

Online Appendix to: The Composition Effects of Tax-Based Consolidations on Income Inequality

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1 Robustness checks on baseline regression

To verify the validity of our baseline results, presented in Section 3 of the Main Text, we carry out a number of robustness checks. We present the tables with the results below. To ease comparison, in Panel (a) of each table we report estimates from our baseline specification.

We start by assessing the response of the economy to different types of consolidation episodes. Panels (b) and (c) of Table 1 report the estimated responses to a 1% of GDP increase in tax revenues during, respectively, any consolidation and spending-based consolidation episodes. The estimated coefficients suggest that the contemporaneous presence of spending cuts and tax hikes might confound the results concerning the effects of tax shocks on the economy. This is why we exclusively consider tax-based consolidation years in our baseline. Second, we address the potential concern that anticipation effects may bias our results. To this end, we use information contained in Alesina et al. (2015a) and Alesina et al. (2015b) to identify unanticipated tax-based consolidations (i.e. decided at year t for implementation in the same year) and we estimate relevant IRFs. The results reported in Panel (d) are qualitatively similar to those obtained in our baseline estimation.¹

Next, we check whether our results are robust to the use of alternative tax shock variables (Table 2). To control for potential endogeneity in the response of tax revenues to the business cycle, we estimate the model using cyclically-adjusted revenues.² We find results very similar to our baseline (Panel (b)). As a further check, and in order to facilitate comparison between our results and those of Woo et al. (2013) and Agnello and Sousa (2014), we also estimate the model employing the original real-time data collected by Devries et al. (2011) and Alesina et al. (2015a).

Next, we observe that some tax-based consolidations spanned over several consecutive years. This could potentially introduce a bias in the estimation. To understand why, consider a consolidation cycle lasting from period t to $t + 1$. If the consolidation of period $t + 1$ was decided by the government in the same period after observing the outcome of the consolidation at t , our results would be biased due to reverse causality. To circumvent this problem, Ball et al. (2013) employ a dummy shock taking value 1 in the first year of the tax-based consolidation cycle and 0 otherwise. However, their approach has two main drawbacks. First, it treats all consolidation cycles as if they were equal in size and length. Second, it unnecessarily sacrifices a large number of observations. An alternative approach is to exclude all consolidation years that might suffer from reverse causality issues. To do so, we use information contained in Alesina et al. (2015b) and Alesina et al. (2015a) in order to construct a shock variable which is the same as in our baseline with the exception that it takes value 0 in all years of tax-based consolidations that were (i) unanticipated (i.e. decided at year t for implementation in the same year), (ii) part of a multi-year consolidation cycle, and (iii) not the first year of such cycle.³ Next, we estimate the model using both a dummy variable à la Ball et al. (2013) and our alternative shock variable. We show results in

¹ Although not statistically different from our baseline, the response of the disposable Gini index becomes insignificant. This might be due the fact that the sample of consolidation episodes is greatly reduced, from 73 to 43.

² Cyclically-adjusted tax revenues are computed according to the following formula (see OECD (2015)):

$$t_t^{ad,i} = t_t^i (y_t^n / y_t)^{\varepsilon_i} \quad (1)$$

where $t_t^{ad,i}$ and t_t^i respectively stand for cyclically and not cyclically-adjusted tax revenues stemming from tax instrument i ; y_t^n is potential per capita output (derived from the IMF output gap measure); y_t is real per capita output and ε_i refer to the elasticity of tax instrument i . Elasticities are taken from the OECD Economic Outlook database inventories (OECD (2015)).

³ The shock variable is constructed according to the following formula: $X_{i,t}^j = d_t^1 (1 - d_t^u (1 - d_t^f)) \Delta t_{i,t}^j$ where d_t^u and d_t^f are two dummy variables: d_t^u takes value 1 in every year of unanticipated tax-based consolidations and 0 otherwise, while d_t^f takes value 1 in each first year of a tax-based consolidation cycle and 0 otherwise.

Table 3. In both cases the IRFs are qualitatively similar to our baseline.⁴ We conclude that our baseline results do not suffer from a reverse causality bias.

In Tables 4 and 5 we show that our baseline results are robust to the inclusion of different deterministic components, the use of different lag specifications, and the use of local projections as an alternative estimation method.⁵ When estimating IRFs from local projections (Table 5), we employ both our standard shock variable (Panels (b) and (c) for results with and without control variables) and the dummy à la Ball et al. (2013) (Panel (d)), so as to directly compare their results with ours. In all cases, the IRFs obtained using local projections are qualitatively similar to those generated by the PVAR methodology.

Furthermore, in Table 6 we show that our results are not driven by particular groups of countries, time periods, or type of shocks. More specifically, we repeat the estimation excluding from the sample, in turn, (i) the period following the global financial crisis (2008-2012), (ii) non-EU countries, (iii) shocks occurring during, or 1 or 2 years after, systemic banking crises, and (iv) shock outliers, i.e. those above the 97.5th percentile or below the 2.5th percentile. We also run the baseline regression by dropping one country at a time (Figure 1).

Next, we show that our results are robust to the selection of alternative endogenous variables and to the inclusion of several control variables. First, we estimate the model employing GDP per hour worked, average hours worked by employed individuals and the employment rate, instead of the GDP, unemployment and participation rates (Table 7). This exercise confirms the validity of our baseline results and suggests that the observed decline in real economic activity following tax-based consolidations is due to a drop in productivity. Second, we verify that our results are not biased by the omission of variables commonly used in the literature as a proxy for: (i) the degree of a country openness (import plus exports as a percentage of GDP), (ii) the progressivity of the tax system (the ratio of direct-to-indirect tax revenues), and (iii) other macroeconomic conditions (Tables 8 and 9).

Finally, since an issue when using the Gini index in cross-country studies is data comparability, we check whether our baseline results are robust to different measures of inequality. As alternative inequality measures, we employ the shares of income belonging to the richest 0.01%, 0.01-1%, and 1-10% individuals, which have been shown by Leigh (2007) to be good proxies of inequality across the income distribution. Additionally, we also use the income ratios of individuals in the 90th, 50th and 10th percentiles of the income distribution. However, these alternative measures of inequality are not without caveats. First, they are based on market rather than disposable incomes. Second, due to data availability, the sample

⁴ As expected, since our baseline shock variable and the dummy à la Ball et al. (2013) measure different things, some quantitative differences emerge when using the latter. However, results remain qualitatively similar.

⁵ To estimate IRFs directly from local projections, we employ the original specification proposed by Jordà (2005) and augment it with the correction proposed by Teulings and Zubanov (2014). Omitting such correction would leave the model misspecified and thus introduce a bias. To understand this point, consider a country i featuring only one fiscal policy shock at $t = 2$. When estimating an IRF(k) using the specification proposed by Jordà (2005), the estimator for $k = 1$ will be biased, since for $t = 1$ $y_{i,t+2}^j$ is already affected by the shock, although this does not appear among the regressors. Hence, after including the Teulings and Zubanov (2014) correction, we estimate the following equation:

$$y_{i,t+k} = c + \sum_{l=1}^2 \beta_l^k y_{i,t-l} + \gamma^{j,k} X_{i,t}^j + \sum_{l=1}^k \theta_l^k X_{i,t+l}^j + \alpha_i + \delta_t + \sum_{l=1}^2 \varphi_l^k Z_{i,t-l}^j + \tau_{it} + \epsilon_{i,t} \quad (2)$$

where $y_{i,t}$ denotes either the log of real GDP per capita, the Gini coefficient, or the unemployment and the labour force participation rate; $X_{i,t+l}$ denotes the shock variable; the term $\sum_{l=1}^k \theta_l^{j,k} X_{i,t+l}^j$ represents the Teulings and Zubanov (2014) correction; $Z_{i,t-l}$ is a vector of the other endogenous variables used as control variables; as in the PVAR specification. Finally, α_i , δ_t , τ_{it} denote, respectively, country-fixed effects, time-fixed effects and country-specific trends, and $k = 0, \dots, 10$ is the time horizon. To obtain the IRFs and construct confidence bands, we use respectively the estimated $\gamma^{j,k}$ coefficients and ± 1.645 cross-section heteroskedasticity robust standard errors.

size is reduced by 46.3% and 35.5% when using top income shares and the income ratios respectively. Bearing in mind these limitations, we present the main results in Tables 10-11 for top income shares and Table 12 for the income ratios.⁶ Although in some cases they are not significant, the new estimates have the expected sign and thus broadly confirm our baseline result that tax-based consolidations reduce income inequality.⁷

⁶ In Table 11 we also show results using top income shares and excluding Spain from the sample, since this country partially drives some of the results.

⁷ We also notice that when we use top income shares, inequality seems to decrease faster than when we use the Gini index. This might be due to the fact that top income shares are estimated based on yearly data, whereas the Gini index provided by the SWIID is constructed through imputation, with the original data being available only at 3 to 5-year intervals.

Table 1: Type of consolidation

	Impact	1y	3y	5y	10y
<i>a) Tax-based consolidation (baseline)</i>					
GDP	-0.56	-0.90	-1.12	-0.76	-0.05
Disposable Gini	-0.02	-0.10	-0.40	-0.27	-0.01
Unemployment	0.07	0.29	0.21	0.18	-0.03
Participation	0.04	0.04	-0.13	-0.14	-0.06
<i>b) Any consolidation</i>					
GDP	-0.30	-0.55	-0.59	-0.30	-0.01
Disposable Gini	0.15	0.24	0.14	0.05	-0.01
Unemployment	-0.03	0.14	0.19	0.07	-0.07
Participation	0.00	-0.07	-0.06	-0.03	0.02
<i>c) Spending-based consolidation</i>					
GDP	-0.11	-0.34	-0.17	-0.01	0.00
Disposable Gini	0.24	0.41	0.40	0.20	-0.01
Unemployment	-0.07	0.07	0.14	-0.03	-0.08
Participation	-0.03	-0.12	0.00	0.04	0.06
<i>d) Unanticipated tax-based consolidation</i>					
GDP	-0.73	-1.27	-1.61	-1.04	-0.03
Disposable Gini	0.02	-0.06	-0.31	-0.21	-0.01
Unemployment	0.10	0.41	0.48	0.35	-0.09
Participation	0.04	0.05	-0.21	-0.19	-0.05

Notes: The table reports the response to a 1% of GDP overall tax-based consolidation shock. Bold numbers indicate significance at the 10% confidence level. The spending-based sample comprises episodes in which spending cuts, as identified through the narrative approach, were larger than tax hikes, and vice versa for the tax-based sample. The unanticipated tax-based sample comprises tax-based episodes in which unanticipated tax hikes, announced during the same year of implementation, were larger than anticipated tax hikes (that is announced in years preceding the implementation year), according to the accounts of Alesina et al. (2015b) and Alesina et al. (2015a).

Table 2: Alternative shock variables

	Impact	1y	3y	5y	10y
<i>a) Ex-post actual tax revenues (baseline)</i>					
GDP	-0.56	-0.90	-1.12	-0.76	-0.05
Disposable Gini	-0.02	-0.10	-0.40	-0.27	-0.01
Unemployment	0.07	0.29	0.21	0.18	-0.03
Participation	0.04	0.04	-0.13	-0.14	-0.06
<i>b) Ex-post cyclically adjusted tax revenues</i>					
GDP	-0.52	-0.78	-0.96	-0.83	-0.44
Disposable Gini	-0.02	-0.10	-0.34	-0.24	-0.05
Unemployment	0.11	0.33	0.21	0.19	0.03
Participation	0.06	0.04	-0.13	-0.15	-0.11
<i>c) Real-time estimates - all consolidations</i>					
GDP	-0.60	-1.29	-1.62	-1.14	-0.15
Disposable Gini	-0.09	-0.02	-0.09	-0.11	-0.04
Unemployment	0.13	0.49	0.52	0.37	-0.09
Participation	0.11	0.08	-0.10	-0.13	-0.03

Notes: Panels (a), (b) and (c) report the response to a 1% of GDP overall tax-based consolidation shock, using alternative tax revenue data (respectively ex-post actual revenues, cyclically adjusted ex-post revenues and real-time estimates). Bold numbers indicate significance at the 10% confidence level.

Table 3: Reverse causality issues

	Impact	1y	3y	5y	10y
<i>a) All tax-based consolidation years (baseline)</i>					
GDP	-0.56	-0.90	-1.12	-0.76	-0.05
Disposable Gini	-0.02	-0.10	-0.40	-0.27	-0.01
Unemployment	0.07	0.29	0.21	0.18	-0.03
Participation	0.04	0.04	-0.13	-0.14	-0.06
<i>b) Excluding years of potential reverse causality issues</i>					
GDP	-0.49	-0.89	-0.85	-0.54	-0.01
Disposable Gini	-0.01	-0.10	-0.43	-0.29	0.01
Unemployment	0.08	0.32	0.08	0.06	-0.02
Participation	0.09	0.02	-0.11	-0.11	-0.05
<i>c) Dummy for first year of tax-based consolidation cycle</i>					
GDP	-0.58	-1.38	-1.92	-1.39	-0.22
Disposable Gini	-0.12	-0.07	-0.19	-0.17	-0.05
Unemployment	0.23	0.54	0.75	0.56	-0.04
Participation	0.18	0.08	-0.12	-0.17	-0.07

Notes: Panels (a) reports the baseline results, that is the response to a 1% of GDP overall tax shock during all tax-based consolidation years. Panel (b) reports the response to a 1% of GDP overall tax shock during all tax-based consolidation years except those when the consolidation was (i) unanticipated (i.e. decided at year t for implementation in the same year), (ii) part of a multi-year consolidation cycle, and (iii) not the first year of such cycle. Panel (c) reports the response to a tax-based consolidation cycle. This is estimated using a dummy variable taking value 1 for the first year of a tax-based consolidation cycle and 0 otherwise. Bold numbers indicate significance at the 10% confidence level.

The shock variable used to estimate the IRFs reported in Panel (b) is constructed according to the following equation: $X_{i,t}^{j,3} = d_t^l(1 - d_t^u(1 - d_t^f))\Delta t_{i,t}^j$, where d_t^u takes value 1 in every year of unanticipated tax-based consolidations and 0 otherwise, while d_t^f takes value 1 in each first year of a tax-based consolidation cycle and 0 otherwise.

Table 4: Alternative deterministic components and lag specifications

	Impact	1y	3y	5y	10y
<i>a) Country and time fixed effects, country-specific linear trends (baseline)</i>					
GDP	-0.56	-0.90	-1.12	-0.76	-0.05
Disposable Gini	-0.02	-0.10	-0.40	-0.27	-0.01
Unemployment	0.07	0.29	0.21	0.18	-0.03
Participation	0.04	0.04	-0.13	-0.14	-0.06
<i>b) Country and time fixed effects, common linear trend</i>					
GDP	-0.63	-1.08	-1.61	-1.41	-0.78
Disposable Gini	-0.02	-0.09	-0.36	-0.24	0.06
Unemployment	0.10	0.41	0.48	0.40	0.02
Participation	0.02	-0.06	-0.34	-0.37	-0.30
<i>c) First differences, country and time fixed effects, no trends</i>					
GDP	-0.47	-0.72	-1.04	-1.01	-0.99
Disposable Gini	0.07	0.06	-0.24	-0.27	-0.27
Unemployment	0.11	0.24	0.17	0.15	0.13
Participation	-0.01	-0.06	-0.29	-0.32	-0.32
<i>d) 3 lags of the endogenous variables</i>					
GDP	-0.40	-0.60	-0.93	-0.61	0.11
Disposable Gini	0.04	-0.03	-0.50	-0.43	0.04
Unemployment	0.13	0.24	0.14	0.08	0.03
Participation	0.04	0.04	-0.23	-0.21	-0.09
<i>e) 4 lags of the endogenous variables</i>					
GDP	-0.32	-0.74	-0.83	-0.46	-0.04
Disposable Gini	0.02	-0.03	-0.48	-0.25	0.05
Unemployment	0.16	0.36	0.20	0.07	0.11
Participation	0.07	0.10	-0.18	-0.10	-0.04

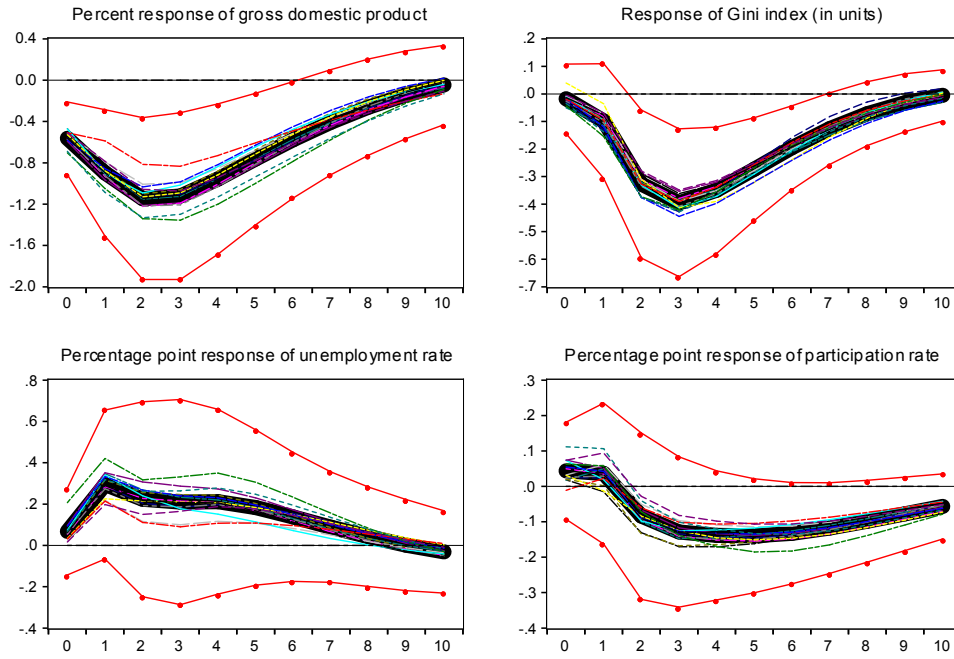
Notes: The table reports the response to a 1% of GDP tax-based consolidation shock. Bold numbers indicate significance at the 10% confidence level. Estimates in Panel (c) report accumulated responses.

Table 5: Estimation from local projections

	Impact	1y	3y	5y	10y
<i>a) PVAR (baseline)</i>					
GDP	-0.56	-0.90	-1.12	-0.76	-0.05
Disposable Gini	-0.02	-0.10	-0.40	-0.27	-0.01
Unemployment	0.07	0.29	0.21	0.18	-0.03
Participation	0.04	0.04	-0.13	-0.14	-0.06
<i>b) Local projections method - with no control variables</i>					
GDP	-0.40	-0.53	-1.17	-1.30	-0.78
Disposable Gini	-0.06	-0.17	-0.57	-0.28	0.03
Unemployment	0.10	0.21	0.31	0.86	0.14
Participation	0.08	-0.01	-0.34	-0.23	-0.18
<i>c) Local projections method - with control variables</i>					
GDP	-0.49	-0.66	-0.76	-1.00	-0.06
Disposable Gini	0.00	-0.06	-0.49	-0.15	-0.06
Unemployment	0.09	0.16	0.13	0.59	-0.27
Participation	0.05	0.00	-0.25	-0.21	0.95
<i>d) Local projections method - first year dummy</i>					
GDP	-0.37	-0.62	-1.70	-1.56	-0.22
Disposable Gini	-0.14	-0.13	-0.32	-0.21	0.64
Unemployment	0.16	0.33	0.69	1.04	-0.27
Participation	0.20	0.20	-0.05	-0.19	0.57

Notes: Panels (a), (b) and (c) report the response to a 1% of GDP overall tax-based consolidation shock. Estimates from panel (d) are obtained replacing the total tax shock variable with a dummy taking value 1 in the first year of a tax-based consolidation episodes and 0 otherwise. Coefficients from Panel (a) are estimated using the PVAR methodology, according to Equation 1 of the Main Text. Coefficients from Panels (b), (c) and (d) are estimated using local projections method, according to Equation 2, with $X_{i,t-l}^j$ being an empty vector for estimates of Panels (b) and (d). Bold numbers indicate significance at the 10% confidence level.

Figure 1: Sample stability - IRFs to a 1% of GDP tax-based consolidation shock



Notes: The figure shows 16 different IRFs to a 1% of GDP tax-based consolidation shock. The solid black line represents the baseline estimation. Each other coloured line represents an IRF estimated over a sample of 15 different countries, rather than all the 16 countries of the baseline specification. The red lines with circles represent the confidence bands of the baseline specification (Figure 1 in Section 3 of the Main Text).

Table 6: Sample selection

	Impact	1y	3y	5y	10y
<i>a) All sample (baseline)</i>					
GDP	-0.56	-0.90	-1.12	-0.76	-0.05
Disposable Gini	-0.02	-0.10	-0.40	-0.27	-0.01
Unemployment	0.07	0.29	0.21	0.18	-0.03
Participation	0.04	0.04	-0.13	-0.14	-0.06
<i>b) Excluding great financial crisis period (sample 1978-2007)</i>					
GDP	-0.55	-0.85	-0.81	-0.47	0.03
Disposable Gini	-0.02	-0.11	-0.42	-0.23	0.04
Unemployment	0.00	0.18	0.10	0.01	-0.07
Participation	-0.01	-0.01	-0.09	-0.11	-0.03
<i>c) Excluding non-EU countries</i>					
GDP	-0.50	-0.68	-0.86	-0.51	0.09
Disposable Gini	0.00	-0.09	-0.35	-0.24	-0.01
Unemployment	0.03	0.20	0.17	0.16	-0.03
Participation	0.02	0.00	-0.16	-0.13	-0.03
<i>d) Excluding consolidations in years of banking crisis</i>					
GDP	-0.60	-0.87	-1.07	-0.71	-0.03
Disposable Gini	0.00	-0.07	-0.37	-0.26	0.00
Unemployment	0.06	0.26	0.16	0.14	-0.04
Participation	0.03	0.02	-0.13	-0.13	-0.05
<i>e) Excluding shock outliers</i>					
GDP	-0.55	-1.07	-1.26	-0.89	-0.11
Disposable Gini	0.00	-0.07	-0.39	-0.27	0.00
Unemployment	0.14	0.45	0.28	0.23	-0.03
Participation	0.08	0.02	-0.16	-0.16	-0.06

Notes: The table reports the response to a 1% of GDP overall tax-based consolidation shock. Bold numbers indicate significance at the 10% confidence level.

Table 7: Alternative specifications with productivity, hours worked and employment

	Impact	1y	3y	5y	10y
GDP per hour worked	-0.23	-0.40	-0.47	-0.40	-0.27
Disposable Gini	-0.06	-0.15	-0.41	-0.26	0.01
Hours worked per employed person	0.10	-0.04	-0.03	0.01	0.05
Employment rate	-0.01	-0.08	-0.17	-0.17	-0.09

Notes: The table reports the response to a 1% of GDP overall tax-based consolidation shock. Bold numbers indicate significance at the 10% confidence level. Hours worked refer to employed individuals. Employment is measured as employed individuals as share of the active population.

Table 8: Omitted variables (1)

	Impact	1y	3y	5y	10y
<i>a) 5-variable PVAR (baseline)</i>					
GDP	-0.56	-0.90	-1.12	-0.76	-0.05
Disposable Gini	-0.02	-0.10	-0.40	-0.27	-0.01
Unemployment	0.07	0.29	0.21	0.18	-0.03
Participation	0.04	0.04	-0.13	-0.14	-0.06
<i>b) Government consumption</i>					
GDP	-0.55	-0.88	-1.11	-0.72	0.02
Disposable Gini	-0.02	-0.10	-0.40	-0.29	-0.05
Unemployment	0.07	0.29	0.21	0.17	-0.05
Participation	0.05	0.04	-0.12	-0.12	-0.03
Government consumption	0.07	0.00	-0.04	-0.09	-0.08
<i>c) Inflation</i>					
GDP	-0.62	-0.95	-1.08	-0.75	-0.14
Disposable Gini	-0.02	-0.10	-0.38	-0.26	-0.01
Unemployment	0.04	0.26	0.16	0.14	0.00
Participation	0.07	0.09	-0.07	-0.10	-0.06
Inflation	0.33	0.18	-0.29	-0.04	-0.03
<i>d) Savings</i>					
GDP	-0.55	-0.86	-1.08	-0.78	0.03
Disposable Gini	-0.02	-0.11	-0.41	-0.28	-0.03
Unemployment	0.07	0.29	0.19	0.18	-0.06
Participation	0.06	0.06	-0.11	-0.14	-0.02
Saving rate	-0.22	-0.23	-0.30	-0.08	0.13

Notes: The table reports the response to a 1% of GDP overall tax-based consolidation shock. Bold numbers indicate significance at the 10% confidence level.

Table 9: Omitted variables (2)

	Impact	1y	3y	5y	10y
<i>e) Trade balance</i>					
GDP	-0.55	-0.49	-0.88	-0.56	0.09
Disposable Gini	-0.02	-0.02	-0.34	-0.37	-0.03
Unemployment	0.07	0.06	0.12	0.02	-0.08
Participation	0.05	0.05	-0.05	-0.08	-0.03
Trade balance	0.07	-0.07	0.19	0.16	0.07
<i>b) Trade openness</i>					
GDP	-0.55	-0.88	-1.12	-0.79	-0.02
Disposable Gini	-0.02	-0.10	-0.38	-0.25	0.00
Unemployment	0.06	0.28	0.20	0.18	-0.07
Participation	0.04	0.04	-0.11	-0.12	-0.04
Import + Exports	0.00	0.58	-0.17	0.32	0.43
<i>c) Employment</i>					
GDP	-0.58	-0.98	-1.30	-0.99	-0.16
Disposable Gini	-0.01	-0.08	-0.38	-0.26	-0.01
Unemployment	0.07	0.32	0.28	0.28	0.00
Participation	0.07	0.06	-0.13	-0.16	-0.08
Employment rate	0.01	-0.17	-0.31	-0.35	-0.07
<i>d) Direct-to-indirect tax ratio</i>					
GDP	-0.52	-0.78	-0.91	-0.59	0.02
Disposable Gini	-0.04	-0.14	-0.46	-0.32	-0.02
Unemployment	0.09	0.33	0.22	0.19	0.01
Participation	0.04	0.04	-0.12	-0.13	-0.07
Direct-to-indirect tax ratio	0.03	0.01	0.00	0.00	0.00

Notes: The table reports the response to a 1% of GDP overall tax-based consolidation shock. Bold numbers indicate significance at the 10% confidence level.

Table 10: Robustness check - Alternative inequality measures (1)

	Impact	1y	3y	5y	10y
<i>a) Disposable Gini index (baseline)</i>					
GDP	-0.56	-0.90	-1.12	-0.76	-0.05
Disposable Gini	-0.02	-0.10	-0.40	-0.27	-0.01
Unemployment	0.07	0.29	0.21	0.18	-0.03
Participation	0.04	0.04	-0.13	-0.14	-0.06
<i>b) Top 0.01% income share</i>					
GDP	-0.28	-0.85	-1.22	-0.90	-0.27
Top 0.01% share	-0.03	-0.05	0.01	0.00	0.00
Unemployment	-0.41	-0.28	-0.13	0.03	-0.06
Participation	0.37	0.39	-0.03	-0.01	0.01
<i>c) Top 0.01-1% income share</i>					
GDP	-0.32	-0.85	-1.13	-0.79	-0.25
Top 0.01-1% share	-0.09	-0.11	0.05	0.06	0.02
Unemployment	-0.46	-0.22	-0.05	0.03	-0.06
Participation	0.44	0.30	-0.13	-0.03	0.02
<i>d) Top 1-10% income share</i>					
GDP	-0.32	-0.89	-1.25	-0.90	-0.18
Top 1-10% share	-0.03	-0.03	0.05	0.10	0.03
Unemployment	-0.52	-0.25	0.00	0.09	-0.05
Participation	0.50	0.36	-0.09	-0.05	-0.02

Notes: The table reports the response to a 1% of GDP overall tax-based consolidation shock. Bold numbers indicate significance at the 10% confidence level.

Table 11: Robustness check - Alternative inequality measures (2)

	Impact	1y	3y	5y	10y
<i>a) Disposable Gini index (baseline)</i>					
GDP	-0.56	-0.90	-1.12	-0.76	-0.05
Disposable Gini	-0.02	-0.10	-0.40	-0.27	-0.01
Unemployment	0.07	0.29	0.21	0.18	-0.03
Participation	0.04	0.04	-0.13	-0.14	-0.06
<i>b) Top 0.01% income share (excluding Spain)</i>					
GDP	-0.49	-1.02	-0.96	-0.53	-0.10
Top 0.01% share	-0.04	-0.09	0.01	0.01	0.00
Unemployment	0.18	0.58	0.17	0.03	-0.05
Participation	0.04	0.03	-0.23	-0.13	0.01
<i>c) Top 0.01-1% income share (excluding Spain)</i>					
GDP	-0.50	-1.04	-1.00	-0.54	-0.09
Top 0.01-1% share	-0.08	-0.23	0.01	0.04	0.02
Unemployment	0.18	0.59	0.23	0.07	-0.06
Participation	0.03	0.02	-0.22	-0.14	0.00
<i>d) Top 1-10% income share (excluding Spain)</i>					
GDP	-0.45	-0.97	-1.05	-0.66	-0.10
Top 1-10% share	-0.09	-0.10	0.06	0.07	0.01
Unemployment	0.12	0.51	0.24	0.17	-0.06
Participation	0.03	0.05	-0.18	-0.14	-0.01

Notes: The table reports the response to a 1% of GDP overall tax-based consolidation shock. Bold numbers indicate significance at the 10% confidence level.

Table 12: Robustness check - Alternative inequality measures (3)

	Impact	1y	3y	5y	10y
<i>a) Disposable Gini index (baseline)</i>					
GDP	-0.56	-0.90	-1.12	-0.76	-0.05
Disposable Gini	-0.02	-0.10	-0.40	-0.27	-0.01
Unemployment	0.07	0.29	0.21	0.18	-0.03
Participation	0.04	0.04	-0.13	-0.14	-0.06
<i>b) 90/10 Income ratio</i>					
GDP	-0.27	-0.53	-0.46	-0.47	-0.27
P90/P10 income ratio	0.12	-1.48	-0.84	0.03	-0.11
Unemployment	0.10	0.33	-0.30	-0.04	0.06
Participation	0.00	0.12	0.07	0.04	-0.02
<i>c) 90/50 Income ratio</i>					
GDP	-0.33	-0.66	-0.58	-0.49	-0.28
P90/P50 income ratio	0.02	-0.63	-1.51	-0.37	-0.08
Unemployment	0.14	0.44	-0.21	-0.03	0.05
Participation	-0.01	0.11	0.05	0.04	-0.01
<i>d) 50/10 Income ratio</i>					
GDP	-0.29	-0.56	-0.53	-0.44	-0.25
P50/P10 income ratio	0.67	0.34	0.75	0.09	0.00
Unemployment	0.15	0.40	-0.31	-0.14	0.05
Participation	0.01	0.14	0.07	0.04	-0.02

Notes: The table reports the response to a 1% of GDP overall tax-based consolidation shock.
Bold numbers indicate significance at the 10% confidence level.

2 Robustness checks on composition effects of tax-based consolidations

2.1 Direct and indirect tax-based consolidations

In this Section we present the robustness checks on our results for direct and indirect tax-based consolidations.

First, we address a potential criticism regarding our methodology. Introducing only one shock at a time (i.e. either direct or indirect taxes) might lead to neglect potential interactions among the different tax instruments. Although the null correlation between direct and indirect tax shocks during tax-based consolidation years makes this line of argument implausible, we check whether our results remain valid once including both shocks simultaneously. The new estimates, reported in Table 13, highlight the robustness of our results to this new specification.

Further, we check whether our results are driven by a particular country. To this purpose, we estimate the model excluding one country at a time. We conclude that our results are robust (Figures 2 and 3).

Finally, we estimate the model using our alternative measures of income inequality: the the top income shares and the income ratios. IRFs are presented in Tables 14-19. The results are broadly in line with what found earlier. Direct taxes significantly reduce the share of income of the very rich agents (the top 0.01%), by 0.1 percentage points on impact and after one year.⁸ Conversely, indirect taxes do not significantly reduce the share of the top 0.01% income earners, but do have some short-term significant negative effects on the income share of the richest 0.01-1% and 1-10% individuals. Moreover, the specifications with the income ratios confirm to a large extent our result that indirect tax-based consolidations reduce income inequality, with the P90/P10 and the P50/P10 ratios shrinking, respectively, by 14.16 and 3.82 percentage points on impact.

⁸ Tax avoidance practices are likely to partially reduce the egalitarian effect of direct taxes, as high-income earners may shift income over time and country more easily than middle and low-income earners (see also Atkinson et al. (2011)).

Table 13: Ordering of shocks

	Impact	1y	3y	5y	10y
<i>a) Direct tax-based</i>					
GDP	-0.59	-0.72	-1.13	-0.80	-0.06
Disposable Gini	0.03	0.13	-0.14	-0.17	0.00
Unemployment	0.06	0.19	-0.06	-0.04	-0.10
Participation	-0.06	0.06	-0.08	-0.08	0.00
<i>b) Indirect tax-based</i>					
GDP	-1.79	-4.10	-4.90	-3.86	-0.74
Disposable Gini	-0.32	-0.79	-1.25	-0.88	-0.17
Unemployment	0.75	1.90	2.43	1.82	0.10
Participation	0.59	0.22	-0.26	-0.56	-0.32
<i>c) Direct taxes (ordered first) and indirect taxes (ordered second) - shock to direct taxes</i>					
Direct taxes	1.00	0.19	0.00	0.01	0.00
Indirect taxes	-0.02	-0.01	0.00	0.00	0.00
GDP	-0.62	-0.77	-1.15	-0.77	-0.02
Disposable Gini	0.03	0.12	-0.14	-0.15	0.01
Unemployment	0.07	0.22	-0.04	-0.04	-0.12
Participation	-0.06	0.05	-0.09	-0.09	0.01
<i>d) Direct taxes (ordered first) and indirect taxes (ordered second) - shock to indirect taxes</i>					
Direct taxes	0.00	-0.08	0.05	0.03	0.01
Indirect taxes	1.00	-0.12	0.04	0.00	0.00
GDP	-1.91	-4.28	-5.05	-3.90	-0.76
Disposable Gini	-0.33	-0.81	-1.27	-0.87	-0.18
Unemployment	0.74	1.90	2.45	1.85	0.07
Participation	0.59	0.22	-0.28	-0.57	-0.31
<i>e) Indirect taxes (ordered first) and direct taxes (ordered second) - shock to direct taxes</i>					
Indirect taxes	0.00	-0.01	0.00	0.00	0.00
Direct taxes	1.00	0.19	0.00	0.01	0.00
GDP	-0.66	-0.87	-1.26	-0.86	-0.03
Disposable Gini	0.02	0.10	-0.17	-0.17	0.00
Unemployment	0.09	0.26	0.01	0.00	-0.12
Participation	-0.05	0.06	-0.10	-0.10	0.00
<i>f) Indirect taxes (ordered first) and direct taxes (ordered second) - shock to indirect taxes</i>					
Indirect taxes	1.00	-0.12	0.04	0.00	0.00
Direct taxes	-0.11	-0.10	0.05	0.03	0.01
GDP	-1.83	-4.18	-4.90	-3.81	-0.76
Disposable Gini	-0.33	-0.82	-1.25	-0.85	-0.18
Unemployment	0.73	1.87	2.45	1.85	0.09
Participation	0.59	0.21	-0.27	-0.55	-0.31

Notes: The table reports the response to a 1% of GDP overall tax-based consolidation shock under alternative ordering of shocks. Bold numbers indicate significance at the 10% confidence level.

Table 14: Robustness check - alternative inequality measures - direct taxes (1)

	Impact	1y	3y	5y	10y
<i>a) Disposable Gini index</i>					
GDP	-0.56	-0.90	-1.12	-0.76	-0.05
Disposable Gini	-0.02	-0.10	-0.40	-0.27	-0.01
Unemployment	0.07	0.29	0.21	0.18	-0.03
Participation	0.04	0.04	-0.13	-0.14	-0.06
<i>b) Top 0.01% income share</i>					
GDP	-0.37	-0.57	-0.93	-0.80	-0.22
Top 0.01% share	-0.07	-0.09	0.01	0.01	0.00
Unemployment	-0.24	-0.33	-0.55	-0.07	-0.05
Participation	0.16	0.35	-0.14	-0.03	0.01
<i>c) Top 0.01-1% income share</i>					
GDP	-0.40	-0.58	-0.84	-0.64	-0.19
Top 0.01-1% share	-0.14	-0.18	0.01	0.07	0.02
Unemployment	-0.29	-0.28	-0.46	-0.05	-0.05
Participation	0.23	0.27	-0.27	-0.06	0.02
<i>d) Top 1-10% income share</i>					
GDP	-0.45	-0.69	-1.20	-1.06	-0.21
Top 1-10% share	0.01	0.02	-0.06	0.11	0.04
Unemployment	-0.37	-0.30	-0.45	0.06	-0.06
Participation	0.34	0.34	-0.07	-0.04	-0.02

Notes: The table reports the response to a 1% of GDP direct tax-based consolidation shock using alternative inequality measures. Bold numbers indicate significance at the 10% confidence level.

Table 15: Robustness check - alternative inequality measures - direct taxes (2)

	Impact	1y	3y	5y	10y
<i>a) Disposable Gini index</i>					
GDP	-0.56	-0.90	-1.12	-0.76	-0.05
Disposable Gini	-0.02	-0.10	-0.40	-0.27	-0.01
Unemployment	0.07	0.29	0.21	0.18	-0.03
Participation	0.04	0.04	-0.13	-0.14	-0.06
<i>b) Top 0.01% income share (excluding Spain)</i>					
GDP	-0.79	-1.20	-1.41	-0.88	-0.22
Top 0.01% share	-0.08	-0.14	-0.01	0.01	0.00
Unemployment	0.24	0.66	0.15	0.01	-0.07
Participation	0.11	0.19	-0.27	-0.18	0.01
<i>c) Top 0.01-1% income share (excluding Spain)</i>					
GDP	-0.75	-1.15	-1.43	-0.93	-0.22
Top 0.01-1% share	-0.11	-0.28	-0.02	0.05	0.03
Unemployment	0.19	0.60	0.19	0.10	-0.09
Participation	0.10	0.19	-0.23	-0.16	0.01
<i>d) Top 1-10% income share (excluding Spain)</i>					
GDP	-0.74	-1.12	-1.41	-1.00	-0.21
Top 1-10% share	-0.04	-0.03	-0.04	0.08	0.01
Unemployment	0.18	0.57	0.17	0.19	-0.08
Participation	0.08	0.18	-0.21	-0.14	-0.01

Notes: The table reports the response to a 1% of GDP direct tax-based consolidation shock using alternative inequality measures. Bold numbers indicate significance at the 10% confidence level.

Table 16: Robustness check - alternative inequality measures - direct taxes (3)

	Impact	1y	3y	5y	10y
<i>a) Disposable Gini index</i>					
GDP	-0.56	-0.90	-1.12	-0.76	-0.05
Disposable Gini	-0.02	-0.10	-0.40	-0.27	-0.01
Unemployment	0.07	0.29	0.21	0.18	-0.03
Participation	0.04	0.04	-0.13	-0.14	-0.06
<i>b) 90/10 Income ratio</i>					
GDP	-0.55	-0.41	-0.40	-0.47	-0.21
P90/P10 income ratio	1.73	-0.36	-3.13	0.25	-0.09
Unemployment	-0.02	0.16	-0.46	0.06	0.06
Participation	-0.11	0.01	-0.03	-0.02	-0.03
<i>c) 90/50 Income ratio</i>					
GDP	-0.62	-0.55	-0.52	-0.45	-0.19
P90/P50 income ratio	-0.01	-0.52	-1.69	-0.26	-0.05
Unemployment	0.04	0.29	-0.37	0.02	0.04
Participation	-0.11	0.01	-0.07	-0.02	-0.02
<i>d) 50/10 Income ratio</i>					
GDP	-0.58	-0.44	-0.49	-0.50	-0.19
P50/P10 income ratio	1.36	0.72	-0.14	0.15	-0.02
Unemployment	0.04	0.23	-0.45	0.02	0.05
Participation	-0.09	0.04	-0.03	-0.04	-0.03

Notes: The table reports the response to a 1% of GDP direct tax-based consolidation shock using alternative inequality measures. Bold numbers indicate significance at the 10% confidence level.

Table 17: Robustness check - alternative inequality measures - indirect taxes (1)

	Impact	1y	3y	5y	10y
<i>a) Disposable Gini index</i>					
GDP	-1.79	-4.10	-4.90	-3.86	-0.74
Disposable Gini	-0.32	-0.79	-1.25	-0.88	-0.17
Unemployment	0.75	1.90	2.43	1.82	0.10
Participation	0.59	0.22	-0.26	-0.56	-0.32
<i>b) Top 0.01% income share</i>					
GDP	-1.48	-4.81	-4.81	-3.10	-0.86
Top 0.01% share	-0.03	0.06	-0.04	0.02	0.01
Unemployment	-0.34	1.30	1.63	0.38	-0.18
Participation	1.37	1.05	-0.02	-0.11	0.01
<i>c) Top 0.01-1% income share</i>					
GDP	-1.59	-4.90	-4.77	-2.89	-0.83
Top 0.01-1% share	-0.44	-0.16	0.15	0.18	0.09
Unemployment	-0.55	1.41	1.91	0.42	-0.21
Participation	1.69	0.92	-0.40	-0.16	0.07
<i>d) Top 1-10% income share</i>					
GDP	-1.44	-4.70	-4.12	-2.58	-0.47
Top 1-10% share	-0.29	-0.37	0.38	0.24	0.08
Unemployment	-0.60	1.26	1.75	0.49	-0.14
Participation	1.44	0.87	-0.36	-0.20	-0.05

Notes: The table reports the response to a 1% of GDP indirect tax-based consolidation shock using alternative inequality measures. Bold numbers indicate significance at the 10% confidence level.

Table 18: Robustness check - alternative inequality measures - indirect taxes (2)

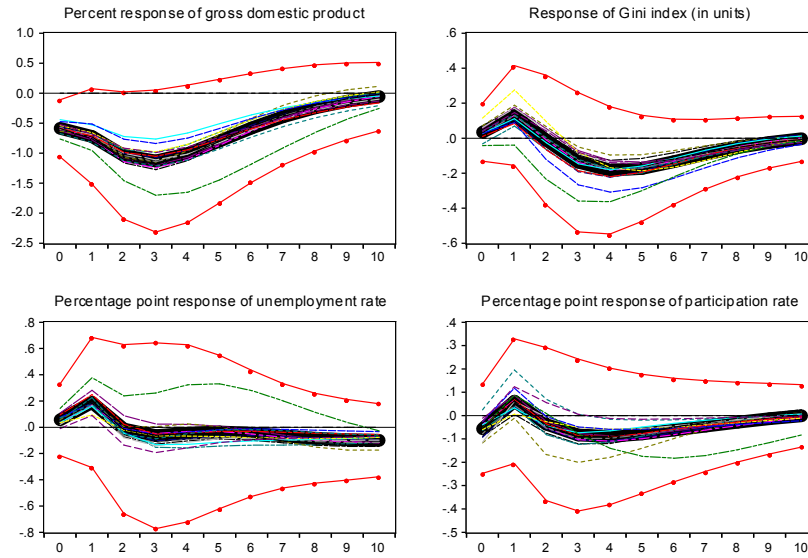
	Impact	1y	3y	5y	10y
<i>a) Disposable Gini index</i>					
GDP	-1.79	-4.10	-4.90	-3.86	-0.74
Disposable Gini	-0.32	-0.79	-1.25	-0.88	-0.17
Unemployment	0.75	1.90	2.43	1.82	0.10
Participation	0.59	0.22	-0.26	-0.56	-0.32
<i>b) Top 0.01% income share (excluding Spain)</i>					
GDP	-1.42	-4.52	-2.17	-0.49	0.34
Top 0.01% share	-0.09	0.04	-0.04	0.03	0.00
Unemployment	0.25	1.65	1.35	0.29	-0.10
Participation	-0.09	-0.77	-0.79	-0.50	0.00
<i>c) Top 0.01-1% income share (excluding Spain)</i>					
GDP	-1.53	-4.69	-2.22	-0.45	0.43
Top 0.01-1% share	-0.51	-0.39	-0.12	0.08	-0.02
Unemployment	0.37	1.87	1.41	0.27	-0.13
Participation	-0.06	-0.75	-0.90	-0.57	-0.01
<i>d) Top 1-10% income share (excluding Spain)</i>					
GDP	-1.39	-4.50	-2.39	-0.85	0.42
Top 1-10% share	-0.20	-0.48	0.60	0.23	-0.04
Unemployment	0.12	1.48	1.33	0.45	-0.21
Participation	-0.02	-0.64	-0.80	-0.58	0.01

Notes: The table reports the response to a 1% of GDP indirect tax-based consolidation shock using alternative inequality measures. Bold numbers indicate significance at the 10% confidence level.

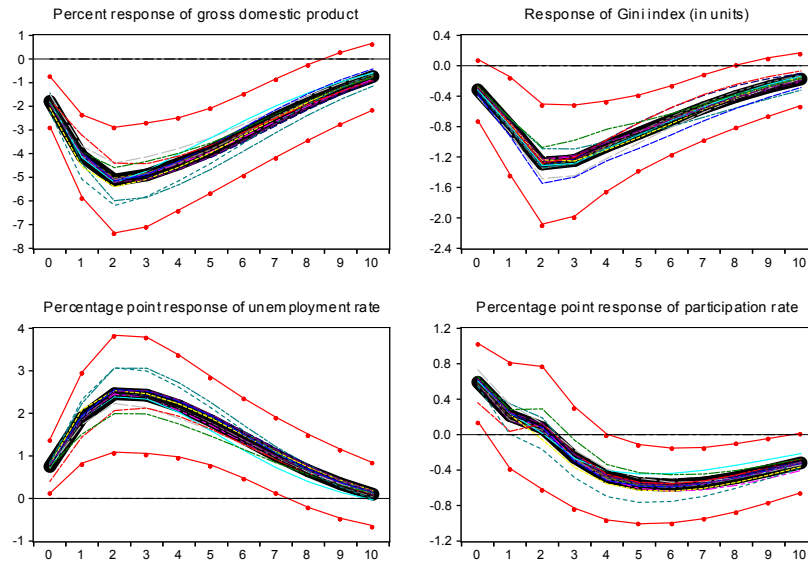
Table 19: Robustness check - alternative inequality measures - indirect taxes (3)

	Impact	1y	3y	5y	10y
<i>a) Disposable Gini index</i>					
GDP	-0.59	-0.72	-1.13	-0.80	-0.06
Disposable Gini	0.03	0.13	-0.14	-0.17	0.00
Unemployment	0.06	0.19	-0.06	-0.04	-0.10
Participation	-0.06	0.06	-0.08	-0.08	0.00
<i>b) 90/10 Income ratio</i>					
GDP	-1.23	-3.59	-4.69	-3.32	-1.35
P90/P10 income ratio	-14.16	-9.74	3.00	-1.60	-0.51
Unemployment	0.94	2.00	2.33	1.04	0.19
Participation	0.20	0.10	-0.11	-0.29	-0.07
<i>c) 90/50 Income ratio</i>					
GDP	-1.30	-3.70	-4.78	-3.39	-1.38
P90/P50 income ratio	-3.47	-2.35	-2.85	-1.04	-0.30
Unemployment	0.95	2.08	2.56	1.15	0.14
Participation	0.19	0.08	-0.09	-0.25	-0.05
<i>d) 50/10 Income ratio</i>					
GDP	-1.19	-3.51	-4.57	-3.08	-1.29
P50/P10 income ratio	-3.82	-2.13	2.04	-0.40	0.03
Unemployment	0.98	2.01	2.10	0.73	0.17
Participation	0.23	0.15	-0.09	-0.20	-0.07

Notes: The table reports the response to a 1% of GDP indirect tax-based consolidation shock using alternative inequality measures. Bold numbers indicate significance at the 10% confidence level.

Figure 2: Sample stability - IRFs to a 1% of GDP direct tax-based consolidation shock

Notes: The figure shows 16 different IRFs to a 1% of GDP direct tax-based consolidation shock. The solid black line represents the baseline estimation (Panel (b) of Table 6 in the Main Text). Each other coloured line represents an IRF estimated over a sample of 15 different countries, rather than all the 16 countries of the baseline specification. The red lines with circles represent the confidence bands of the baseline specification.

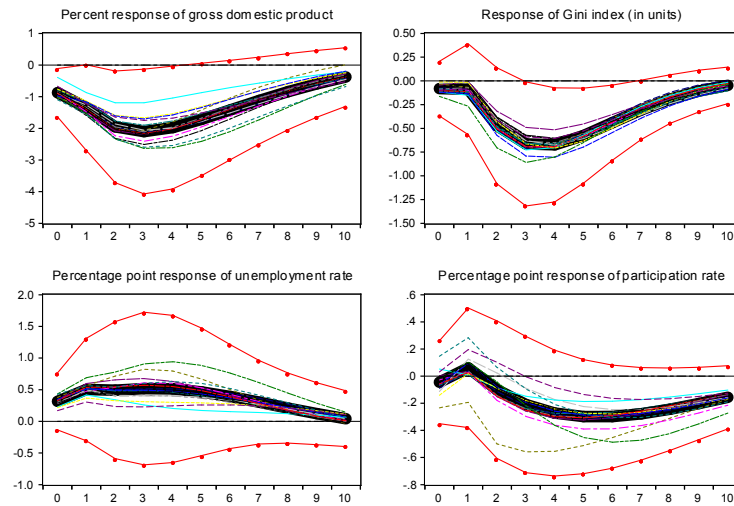
Figure 3: Sample stability - IRFs to a 1% of GDP indirect tax-based consolidation shock

Notes: The figure shows 16 different IRFs to a 1% of GDP indirect tax-based consolidation shock. The solid black line represents the baseline estimation (Panel (c) of Table 6 in the Main Text). Each other coloured line represents an IRF estimated over a sample of 15 different countries, rather than all the 16 countries of the baseline specification. The red lines with circles represent the confidence bands of the baseline specification.

2.2 Composition effects of direct-tax based consolidations

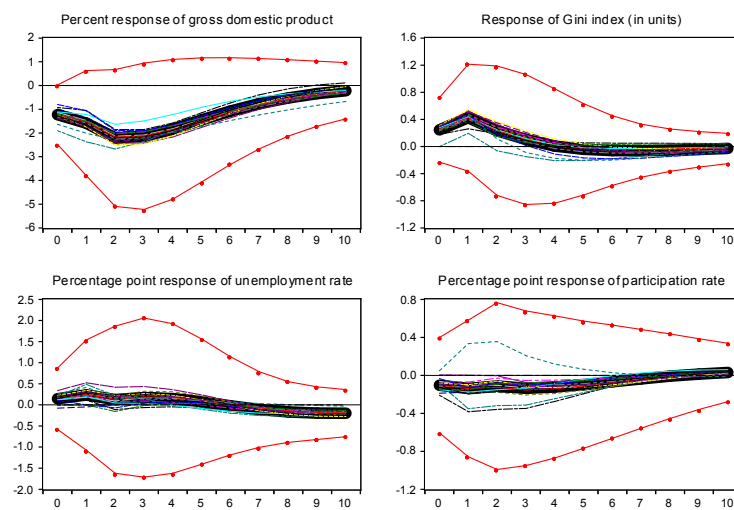
Below we show the country stability robustness checks for personal, corporate and SSC tax-based consolidations. This exercise entails repeating the estimation 16 number of times, each time excluding one different country. While for personal and corporate our results are robust, the estimated responses of the labour force participation to a SSC tax-based consolidation is driven by a single country. When this country is excluded, the response of the labour force participation is not statistically different from 0.

Figure 4: Sample stability - IRFs to a 1% of GDP personal tax-based consolidation shock

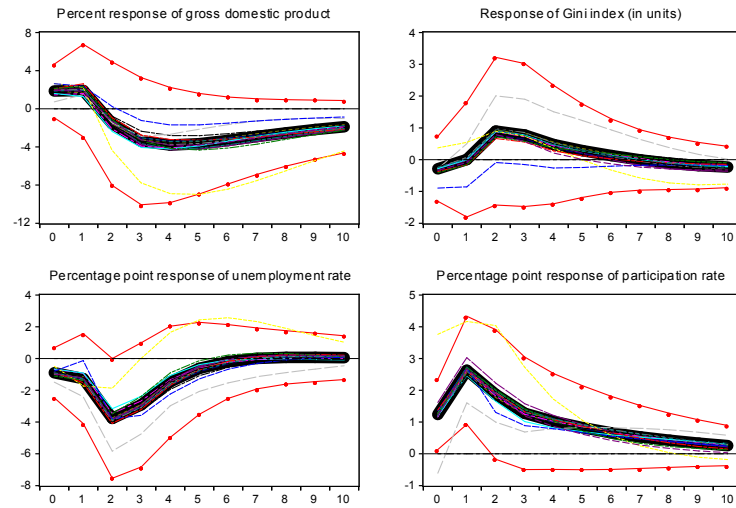


Notes: The figure shows 16 different IRFs to a 1% of GDP personal tax-based consolidation shock. The solid black line represents the baseline estimation (Panel (b) of Table 8 in the Main Text). Each other coloured line represents an IRF estimated over a sample of 15 different countries, rather than all the 16 countries of the baseline specification. The red lines with circles represent the confidence bands of the baseline specification.

Figure 5: Sample stability - IRFs to a 1% of GDP corporate tax-based consolidation shock



Notes: The figure shows 16 different IRFs to a 1% of GDP corporate tax-based consolidation shock. The solid black line represents the baseline estimation (Panel (c) of Table 8 in the Main Text). Each other coloured line represents an IRF estimated over a sample of 15 different countries, rather than all the 16 countries of the baseline specification. The red lines with circles represent the confidence bands of the baseline specification.

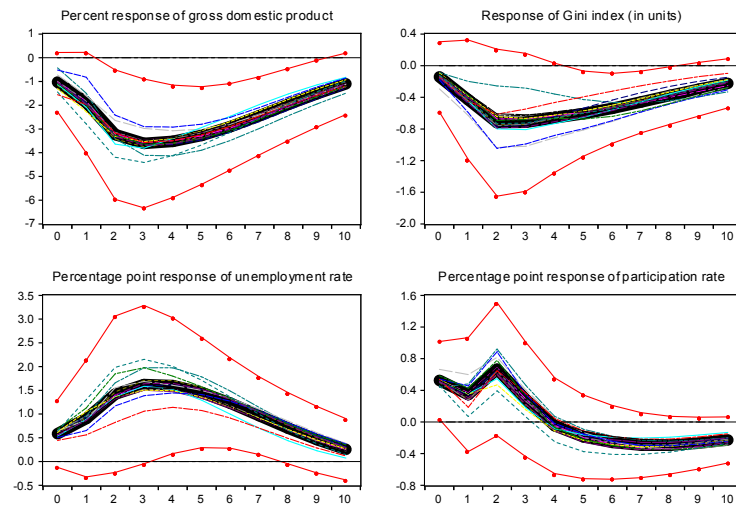
Figure 6: Sample stability - IRFs to a 1% of GDP SSC-based consolidation shock

Notes: The figure shows 16 different IRFs to a 1% of GDP SSC-based consolidation shock. The solid black line represents the baseline estimation (Panel (d) of Table 8 in the Main Text). Each other coloured line represents an IRF estimated over a sample of 15 different countries, rather than all the 16 countries of the baseline specification. The red lines with circles represent the confidence bands of the baseline specification.

2.3 Composition effects of indirect-tax based consolidations

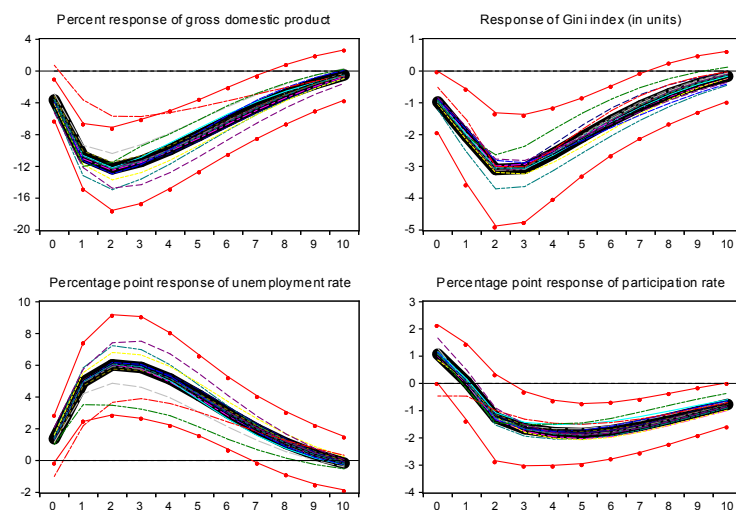
Below we show the country stability robustness checks for GT and SGS tax-based consolidations. This exercise entails repeating the estimation 16 number of times, each time excluding one different country. While for GT our results are robust, those for SGS tax-based consolidations are not.

Figure 7: Sample stability - IRFs to a 1% of GDP GT-based consolidation shock



Notes: The figure shows 16 different IRFs to a 1% of GDP GT-based consolidation shock. The solid black line represents the baseline estimation (Panel (b) of Table 9 in the Main Text). Each other coloured line represents an IRF estimated over a sample of 15 different countries, rather than all the 16 countries of the baseline specification. The red lines with circles represent the confidence bands of the baseline specification.

Figure 8: Sample stability - IRFs to a 1% of GDP SGS-based consolidation shock



Notes: The figure shows 16 different IRFs to a 1% of GDP SGS-based consolidation shock. The solid black line represents the baseline estimation (Panel (c) of Table 9 in the Main Text). Each other coloured line represents an IRF estimated over a sample of 15 different countries, rather than all the 16 countries of the baseline specification. The red lines with circles represent the confidence bands of the baseline specification.

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