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The Composition of Fiscal Adjustments: Economic and Social Implications

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Abstract

We examine episodes of fiscal adjustments in OECD countries from 2000 to 2014 and analyse its short- and long-run impact on economic growth and inequality. This paper offers two results. First, in line with previous literature, we find that in the short run, spending-based adjustments are more expansionary than tax-based adjustments, although they are associated with higher inequality. Second, we find that in the long run, spending-based adjustments are still more expansionary, and their impact on inequality is smaller than that of tax-based adjustments.

Keywords

fiscal adjustment, fiscal consolidation, inequality, growth

Cover Page Footnote

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1 Introduction

The fiscal adjustments implemented in many countries since the financial crisis have become a major source of controversy. The governments responsible claim they were necessary to reduce the excessive budget deficits. In some cases they seem to be correlated with an increase in GDP growth. However, spending cuts and tax increases have had high social costs at the same time. Inequality has risen and youth unemployment has reached excessive levels in countries like Italy or Spain.

The debate about the effects fiscal adjustments is broad and encompasses many different areas. In this paper we attempt to focus on periods where governments have implemented measures of fiscal consolidation in recent years. Our goal is to analyse the effects of these policies in two areas at the centre of the debate: economic growth and inequality. We look at the different impact if they are mostly implemented through tax increases or spending cuts. We do not aim to make a point for austerity measures being implemented or not in response to economic distress.

This paper is organised as follows. In the next section, we discuss the most relevant literature regarding this area. Section 3 examines the data and methodology, and defines different kinds of fiscal adjustments. Section 4 presents empirical analysis on the short- and long-term effect of the composition of fiscal adjustments on growth and inequality. Section 5 presents further evidence of the results. The last section concludes.

2 Literature review

This paper is related to two different lines of literature. The first is the literature on the impact and composition of fiscal adjustments. Early studies on the potential expansionary effects of fiscal consolidations were carried out by

Giavazzi and Pagano (1990 and 1996). They use country-specific case studies and cross-country evidence to show how fiscal consolidations can be associated with "non-Keynesian" expansionary effects (Feldstein, 1982). The first paper to analyse the composition of large fiscal adjustments is Alesina and Perotti (1995). In line with further evidence by the IMF (1996), they argue that spending-based fiscal adjustments are more effective in stabilising debt to GDP ratios and can have more expansionary effects than tax-based adjustments.

Several studies by Alesina and Ardagna (1998, 2010 and 2012) expand those analyses and share most of the previous conclusions. Most of the studies prior to 2010 use the cyclically adjusted primary balance as the main measure of fiscal consolidations, as proposed by Blanchard (1993). Romer and Romer (2010) propose a new "narrative" approach that involves a case-by-case analysis of each fiscal consolidation episode. Studies using this approach include the IMF (2011) and Alesina *et al.* (2014). The evidence of these studies suggests no change in overall conclusions.

The second line of literature englobes the studies relating episodes of fiscal adjustments to changes in inequality of income, suggesting a potential trade-off between growth and inequality. The existence of this trade-off was accepted in the early 20th century (Boix, 1996), until the rise of Keynesian economics, when new sets of policies that were positive for both inequality and growth were proposed.

Mulas-Granados (2003) argues that the neoclassical paradigm came back to dominance in the 70s. Mulas-Granados (2005) first studied the potential short-run trade-off between growth and inequality. He shows that in the short term, spending-based adjustments can be more expansionary than tax-based adjustments but at the same time lead to higher inequality. Similarly, tax-based adjustments are less expansionary (or contractionary) but increase inequality by less.

The modern empirical literature on this subject is quite limited, although it has been expanded in the past few years. Recent evidence suggesting that spending cuts lead to more inequality than tax increases has been developed by Agnello and Sousa (2012) and Woo *et al.* (2013). The Gini coefficient is broadly used to measure inequality in these studies. Ball *et al.* (2013) use the "narrative" approach to identify fiscal consolidations and reach similar conclusions. All of these studies focus on the short-run impact.

Overall, past literature suggests that in the short run spending-based adjustments lead to more economic growth but are also more harmful for inequality than tax-based adjustments, therefore creating a trade-off. This paper focuses on (i) analysing whether this trade-off holds for our sample and (ii) investigating whether it holds in the long term.

3 Data, definitions and methodology

3.1 Data

The growth data spans 30 OECD countries in the years 2000 to 2014. The inequality data is more restricted, spanning 28 OECD countries over the years 2000 to 2012. Further information about countries, time periods, definitions of variables and sources is included in the appendix. To measure economic growth we use the logarithm of real GDP per capita to normalise the data, as per previous literature. The main measure of inequality used is the Gini coefficient multiplied by 100, also consistent with previous studies.

3.2 Definitions of fiscal adjustments

In order to measure the impact of fiscal adjustments we use the cyclically adjusted primary balance (CAPB) as the measure of the government's fiscal stance. The data from the "narrative" method mentioned previously is limited and not available for this analysis. CAPB is calculated by subtracting the effects

of business cycle fluctuations from the primary budget balance, as calculated by the OECD. The main assumption is that once the primary balance is adjusted for business cycles, most of its fluctuations come from policy changes. Therefore, an increase in the CAPB would indicate a fiscal adjustment.

CAPB is used to measure fiscal consolidations in several studies, such as Alesina and Ardagna (1998, and 2012). However, it is not a perfect measure and can lead to biased results (Romer and Romer, 2010). CAPB may account for non-policy factors which are correlated with exogenous variables affecting inequality or growth. For example, a boom in the stock market leads to higher earnings and therefore higher tax revenues. This shows as an improvement in CAPB although not being in response to fiscal adjustments. Moreover, this is likely to affect other variables, for example higher consumption and investment. Therefore, the correlation between an increase in CAPB and the error term is likely to be positive. This can lead to an upwards biased estimate (IMF, 2011). CAPB may also suffer from measurement error if it omits periods during which fiscal adjustments were accompanied by offsetting adverse shocks.

In order to deal with part of this issue we will restrict the definition of fiscal adjustment to periods where the reduction can be considered too big to be "business as usual". Past literature used definitions to consider only periods of fiscal adjustments where the reduction was in the range of 1-2 per cent. We adopt the following definitions:

Definition 1. *A period of fiscal consolidation is a year when the cyclically adjusted primary balance (CAPB) improves by 1% or more.*

This allows us to ignore all periods where the change in CAPB is likely to be due to exogenous changes in other variables instead of policy changes. We do not aim to distinguish between discretionary and non-discretionary policies, and assume firms and households react to both in a similar way.

Definition 2. *A tax-based fiscal adjustment is a period where CAPB improves by 1% or more and government revenues as % of GDP increase by 0.5% or more.*

When estimating tax-based fiscal adjustments in the baseline equation we include Gross Fixed Capital Formation (GFCF) as a control variable. GFCF measures the value of net investment in fixed assets in an economy. This way we control for improvements in economic activity that could be biasing upwards part of the estimates.

Definition 3. *A spending-based fiscal adjustment is a period where CAPB improves by 1% or more and government spending as % of GDP decreases by 0.5% or more.*

When estimating spending-based adjustments in the main model we will include as a control variable the percentage of people who are not in the age of working. This way we control for changes in spending that need to be carried out as a response to demographic changes, and may be biasing the results.

Other variables included in all the baseline specifications are the exchange rate in the same period (controlling for currency fluctuations) and the short-term interest rate (controlling for changes in monetary policy). The log of per-capita GDP and its squared term are also included in regressions on inequality (see Barro, 2008).

3.3 Methodology

In order to measure the effects of fiscal consolidations on growth and inequality we use the following baseline specification model:

$$Y_{i,t} = \sum_{j=1}^{2} \alpha_j Y_{i,t-j} + \sum_{s=1}^{3} \beta_s CAPB_{i,t-s} + \sum_{k=1}^{2} \gamma_k \boldsymbol{X}_{i,t-k} + \mu_{i,t} \qquad (1)$$

$$\mu_{i,t} = \lambda_i + \varepsilon_{i,t}$$

where subscripts *i* and *t* index countries and years, *Y* is the dependent variable, *CAPB* is equal to one in periods of fiscal adjustments (as previously defined) and zero otherwise, and $\boldsymbol{X}'$ is a vector of control variables (see previous section). The error term μ contains country-specific fixed effects λ. Equation (1) is estimated over the sample by difference GMM (Arellano-Bond).

It is assumed that both real GDP and the Gini coefficient are dynamic variables, that is, they depend on their own past realizations. Following past analyses (Agnello and Sousa, 2012, Alesina *et al*, 2015) we assume a linear functional relationship across time. The last assumption of this model is non-contemporaneity: due to long transmission mechanisms and fiscal policy lags, we assume changes in the CAPB take at least one period to have an impact on the dependent variables. This implies current decisions are based on past outcomes. Therefore, we will focus on analysing the impact on adaptive expectations rather than rational expectations.

The aim of this study is to measure the short and long-run impact of a 1 percentage point change in CAPB on growth and inequality. Results are presented for the estimated cumulate responses on changes in CAPB at periods t+1, t+2, t+3 and the long-run effect. Robust standard errors of the impulse responses are calculated via the delta method (Alesina and Ardagna, 2012). Equation (1) is estimated separately for periods of spending- and tax-based fiscal consolidations (as per the previous definitions). Finally, the various specifications are estimated with other proxies for inequality and different control variables to ensure the main results are consistent and sound.

Several estimation problems may arise from equation (1). In a dynamic model, lags of the dependent variable will be correlated with the error term, which is a source of bias and autocorrelation. While by assuming non-contemporaneity the potential endogeneity problem from reverse causality is eliminated, independent variables are not likely to be strictly exogenous either. For instance, changes in *CAPB* are likely to be correlated with past realizations

of the error (IMF, 2011). Fixed effects contained in the error term may be correlated with other endogenous variables too. Thus, OLS estimation would yield biased results.

Difference GMM (Arellano-Bond) uses first-differences to transform equation (1) into

$$\Delta Y_{i,t} = \sum_{j=1}^{2} \alpha_j \Delta Y_{i,t-j} + \sum_{s=1}^{3} \beta_s \Delta CAPB_{i,t-s} + \sum_{k=1}^{2} \gamma_k \Delta \boldsymbol{X}_{i,t-k} + \Delta \mu_{i,t} \quad (2)$$

and

$$\Delta \mu_{i,t} = \Delta \lambda_i + \Delta \varepsilon_{i,t}$$

or

$$\mu_{i,t} - \mu_{i,t-1} = (\lambda_i - \lambda_i) + (\varepsilon_{i,t} - \varepsilon_{i,t-1})$$

therefore removing fixed effects.

However, all variables on the right hand side of equation (1) are still endogenous because, for instance, the term $Y_{i,t-1}$ in $\Delta Y_{i,t-1} = Y_{i,t-1} - Y_{i,t-2}$ is correlated with the term $\mu_{i,t}$ in $\Delta\mu_{i,t} = \mu_{i,t} - \mu_{i,t-1}$. Deeper lags can be used as instruments since they are correlated with the previous lag but not with the error. For instance, $\Delta Y_{i,t-2}$ and $Y_{i,t-2}$ are related to $\Delta Y_{i,t-1} = Y_{i,t-1} - Y_{i,t-2}$ but not to the error term $\Delta\mu_{i,t} = \mu_{i,t} - \mu_{i,t-1}$.

Instruments can be assumed valid unless the errors are serially correlated (Roodman, 2006). Since $\Delta\mu_{i,t}$ is related to $\Delta\mu_{i,t-1}$ because of the shared $\mu_{i,t-1}$ term, negative first order serial correlation is likely to appear in the first differenced residuals. Therefore it is only required that there is no second order serial correlation (Arellano and Bond, 1991). Tests for second order autocorrelation in the first-differenced residuals are reported in all regressions, as well as Sargan tests for the joint validity of instruments.

4 Results

We study whether spending-based adjustments increase both economic growth and inequality by more than tax-based adjustments, therefore creating a trade-off. We compare the findings in the short and long term. Table 1 shows the cumulated effect of a 1% improvement in CAPB on real GDP (columns 1-3) and the Gini coefficient (columns 4-6) after one, two and three years, and the long-run effect. Results are broken down into (i) all adjustments, (ii) spending-based adjustments and (iii) tax-based adjustments.

4.1 Growth

Estimates in columns 1-3 show that fiscal consolidations have a statistically significant expansionary effect on GDP both in the short and long run. This adds evidence to the hypothesis of expansionary fiscal adjustments as initially proposed by Giavazzi and Pagano (1990). On average, a 1% fiscal adjustment is associated with an increase in GDP of 0.2-0.3 percent within three years and 1.1-1.6 percent in the long term. The magnitude of these results is similar to previous literature, including Mulas-Granados (2005) and Alesina and Ardagna (2012).

The long-run results suggest the effect of fiscal consolidations is persistent across time. This points to supply-side effects being the major driver of the impact, since they are more likely to be structural and have a higher long-term impact than demand-side effects. Moreover, since this model is based on adaptive expectations, it is not likely to capture demand-side effects relying on rational expectations. Structural reforms that may accompany fiscal adjustments are improvements in business capacity constraints and labour market reforms. Its effects are likely to be persistent and take place in the medium term (Summers, 2012).

Table 1. The effects of fiscal adjustments on real per capita GDP growth and Gini coefficients

	Log of real GDP per capita			Gini coefficient		
	(1) All Adjustments	(2) Spending-Based	(3) Tax-Based	(4) All Adjustments	(5) Spending-Based	(6) Tax-Based
ΔCAPB – t+1	0.184***	0.268***	0.178	0.112	0.239**	0.069
	(0.062)	(0.101)	(0.115)	(0.070)	(0.103)	(0.049)
ΔCAPB – t+2	0.204**	0.348***	0.198	0.080	0.147***	0.139**
	(0.103)	(0.104)	(0. 161)	(0.053)	(0.053)	(0.062)
ΔCAPB – t+3	0.218	0.293**	0.310**	0.149***	-0.006	0.311***
	(0.139)	(0.129)	(0.125)	(0.034)	(0.054)	(0.078)
ΔCAPB – Long term	1.171	1.590**	1.119*	0.417***	0.381***	0.613**
	(0.736)	(0.803)	(0.574)	(0.130)	(0.142)	(0.243)
Sargan test	0.000	0.000	0.002	0.023	0.440	0.304
AR(2)	0.055	0.501	0.452	0.958	0.100	0.092
Observations	330	119	118	139	48	47

Note: GMM estimation using Arellano-Bond. Table reports point estimates and delta method standard errors for cumulative effect of a 1% fiscal consolidation in t+1, t+2, t+3 and long run. Dependent variables: logarithm of real GDP in columns 1-3; Gini coefficient in columns 4-6. Control variables Log of real GDP per capita: exchange rate, first and second lags of short-term interest rate, population not in the age of working (all and spending-based adjustments), and grossed fixed capital formation (all and tax-based adjustments). Control variables Gini coefficient: real GDP per capita, real GDP per capita squared, exchange rate, and first and second lags of short-term interest rate, average growth of G7 countries, population not in the age of working (all and spending-based adjustments), and grossed fixed capital formation (all and tax-based adjustments). Significance levels: *** p<0.01, ** p<0.05, * p<0.1

The overall direction of these effects is invariant if they are divided between spending- and tax-based adjustments (columns 2 and 3). However, spending-based adjustments have a higher expansionary effect than tax-based adjustments in most periods, with peak effects of 1.590 percent and 1.119 percent respectively in the long run. Therefore, results suggest that fiscal multipliers are negative, and are greater (in absolute terms) for spending-based consolidations than for tax-based consolidations. Several studies including Alesina *et al.* (2014) and Alesina and Ardagna (2012) support this evidence. We now analyse potential reasons for this effect.

Regarding spending-based adjustments, Guajardo *et al.* (2011) argue that this may be due to monetary easing accompanying large spending cuts. Yet, as previously mentioned, monetary policy is included as a control variable in the above regression. Lane and Perotti (1996), argue that a reduction in government employment and wages weakens the power of unions. It reduces labour demand and wages demanded by workers, and can increase long-term profitability and investment. This may be accounting for part of the long run expansionary effect captured in the results.

On the other hand, tax-based fiscal consolidations seem to have smaller effects on output. Romer and Romer (2010) show that permanent tax increases reduce general investment and consumption, mainly on durable goods. Moreover, increases in income taxes decrease post-tax real wages (Alesina and Ardagna, 1997). In unionized imperfectly competitive labour markets, which is the case in OECD countries (Blanchflower, 1996), unions demand higher pre-tax real wages to reflect the higher taxes. This may harm competitiveness and investment, and decrease output growth. Therefore, this suggests the labour market effect from tax-based consolidations will be smaller in the long run.

4.2 Inequality

Estimates suggest that an improvement of 1% in CAPB increases inequality in all periods (column 4), with an overall impact of 0.417 on the long-run Gini coefficient.

Comparing between spending- and tax-based adjustments (columns 5 and 6), it can be observed how this effect varies across time, but always points to increases in inequality. Analysing the short-run results, particularly after two periods, spending-based adjustments seem to be more harmful than tax-based adjustments. Point estimates for the short-run effect on inequality of spending and tax-based consolidations are 0.147 and 0.139, respectively, both statistically significant. This is in line with the hypothesis of a

short-term trade-off between growth and inequality. Both the direction and magnitude are consistent with results by Agnello and Sousa (2012) and Ball *et al.* (2013).

Long-run estimates suggest that spending-based adjustments have a smaller impact on inequality than tax-based adjustments. The estimates are 0.381 and 0.613 respectively, both highly significant. Therefore, this suggests that in the long run spending-based adjustments increase inequality by less than tax-based adjustments. The short-run trade-off between growth and inequality seems to disappear in the long run. This expands the scope of the previous literature, and points to the existence of different medium and long-term dynamics in the effects of tax increases and spending cuts.

To expand our results, in tables 2 and 3 we regress the baseline model on the share of income held by each quintile in society. We control for monetary policy, the percentage of population not in the age of working, the exchange rate, and the log of per-capita GDP and its squared term. Results show that increases in CAPB raise the income share of the top 20% while decreasing the income share of the rest (Table 2). The result is the same regardless of the design of the fiscal adjustment (Table 3).

The statistically significant short-term results (period 2 for the first and third quintiles, and period 1 for the second quintile) suggest that spending-based adjustments increase the income share of the top 20% by more and decrease the income share of the rest by more than tax-based adjustments. This adds evidence to the short-run trade-off between inequality and growth.

However, the long-term results suggest that spending-based adjustments increase the income share of the top 20% by less and decrease the income share of the rest by less than tax-based adjustments. This adds further evidence to the existence of different medium and long-term dynamics in the impact of tax increases and spending cuts that eliminate the short-run trade-off. We now turn to investigate channels that explain this result.

We start by analysing the effects of spending-based adjustments. The OECD (2012) argues that cuts in social transfers lead to effective fiscal consolidations, since they create disincentives to work. Social transfers are mainly directed towards lower-income groups such as the unemployed and the disabled. These groups rely on such transfers as their

Table 2. The effects of fiscal adjustments on share of income held by each quintile of population (all adjustments)

	Share of Income per quintile				
	(1) First	(2) Second	(3) Third	(4) Fourth	(5) Fifth
ΔCAPB – t+1	0.134***	-0.042***	-0.047***	-0.026**	-0.023
	(0.042)	(0.013)	(0.011)	(0.010)	(0.018)
ΔCAPB – t+2	0.095***	-0.029***	-0.042***	-0.031***	-0.002
	(0.030)	(0.007)	(0.012)	(0.011)	(0.018)
ΔCAPB – t+3	0.139***	-0.048***	-0.045***	-0.020*	-0.031**
	(0.041)	(0.011)	(0.014)	(0.012)	(0.013)
ΔCAPB – Long term	0.425***	-0.135***	-0.145***	-0.080***	-0.069***
	(0.101)	(0.025)	(0.031)	(0.025)	(0.027)
Sargan test	0.009	0.019	0.024	0.067	0.264
AR(2)	0.473	0.539	0.201	0.639	0.811
Observations	139	139	139	139	139

Note: GMM estimation using Arellano-Bond. Table reports point estimates and delta method standard errors for cumulative effect of a 1% fiscal consolidation in t+1, t+2, t+3 and long run. Dependent variables: share of income held by the 1st, 2nd, 3rd, 4th, and 5th quintiles in columns 1, 2, 3, 4, and 5, respectively. Control variables: real GDP per capita, real GDP per capita squared, and first and second lags of short-term interest rate, exchange rate and population not in the age of working. Significance levels: *** p<0.01, ** p<0.05, * p<0.1

Table 3. The effects of fiscal adjustments on share of income held by each quintile of population (by composition)

	Share of income per quintile									
	(6) First Spending-based	(7) First Tax-based	(8) Second Spending-based	(9) Second Tax-based	(10) Third Spending-based	(11) Third Tax-based	(12) Fourth Spending-based	(13) Fourth Tax-based	(14) Fifth Spending-based	(15) Fifth Tax-based
ΔCAPB – t+1	0.118*	0.067	-0.041*	-0.012***	-0.037	-0.033**	-0.013	-0.026**	-0.026	0.004
	(0.068)	(0.041)	(0.021)	(0.011)	(0.026)	(0.016)	(0.023)	(0.009)	(0.035)	(0.011)
ΔCAPB – t+2	0.092***	0.048*	-0.016	-0.008	-0.044**	-0.021***	-0.019	-0.017*	-0.020	-0.002
	(0.035)	(0.026)	(0. 013)	(0.007)	(0.017)	(0.007)	(0. 022)	(0.017)	(0.023)	(0.012)
ΔCAPB – t+3	0.018	0.183***	-0.006	-0.065***	-0.013	-0.060**	-0.020	-0.027	0.016	-0.025
	(0.91)	(0.068)	(0.024)	(0.021)	(0.032)	(0.028)	(0.025)	(0.015)	(0.018)	(0.017)
ΔCAPB – Long term	0.231**	0.276***	-0.063*	-0.075***	-0.092**	-0.097***	-0.054	-0.059**	-0.031	-0.023
	(0.092)	(0.095)	(0.033)	(0.023)	(0.038)	(0.029)	(0.034)	(0.024)	(0.036)	(0.033)
Sargan test	0.427	0.369	0.397	0.310	0.472	0.487	0.695	0.563	0.872	0.660
AR(2)	0.092	0.657	0.074	0.688	0.063	0.098	0.881	0.500	0.430	0.047
Observations	48	46	48	46	48	46	48	46	48	46

Note: GMM estimation using Arellano-Bond. Table reports point estimates and delta method standard errors for cumulative effect of a 1% fiscal consolidation in t+1, t+2, t+3 and long run. Dependent variables: share of income held by the 1st, 2nd, 3rd, 4th, and 5th quintiles in columns 6-7, 8-9, 10-11, 12-13, and 14-15, respectively. Control variables: real GDP per capita, real GDP per capita squared, and first and second lags of short-term interest rate, exchange rate and population not in the age of working. Significance levels: *** p<0.01, ** p<0.05, * p<0.1

primary source of income. Cuts in those areas will therefore increase inequality, as the higher-income groups are unaffected. Regarding the long-terms gains in incentives and productivity claimed by the OECD (2012), they could potentially be influencing the relative decrease in the long-term impact of spending cuts compared to tax increases.

Alesina and Perotti (1995) and Moral-Benito (2012) show that cuts in public sector wages are one of the main areas where governments decrease expenditures when carrying out fiscal adjustments. Jenkins *et al*. (2011) show that the share of wages in the incomes of lower-income groups is significantly higher than in the rest of groups. Therefore, wage decreases are likely to increase inequality in the short run, as these groups will see their main source of income decrease while the effect on other groups' income will be relatively smaller. We previously suggested that as proposed by Lane and Perotti (1996), decreases in public wages can create expansionary effects in the long run. If this leads to a reduction in unemployment, then the long-term impact of spending cuts on inequality may be smaller.

We now turn to the effects of tax-based adjustments. The IMF (1996) shows earning and corporate taxes have longer lags, so their biggest impact on inequality is felt in the long term, as reflected in the results. Multiple studies including the OECD (2012) argue that regressive taxes such as VAT have a much bigger impact on inequality than income and corporate taxes. Since such types of taxes are paid equally by everyone regardless of their wealth or income, the relative effect over an individual's income is higher in lower-income groups.

Corporate taxes can also be considered as a source of inequality. As argued by Kotlikoff (2011), higher corporate taxes can lead to firm relocation and investment fleeing to look for higher returns. This may create unemployment and leave the workers bearing the tax increase, instead of corporations. Increases in inequality from this rise in unemployment would be felt in the medium and long run given the time it takes for firms to relocate. Taxes on earnings are progressive so they tend to have a lower negative effect on inequality than regressive taxes (Woo *et al*. 2012).

Overall, our results show that in the short run, spending-based adjustments lead to higher growth and higher inequality than tax-based adjustments. This is in line with the short run trade-off proposed by Mulas-Granados (2005). Results also suggest that this

trade-off disappears in the long-run. Estimates for the long-run effect suggest spending-based adjustments lead to higher growth and lower inequality than tax-based adjustments.

5 Robustness checks

In this section we study alternative specifications in order to check the robustness of the previous analysis. Tables with results are included in the appendix (tables 4-11).

5.1 Growth

In table 4 we add extra control variables to the GDP regressions, namely private consumption, exchange rate fluctuations in the same period and a year trend (columns 1-3). Results are consistent with our previous estimates. Adding the average growth of the G7 countries instead of private consumption (columns 4-6), tax increases become more expansionary than spending cuts in the long run, but results are not statistically significant.

Next, we modify the baseline equation to include the same independent variables in the equations for both spending cuts and tax increases, together with a year trend (Columns 7-9). Most results are significant and suggest spending cuts are more expansionary than tax increases in all periods except period 3.

Finally, in table 5, we include different sets of control variables than in the baseline specification. In columns 10-12, we control for exchange rate fluctuations in the same period, the long-term government yield and a year trend. All results are smaller than in previous specifications. There is no statistically significant evidence that spending cuts are more expansionary than tax increases in the short run. In columns 13-15 we control for exchange rate fluctuations in the same period and government debt as a percentage of GDP. The magnitude of this results is similar to the initial one, and overall estimates are broadly consistent with previous analysis.

5.2 Inequality

In tables 6 and 7 we analyse the robustness of the results on the Gini coefficient. In columns 1-3 we include a time trend. In columns 4-6 we also include additional control variables, namely the unemployment rate and private consumption. Results are consistent

with the previous estimates. Tax increases seem to be less harmful in the short run when estimates are statistically significant, but more harmful in the long run.

Moreover, we analyse the baseline regression using the same independent variables for both tax increases and spending cuts, and include a time trend. Results are presented in columns 7-9. Estimates are still consistent with the previous analysis. As an alternative set of control variables we use the average growth of G7 countries and the unemployment rate (columns 10-12). This alters the results significantly. The long-run effects of overall, spending- and tax-based consolidations drop from 0.417, 0.381 and 0.613 in the initial estimation to 0.379, 0.271 and 0.347, respectively. However, the relative impact of spending and tax-based adjustments in the short and long run is unchanged.

Alternative specifications for the regressions on the income share held by each quintile of the population are presented in tables 8-9 and 10-11. In tables 8-9 we include a year trend instead of exchange rate fluctuations. In tables 10-11 we include a year trend, the average growth of G7 countries and gross fixed capital formation, instead of short-term interest rates and the percentage of population not in the age of working. Both estimations yield similar results to the ones previously obtained.

6 Concluding remarks

6.1 Conclusion

In recent years there has been a lively debate about the positive and negative impacts of austerity measures. In this paper we have studied the different impact that fiscal adjustments have on inequality and growth according to their composition. Results suggest there is a short-term trade-off between growth and inequality when implementing fiscal adjustments: in the short run, spending-based adjustments increase economic growth by more than tax-based adjustments, but increase inequality by more as well. However, results suggest that in the long run this trade-off disappears. Long-run estimates suggest that spending-based adjustments are more expansionary and increase inequality by less than tax-based adjustments. This expands on previous literature and suggests the existence of different medium-term dynamics in the impacts of fiscal policy.

While this analysis provides an argument for spending- rather than tax-based adjustments, it focuses on overall effects. Therefore, policy implications cannot be drawn without previously studying the specific areas where spending cuts and tax increases are implemented. For example, spending cuts in disability benefits are likely to have a greater impact on inequality than any tax increase. Similarly, since higher levels of income tend to save more, taxing those savings in not likely to be as harmful for growth as VAT increases. Further analysis should focus on providing more detailed estimates on which kinds of spending cuts and tax increases lead to better and worse outcomes.

6.2 Limitations

The main limitations of this analysis are the small number of observations and our measure of fiscal adjustments. A larger dataset and the use of the "narrative" approach to calculating fiscal adjustments could improve the evidence presented. All regressions pass the test for second order serial correlation or can only be rejected at the 10% level. Sargan tests reject the joint validity of instruments in some occasions, meaning that the lags of some variables used as instruments are correlated with the error term. This was expected since both GDP and inequality measures are affected by a large amount of factors that appear in the error term. As pointed out previously, the results of this analysis may have an upward bias. However, this is less relevant when analysing the relative effect between tax and spending adjustments, assuming the magnitude and direction is the same for both.

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Data appendix

Variables definitions and sources

- *Economic growth* = logarithm of real per capita GDP (World Bank)
- *Gini coefficient* = measures the deviation from a perfectly equal distribution of the distribution of after tax income (World Bank)
- *Share of income per quintile* = share income that accrues to subgroups of population indicated by quintiles (World Bank)
- *Cyclically adjusted primary balance (CAPB)* = cyclically adjusted primary deficit as a share of GDP (OECD)
- *Government revenue* = general government total receipts, as % of GDP (OECD)
- *Government spending* = total disbursements of general government, as a percentage of GDP (OECD)
- *Gross fixed capital formation (GFCF)* = additions to the fixed assets of the economy plus net changes in the level of inventories (World Bank)
- *Population not in the age of working* = population older than 65 or younger than 15, as a % of total population (OCED)
- *Exchange rate* = national currency per USD (OECD)
- *Short-term interest rate* = short-term interest rate set by the central bank (OECD)
- *Private consumption* = value of goods and services acquired and consumed by households, as a % of GDP (OECD)
- *Government debt* = government gross financial liabilities, as % of GDP (OECD)
- *G7 growth* = average per capita growth of G7 economies (OECD)
- *Unemployment rate* = number of unemployed individuals as a % of the labour force (OECD)

Sample country list[1]

Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, the Netherlands*, New Zealand, Norway, Poland, Portugal, the Slovak Republic*, Slovenia, Spain, Sweden, Switzerland, the United Kingdom and the United States.

[1] * indicates no data for Gini coefficients

Descriptive statistics for selected variables

Variable	Mean	Standard deviation	Min	Max	Observations
ΔEconomic growth	1.282	2.911	-15.735	10.367	420
ΔGini coefficient	-0.117	1.154	-6.520	4.090	190
ΔShare of income of the 1st quintile	-0.120	0.937	-4.840	2.840	190
ΔShare of income of the 2nd quintile	0.036	0.304	-1.010	1.890	190
ΔShare of income of the 3rd quintile	0.048	0.297	-1.050	1.260	190
ΔShare of income of the 4th quintile	0.039	0.303	-0.830	1.680	190
ΔShare of income of the 5th quintile	-0.003	0.377	-2.070	1.680	190
ΔCAPB	-0.003	2.439	-17.824	17.898	420
ΔGovernment revenue	0.049	1.157	-4.200	6.722	420
ΔGovernment spending	0.210	2.589	-20.167	18.474	420
ΔGFCF	-0.265	1.948	-11.120	6.783	417
Δ Population not in the age of working	0.367	-0.333	-0.232	1.557	420
ΔExchange rate	-0.299	18.363	-120.971	174.085	420
ΔShort-term interest rate	-0.382	1.290	-6.943	3.084	420
ΔPrivate consumption	-0.003	0.009	-0.047	0.048	420
ΔGovernment debt	2.263	6.581	-17.378	54.994	420
ΔG7 growth	-0.172	2.375	-4.028	6.985	420
ΔUnemployment rate	0.093	1.246	-4.295	7.917	420

Table 4. The effects of fiscal adjustments on real per capita GDP growth for different sets of variables (a)

	Log of real GDP per capita								
	(1) All Adjustments	(2) Spending-Based	(3) Tax-Based	(4) All Adjustments	(5) Spending-Based	(6) Tax-Based	(7) All Adjustments	(8) Spending-Based	(9) Tax-Based
ΔCAPB – t+1	0.188***	0.224***	0.112	0.165***	0.171**	0.140	0.183***	0.269***	0.181*
	(0.063)	(0.008)	(0.101)	(0.062)	(0.076)	(0.109)	(0.063)	(0.089)	(0.104)
ΔCAPB – t+2	0.213**	0.254***	0.138	0.182*	0.176**	0.139	0.203*	0.302***	0.191
	(0.107)	(0.087)	(0.157)	(0.102)	(0.071)	(0.152)	(0.104)	(0.094)	(0.147)
ΔCAPB – t+3	0.238	0.189**	0.252	0.187	0.158*	0.219	0.217	0.231**	0.284*
	(0.152)	(0.090)	(0.176)	(0.139)	(0.083)	(0.173)	(0.143)	(0.103)	(0.160)
ΔCAPB – Long term	1.373*	0.774***	0.757	1.013	0.595**	0.878	1.206	1.173**	0.977*
	(0.796)	(0.293)	(0.533)	(0.733)	(0.238)	(0.698)	(0.763)	(0.481)	(0.561)
Set of control variables 1	✓	✓	✓						
Set of control variables 2				✓	✓	✓			
Set of control variables 3							✓	✓	✓
Sargan test	0.000	0.001	0.013	0.000	0.000	0.004	0.000	0.003	0.006
AR(2)	0.011	0.941	0.541	0.053	0.623	0.541	0.037	0.677	0.450
Observations	328	119	118	328	119	118	328	119	118

Note: GMM estimation using Arellano-Bond. Table reports point estimates and delta method standard errors for cumulative effect of a 1% fiscal consolidation in t+1, t+2, t+3 and long run. Dependent variables: logarithm of real GDP in all columns. All specifications contain full set of country fixed effects. Significance levels: *** p<0.01, ** p<0.05, * p<0.1
Set of control variables 1 includes: Time trend, exchange rate, and first and second lags of short-term interest rate, population not in the age of working (all and spending-based adjustments), grossed fixed capital formation (all and tax-based adjustments) and private consumption as % of GDP.
Set of control variables 2 includes: Time trend, exchange rate, and first and second lags of short-term interest rate, population not in the age of working (all and spending-based adjustments), grossed fixed capital formation (all and tax-based adjustments) and average growth of G7 countries.
Set of control variables 3 includes: Time trend, exchange rate, and first and second lags of short-term interest rate, population not in the age of working, grossed fixed capital formation.

Table 5. The effects of fiscal adjustments on real per capita GDP growth for different sets of variables (b)

	Log of real GDP per capita					
	(10) All Adjustments	(11) Spending-Based	(12) Tax-Based	(13) All Adjustments	(14) Spending-Based	(15) Tax-Based
ΔCAPB – t+1	0.129**	0.240***	0.161	0.227***	0.334***	0.277**
	(0.053)	(0.087)	(0.105)	(0.047)	(0.122)	(0.127)
ΔCAPB – t+2	0.109	0.226***	0.232*	0.324***	0.407**	0.409**
	(0.075)	(0.070)	(0.128)	(0.067)	(0.182)	(0.192)
ΔCAPB – t+3	0.084	0.204**	0.143	0.350***	0.326	0.369*
	(0.101)	(0.100)	(0.135)	(0.090)	(0.205)	(0.212)
ΔCAPB – Long term	0.459	0.760***	0.599	1.805***	1.760	1.693*
	(0.407)	(0.270)	(0.384)	(0.460)	(1.415)	(0.982)
Set of control variables 4	✓	✓	✓			
Set of control variables 5				✓	✓	✓
Sargan test	0.000	0.000	0.002	0.000	0.000	0.001
AR(2)	0.005	0.661	0.629	0.007	0.610	0.752
Observations	328	119	118	328	119	118

Note: GMM estimation using Arellano-Bond. Table reports point estimates and delta method standard errors for cumulative effect of a 1% fiscal consolidation in t+1, t+2, t+3 and long run. Dependent variables: logarithm of real GDP in all columns. All specifications contain full set of country fixed effects. Significance levels: *** p<0.01, ** p<0.05, * p<0.1
Set of control variables 4 includes: Time trend, exchange rate, and first and second lags of long-term government yield.
Set of control variables 5 includes: Exchange rate and first and second lags of government debt.

Table 6. The effects of fiscal adjustments on Gini coefficients for different sets of variables (a)

	Gini coefficient					
	(1) All Adjustments	(2) Spending-Based	(3) Tax-Based	(4) All Adjustments	(5) Spending-Based	(6) Tax-Based
ΔCAPB – t+1	0.121*	0.240***	0.067	0.137*	0.254**	0.080*
	(0.072)	(0.092)	(0.045)	(0.070)	(0.101)	(0.044)
ΔCAPB – t+2	0.085*	0.147***	0.135**	0.101**	0.070	0.143***
	(0.050)	(0.053)	(0.055)	(0.044)	(0.060)	(0.051)
ΔCAPB – t+3	0.125***	-0.028	0.299***	0.135***	-0.046	0.239***
	(0.031)	(0.043)	(0.069)	(0.035)	(0.042)	(0.081)
ΔCAPB – Long term	0.381***	0.360***	0.637***	0.422***	0.278***	0.452**
	(0.124)	(0.126)	(0.243)	(0.112)	(0.097)	(0.200)
Set of control variables 1	✓	✓	✓			
Set of control variables 2				✓	✓	✓
Sargan test	0.026	0.584	0.352	0.021	0.583	0.378
AR(2)	0.683	0.166	0.0531	0.601	0.278	0.092
Observations	139	48	47	139	48	47

Note: GMM estimation using Arellano-Bond. Table reports point estimates and delta method standard errors for cumulative effect of a 1% fiscal consolidation in t+1, t+2, t+3 and long run. Dependent variables: Gini coefficient in all columns. All specifications contain full set of country fixed effects. Significance levels: *** p<0.01, ** p<0.05, * p<0.1
Set of control variables 1 includes: Logarithm of real GDP, Logarithm of real GDP squared, exchange rate, time trend and first and second lags of short-term interest rate, population not in the age of working (all and spending-based adjustments), grossed fixed capital formation (all and tax-based adjustments) and average growth of G7 countries.
Set of control variables 2 includes: Logarithm of real GDP, Logarithm of real GDP squared, exchange rate, time trend and first and second lags of short-term interest rate, population not in the age of working (all and spending-based adjustments), grossed fixed capital formation as percentage of GDP (all and tax-based adjustments), average growth of G7 countries, unemployment rate and private consumption as percentage of GDP.

Table 7. The effects of fiscal adjustments on Gini coefficients for different sets of variables (b)

	Gini coefficient					
	(7) All Adjustments	(8) Spending-Based	(9) Tax-Based	(10) All Adjustments	(11) Spending-Based	(12) Tax-Based
ΔCAPB – t+1	0.121*	0.231***	0.074	0.108**	0.124**	0.061
	(0.072)	(0.084)	(0.046)	(0.057)	(0.058)	(0.053)
ΔCAPB – t+2	0.085*	0.173***	0.135**	0.072*	0.125**	0.083***
	(0.050)	(0.051)	(0.052)	(0.041)	(0.053)	(0.028)
ΔCAPB – t+3	0.125***	-0.055	0.284***	0.138***	0.030	0.234***
	(0.031)	(0.047)	(0.071)	(0.035)	(0.045)	(0.055)
ΔCAPB – Long term	0.381***	0.349***	0.606**	0.379***	0.271**	0.347***
	(0.124)	(0.110)	(0.238)	(0.102)	(0.125)	(0.080)
Set of control variables 3	✓	✓	✓			
Set of control variables 4				✓	✓	✓
Sargan test	0.026	0.601	0.334	0.024	0.529	0.377
AR(2)	0.683	0.155	0.064	0.904	0.133	0.118
Observations	139	48	47	139	48	47

Note: GMM estimationn using Arellano-Bond. Table reports point estimates and delta method standard errors for cumulative effect of a 1% fiscal consolidation in t+1, t+2, t+3 and long run. Dependent variables: Gini coefficient in all columns. All specifications contain full set of country fixed effects. Significance levels: *** p<0.01, ** p<0.05, * p<0.1
Set of control variables 3 includes: Logarithm of real GDP, Logarithm of real GDP squared, exchange rate, time trend and first and second lags of short-term interest rate, population not in the age of working as % of total population, grossed fixed capital formation and average growth of G7 countries.
Set of control variables 4 includes: Logarithm of real GDP, Logarithm of real GDP squared and first and second lags of average growth of G7 countries and unemployment rate.

Table 8. The effects of fiscal adjustments on share of income held by each quintile of population (all adjustments) for an alternative set of variables (a)

	Share of Income per quintile				
	(1) First	(2) Second	(3) Third	(4) Fourth	(5) Fifth
ΔCAPB – t+1	0.125***	-0.039***	-0.044***	-0.025**	-0.021
	(0.045)	(0.142)	(0.011)	(0.011)	(0.018)
ΔCAPB – t+2	0.077**	-0.023***	-0.037***	-0.031***	0.000
	(0.032)	(0.008)	(0.012)	(0.010)	(0.018)
ΔCAPB – t+3	0.112***	-0.038***	-0.037***	-0.019**	-0.024*
	(0.030)	(0.009)	(0.014)	(0.010)	(0.014)
ΔCAPB – Long term	0.342***	-0.109***	-0.121***	-0.079***	-0.056*
	(0.080)	(0.222)	(0.027)	(0.025)	(0.030)
Sargan test	0.023	0.054	0.060	0.147	0.390
AR(2)	0.561	0.474	0.096	0.551	0.648
Observations	139	139	139	139	139

Note: GMM estimation using Arellano-Bond. Table reports point estimates and delta method standard errors for cumulative effect of a 1% fiscal consolidation in t+1, t+2, t+3 and long run. Dependent variables: share of income held by the 1st, 2nd, 3rd, 4th, and 5th quintiles in columns 1, 2, 3, 4, and 5, respectively. Control variables: real GDP per capita, real GDP per capita squared, year trend and first and second lags of short-term interest rate and population not in the age of working. All specifications contain full set of country fixed effects. Significance levels: *** p<0.01, ** p<0.05, * p<0.1

Table 9. The effects of fiscal adjustments on share of income held by each quintile of population (by composition) for an alternative set of variables (a)

	Share of income per quintile									
	(6) First Spending-based	(7) First Tax-based	(8) Second Spending-based	(9) Second Tax-based	(10) Third Spending-based	(11) Third Tax-based	(12) Fourth Spending-based	(13) Fourth Tax-based	(14) Fifth Spending-based	(15) Fifth Tax-based
ΔCAPB – t+1	0.125**	0.079*	-0.044**	-0.019	-0.042**	-0.036**	-0.016	-0.027**	-0.030	-0.003
	(0.005)	(0.045)	(0.019)	(0.014)	(0.019)	(0.016)	(0.016)	(0.013)	(0.024)	(0.011)
ΔCAPB – t+2	0.121***	0.043	-0.024*	-0.003	-0.054***	-0.019**	-0.031**	-0.022***	-0.016	-0.001
	(0.037)	(0.030)	(0.014)	(0.008)	(0.011)	(0.008)	(0.014)	(0.008)	(0.017)	(0.010)
ΔCAPB – t+3	0.001	0.183***	-0.001	-0.062***	-0.009	-0.057***	-0.017	-0.033**	0.017	-0.025
	(0.042)	(0.047)	(0.013)	(0.010)	(0.013)	(0.022)	(0.013)	(0.019)	(0.019)	(0.015)
ΔCAPB – Long term	0.248**	0.287***	-0.070*	-0.077***	-0.100***	-0.094***	-0.058**	-0.067***	-0.030	-0.029
	(0.102)	(0.083)	(0.036)	(0.025)	(0.033)	(0.023)	(0.027)	(0.022)	(0.042)	(0.027)
Sargan test	0.480	0.420	0.419	0.386	0.455	0.650	0.720	0.532	0.878	0.696
AR(2)	0.201	0.645	0.193	0.019	0.249	0.720	0.976	0.389	0.410	0.048
Observations	48	46	48	46	48	46	48	46	48	46

Note: GMM estimation using Arellano-Bond. Table reports point estimates and delta method standard errors for cumulative effect of a 1% fiscal consolidation in t+1, t+2, t+3 and long run. Dependent variables: share of income held by the 1st, 2nd, 3rd, 4th, and 5th quintiles in columns 6-7, 8-9, 10-11, 12-13, and 14-15, respectively. Control variables: real GDP per capita, real GDP per capita squared, year trend and first and second lags of short-term interest rate and population not in the age of working. All specifications contain full set of country fixed effects. Significance levels: *** p<0.01, ** p<0.05, * p<0.1

Table 10. The effects of fiscal adjustments on share of income held by each quintile of population (all adjustments) for an alternative set of variables (b)

	Share of Income per quintile				
	(1)	(2)	(3)	(4)	(5)
	First	Second	Third	Fourth	Fifth
ΔCAPB – t+1	0.104**	-0.021	-0.035***	-0.024**	-0.018
	(0.042)	(0.013)	(0.010)	(0.010)	(0.018)
ΔCAPB – t+2	0.063**	0.013	-0.031***	-0.023**	0.004
	(0.026)	(0.009)	(0.012)	(0.009)	(0.017)
ΔCAPB – t+3	0.117***	-0.038***	-0.042***	-0.021**	-0.026
	(0.031)	(0.009)	(0.014)	(0.010)	(0.016)
ΔCAPB – Long term	0.324***	-0.087***	-0.114***	-0.069***	-0.050
	(0.077)	(0.022)	(0.028)	(0.022)	(0.035)
Sargan test	0.017	0.034	0.070	0.071	0.401
AR(2)	0.600	0.369	0.078	0.297	0.179
Observations	139	139	139	139	139

Note: GMM estimation using Arellano-Bond. Table reports point estimates and delta method standard errors for cumulative effect of a 1% fiscal consolidation in t+1, t+2, t+3 and long run. Dependent variables: share of income held by the 1st, 2nd, 3rd, 4th, and 5th quintiles in columns 1, 2, 3, 4, and 5, respectively. Control variables: real GDP per capita, real GDP per capita squared, year trend and first and second lags average growth of G7 countries and gross fixed capital formation. All specifications contain full set of country fixed effects. Significance levels: *** p<0.01, ** p<0.05, * p<0.1

Table 11. The effects of fiscal adjustments on share of income held by each quintile of population (by composition) for an alternative set of variables (b)

	Share of income per quintile									
	(6) First Spending-based	(7) First Tax-based	(8) Second Spending-based	(9) Second Tax-based	(10) Third Spending-based	(11) Third Tax-based	(12) Fourth Spending-based	(13) Fourth Tax-based	(14) Fifth Spending-based	(15) Fifth Tax-based
ΔCAPB – t+1	0.129**	0.101***	-0.042**	-0.029**	-0.042**	-0.035***	-0.018	-0.011	-0.038**	-0.018
	(0.056)	(0.036)	(0.018)	(0.012)	(0.020)	(0.012)	(0.019)	(0.021)	(0.017)	(0.015)
ΔCAPB – t+2	0.132***	0.090***	-0.023*	-0.031***	-0.055***	-0.026***	-0.024**	0.000	0.021	-0.028
	(0.040)	(0.032)	(0.012)	(0.010)	(0.012)	(0.010)	(0.011)	(0.015)	(0.018)	(0.021)
ΔCAPB – t+3	0.029	0.218***	-0.012	-0.082***	-0.014	-0.068***	-0.018	-0.022	0.008	-0.037**
	(0.044)	(0.040)	(0.013)	(0.009)	(0.014)	(0.018)	(0.017)	(0.019)	(0.013)	(0.018)
ΔCAPB – Long term	0.286***	0.376***	-0.078*	-0.133***	-0.107***	-0.105***	-0.057*	-0.027	-0.051	-0.084
	(0.107)	(0.072)	(0.037)	(0.024)	(0.033)	(0.019)	(0.030)	(0.034)	(0.031)	(0.056)
Sargan test	0.483	0.459	0.441	0.420	0.348	0.635	0.548	0.604	0.720	0.709
AR(2)	0.182	0.309	0.201	0.034	0.178	0.806	0.331	0.740	0.208	0.043
Observations	48	46	48	46	48	46	48	46	48	46

Note: GMM estimation using Arellano-Bond. Table reports point estimates and delta method standard errors for cumulative effect of a 1% fiscal consolidation in t+1, t+2, t+3 and long run. Dependent variables: share of income held by the 1st, 2nd, 3rd, 4th, and 5th quintiles in columns 6-7, 8-9, 10-11, 12-13, and 14-15, respectively. Control variables: real GDP per capita real GDP per capita squared, year trend and first and second lags average growth of G7 countries and gross fixed capital formation. All specifications contain full set of country fixed effects. Significance levels: *** p<0.01, ** p<0.05, * p<0.1