we cannot directly trace back changes in economic growth to fiscal consolidations only, which renders the application of the SCM in case of Spain (1989), the USA (1988), and Ireland (1987) inappropriate. Another example is the outbreak of the Asian crisis in 1997, which leads to the exclusion of the case study in Japan.[6] Finally, the fiscal consolidation in the Netherlands is particularly close to the outbreak of the financial and economic crisis and thus does not serve as a suitable case study.[7]

[6] We further exclude Japan from the donor pool of other case studies if the regarded time period includes the Asian crisis.

[7] We also exclude the case studies in the USA and France due to the parallel 1994 (USA) and 1998 (France) Soccer World Cups. We also had to drop possible case studies where we could not attain an appropriate fit between the economic growth trajectory of the treated and the synthetic unit in the pre-treatment period.

Figure 3: Overview of top 50% and top 25% of fiscal consolidation periods based on the qualitative definition by Devries et al. (2011)



Notes: The figure presents the top 50% (light *and* dark grey coloured squares, threshold budgetary improvement of 0.74% GDP) and the top 25% (only dark grey coloured squares, threshold budgetary improvement of 1.47% GDP) of fiscal consolidation episodes based on the qualitative definition by Devries et al. (2011).

Table 2: Selection of case studies and donor pool

Case study	Year	Adjustment (spending/revenue)	Sample	Donor Pool
Austria	1996	2.41% GDP (63/37)	Top 25%	Australia, Canada, Denmark, France, (Ireland), the Netherlands, Portugal, UK, USA
Belgium	1992	1.79% GDP (45/55)	Top 25%	Australia, Canada, Denmark, France, Germany, the Netherlands, Portugal, UK, USA
Portugal	1983	2.30% GDP (41/59)	Top 25%	Australia, Canada, Finland, France, (Germany), Italy, Japan, Sweden, USA
Spain	1994	1.60% GDP (100/0)	Top 25%	Australia, Canada, Denmark, France, Ireland, the Netherlands, Portugal, UK, USA
Sweden	1984	0.90% GDP (77/23)	Top 50%	Finland, France, Italy, Japan, USA
United Kingdom	1994	0.83% GDP (18/82)	Top 50%	Australia, Denmark, (Ireland), Portugal

Notes: The table shows the selected case studies and their respective donor pool for the application of the SCM based on the adjusted sample (see Figure 3). Countries in parenthesis are excluded due to missing values for the dependent or predictor variables. Japan is not included in the donor pool if the regarded period includes the Asian crisis.

Table 2 presents an overview of the selected case studies and the corresponding donor pools.

4.3. Application of synthetic control method

We compile a comprehensive panel of various predictors of economic growth for the 1978–2009 period for all countries listed in Figure 1. With the exception of Worldbank data on education, all data were downloaded from OECD Statistics. In particular, we include information on *real GDP growth*, *inflation*, *unemployment rate*, *terms of trade growth*, *gross fixed capital formation per capita growth*, *general government consumption expenditure per capita growth*, *employment in agriculture, industry* and *service*, *life expectancy*, *population growth*, *enrollment in primary* and *secondary school* and the *working age fraction*. Table A.1 in the appendix presents an overview of all variables, sources, and codings.

To investigate the long-run effect of fiscal consolidation on economic growth, we use the

cumulated growth rate of real GDP as outcome variable. The application of (purchasing power parity adjusted) GDP per capita or annual GDP growth rates is inappropriate because both measures do not offer insights into long-run growth effects. Furthermore, the volatility is too high to attain satisfying fits between the treated unit and the synthetic control unit in the pre-treatment period.

The general procedure for the application of the SCM is as follows: For the baseline specification we only focus on the 'root mean squared prediction error' (RMSPE), i.e., we search for the combination of donor countries and predictor variables that minimises the RMSPE (see the results in section 5).[8] In the sensitivity analysis, we additionally focus on mean figures of predictor variables. Assuming that a sizeable mismatch between average values interferes the explanatory power of the respective predictor, we exclude predictors with large deviations from the model. These alternative specifications are presented in section 6.

5. Baseline results

We present results for each individual case study in the following. For each study, we first include a brief description of the fiscal consolidation efforts based on Devries et al. (2011). Second, we present the graphical comparison of the treated unit with the synthetic control unit and derive conclusions. Those graphs additionally include information on the amount of fiscal adjustment and its distribution on the revenue and expenditure side, a comparison of the pre-treatment average values between the treated unit and its synthetic control group, information on predictor and country weights, as well as the corresponding figure of the root mean squared prediction error (RMSPE).

5.1. Austria 1996

The fiscal consolidation in Austria 1996 is composed of spending cuts amounting to 1.53% GDP and tax increases equal to 0.88% GDP (Devries et al., 2011, p. 15). The total budgetary improvement of the fiscal adjustment is 2.41% GDP.

In a nutshell, the results reveal a negative impact of the fiscal consolidation (see Figure 4). Without consolidation, Austria would have followed a higher economic growth trajectory. In the first four years after the fiscal consolidation, the growth difference amounts to approximately 2.5 percentage points, which further increases in the beginning of the new century.

[8] We use the STATA *synth* package provided by Abadie et al. (2015) with the *nested* and *allopt* options.

5.2. Belgium 1992

The fiscal consolidation in Belgium 1992 comprised spending cuts of 0.80% GDP and tax increases of 0.99% GDP, resulting in a budgetary improvement amounting to 1.79% GDP (Devries et al., 2011, p. 18). The effects on economic growth are presented in Figure 5.

As for Austria, the fiscal consolidation in Belgium points towards long-run negative consequences. While there were recessionary tendencies in the immediate aftermath of the implemented fiscal consolidation in 1992, Belgium's economy again strengthened and accomplished an increasing cumulative growth trajectory of real GDP. However, according to the evolution of economic growth of the synthetic Belgium without consolidation, Belgium did not achieve the economic growth trajectory which would have been possible without fiscal consolidation. After eight years, the cumulated difference is equal to approximately 8 percentage points.

5.3. Portugal 1983

The fiscal consolidation in Portugal 1983 is composed of spending cuts amounting to 0.95% GDP and tax increases equal to 1.35% GDP (Devries et al., 2011, p. 65). The total effect was a budgetary improvement of 2.3% GDP, implying a rather large scale fiscal consolidation (i.e., the consolidation is among the top 10% of all consolidations).

In a nutshell, the results can be summarised as 'short-term losses vs. long-term gains' (see Figure 6). While there was a slump in Portuguese growth of real GDP directly after the fiscal consolidation, the economy became stronger and stronger and the cumulated growth rate outpaced the counterfactual economic growth without consolidation in 1987. Approximately four years after the consolidation, Portugal achieved a higher growth trajectory than in the absence of consolidation.

5.4. Spain 1994

The fiscal consolidation in Spain 1994 resulted in a budgetary improvement of 1.60% GDP, achieved by spending cuts only (Devries et al., 2011, p. 71).

The result indicates a GDP growth supporting effect of austerity, which is even more pronounced in the medium- and in the long-term (see Figure 7). Directly after the fiscal consolidation, Spain achieved a higher growth of real GDP than in the counterfactual situation without consolidation. Around 1997, the Spanish economy gained additional momentum, which further widened the gap. Overall, due to the fiscal consolidation, Spain achieved a higher economic growth trajectory compared to the counterfactual situation without fiscal consolidation.

5.5. Sweden 1984

The fiscal consolidation in Sweden 1984 was characterised by spending cuts amounting to 0.69% GDP and tax increases equal to 0.21% GDP (Devries et al., 2011, p. 72). This budgetary improvement was equal to 0.90% GDP.

The results suggest a higher economic growth trajectory after the implementation of the fiscal consolidation in 1984 (see Figure 8). However, the results must be treated with caution because of the rather poor match of the economic growth trajectories in the pre-treatment period. This also displays in the rather high RMSPE, especially compared to the RMSPE figures of the case studies in Austria, Belgium, Portugal, and Spain.

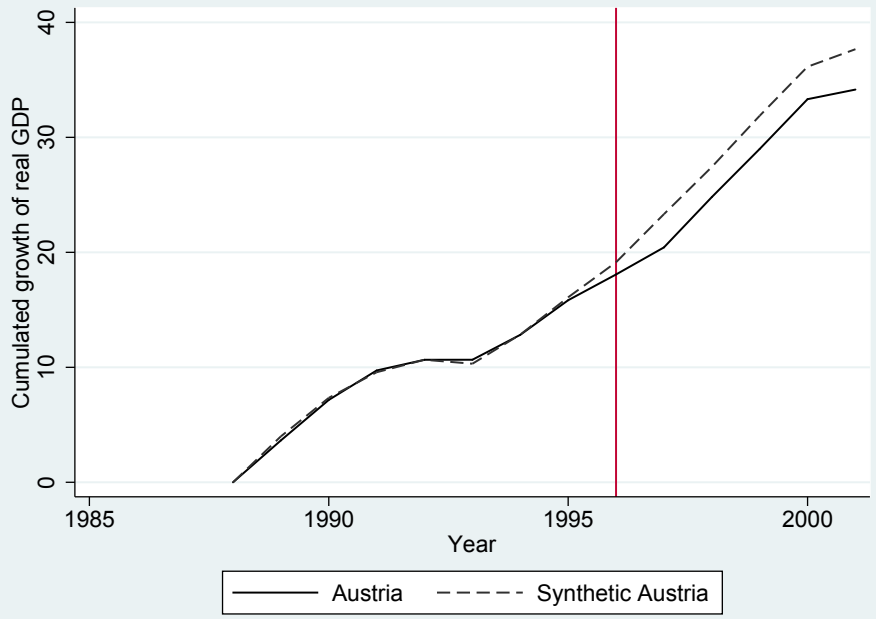
5.6. United Kingdom 1994

The fiscal consolidation in the United Kingdom 1994 covered spending cuts amounting to 0.15% GDP and tax increases in the amount of 0.68% GDP (Devries et al., 2011, p. 76). The total budgetary improvement added up to 0.83% GDP.

The results reveal only minor differences in the post consolidation economic growth trajectories between the United Kingdom and its synthetic control (see Figure 9). Nonetheless, the UK achieved a higher growth trajectory in the aftermath of the fiscal consolidation compared to the counterfactual situation without fiscal consolidation, i.e., in the complete post-consolidation period, the growth trajectory was higher than it would have been without consolidation.

Figure 4: Fiscal consolidation in Austria 1996

Adjustment 2.41% GDP (63% spending cuts and 37% revenue increases)



Selected Variables	Austria	Synthetic	Weight
Consumption exp. (p.c.) growth	5.58	6.58	1.62%
Employment in industry	35.57	27.08	0.59%
Employment in service	56.92	66.21	5.55%
Gross fixed capital (p.c.) growth	5.66	4.88	31.79%
Inflation	2.98	3.76	35.19%
Life expectancy	75.93	76.43	12.67%
Population growth	0.61	0.45	5.25%
School enrollment in primary school	101.30	106.80	0.78%
Terms of trade growth	-0.05	0.44	3.67%
Working age fraction	46.73	48.49	2.83%

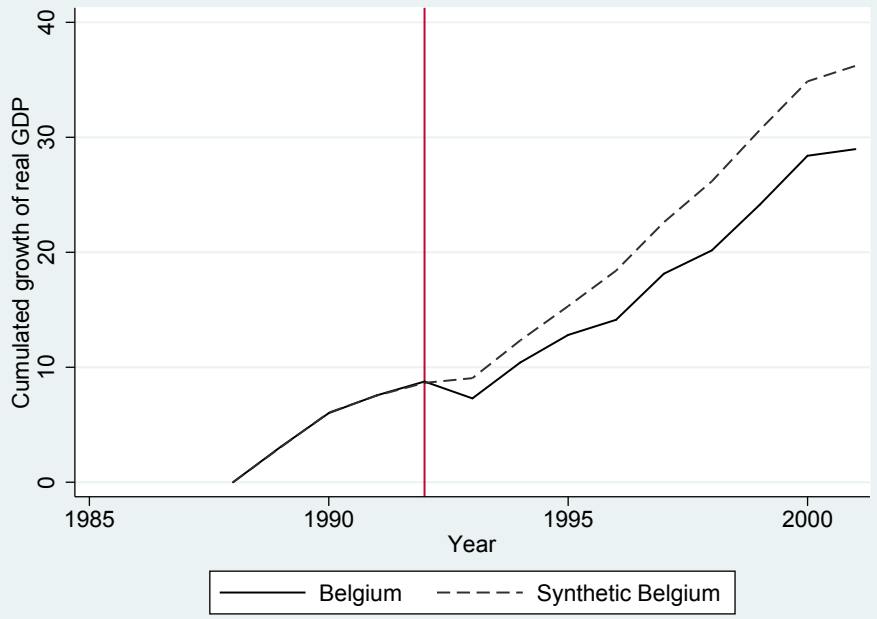
Selected countries and weights:
Denmark (12.3%), France (11.2%), Netherlands (56.3%), Portugal (20.2%)

Root Mean Squared Prediction Error (RMSPE): 0.213

Notes: The table shows the pre-treatment average values for the predictor variables for Austria, the synthetic Austria and the variable weight allocated by the SCM.

Figure 5: Fiscal consolidation in Belgium 1992

Adjustment 1.79% GDP (45% spending cuts and 55% revenue increases)



Selected Variables	Belgium	Synthetic	Weight
Employment in agriculture	2.72	4.82	13.46%
Employment in industry	28.30	26.45	0.70%
Employment in service	68.97	68.70	11.09%
Inflation	2.72	2.36	14.76%
Life expectancy	75.95	76.52	0.34%
School enrollment in primary school	100.53	102.09	55.87%
Terms of trade growth	0.52	0.08	0.64%
Unemployment rate	7.30	6.33	0.72%
Working age fraction	42.36	49.15	2.35%

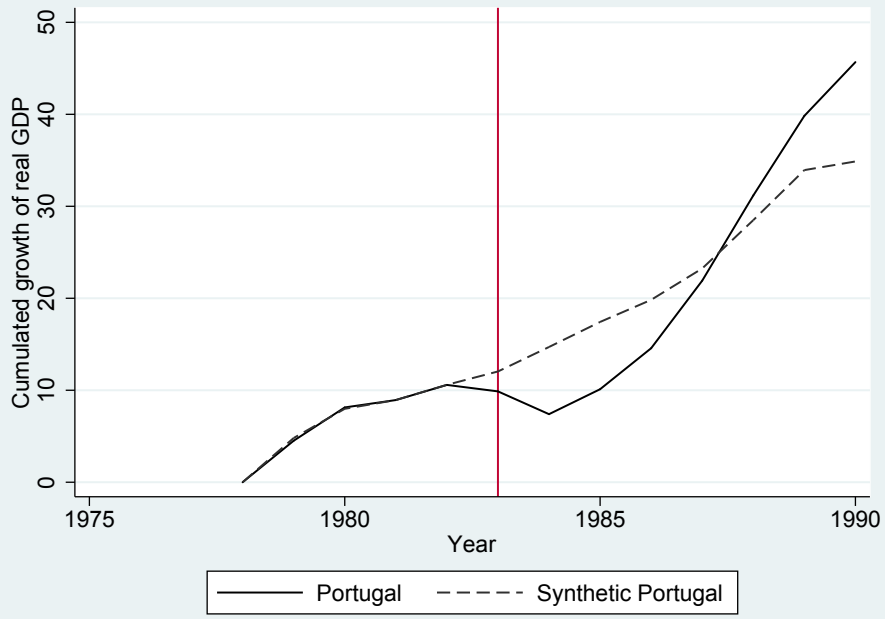
Selected countries and weights:
Denmark (22.8%), Netherlands (73.5%), United States (3.8%)

Root Mean Squared Prediction Error (RMSPE): 0.031

Notes: The table shows the pre-treatment average values for the predictor variables for Belgium, the synthetic Belgium and the variable weight allocated by the SCM.

Figure 6: Fiscal consolidation in Portugal 1983

Adjustment 2.30% GDP (41% spending cuts and 59% revenue increases)



Selected Variables	Portugal	Synthetic	Weight
Consumption exp. (p.c.) growth	24.61	14.77	0.56%
Employment in agriculture	28.06	11.07	17.17%
Employment in industry	36.20	34.70	2.84%
Life expectancy	71.48	74.02	46.75%
Population growth	0.96	0.52	0.29%
School enrollment in primary school	120.94	102.75	22.57%
Terms of trade growth	-1.57	-1.90	8.96%
Unemployment rate	8.32	5.60	0.80%
Working age fraction	43.96	46.91	0.04%

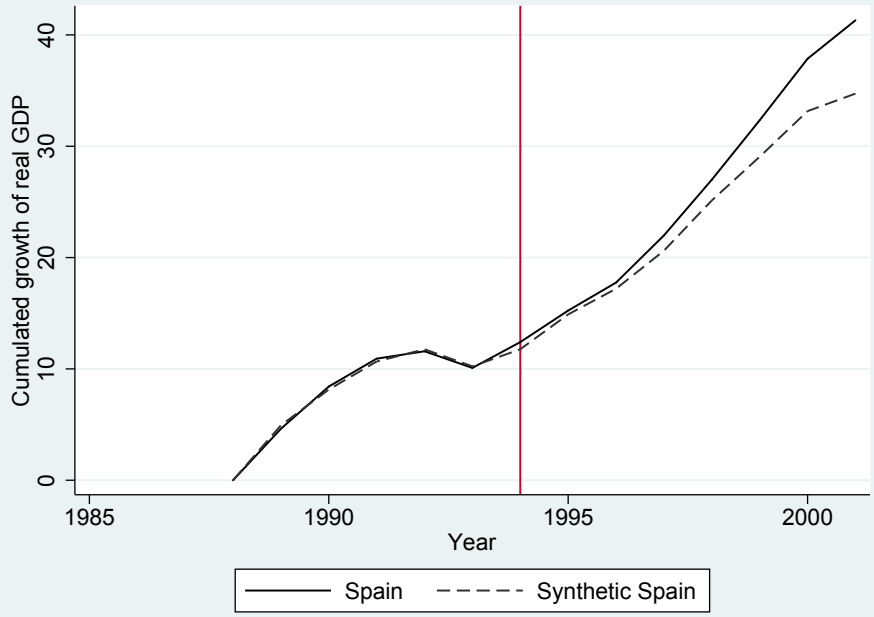
Selected countries and weights:
Australia (11.7%), Finland (45.4%), France (34.4%), Italy (8.5%)

Root Mean Squared Prediction Error (RMSPE): 0.148

Notes: The table shows the pre-treatment average values of the predictor variables for Portugal, the synthetic Portugal as well as the variable and selected country weights allocated by the SCM.

Figure 7: Fiscal consolidation in Spain 1994

Adjustment 1.60% GDP (100% spending cuts and 0% revenue increases)



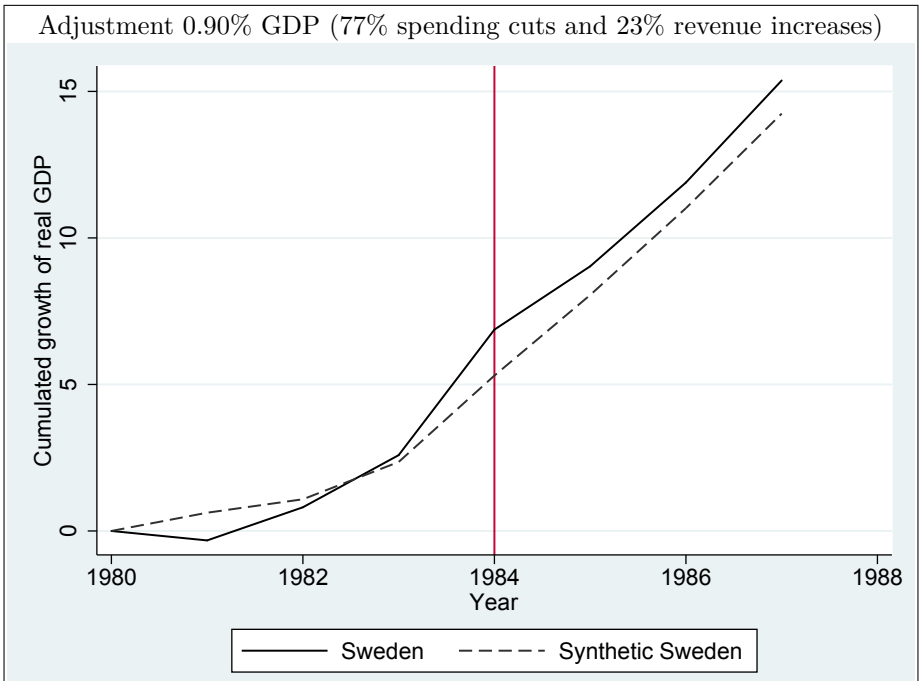
Selected Variables	Spain	Synthetic	Weight
Consumption exp. (p.c.) growth	12.12	11.21	23.36%
Employment in agriculture	11.35	9.69	16.10%
Employment in industry	32.85	29.91	5.45%
Employment in service	55.76	60.39	11.72%
Gross fixed capital (p.c.) growth	8.44	6.99	8.25%
Inflation	5.78	5.97	8.82%
Life expectancy	77.25	75.88	9.75%
School enrollment in primary school	106.15	114.58	8.17%
Working age fraction	37.99	45.89	8.34%

Selected countries and weights:
France (51.5%), Netherlands (8.4%), Portugal (40.1%)

Root Mean Squared Prediction Error (RMSPE): 0.218

Notes: The table shows the pre-treatment average values of the predictor variables for Spain, the synthetic Spain as well as the variable and selected country weights allocated by the SCM.

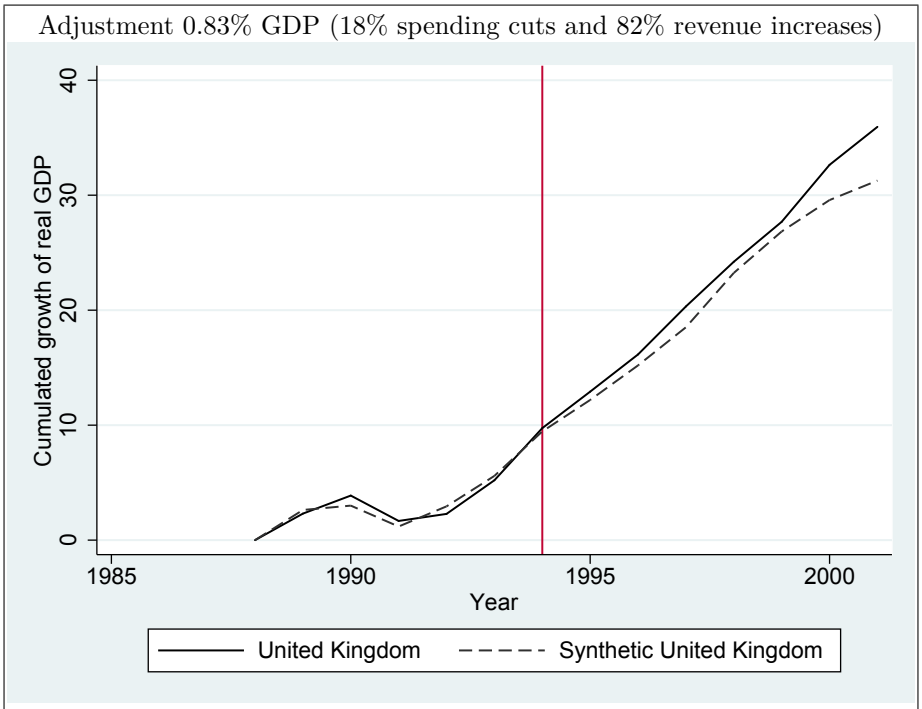
Figure 8: Fiscal consolidation in Sweden 1984



Selected Variables	Sweden	Synthetic	Weight
Consumption exp. (p.c.) growth	11.07	21.40	1.87%
Employment in agriculture	5.55	13.11	0.19%
Employment in industry	30.92	36.56	2.24%
Employment in service	63.52	50.31	7.54%
Gross fixed capital (p.c.) growth	10.16	17.66	2.87%
Life expectancy	76.32	74.38	1.50%
Population growth	0.10	0.31	74.21%
School enrollment in primary school	97.16	99.63	3.30%
School enrollment in secondary school	86.98	77.72	4.40%
Terms of trade growth	-1.88	-0.70	1.16%
Unemployment rate	3.64	6.09	0.57%
Working age fraction	53.19	43.27	<0.01%
Selected countries and weights: Finland (20.3%), Italy (79.7%)			
Root Mean Squared Prediction Error (RMSPE): 0.505			

Notes: The table shows the pre-treatment average values of the predictor variables for Sweden, the synthetic Sweden as well as the variable and selected country weights allocated by the SCM.

Figure 9: Fiscal consolidation in the United Kingdom 1994



Selected Variables	UK	Synthetic	Weight
Consumption exp. (p.c.) growth	6.88	6.62	35.53%
Employment in service	66.73	68.32	4.12%
Inflation	5.08	4.90	24.73%
Life expectancy	75.80	76.82	1.95%
School enrollment in primary school	105.65	106.15	12.06%
Unemployment rate	8.67	8.32	20.93%
Working age fraction	49.87	49.28	0.64%
Selected countries and weights: Australia (88%), Denmark (6.3%), Portugal (5.7%)			
Root Mean Squared Prediction Error (RMSPE): 0.528			

Notes: The table shows the pre-treatment average values for the predictor variables for the United Kingdom, the synthetic United Kingdom and the variable weight allocated by the SCM.

6. Discussion and sensitivity analyses

To summarise, three out of six case studies indicate a long-run positive impact of fiscal consolidation on economic growth (case studies in Portugal, Spain, and the United Kingdom), the case studies in Austria and Belgium point to negative effects, and the case study in Sweden has only limited interpretable effects.

For the sensitivity analyses, we augment these results with additional alternative specifications. While the selection of the baseline model was only based on the minimum RMSPE, we now additionally take mean figures of the predictor variables into account. For each case study, we consecutively drop predictor variables with large differences in mean figures between the treated unit and its synthetic control. We then select the two alternative specifications with the smallest RMSPE *and* highly comparable mean figures of predictor variables.

The results of these adjustments are presented in Figure 10 to Figure 12. We distinguish between rather spending based consolidations (Figure 10), rather revenue based consolidations (Figure 11) and equally spending and revenue based consolidations (Figure 12). For each case study, we display the economic growth trajectory of the treated unit, the synthetic control with the minimum RMSPE as already shown in Section 5, and the two alternative specifications.

With the exception of the case study in Sweden, all of our results are highly robust.[9] Both, the development of the economic growth trajectories and the magnitude of the difference between various alternative synthetic control units is comparable to the baseline results. In Sweden, however, a change in the model specification - at the cost of a higher RMSPE - changes the interpretation of the results to the opposite. As for the Swedish baseline result, the pre-treatment fit of the economic growth trajectories in Sweden are rather bad and the RMSPEs are comparable high, implying that this result should be treated with caution. Table 3 summarises the results.

7. Conclusion

We contribute to the literature on the long-run effect of fiscal consolidation on economic growth by applying a novel method for quantitative case studies. The method is innovative because it uses information from various countries that did not consolidate during the regarded period to construct a synthetic control group. The procedure thus allows for a comparison of economic growth trajectories for the *same* unit of observation with and without the treatment.

[9] This is also true for further alternative specifications which are not presented.

Figure 10: Sensitivity tests with alternative model specifications: primarily spending based consolidations

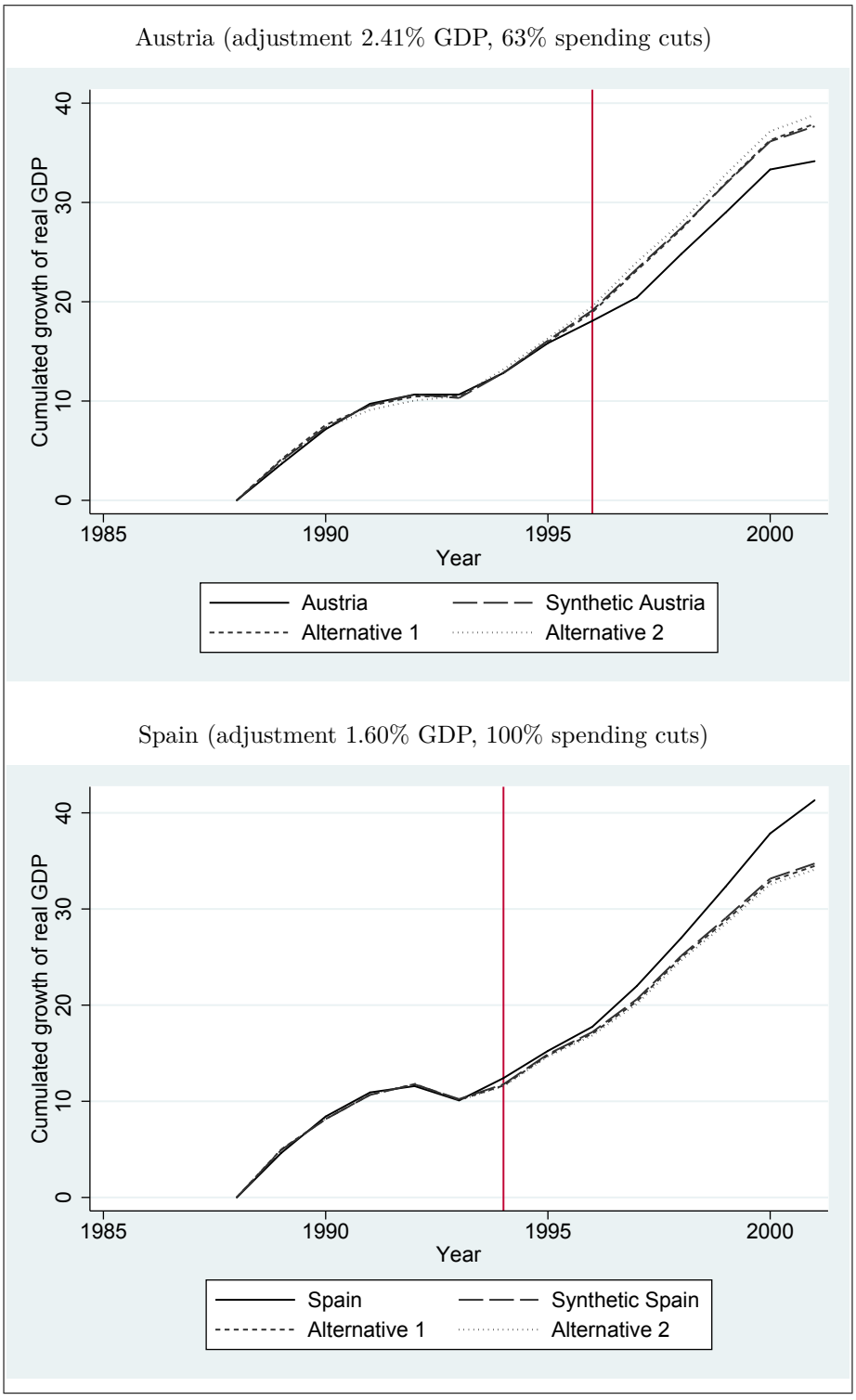


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Figure 10: continued

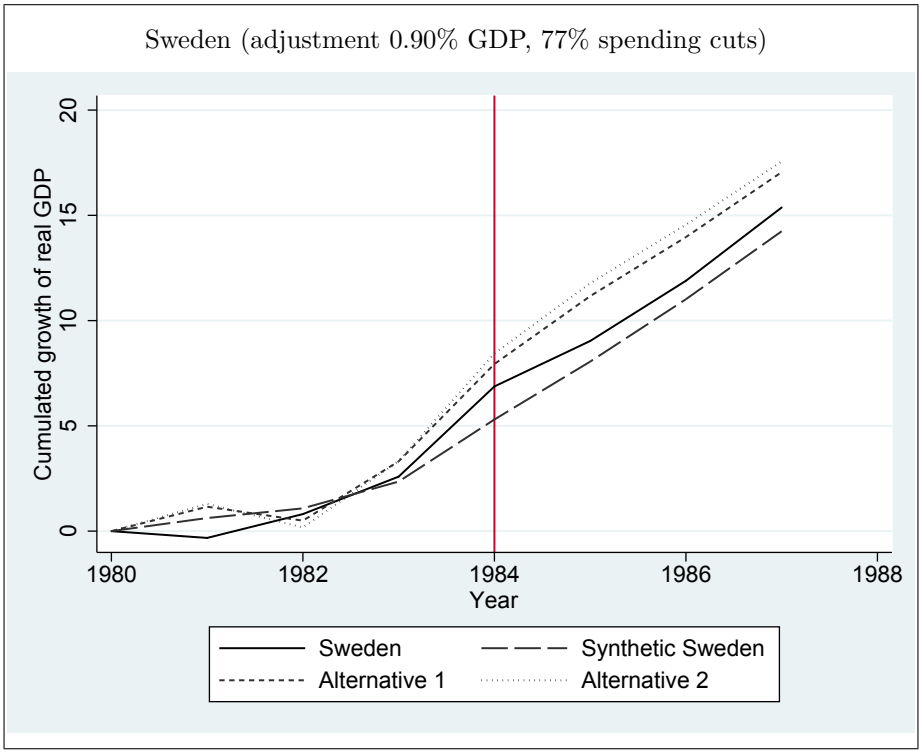

Figure 11: Sensitivity tests with alternative model specifications: primarily revenue based consolidation

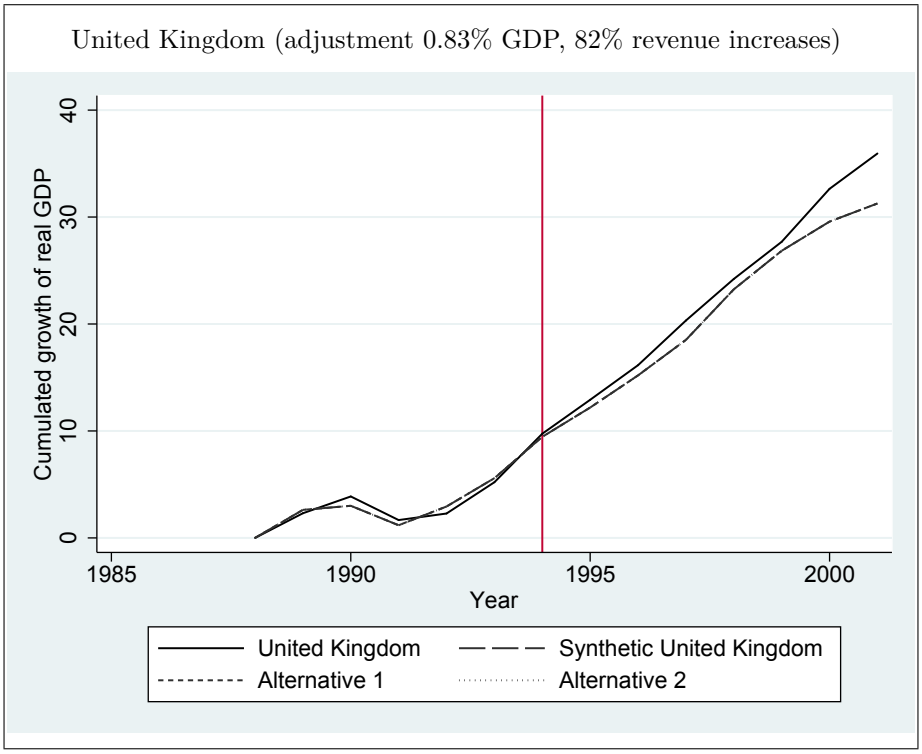

Figure 12: Sensitivity tests with alternative model specifications: equally shared consolidations

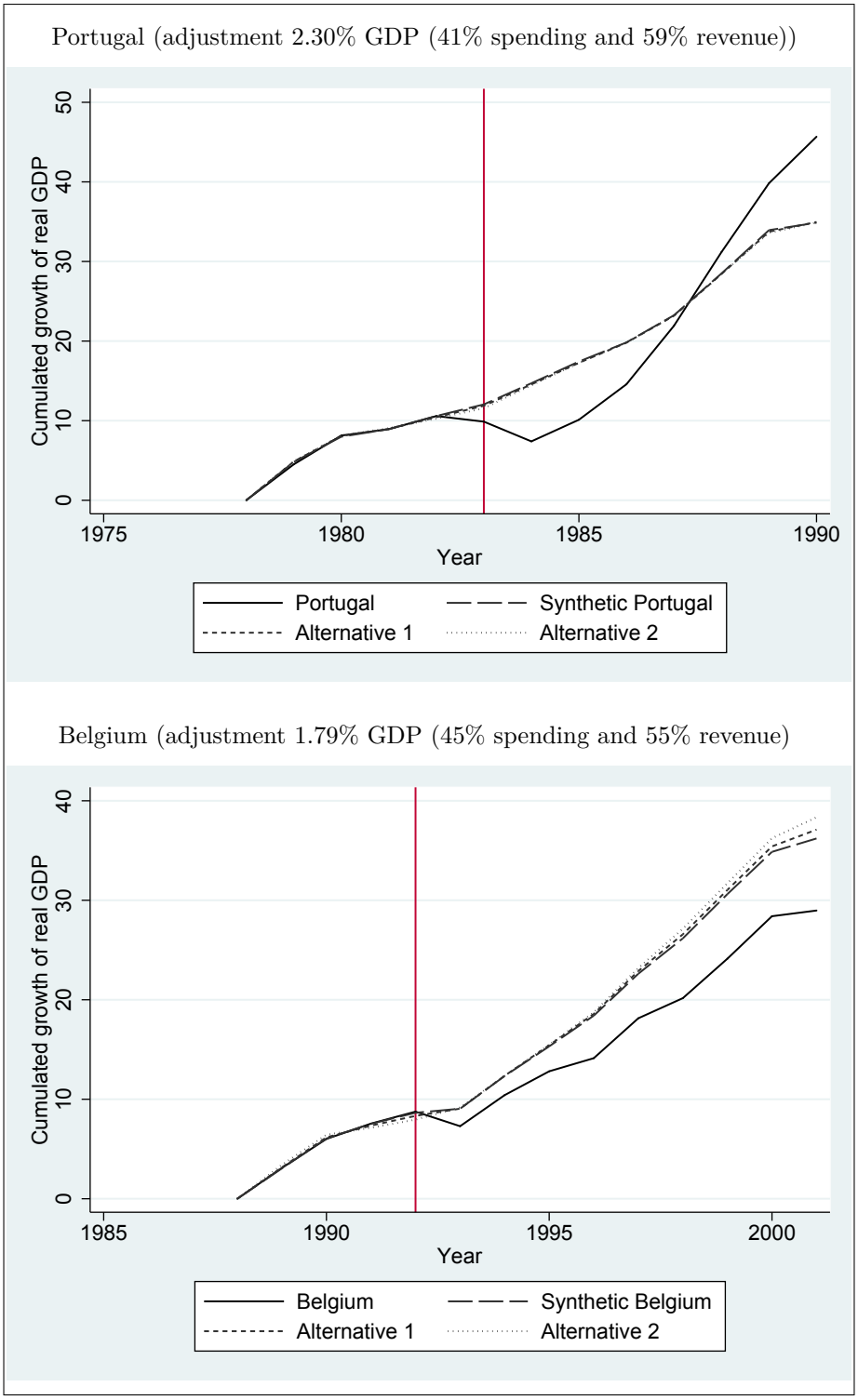

Table 3: Summary of results

	Type of fiscal consolidation (total adjustment % GDP)		
	Primarily spending	Primarily revenue	Equally shared
Negative effect	Austria (2.41%)		Belgium (1.79%)
Positive effect	Spain (1.60%)	UK (0.83%)	Portugal (2.30%)
Not interpretable	Sweden (0.90%)		

Notes: The table summarises results for the long-run effect of fiscal consolidation on economic growth in six case studies. A positive effect indicates that the economic growth trajectory after the fiscal consolidation was higher than in case without a fiscal consolidation (and vice versa for negative effects). The result for Sweden is not robust and thus not interpretable.

We implement the synthetic control method (SCM) in six case studies of OECD countries. For the identification of fiscal consolidations, we use a qualitative (narrative) definition based on the evaluation of policy documents (Devries et al., 2011). The dataset comprises information on 173 consolidation episodes for 17 OECD countries for the 1978-2009 period. The authors use historical policy documents such as budget speeches or budget reports and examine the policymakers' intentions at the timing of the implementation of fiscal consolidations to ensure that changes in fiscal variables were primarily motivated by a deficit reduction instead of a response to cyclical or discretionary economic fluctuations.

We orient on the following two principles for the selection of case studies: the consolidating countries are denoted by a sufficient number of pre- as well as post-treatment periods without consolidation and there is an adequate number of countries that did not consolidate during the complete period. Based on these criteria, fiscal consolidations in Austria (1996), Belgium (1992), Portugal (1983), Spain (1994), Sweden (1984), and the United Kingdom (1994) render the application of the SCM feasible.

Our results do not offer clear-cut evidence on the long-run economic growth effects of fiscal consolidation. Three case studies point to rather positive effects (case studies in Portugal, Spain, and the United Kingdom) while two case studies indicate a negative effect on economic growth trajectories (case studies in Austria and Belgium). The result of the case study in Sweden is not robust and must be discarded. Furthermore, there is no exact pattern with respect to the type of fiscal consolidation. Distinguishing between primarily spending based, primarily revenue based, and equally shared revenue and spending based consolidations, we find both positive and negative effects for primarily spending based and equally shared consolidations. It is also not appropriate to draw general conclusions from the single primarily revenue based consolidation in the United Kingdom. Finally, the total adjustment in percent of GDP does not seem to affect the long-run growth prospects. Large and small scale consolidations are equally distributed across case studies with positive and negative effects (see Table 3).

Overall, our results add to the ongoing discussion on the effects of fiscal consolidation on economic growth. However, in contrast to recent studies that also rely on the narrative approach for defining fiscal consolidations and that reject the hypothesis of non-Keynesian effects (see, e.g., the studies by Guajardo et al. (2014), Hernández de Cos and Moral-Benito (2013), and Yang et al. (2015)), our results point to a rather careful interpretation. For each consolidation, so far undetected country specific features may play a role too and should be investigated in further research.

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A. Appendix

Table A.1: Variable Description

Variable	Description	Source
Real GDP growth	Growth rate of real GDP (percent).	OECD
Inflation	Inflation (percent).	OECD
Unemployment rate	Number of persons unemployed to the total number of persons in the labor force (percent).	OECD
Terms of trade growth	Growth rate of terms of trade (percent).	OECD
Gross fixed capital formation (p.c.) growth	Growth rate of gross fixed capital formation (per capita).	OECD
General government consumption exp. (p.c.)	Growth rate of general government consumption expenditure (per capita).	OECD
Employment in agriculture	Civilian employment in agriculture to total civilian employment (percent).	OECD
Employment in industry	Civilian employment in industry to total civilian employment (percent).	OECD
Employment in service	Civilian employment in service to total civilian employment (percent).	OECD
Life expectancy	Life expectancy of total population at birth (years).	OECD
Population growth	Growth rate of population (percent).	OECD
School enrollment in primary school	Total enrollment in primary education, regardless of age, expressed as a percentage of the population of official primary education age (percent). Figures can exceed 100% due to the inclusion of over-aged and under-aged students because of early or late school entrance and grade repetition.	Worldbank
School enrollment in secondary school	Total enrollment in secondary education, regardless of age, expressed as a percentage of the population of official secondary education age (percent). Figures can exceed 100% due to the inclusion of over-aged and under-aged students because of early or late school entrance and grade repetition.	Worldbank
Working age fraction	Number of persons in the labor force to total population (percent).	OECD