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Labour market rigidity and expansionary austerity

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ABSTRACT

This study provides new evidence on how labour market rigidities affect the transmission of fiscal consolidations using a sample of 17 OECD countries. Owing to a novel empirical approach, the outcomes of consolidations are modelled as a function of employment and wage rigidities. The evidence confirms that tax-based consolidations are distortionary, while expenditure-based consolidations have wealth effects. These effects are then magnified by flexible employment and rigid wages, while they are moderated by rigid employment and flexible wages. This indicates that labour market conditions influence how fiscal consolidation is propagated in the economy by affecting both the magnitude and the transmission channels of consolidation plans. This result has crucial policy implications and suggests that the design of consolidation plans should account for the labour market structure.

1. Introduction

Can the structure of the labour market affect the responses of macroeconomic variables to fiscal policy? To answer such a question, theoretical studies augment business cycle models with two broad categories of rigidities: (i) frictions limiting flows in and out of employment, such as hiring-firing costs (e.g. Cacciatore et al., 2021); and (ii) frictions limiting the adjustment of real wages, such as downward wage rigidity (e.g Shen and Yang, 2018). These studies find conflicting evidence on the role of labour market frictions, thereby revealing results that depend on the assumptions of the model employed. This lack of theoretical consensus is combined with scarce empirical evidence: only a few studies empirically assess the role of the labour market in the transmission of fiscal policy.

This paper contributes to this research program by providing new stylized facts on the influence of the labour market structure on the effects of fiscal policy. Using data from 1978 to 2014, the paper investigates how labour market rigidities affect the transmission of consolidation plans in a panel of 17 countries. To this aim, the paper proposes a novel estimation approach, the Interacted Panel Local Projection (IPLP), in which the responses of economic variables to consolidations vary deterministically with measures of labour market rigidity: the Employment Protection Legislation (EPL) and the Unemployment Benefit Replacement Rate (UBRR). The presence of a deterministic relationship is advantageous because it allows us to consider the multidimensional character of both labour market structures and consolidation plans, while preserving the information provided by continuous variables.

As a preliminary step, the paper assesses the average effect of consolidations, finding that tax-based consolidations have a stronger and longer depressive effect, while expenditure-based consolidations are generally inflationary and with much milder effects on

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consumption. In line with extant studies (e.g. Barro and Redlick, 2011; Alesina et al., 2017), these results suggest the presence of a wealth effect in expenditure cuts and a distortionary effect in tax hikes.

Then, the paper shows that labour market characteristics influence the transmission of consolidations. When looking at job regulation, the evidence indicates that lower EPL exacerbates the contractionary effect of tax-based plans and it turns the otherwise depressive effect of expenditure-based plans into an expansion. The latter result is due to the fact that the looser job regulation amplifies the positive wealth effect of expenditure-based consolidations, which then become expansionary. This mechanism reconciles my findings with the ones in previous studies (Cacciatore et al., 2021). On the wage rigidity side, lower UBRR moderates the depressive effect of tax-based consolidations, while the expansionary role of expenditure-based plans becomes not significant. The paper also shows how the economic responses to consolidations change monotonically, but not always linearly, along the rigidities' distribution.

These facts suggest that the effects of consolidations depend on the ratio of wage flexibility to employment flexibility. This ratio proxies the relative cost, for firms, of adjusting wages instead of employment: as a result, firms reduce wages when wages are more flexible than employment (and vice versa). The resulting reduction in wages produces a negative income effect, which offsets the wealth effect of expenditure-based consolidations and tapers the distortionary effect of tax-based consolidations. On the contrary, relatively more flexible employment mutes the response of wages, thus reinforcing the effects of consolidations. As a consequence, the outcome of consolidation also depends on how labour frictions affect the households' allocation of leisure and consumption.

The results have clear policy and modelling implications. On the policy side, when designing consolidation plans, governments should account for the structure of the labour market. This can be particularly relevant in the European Union, where extensive labour market reforms are among the priorities of several governments: these reforms will likely modify the structure of the labour market, thereby changing the effects of consolidation. On the modelling side, theoretical models should incorporate the labour market structure when analysing the effects of fiscal policy, in that different structures can largely modify the transmission channels of fiscal shocks.

The paper extends the studies investigating the relationship between the labour market and the transmission of fiscal policy, which have traditionally focused on employment rigidity and expenditure shocks, theoretically (Monacelli et al., 2010; Campolmi et al., 2011; Brückner and Pappa, 2012; Faia et al., 2013; Cacciatore et al., 2021) and empirically (Auerbach and Gorodnichenko, 2012a; Turrini, 2013). My paper extends this literature along two dimensions. First, my paper adds wage rigidity and taxation to the policy mix in an empirical setting, thereby showing that is the rigidities' ratio what makes employment more volatile and, thus, generates the amplification mechanism discussed in previous studies (e.g. Cacciatore et al., 2021). Furthermore, the use of two indicators (EPL and UBRR) increases the interpretability of the results from a theoretical perspective. Second, the empirical methodology: while those studies employ a dummy-based approach, my paper employs the IPLP. The new methodology overcomes some limitations of the dummy-based approach, namely that the discretization of a continuous variable can produce inefficient or misleading estimates (see Rucker et al., 2015). In addition, it allows to sharpen the results by providing precise evidence on the role of the rigidities at the margins.

This paper also builds upon the literature on consolidations (for a survey, see Alesina et al., 2019a,b). In particular, Alesina and Ardagna (2013) documents that least costly consolidations are those that were accompanied by labour market liberalizations, i.e. reductions in EPL, while Alesina et al. (2019a) shows that these liberalizations do not affect the likelihood of consolidations. However, these studies do not clarify if the cost of consolidations reduces because the liberalization stimulates the economy, thus partially offsetting the depressive role of consolidations, or because the different structures of the labour market change the transmission of consolidations. My paper fills this gap by showing that the labour market structure modifies the effects of consolidations and by providing evidence on the channels involved in this change. In doing this, my empirical evidence suggests that households respond more to risks associated with wages than to those associated with unemployment, whereas confidence does not play a major role in contrast with recent studies (Beetsma et al., 2015, 2021).

Finally, this paper contributes a novel empirical methodology, the IPLP. Compared to extant methodologies (e.g. Sa et al., 2014; Ramey and Zubairy, 2018), the IPLP offers a good balance between parsimony and completeness. As a matter of fact, the proposed methodology uses a more parsimonious specification to explore interactions between shocks and exogenous indicators whereas it does not dichotomize these indicators. This allows investigating how the transmission of shocks changes along their entire distribution of the indicators while saving degrees of freedom, thus demanding less data compared to Interacted VARS (Towbin and Weber, 2013).

The paper is organized as follows: Section 2 presents the data; Section 3 discusses the methodology; Section 4 reports and discusses the main results and extensions; Section 5 concludes.

2. The data

The dataset contains yearly observations for a panel of 17 OECD countries,[2] covering the period 1978–2014. Macroeconomic data come primarily from the OECD.[3] CPI and Total Factor Productivity (TFP) are collected from AMECO and the Long Term Productivity Database (Bergeaud et al., 2016), respectively. Missing observations have been reconstructed from additional sources: a detailed description is included in Appendix.

[2] Austria, Australia, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, The Netherlands, Portugal, Spain, Sweden, UK, and US.

[3] OECD Economic Outlook Database, n. 106 (October 2019); and Main Economy Indicators (MEI), October 2019, for the Economic Sentiment Indicators.

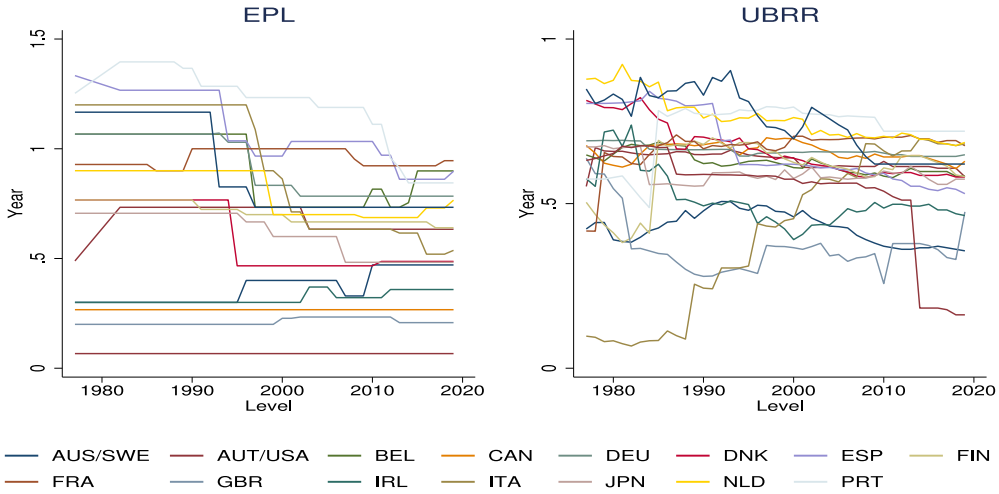

Fig. 1. EPL and UBRR,1978–2019. Notes. The figure displays the values of EPL and UBRR employed in the paper. The Appendix details how these variables have been reconstructed.

Data on fiscal consolidations are taken primarily from Alesina et al. (2018). The original (Alesina et al., 2018) dataset has been extended to preserve the widest cross-sectional heterogeneity with observations on The Netherlands from Alesina et al. (2015a).[4] The data report information on *consolidation plans* by disentangling the component of consolidation that is announced and implemented in the same year and changes that are approved in one year but implemented up to 5 periods ahead. In addition, the consolidation plans distinguish between *tax-* and *expenditure-based* plans: a plan is defined as *tax-* (*expenditure-*) *based* if more than half of the expected change of the primary balance is due to a tax hike (expenditure cut), thereby making the two measures orthogonal to one another (Alesina et al., 2015a).

The role of the labour market is investigated by means of two indicators. The first is the Employment Protection Legislation (EPL), which measures the stringency of hiring and firing regulations and has been gathered from the CEP-OECD and OECD databases. The other is the Unemployment Benefit Replacement Rate (UBRR), which measures the size of unemployment benefits over the average wage and has been collected from Van Vliet and Caminada (2012) and the OECD databases. Because the latest release of these indicators does not cover the entire period considered, similar to other studies (e.g. Abbritti and Weber, 2018) I extended them with the normalized growth rates of the same variable in other datasets.[5]

Fig. 1 plots the two measures. As the figure shows, the two measures fluctuate in both cross-sectional and time series dimensions. The total standard deviation of EPL is 0.35, with a cross-sectional standard deviation of 0.33 and a time series standard deviation of 0.12. UBRR has a total standard deviation of 0.15, while cross-sectional and time series standard deviations are, respectively, 0.12 and 0.10. These values are reassuring on the fact that these variables display sufficient variation in all dimensions to provide robust estimates. Moreover, the two measures display a correlation of approximately 0.38: therefore, the empirical model must control for this to correctly estimate the marginal role of each rigidity.

2.1. The distribution of consolidation plans

This section briefly explores how consolidation plans are distributed along EPL and UBRR. Apart from providing a summary of the distribution of consolidations, this preliminary step is essential to verify whether consolidations' size varies systematically across labour market characteristics. If consolidations have different sizes for different levels of EPL and UBRR, then the estimates might reflect a different consolidation size instead of a different labour market structure.

As a benchmark, Table 1 reports the number of plans in the dataset by type and magnitude. We can observe that out of a total of 197 plans, approximately two-thirds are expenditure-based and that approximately the same share consists of plans larger than 0.75% of GDP. Tax- and expenditure-based plans have a similar distribution of magnitudes (between half and two-thirds of the plans are larger than 0.75%, while one-fourth are between 0.75% and 0.25% and below 0.25%).

Table 2 explores the role of EPL and UBRR by evaluating how type-magnitude distributions change across the medians of the two indicators. Broadly speaking, tax-based plans are evenly distributed across rigidities while expenditure-based plans >0.75% are slightly over-represented when EPL is above the median and the ones ≤0.75% are over-represented when UBRR is above the median.[6] These results are reassuring about the absence of a systematic relation between the consolidations' size and the indicators.

[4] The results are not affected if this country is excluded. Note that both databases, Alesina et al. (2015a, 2018), build on an original dataset by Guajardo et al. (2014).

[5] The methodology is detailed in the Appendix.

[6] I also explored the geographical distribution of plans (reported in the Appendix). In EU countries, where labour markets are generally more rigid, plans concentrate above the medians of the two measures.

Table 1
Number of fiscal plans by type and magnitude.

Change level	>0.75%	0.75% ≥ x > 0.25%	≤0.25%	Total
Tax-based	36	17	12	65
Expenditure-based	74	29	29	132
Total	110	46	41	197

Notes. The table reports the number of tax- and expenditure-based plans with a magnitude higher than 75%, between 75% and 25%, and lower or equal than 25%. The magnitude of consolidation plans is expressed in GDP percentages.

Table 2
Number of fiscal plans by type, magnitude, and labour market rigidities.

Change level	>0.75%	0.75% ≥ x > 0.25%	≤0.25%	Total
EPL ≥ the median				
Tax	18	6	5	29
Expenditure	46	10	12	68
Total	64	16	17	97
EPL < the median				
Tax	19	11	7	37
Expenditure	33	19	17	69
Total	52	30	24	106
UBRR ≥ the median				
Tax	20	6	8	34
Expenditure	38	18	23	79
Total	58	24	31	113
UBRR < the median				
Tax	16	11	4	40
Expenditure	36	11	6	53
Total	52	22	10	84

Notes. The table reports the number of tax- and expenditure-based plans with a magnitude higher than 75%, between 75% and 25%, and lower or equal than 25% when EPL and UBRR are above or below their medians. The magnitude of consolidation plans is expressed in GDP percentages.

3. Empirical strategy

3.1. Model estimation

To assess how the effects of consolidations vary along with labour market rigidities, I propose a novel approach: the Interacted Panel Local Projection (IPLP). This approach takes advantage of the nature of consolidations, which a large number of studies indicate to be a good measure of the innovations in government balance (Guajardo et al., 2014; Alesina et al., 2015a,b; Beetsma et al., 2015; Alesina et al., 2017, 2018; Beetsma et al., 2021). Consequently, the economic dynamics can be approximated with a moving average (MA) representation: owing to this more parsimonious specification, this methodology can precisely assess the interactions between the labour market structure and consolidations.[7]

Define

$$\boldsymbol{e}^{\kappa}_{i,t,j} = \begin{bmatrix} r^{\kappa}_{i,t,j} \\ s^{\kappa}_{i,t,j} \end{bmatrix}'; \qquad \boldsymbol{\Omega}_{i,t} = \begin{bmatrix} epl_{i,t} \\ ubrr_{i,t} \\ epl_{i,t} \times ubrr_{i,t} \end{bmatrix}'; \qquad \boldsymbol{X}_{i,t} = \begin{bmatrix} gdp_{i,t} \\ cpi_{i,t} \\ un\_r_{i,t} \\ gbp_{i,t} \\ lt\_r_{i,t} \\ glob_{i,t} \end{bmatrix}'; \qquad \boldsymbol{e}^{\kappa,int}_{i,t,j} = \boldsymbol{e}^{\kappa}_{i,t,j} \otimes \boldsymbol{\Omega}_{i,t}; \qquad \alpha^{int}_{i} = \alpha_i \boldsymbol{\Omega}_{i,t};$$

where subscripts i and t indicate, respectively, country and time. $\boldsymbol{e}^{\kappa}_{i,t,j}$ are the elements of consolidation plans, where κ specifies the plan's component: unexpected, u, or announced, a. $j = 0, \ldots, 3$ indicates the period $t + j$ when the component is implemented.

[7] Other studies, like Alesina et al. (2015b), employed an MA representation in the context of consolidations. The Appendix contains a detailed discussion on the relationship between these models and the one employed here.

Consolidations can be tax- or expenditure-based, as indicated by $r^{\kappa}_{i,t,j}$ and $s^{\kappa}_{i,t,j}$, respectively. $\Omega_{i,t}$ contains $epl_{i,t}$ and $ubrr_{i,t}$ that are the levels of EPL and UBRR, and their interaction. $\boldsymbol{X}_{i,t}$ is the vector of exogenous controls. Finally, α_i are country fixed effects.

The interacted variables are denoted by the superscript *int*. It must be noted that the inclusion of the interaction between EPL and UBRR in $Z_{i,t}$ controls for the correlation between EPL and UBRR and its possible effect on the transmission of shocks. In this manner, the model can identify and investigate the marginal effect of each indicator. To avoid possible magnitude effects, EPL and UBRR have been normalized.

In $\boldsymbol{X}_{i,t}$, $gdp_{i,t}$ is output, $cpi_{i,t}$ is the consumer price index, $un\_r_{i,t}$ is the unemployment rate, $gpb_{i,t}$ the government primary balance over potential GDP,[8] $lt\_r_{i,t}$ the 10-year sovereign bond yield (a proxy for the long-term interest rate), and $glob_{i,t}$ is the world GDP. gdp, cpi, and $glob$ enter in log-differences, while the other variables are in simple differences.

The model estimated is described in Eq. (1):

$$\Delta z_{i,t} = \alpha_i + \sum_{p=0}^{3} e^{u}_{i,t-l,0}\boldsymbol{\beta}_p + \sum_{l=1}^{3} e^{a}_{i,t-l,0}\boldsymbol{\gamma}_l + \sum_{j=1}^{3} e^{a}_{i,t,j}\boldsymbol{\mu}_j + \sum_{n=0}^{3} \boldsymbol{X}_{i,t-n}\boldsymbol{\Psi}_n + \alpha^{int}_i + \sum_{p=0}^{3} e^{u,int}_{i,t-l,0}\boldsymbol{\beta}^{int}_p + \sum_{l=1}^{3} e^{a,int}_{i,t-l,0}\boldsymbol{\gamma}^{int}_l + \sum_{j=1}^{3} e^{a,int}_{i,t,j}\boldsymbol{\mu}^{int}_j + u_{i,t} \quad (1)$$

where $\Delta z_{i,t}$ is the variable of interest in differences and $u_{i,t}$ is the error term.

Eq. (1) constitutes the baseline model. In this model, consolidation plans can affect the economy through three channels. First, *a shock effect*, $\boldsymbol{\beta}_0$, due to the unexpected change in the government balance determined by the component of the plan announced and implemented in the same year, $e^{u}_{i,t,0}$. Second, *a news effect*, μ_j, due to the change in the government balance that is announced at time t but implemented in period $t+j$, $e^{a}_{i,t,j}$. Third, *an implementation effect*, $\boldsymbol{\gamma}_l$, due to the realization of the change in the government balance announced l periods before and implemented in t (therefore $j = 0$), $e^{a}_{i,t-l,0}$. To avoid double-counting, lags of $e^{a}_{i,t,j}$ are excluded because their dynamic effect is already captured by the lags of $e^{a}_{i,t,0}$.

The presence of interacted terms lets these three effects vary with the structure of the labour market. This is done by estimating an average effect that is the same for all units, captured by β_p, γ_l, and μ_j, and an effect that changes with the values of EPL and UBRR and their interaction, captured by β^{int}_p, γ^{int}_l, and μ^{int}_j. The MA representation is truncated to three years.[9]

$\boldsymbol{X}_{i,t}$ is added to the equation to control for possible movements in exogenous variables, since the exogeneity and predictability of consolidations are still debated in the literature. Certain studies (De Cos and Moral-Benito, 2016; Jordà and Taylor, 2016) find that consolidation episodes are predicted by agents and are autocorrelated. Other studies (Alesina et al., 2017, 2018) highlight that the *size* of consolidation plans remains largely unpredictable, thereby constituting a source of identification robust to endogeneity and foresight.[10] Given these mixed results, I decided to follow a conservative approach by including variables containing information on current and future consolidations in the model.

$\boldsymbol{X}_{i,t}$ enters lagged up to three periods. The contemporaneous effects of gdp, un_r, and gbp are restricted to zero, while they are unrestricted for long-term rates and global economic activity. The inclusion of the lagged variables is crucial to control for a possible foresight component driven by previous economic fluctuations and implemented fiscal policies. The inclusion of contemporaneous long-term rates controls for possible effects that shocks on the cost of sovereign debt may exert on governments' choice to implement a consolidation plan: as a matter of fact, Beetsma et al. (2021) shows that long-term rates are the crucial driver of the endogeneity ascertained in De Cos and Moral-Benito (2016) and Jordà and Taylor (2016). Finally, as in Jordà et al. (2020), the inclusion of a global economic indicator is a parsimonious way to control for common shocks across units that can correlate with consolidations. The resulting specification is equivalent to a n-dimensional recursive Interacted Panel VAR (Towbin and Weber, 2013; Sa et al., 2014; Abbritti and Weber, 2018) where consolidations are ordered third after the long-term interest rates and global fluctuations.[11]

As mentioned above, Eq. (1) is estimated by means of fixed effects. This approach is not new for interacted panel models: for example, Auerbach and Gorodnichenko (2012b) and Cacciatore et al. (2021) employ fixed effect to estimate the interaction of EPL – which, in their approach, is transformed into a dummy – and fiscal policy. In addition, Towbin and Weber (2013) investigate the role of the exchange rate regimes in shaping the economic responses by estimating a panel VAR with fixed effects. Notably, the use of interactions should alleviate the bias generated by imposing a common slope to heterogenous coefficients (Pesaran and Smith, 1995) in that it allows the slopes to (deterministically) vary (Towbin and Weber, 2013).

To calculate the dynamic effects of the different components, the baseline regression is then estimated iteratively along the horizon $h = [0, \dots, H]$, similarly to Jorda (2005)'s local projection. This is reported in Eq. (2), which differs from Eq. (1) in that all coefficients now contain the superscript h because they are horizon-specific. To obtain directly cumulated impulse responses, the dependent variable is now defined as $\Delta z_{i,h} = z_{i,t+h} - z_{i,t-1}$: in other words, it represents the difference between the value of variable z at time h and time $t-1$.

$$\Delta z_{i,h} = \alpha^{h}_i + \sum_{p=0}^{3} e^{u}_{i,t-l,0}\boldsymbol{\beta}^{h}_p + \sum_{l=1}^{3} e^{a}_{i,t-l,0}\boldsymbol{\gamma}^{h}_l + \sum_{j=1}^{3} e^{a}_{i,t,j}\boldsymbol{\mu}^{h}_j + \sum_{n=0}^{3} \boldsymbol{X}_{i,t-n}\boldsymbol{\Psi}^{h}_n + \alpha^{h,int}_i + \sum_{p=0}^{3} e^{u,int}_{i,t-l,0}\boldsymbol{\beta}^{h,int}_p + \sum_{l=1}^{3} e^{a,int}_{i,t-l,0}\boldsymbol{\gamma}^{h,int}_l + \sum_{j=1}^{3} e^{a,int}_{i,t,j}\boldsymbol{\mu}^{h,int}_j + u_{i,t} \quad (2)$$

[8] Following Ramey and Zubairy (2018), I scaled the primary balance on trend GDP to reduce the correlation with innovations in GDP.

[9] As indicated in Montiel Olea and Plagborg-Møller (2021), the sufficient number of lags is the number of periods required by impulse responses to stabilize, in my case 2, plus one. The inclusion of three lags is also coherent with the largest part of studies on consolidations (see Alesina et al., 2019a,b, for a review). Changes in the number of lags do not significantly affect the results.

[10] Alesina et al. (2017) shows that economic variables do not granger-cause consolidation plans using.

[11] VARs and Local Projections are symmetric and convey the same results conditional on the inclusion of sufficient lags, as recently showed in Plagborg-Møller and Wolf (2021). This symmetry is discussed in the context of consolidation plans in Alesina et al. (2018, 2019b). The Appendix contains a comparison between the model in this paper and Alesina et al. (2015b)'s baseline model.

In contrast with Jordá's local projections, it is not sufficient to collect the sequence of β_0^h and $\beta_0^{h,int}$ to produce impulse responses. This is because it is crucial to account for the multi-year nature of the consolidation plans. Following Alesina et al. (2015a), this is done by computing an impulse response to an initial unexpected consolidation and then relating the unexpected component of the consolidation in year t to the anticipated components to be implemented in years $t+1$, $t+2$, $t+3$. This is possible owing to a set of auxiliary regressions reported in Eq. (3).

$$\begin{aligned} r^a_{i,t,j} &= r^u_{i,t}\theta^r_j + \epsilon^{r,j}_{i,t} \\ s^a_{i,t,j} &= s^u_{i,t}\theta^s_j + \epsilon^{s,j}_{i,t} \end{aligned} \tag{3}$$

with $j = 1, 2, 3$.

To exemplify, $\theta^r_1 r^u_{i,t}$ represents the average change in government balance announced in year t for the following year, when a tax-based consolidation plan is approved. In other words, we can interpret the vector $\boldsymbol{\Theta} = [\theta^r_1, \theta^r_2, \theta^r_3, \theta^s_1, \theta^s_2, \theta^s_3]'$ as an estimate of the announced component of a fiscal plan when the unexpected component is equal to 1% of GDP.

The estimates for $\boldsymbol{\Theta}$ are reported in Table 3, and are very close to the ones reported in other studies (e.g. Alesina et al., 2015a, 2018).

Table 3
Estimates of $\boldsymbol{\Theta}$.

	θ^r_1	θ^r_2	θ^r_3	θ^s_1	θ^s_2	θ^s_3
r^u	0.234***	0.0320***	0.0163***			
	(12.12)	(3.41)	(4.64)			
s^u				0.0894***	0.0359***	0.0151***
				(3.84)	(4.13)	(3.38)

Notes. The table reports the estimates for the parameters θ^r_j and θ^s_j; t statistics in parentheses; * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$. Estimates are based on the univariate panel regressions described in Eq. (3).

The model estimated with Eq. (1) is then used to simulate the effect of an average plan, either tax- or expenditure-based. Similar to other studies in the literature (e.g. Alesina et al., 2015a), the simulations are constructed by solving dynamically forward the system described by Eqs. (1) and (3) with and without shocks. Impulse responses are computed as the difference between these scenarios. This strategy constitutes an application of the Generalize Impulse Response Function (Koop et al., 1996) it is particularly attractive because it can easily accommodate the three sources of heterogeneity of the case at hand: the type of consolidation, the design of the consolidation, and the rigidities.[12]

To conclude the discussion of the estimation methodology, it is worth noting three additional ingredients of the baseline model. First, I consider announced changes in government balance up to only 3 periods ahead despite the dataset would allow using changes in the fiscal balance up to 5 periods ahead. The reason for this is that plans with a horizon longer than 3 years are rare and are often modified during their phasing-in. Therefore, their inclusion is detrimental to simulations in that the estimated parameters have a low or null significance.

Second, fiscal plans are interacted with rigidities, $\boldsymbol{\Omega}_{i,t}$, while the set of controls is not. This maintains a parsimonious approach, but it also restricts the coefficients of controls to remain the same when EPL and UBRR levels change. In other words, the model assumes that agents' expectations on consolidations and correlations between controls and consolidations do not depend on the labour market structure.

Third, a correlation between consolidations and the labour market indicators can bias the results, because labour market reforms have significant business cycle effects (Duval et al., 2020). Although (Alesina et al., 2019b) excludes the presence of a significant correlation between labour market reforms and consolidations, the robustness exercise also includes a specification in which EPL and UBRR are lagged of one period to validate the results against possible correlations.

3.2. Interpretation of the interaction effects

As the model is non-standard, an illustration is useful. Consider a simplified version with the tax-based plan only, $r_{i,t}$, and no interactions. The unexpected change in the government balance is 1% of GDP. Eq. (4) describes the effects of this plan on a generic variable $z_{i,t}$ at time h:

$$E(\Delta z_{i,h} \mid r^u_{i,t} = 1\%, I_t) - E(\Delta z_{i,h} \mid r^u_{i,t} = 0, I_t) = \beta_0^{h,r} + \sum_{j=1}^{3} \theta^r_j \mu_j^{h,r} \tag{4}$$

where I_t is the information set available at time t represented by the variables and lags included in Eq. (1).

Eq. (4) makes explicit the role of the various components of plans. At time h, the tax-based plan approved at $t = 0$ directly affects z through the parameter $\beta_0^{h,r}$, which captures the shock effect on impact for $h = 0$ and its dynamics for $h \geq 1$. In addition, a

[12] Given the high non-linearity of the system, the confidence intervals are estimated with 1000 bootstrap replications of the model. In greater detail, I estimate the model, take the empirical residuals, generate new panel series for the dependent variable by resampling the residuals, and re-estimate the model, for 1000 times. I employ a block bootstrap of size three to preserve the possible autocorrelation and panel structure of residuals. Finally, I extract the confidence intervals and the median from the empirical distribution of simulated models. The Appendix contains further details.

change in r_t^{μ} varies $r_{t,j}^{a}$ by a quantity θ_j^r. The effects of this change in the announced component are captured by $\theta_j^r \mu_j^{h,r}$, where $\mu_j^{h,r}$ represents a convolution of the announcement and the implementation effects. As a matter of fact, $\mu_j^{h,r}$ estimates the announcement effect, for $h = 0$, and its dynamics, for $h \geq 1$. However, $\mu_j^{h,r}$ also embeds the implementation effect and its dynamics for $h = j$ and $h \geq j + 1$, respectively.

This example clarifies why the parameters in Θ are essential to assess the effects of consolidations. The reason for this is that the unanticipated and anticipated components are correlated and such correlations cannot be assumed away when the model is simulated. It is worth noting how these effects are singled out from the effects of the implementation and announcement of past plans — these are included in Eq. (1).

Eq. (5) describes what happens when we allow the coefficient to depend on one indicator only, the EPL (but this can be straightforwardly extended to the case of multiple indicators):

$$E(\Delta z_{i,h} \mid r_{i,t}^{\mu} = 1\%, I_t) - E(\Delta z_{i,h} \mid r_{i,t}^{\mu} = 0, I_t) = \beta_0^{h,r} + \sum_{j=1}^{3} \theta_j^r \mu_j^{h,r} + \beta_0^{h,r,epl} \cdot epl^{P_i} + \sum_{j=1}^{3} \theta_j^r \mu_j^{h,r,epl} \cdot epl^{P_i} \tag{5}$$

As Eq. (5) shows, the coefficients of tax-based consolidation are evaluated at specific values of the indicators, indicated by epl^{P_i}, thereafter impulse responses can be computed. Because EPL is defined over a continuous range, as a benchmark they are evaluated at a lower (20th) percentile and a higher (80th) percentile value by varying only one of the two rigidities, while the other remains at the median of its distribution (also UBRR is defined over a continuous range). This is equivalent to simulating the marginal effect of each indicator and this is possible because the correlation between the indicators is controlled for by including the interaction of EPL and UBRR in Eq. (1).

The discussed methodology constitutes a relevant advancement compared to previous studies on the role of the labour market in the transmission of fiscal policy (Auerbach and Gorodnichenko, 2012a; Turrini, 2013; Cacciatore et al., 2021). These studies transformed the EPL from a continuous variable to a 0/1 dummy. While the continuous indicator imposes that the response changes in a linear manner with the indicator value, the dummy determines a threshold effect relationship. This implies that the results might depend on the choice of the threshold and the exploration of the marginal effect of a change in the indicator.

In addition, the use of two indicators increases the interpretability of the results from a theoretical perspective. As a matter of fact, the indicators can be considered proxies for major labour market rigidities. Broadly speaking, EPL constitutes a natural candidate to quantify the level of employment rigidity because the more difficult the hiring and firing, the costlier it is to adjust employment for firms. UBRR represents a good measure of wage rigidity because workers are more reluctant to reduce their wages during crises, when unemployment benefits are larger. Because of the presence of a downward rigidity, firms avoid increasing wages during expansions, thereby also setting into motion upward wage rigidity.

These features led previous studies to identify employment rigidity with EPL (e.g. Cacciatore et al., 2021). However, this identification is controversial because EPL also correlates with wage rigidity (Babecký et al., 2010). The inclusion of two measures, each of them theoretically more closely related to one rigidity, and their interaction should clean the estimates of these spurious relations and, thus, improve the interpretability of the parameters. I validate this intuition ex-post by assessing whether the response of unemployment (wages) to consolidations reduces when EPL (UBRR) increases.

4. Results

This section discusses the baseline results for the model in Eq. (1). All figures express the estimated effects in percentage deviations (y-axis) for a horizon of five years (x-axis), where shadow areas represent the 90% confidence intervals.

Previous research (Guajardo et al., 2014; Alesina et al., 2015a; Beetsma et al., 2015; Alesina et al., 2017; Beetsma et al., 2021) shows that output and its components (investment and consumption), economic sentiment (ESI for consumers), and short-term interest rate (as an indicator of the reaction of monetary authorities) should be analysed to adequately assess the transmission of consolidations to the economy. In addition, I investigate the response of unemployment rate and wages to study the response of the labour market. Finally, I include prices and TFP because recent studies (e.g. Jørgensen and Ravn, 2022) demonstrate that the responses of these two variables help in better delineating the role of fiscal policy for the supply side of the economy, thereby sharpening the discussion on the mechanism linking labour market rigidities and the effects of consolidations.

4.1. The average effect of consolidations

To better discuss the role of labour market institutions in transmitting consolidations, it might be instructive to first investigate the simulated responses for the model without interactions. Fig. 2 reports the results of this experiment by reporting the simulated response to tax-based consolidations in blue and expenditure-based consolidations in red as percentage deviations in a horizon of 5 years. Estimated medians are represented by dashed lines and 90% confidence intervals with shaded areas.

The results are qualitatively similar to previous studies: tax-based consolidations depress economic activity more and for longer than expenditure-based plans. The responses of the labour market and prices reflect this difference, with tax-based episodes producing larger effects on unemployment, wages, and prices. TFP increases and short-term interest rate declines after expenditure-based events only. Compared to other studies (e.g. Alesina et al., 2015a), the effect on prices is significantly different between consolidations – with prices modestly reducing after tax-based consolidations – and the short-term rate reduces only after expenditure-based shocks. This discrepancy with previous studies is due to the inclusion of controls, thus suggesting that foresight might be still of concern for consolidations.

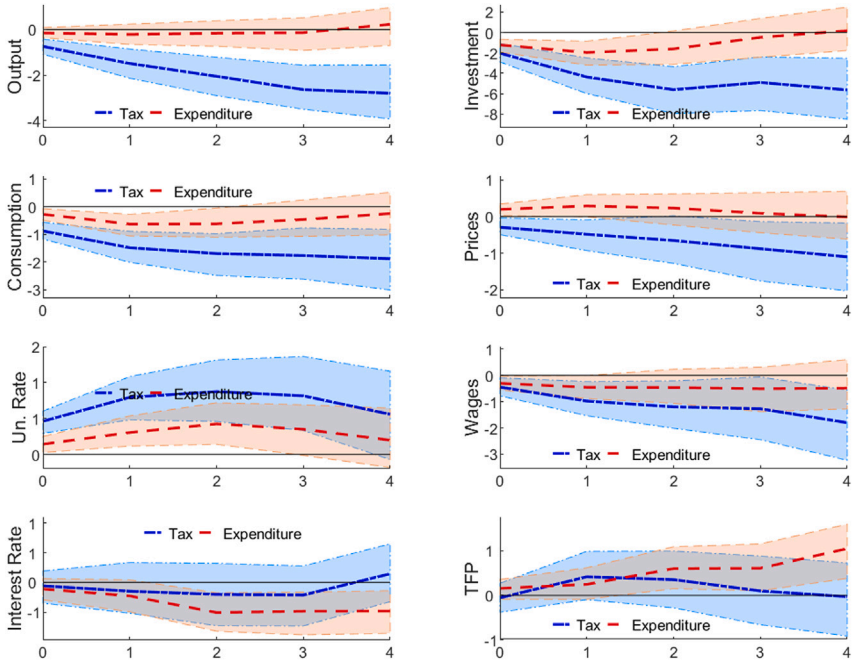

Fig. 2. The average effect of consolidations. Notes. Average response to a tax- (blue) and expenditure-based consolidation (red) of 1% of GDP in the sample for output, investment, consumption, CPI, unemployment rate, wages, short-rerm interest rate, and TFP. Shaded areas are 90% confidence intervals, calculated with 1000 bootstrap replications. Deviations are in percentage points (x-axis) for a horizon of 5 years (y-axis). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

These results can be better interpreted through the lens of theoretical models. In textbook New-Keynesian models, the varied effect of fiscal consolidations depends on three ingredients (for a review of the effects of fiscal policy in New-Keynesian models, see Coenen et al., 2012). First, the presence of a wealth effect due to future tax savings reduces the depressive effect of consolidations by sustaining private consumption (Monacelli et al., 2010). Second, the distortionary effect of taxes affects the supply side and thus, reduces potential output (Barro and Redlick, 2011). Third, the crowding-in of private demand due to the deflationary effect of consolidations leads the monetary authority to lower interest rates, thereby stimulating investment and consumption (Giavazzi and Pagano, 1995; Alesina and Ardagna, 2013).

In the data, tax-based consolidations reduce economic activity persistently. This suggests that tax-based consolidations can have a distortionary effect and reduce potential output. After a tax-based consolidation, the large fall in aggregate demand leads unemployment to increase and wages to decline, while private demand is not crowded-in. This is because the interest rate remains stable, whereas prices reduce; this pushes up real interest rates, thus discouraging investment. Such an effect is not immediate and this lag explains why the responses of investment to the two types of consolidation are similar on impact and then begin diverging.

The empirical results suggest that the milder effect of expenditure-based consolidation is driven primarily by the smaller reaction of consumption. Such a result can be explained by the wealth effect, which moderates the fall in aggregate demand and the increase in unemployment by sustaining consumption.[13] I also find that expenditure-based consolidations stimulate productivity in the medium term. The data suggest that two channels drive this result: on the one hand, expenditure-based consolidations cause a fall in interest rates that sustain investment, thereby preventing productivity to fall because of a reduction in fixed capital. On the other hand, the fall in wages caused by the consolidation reduces firms' marginal costs and, thus, expands the resources available to increase capacity utilization, eventually leading to productivity growth (the presence of a similar channel is discussed in Jørgensen and Ravn, 2022).

This brief discussion reveals that the responses of wages and employment play a pivotal role in the transmission of consolidations. Then, the question is what would happen if one of the two variables becomes rigid and it cannot adjust.

4.2. The role of the employment protection

In this section, I discuss the simulations for tax- and expenditure-based plans when EPL or UBRR are high (80th percentile) or low (20th percentile). All figures report the median of simulations (dashed lines) and 90% confidence intervals (shaded areas) in

[13] Alesina et al. (2017) argued that expenditure-based consolidations have a strong wealth effect because consolidations are multiannual plans and, therefore, the planned expenditure cuts are strongly persistent. The higher persistence increases the present value of transfers, which generates a larger positive shock in households' wealth. This effect is absent in tax-based consolidations because of their distortionary nature.

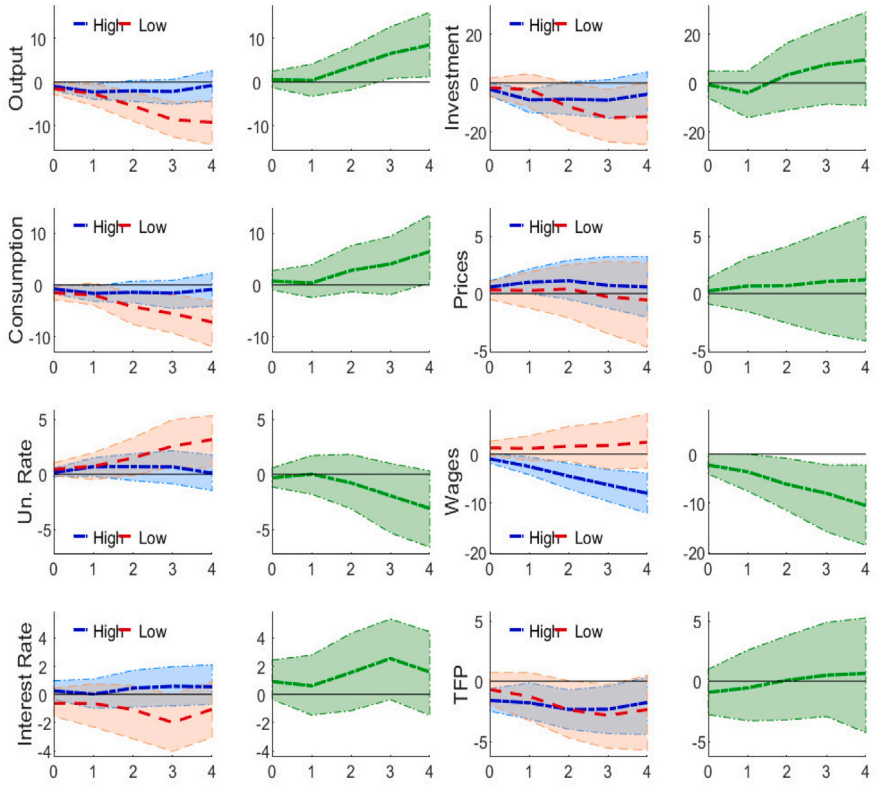

Fig. 3. Role of EPL for tax-based consolidations. Notes. Responses of output, investment, consumption, CPI, unemployment rate, wages, short-rerm interest rate, and TFP to a tax-based plan of 1% of GDP according to the distribution of EPL. The blue (red) line reports the simulation relative to the 80th (20th) percentile of EPL, the green line represents the median of the difference between the two levels of rigidity. Shaded areas are 90% confidence intervals, calculated with 1000 bootstrap replications. Deviations are in percentage points (x-axis) for a horizon of 5 years (y-axis). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

red for low levels of rigidity and in blue for high levels of rigidity. The difference between the two levels is indicated with green dashed lines (median) and shadow areas (90% confidence intervals). Responses are in percentage deviations (x-axis) over a horizon of five years (y-axis). The results are robust to a large battery of perturbations which are reported in the Appendix.

Fig. 3 displays how the responses to tax-based consolidations change with EPL. A reduction in EPL magnifies the depressive effect of tax-based consolidations by increasing the size and persistence of the reduction in output. This change in output response is driven more by consumption than by investment, since the former displays a stronger decoupling. In addition, when EPL reduces, the increase in unemployment becomes more persistent, while the fall in wages mutes. Changes in EPL do not affect the response of TFP, while prices increase significantly only when EPL is high, and the interest rate reduces moderately only when EPL is low — and they remain unaffected otherwise.

EPL also affects the transmission of expenditure-based consolidations, as described in Fig. 4. Expenditure-based plans are contractionary when EPL increases and expansionary when EPL reduces — similar changes are also visible for consumption and investment. When EPL is high, the reduction in output is associated with a transitory increase in unemployment and a persistent decline in wages, while interest rate and TFP reduce moderately. Conversely, when EPL is low, the expansionary effect of expenditure-based plans correlates with a reduction in unemployment and with stable wages, while interest rate and TFP increase. Expenditure-based plans are always inflationary, with prices increasing further when EPL is low.

Theoretical models can guide us in rationalizing the results. These models identify two counteracting channels through which EPL, as a measure of hiring-firing costs, can affect the transmission of fiscal policy. On the one hand, higher hiring-firing costs reduce the elasticity of job creation and destruction to fiscal shocks, thereby moderating the effect of fiscal policy (Faia et al., 2013; Cacciatore et al., 2021). The reason for this is that an increase in labour protection lowers the incentive for firms to hire (or fire) employees and this diminishes the responsiveness of aggregate consumption to fiscal shocks. Consequently, if this channel dominates, consolidations have stronger effects when EPL is low.

On the other hand, larger hiring-firing costs can amplify the effects of fiscal policy by inducing a negative relationship between fiscal shocks and wages. For example, Monacelli et al. (2010) showed that the negative wealth effect of an expansionary fiscal policy lowers the reserve wage by reducing the value of non-working activities. When employment protection increases, a larger share of the fall in reserve wage transfers to bargained wages: the reduction of bargained wages stimulates firms' hiring, thereby increasing employment and, therefore, aggregate demand. If this channel dominates, consolidations have stronger effects when EPL is high.

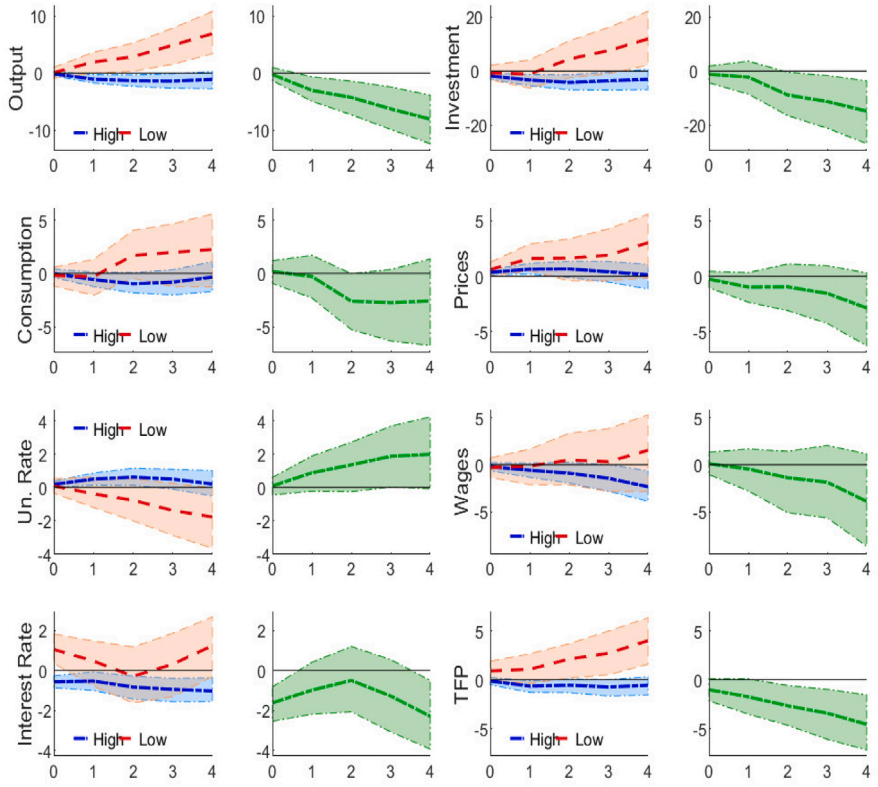

Fig. 4. Role of EPL in expenditure-based consolidations. Notes. Responses of output, investment, consumption, CPI, unemployment rate, wages, short-rerm interest rate, and TFP to a expenditure-based plan of 1% of GDP according to the distribution of EPL. The blue (red) line reports the simulation relative to the 80th (20th) percentile of EPL, the green line represents the median of the difference between the two levels of rigidity. Shaded areas are 90% confidence intervals, calculated with 1000 bootstrap replications. Deviations are in percentage points (x-axis) for a horizon of 5 years (y-axis). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

The empirical evidence suggests that the first channel dominates. However, the results indicate that the response of wages plays a pivotal role too, thus identifying an additional channel that works in coordination with hiring-firing costs. These two channels magnify (or minimize) the wealth effect and distortionary effect that characterize expenditure-based consolidations and tax-base consolidations, respectively, as we have seen above.

On the revenue side, a reduction in hiring-firing costs (lower EPL) exacerbates the increase in unemployment following a tax-based consolidation. Therefore, aggregate consumption falls significantly more than the high EPL case. Simultaneously, wages do not decline along with productivity: this misalignment, in coordination with the reduction in aggregate demand and the stability of prices, reduces firms' margins and, eventually, leads them to cut investment. These two effects contribute to increasing the depressive effect of consolidation substantially.

On the expenditure side, the low hiring-firing costs lead to more stable wages after the approval of the plan as firms prefer to lay off workers. Because expenditure-based consolidations have only a moderate effect on impact, this wage stability allows the wealth effect to generate a positive reaction in consumption, which stimulates aggregate demand. As a response to the increase in economic activity, firms have the incentive to raise investment and the utilization rate of technology, which in turn generates an increase in TFP. Instead, when EPL is high, firms respond by reducing wages (not increasing them, as predicted by Monacelli et al., 2010). This produces a negative income effect, which – offsetting the wealth effect – leads to a decline in consumption and, thus, economic activity.

The larger positive effect of spending cuts appears to be in contrast with the results in Cacciatore et al. (2021), which find that increases in public expenditures drive stronger output gains when EPL is low. As a logical consequence, reductions in expenditures, like consolidations, should generate larger output *losses* when EPL is low, however I find that they produce stronger output *increases*. This mismatch can be explained by the different nature of the shocks in the two studies: while I use consolidations, which are very persistent changes, Cacciatore et al. (2021) uses forecast errors, which have a more transitory nature. The persistence of spending cuts generates a strong wealth effect, which determines that expenditure-based consolidations are expansionary, and not contractionary as in other identification schemes (Alesina et al., 2019a). Therefore, a low level of EPL magnifies an expansionary shock and not a contractionary one.

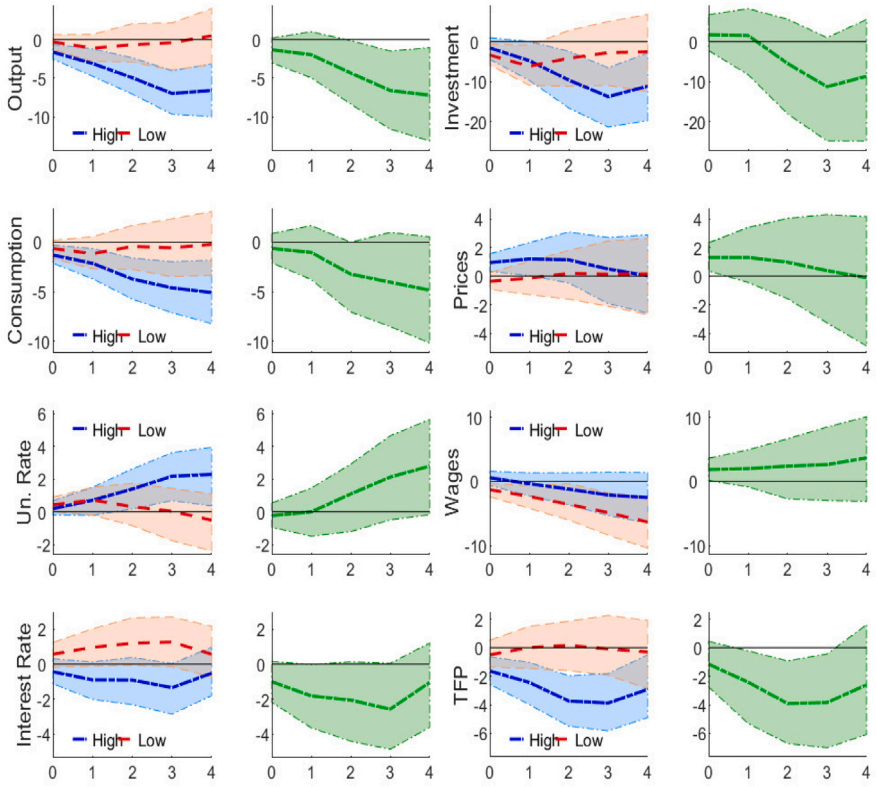

Fig. 5. Role of UBRR in tax-based consolidations. Notes. Responses of output, investment, consumption, CPI, unemployment rate, wages, short-rerm interest rate, and TFP to a tax-based plan of 1% of GDP according to the distribution of EPL. The blue (red) line reports the simulation relative to the 80th (20th) percentile of EPL, the green line represents the median of the difference between the two levels of rigidity. Shaded areas are 90% confidence intervals, calculated with 1000 bootstrap replications. Deviations are in percentage points (x-axis) for a horizon of 5 years (y-axis). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

4.3. The role of the benefit ratio

Fig. 5 displays how replacement rates affect the transmission of tax-based consolidations. The depressive effects of these consolidations are larger with a higher is UBRR, a difference driven more by consumption than by investment; however the difference in investment response is larger compared to the EPL case. Higher UBRR is associated with a larger growth in unemployment, stable wages, declining interest rate, and mild price increase. On the contrary, with low UBRR tax-based plans have a mild effect on unemployment but wages decline more, prices remain stable, and interest rate moderately increases. Changes in UBRR also affects the response of TFP, which reduces after tax-based episodes only if UBRR is high.

Fig. 6 plots the responses to expenditure-based consolidations when UBRR changes. Higher levels of UBRR are associated with a significant increase in output and consumption, stable wages, a moderate increase in prices and unemployment, and a reduction in investment and TFP. Consolidations become inflationary with low UBRR. This larger inflationary effect correlates with a short-lived contraction in economic activity as well as in wages, consumption, and interest rate, while unemployment increases. Interestingly, TFP increases in this case, while investment remains unaffected. This indicates that firms have the incentive to increase capacity utilization.

To some extent, these results show that the role of UBRR is symmetric to the one of EPL. The rationale behind this is that when wages are rigid or hiring-firing costs are low, for firms it is more convenient to lay off workers instead of reducing wages. By symmetry, when wages are flexible or hiring-firing costs are high, it is advantageous for firms to adjust wages instead of employment. Therefore, a higher level of UBRR correlates with more stable wages and larger unemployment fluctuations and, thus, magnifies the distortionary effect of tax-based consolidations and the wealth effect of expenditure-based consolidations, which is similar to low EPL.

However, from a theoretical perspective increases in UBRR have two distinctive counteracting effects that distinguish them from reductions in EPL. On the one hand, a higher UBRR makes wages more rigid downward because it increases the value of the outside option and non-working activities. This implies that, when unemployment grows, wages cannot decline (while they can in the low EPL case) and the marginal cost remains stable or can even increase in the presence of moderate deflation. As a consequence, firms need to reduce investment when facing a declining aggregate demand (Shen and Yang, 2018, discussess a similar channel for a

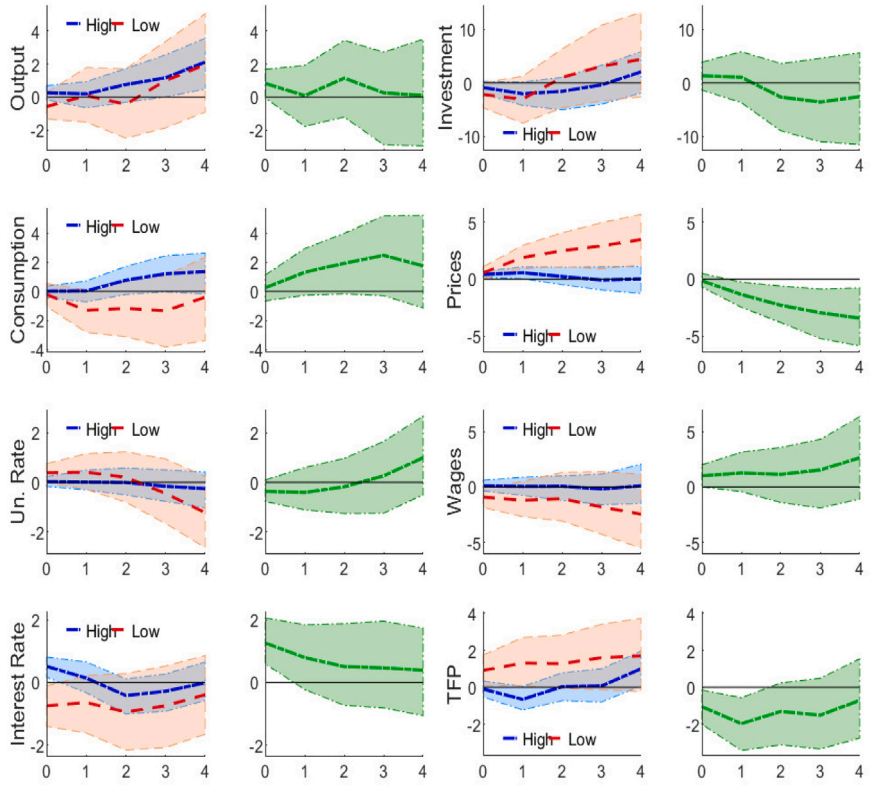

Fig. 6. Role of UBRR in expenditure-based consolidations. Notes. Responses of output, investment, consumption, CPI, unemployment rate, wages, short-rerm interest rate, and TFP to a expenditure-based plan of 1% of GDP according to the distribution of EPL. The blue (red) line reports the simulation relative to the 80th (20th) percentile of EPL, the green line represents the median of the difference between the two levels of rigidity. Shaded areas are 90% confidence intervals, calculated with 1000 bootstrap replications. Deviations are in percentage points (x-axis) for a horizon of 5 years (y-axis). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

fiscal expansion). On the other hand, higher UBRR sustains consumption because it guarantees a higher income for the unemployed and more stable wages for the employed, a role that low EPL does not necessarily play.

According to the empirical estimates, the channel identified by Shen and Yang (2018) dominates: UBRR affects the response of wages more than the EPL and, thus, the responses show a divergence in investment. This drives an asymmetry in the effects of EPL and UBRR and expands the role of investment in output fluctuations. On the revenue side, the larger fall in investment exacerbates the output loss when UBRR is high compared to the low EPL case. On the expenditure side, when UBRR is high, the fall in investment due to the stability in wages moderates the expansionary effect of expenditure-based consolidations as well as its inflationary pressure.

The wide divergence in the response of investment across levels of UBRR explains why TFP reduces after a consolidation only when UBRR is high: the stability of wages and employment (at least on impact) leads firms to reduce capacity utilization. In this context, the presence of mild inflationary pressure is in line with Jørgensen and Ravn (2022), and suggests that the distortionary effect of taxation is amplified in this case.

In addition, the evidence indicates that larger unemployment benefits do not sustain consumption in all circumstances: as a matter of fact, consumption largely reduces after a tax-based consolidation even when UBRR is high. A possible explanation for this is that the distortionary effect of taxation offsets the positive role of unemployment benefits because of the considerable increase in unemployment that the distortion causes.

4.4. The marginal effect of rigidities

The IPLP estimates how the effects of consolidations change along with the entire rigidities' distribution. To investigate this further, Figs. 7 and 8 plot how the effects of, respectively, tax- and expenditure-based consolidations vary along the distribution of EPL (left panel) and UBRR (right panel). Because the response of GDP can summarize the entire economic system, both figures display the responses of output after 4 years. As before the median estimate with a dark red dashed line and the 90% confidence intervals with the red shaded areas.

In line with the previous evidence, Fig. 7 confirms that high (low) levels of EPL (UBRR) are necessary to mute the otherwise contractionary effect of tax-based consolidations. The effects of consolidations become insignificant above the 75th percentile of

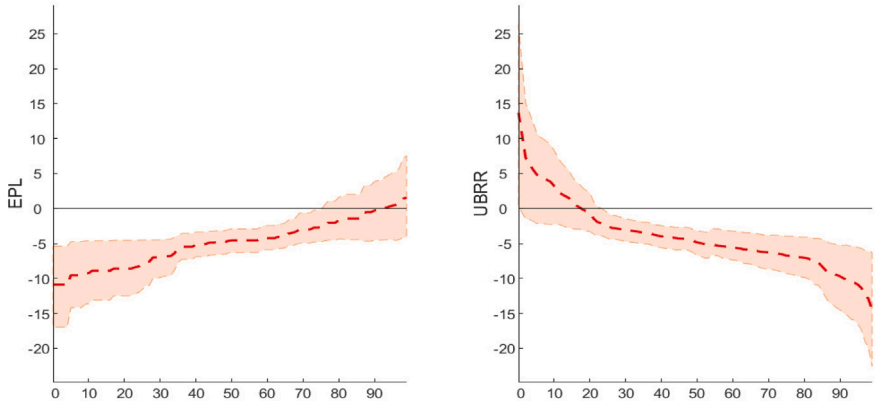

Fig. 7. Change in output response to tax-based plans along rigidities. Notes. The figure displays the variation of the effects of tax-based consolidations on output after 4 periods along the distributions of EPL (left) and UBRR (right). Dashed lines are the median estimates, shaded areas are the 90% confidence levels. The vertical axis is the effect consolidation on output after 4 periods, the horizontal axis reports the percentiles of the distributions.

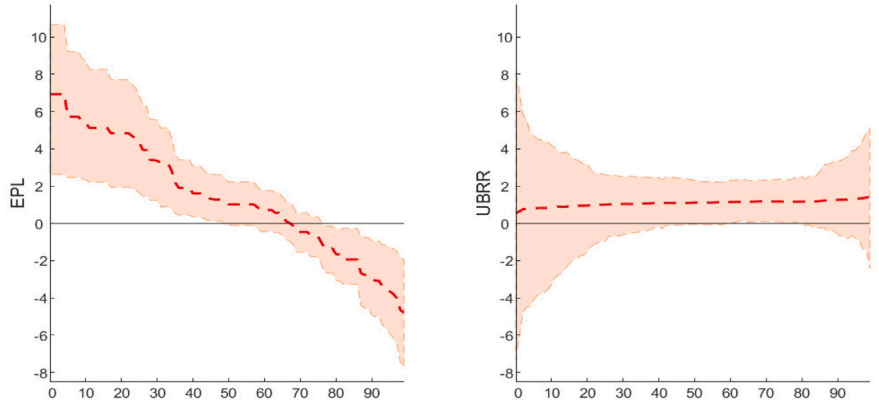

Fig. 8. Change in output response to expenditure-based plans along rigidities. Notes. The figure displays the variation of the effects of expenditure-based consolidations on output after 4 periods along the distributions of EPL (left) and UBRR (right). Dashed lines are the median estimates, shaded areas are the 90% confidence levels. The vertical axis is the effect consolidation on output after 4 periods, the horizontal axis reports the percentiles of the distributions.

EPL and below the 25th of UBRR, changing monotonically along with the two distributions. It is worth noting how this change is not linear for UBRR because it accelerates at the extremes, i.e. before the 15th and after the 85th percentile.

Fig. 8 presents the results of the same experiment for expenditure-based consolidations, which are similar to the ones of tax-based episodes. The response of output switches from expansionary to contractionary around the 75th percentile of EPL, with a neutral response between the 60th and the 75th percentile and a moderate acceleration in the change of the response at the extremes. Instead, the response along the UBRR distribution does not change significantly, thereby indicating differences mostly related to a modification in the significance levels.

These results are informative in two dimensions. First, they show that the response of the economy to consolidations changes monotonically with rigidities but the change is not linear. Except UBRR in expenditure-based plans, "extreme" values of EPL and UBRR (below the 15th percentile and above the 85th percentile) generate a difference in output response that is more than proportional to the difference between responses closer to the median. This represents crucial information for policymakers, as the effects of consolidations can be rather different from the average estimates in countries with labour markets on the extremes.

Second, the results suggest that the previous studies based on dummy approaches (e.g. Cacciatore et al., 2021) can convey biased or incomplete information. My results show that there are no significant discontinuities in the effects of consolidations that can justify the thresholds employed in previous studies to discretize the EPL.[14] Therefore, the extant studies average the effects of fiscal policy at the extremes of the distribution, which are significantly different, with the ones closer to the thresholds, which are similar. Thereby, the difference between the averages above and below the threshold estimates a role of EPL smaller compared to what emerges by examining the entire distribution.

[14] The thresholds are the median (Auerbach and Gorodnichenko, 2012b; Turrini, 2013) and the 75th percentile (Cacciatore et al., 2021). Noteworthy, expenditure-based consolidations effects change sign around the 75th percentile of EPL as a result of a smooth variation.

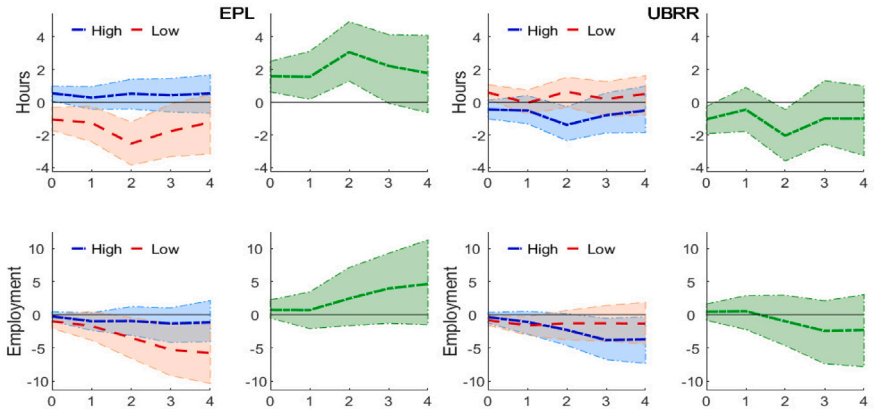

Fig. 9. Tax-based plan: employment and average hours. Notes. The figure plots the response of total employment and average worked hours to a tax-based plan of 1% of GDP according to the distribution of EPL (left two columns) and UBRR (right two columns). The blue (red) line reports the simulation relative to the 80th (20th) percentile of EPL and UBRR distribution, the green line represents the median of the difference between the two levels of rigidity. Shaded areas are 90% confidence intervals, calculated with 1000 bootstrap replications. Deviations are in percentage points (x-axis) for a horizon of 5 years (y-axis). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

4.5. Extensions

4.5.1. Effects on the margins

The baseline results indicate that tax-based consolidations are distortionary, while expenditure-based consolidations increase households' wealth. Previous studies (e.g. Barro and Redlick, 2011) suggest that these effects have crucial consequences on the trade-off between leisure and consumption that is faced by households. On the one hand, tax hikes should produce a substitution effect: because higher taxes reduce the real wage, households have a lower incentive to work and substitute consumption with leisure. On the other hand, the higher wealth generated by spending cuts leads households to increase their leisure without reducing consumption, thereby producing an income effect. To explore these channels, Figs. 9 and 10 plot the responses of hours worked (intensive margin) and employment (extensive margin). The results for EPL are given in the left column and those for UBRR are given in the right column.

The results are in line with the findings in previous sections: the negative effect of tax-based consolidations exacerbates when employment is relatively more flexible than wages (low EPL and high UBRR), thereby reducing employment and hours (Fig. 9). Under similar rigidity levels, the expansionary effects of expenditure-based plans lead to an increase in employment and hours worked (Fig. 10). Therefore, the economy adjusts through both margins, despite these being affected with different timing: hours worked respond immediately and then quickly return to equilibrium, while the response of employment is slower but more persistent. This is due to the presence of hiring-firing costs, which make it more convenient to modify the intensive margin in the short term, whereas they increase the persistence of employment fluctuations.

The exercise offers a few additional insights on the role of the labour market if the two margins are examined separately. The first, crucial, result is that the responses of employment mirror the ones of unemployment rate in the baseline. This suggests that movements in and out of the labour force play only a marginal role compared to fluctuation in employment in determining the reaction of the labour market to consolidations: the response of the labour market is driven mainly by labour demand. This supports and reinforces the narrative used in the previous section to rationalize the empirical findings.

Hours worked increase after tax-based consolidations when EPL is high and UBRR is low. The reason for this is that tax-based consolidations reduce wages when wages are relatively more flexible than employment. The reduction in wages generates a negative income effect that increases households' incentive to work and pushes up hours worked. This increase offsets the reduction in hours worked due to the substitution effect of tax hikes, thereby sustaining consumption and growth. When wages remain stable (low EPL and high UBRR), the income effect does not take place and hours worked reduce because the substitution effect prevails.

Expenditure-based consolidations increase hours worked when EPL is low and UBRR high. This result can be explained by the expansionary effect that these consolidations have, which leads firms to increase production and, therefore, require more labour input. In other words, the reduction in hours worked is expected because the wealth effect of expenditure cuts is masked by the general equilibrium effect of the economic expansion. However, when conditions allow for a reduction in wages (high EPL and low UBRR), the consequent income effect strengthens the one generated by the expenditure-based consolidation, thereby driving a fall in hours worked.

4.5.2. The role of confidence and follow-ups

In line with other studies in the field (e.g. Barro and Redlick, 2011; Alesina et al., 2017), the evidence in this study suggests that tax- and expenditure-based consolidations are inherently different: the former has a distortionary nature, and the latter has a strong wealth effect. However, previous studies indicated other explanations for the different effects of consolidations. Guajardo

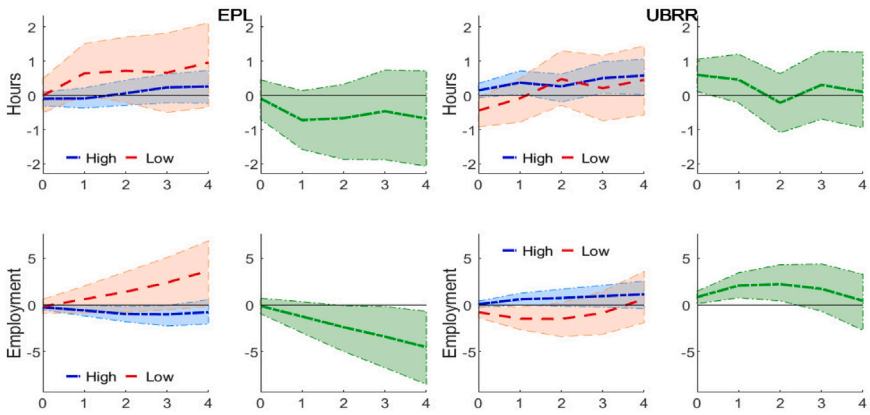

Fig. 10. Expenditure-based plan: employment and average hours. Notes. The figure plots the response of total employment and average worked hours to an expenditure-based plan of 1% of GDP according to the distribution of EPL (left two columns) and UBRR (right two columns). The blue (red) line reports the simulation relative to the 80th (20th) percentile of EPL and UBRR distribution, the green line represents the median of the difference between the two levels of rigidity. Shaded areas are 90% confidence intervals, calculated with 1000 bootstrap replications. Deviations are in percentage points (x-axis) for a horizon of 5 years (y-axis). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

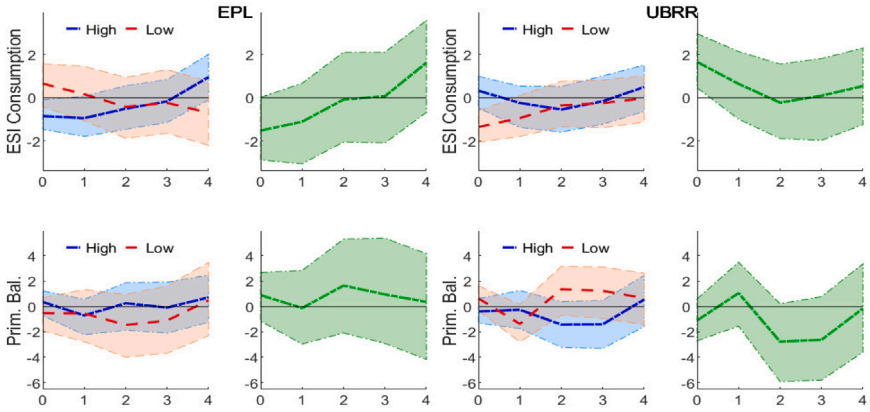

Fig. 11. Tax-based plan: confidence and follow-ups. Notes. The figure plots the response of ESI for consumers and government primary balance over potential GDP to a tax-based plan of 1% of GDP according to the distribution of EPL (left two columns) and UBRR (right two columns). The blue (red) line reports the simulation relative to the 80th (20th) percentile of EPL and UBRR distribution, the green line represents the median of the difference between the two levels of rigidity. Shaded areas are 90% confidence intervals, calculated with 1000 bootstrap replications. Deviations are in percentage points (x-axis) for a horizon of 5 years (y-axis). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

et al. (2014) demonstrates that monetary policy is generally more accommodative during expenditure-based consolidation, thereby crowding-in private demand. Beetsma et al. (2015) shows that households' confidence is a major transmission channel of consolidations and can explain the difference between tax-based and expenditure-based plans. Beetsma et al. (2021) establishes that larger actual follow-up following a tax-based announcement helps to explain its stronger effect.

I do not find that the response of the monetary authorities is systematically different during tax-based and expenditure-based consolidations and across labour market conditions. Therefore, differences in monetary policy cannot explain the difference in economic responses, in line with other studies (see, for a review Alesina et al., 2019a,b). However, the discussed evidence cannot rule out the role of confidence and follow-up. I explore this possibility in Figs. 11 and 12, which plot the response of a measure of consumers' confidence, the ESI for consumers, and the government primary balance scaled by potential GDP. Results for EPL are on the left column and for UBRR are on the right column.

According to the results, the response of consumers' confidence depends on labour market institutions. Confidence always reduces after consolidations when EPL is high and UBRR is low, while it increases when the two indicators are on the other side of their distribution. Therefore, the drop in confidence is correlated with the decline in wages: this suggests that households respond more to risks associated with wages than to those associated with unemployment. This evidence indicates that output fluctuations are modest when confidence reduces the most, a result that speaks against a prominent role of household confidence in explaining the different effects of consolidation along labour market characteristics.

The responses of primary balance are never statistically different for tax-based consolidations, while the difference is moderately significant for expenditure-based plans. In the latter type of consolidation, there is a greater increase in primary balance when the

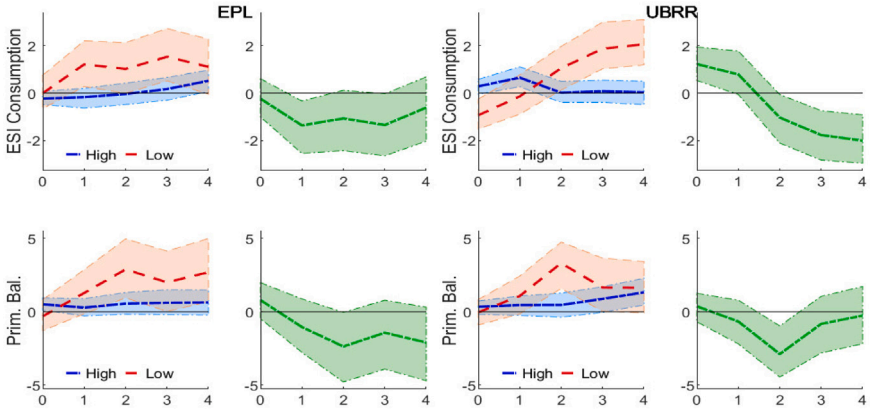

Fig. 12. Expenditure-based plan: confidence and follow-ups. Notes. The figure plots the response of ESI for consumers and government primary balance over potential GDP to an expenditure-based plan of 1% of GDP according to the distribution of EPL (left two columns) and UBRR (right two columns). The blue (red) line reports the simulation relative to the 80th (20th) percentile of EPL and UBRR distribution, the green line represents the median of the difference between the two levels of rigidity. Shaded areas are 90% confidence intervals, calculated with 1000 bootstrap replications. Deviations are in percentage points (x-axis) for a horizon of 5 years (y-axis). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

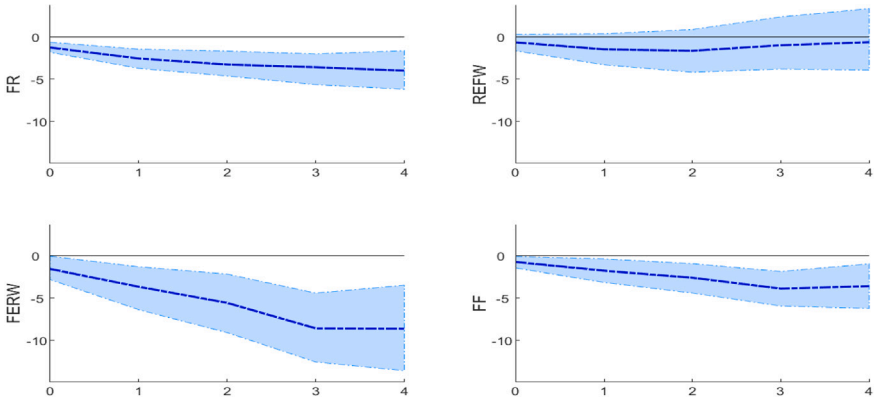

Fig. 13. Tax-based plan: overall rigidity. Notes. Response of output to tax-based consolidation of 1% of GDP when the levels of EPL and UBRR are changed contemporaneously. Fully rigid (FR)): both EPL and UBRR are at the 80th percentile; Fully flexible (FF): both EPL and UBRR are at the 20th percentile; Employment Rigid vs Wage Flexible (REFW): EPL is at the 80th percentile and UBRR at the 20th percentile; Employment Flexible and Wages Rigid (FERW): EPL is at the 20th percentile and UBRR is at the 80th percentile. The blue line reports the median simulation while shaded areas are 90% confidence intervals, calculated with 1000 bootstrap replications. Deviations are in percentage points (x-axis) for a horizon of 5 years (y-axis). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

UBRR and EPL are low compared to when they are high. This effect does not systematically correlate with stronger depressive effects of expenditure-based consolidations: therefore, primary balance does not play a significant role in explaining the different effects of consolidations across labour market institutions.

4.5.3. The role of total labour market rigidity

This section discusses how different combinations of labour market rigidities affect the transmission of consolidation. This is a crucial exercise since these rigidities are rarely in isolation from one another. To this aim, I simulated the effects of consolidations by changing both rigidities along the respective percentiles. In addition, the level of the interaction between rigidities was changed when required (e.g. when both rigidities are at the 80th percentile and also the interaction is at the 80th percentile) to take into account possible effects due to the correlation between rigidities.

Figs. 13 and 14 report the estimates for this experiment: the quadrants display the response of output to consolidations when EPL is high UBRR is low (Fully Rigid, FR), both low (Fully Flexible, FF), high EPL and low UBRR (Rigid Employment and Flexible Wages, REFW), and when EPL is low and UBRR is high (Rigid Employment and Flexible Wages, FERW). As in the previous exercise, the dotted line is the estimation median and the shaded blue area represents the 90% confidence interval.

As expected, only the REFW combination can potentially offset the depressive effect of tax-based consolidations. This is because it maximizes the share of adjustment that weighs on wages, thereby moderating the negative effects of these consolidations on

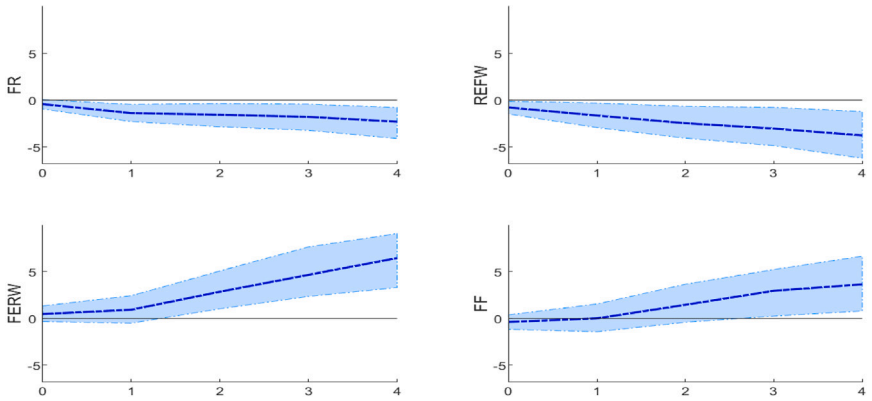

Fig. 14. Expenditure-based plan: overall rigidity. Notes. Response of output to expenditure-based consolidation of 1% of GDP when the levels of EPL and UBRR are changed contemporaneously. Fully rigid (FR)): both EPL and UBRR are at the 80th percentile; Fully flexible (FF): both EPL and UBRR are at the 20th percentile; Employment Rigid vs Wage Flexible (REFW): EPL is at the 80th percentile and UBRR at the 20th percentile; Employment Flexible and Wages Rigid (FERW): EPL is at the 20th percentile and UBRR is at the 80th percentile. The blue line reports the median simulation while shaded areas are 90% confidence intervals, calculated with 1000 bootstrap replications. Deviations are in percentage points (x-axis) for a horizon of 5 years (y-axis). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

aggregate demand. For a similar reason, the combination that magnifies output loss the most is the FERW. FF and FR labour markets lie somewhere in between these two extremes, with FR economies that show larger and more persistent negative effects than FF.

The results for expenditure-based consolidations mirror what we have seen for tax-based plans. Because their wealth effect is magnified when the adjustment weighs on employment, expenditure-based consolidations are expansionary in FERW labour markets, while they become recessionary in REFW labour markets. Since the expansionary effect vanishes when employment is rigid, FR labour markets can generate very persistent and significant output losses, while expenditure-based consolidation is moderately expansionary in FF markets. These latter results suggest that firms are more likely to reduce wages when the labour market is completely rigid and that they are more likely to reduce employment when the labour market is fully flexible. This asymmetry should be sharpened by future research.

These results confirm that the government should implement different types of consolidations depending on their labour market characteristics. In this manner, they can minimize the costs of consolidations, or even stimulate the economy. In addition, these results suggest that it can be convenient to implement specific labour market reforms before approving consolidation plans. In this way, governments can modify the transmission of consolidations and, eventually, their total effects.

5. Conclusions

An accurate estimation of the effects of consolidation is crucial to understanding the outcomes of future fiscal consolidations in a rapidly changing world. In this paper, I show that the outcome of consolidations depends on the structure of the labour market.

The paper investigates the role of employment and wage rigidities through a new methodology that allows for interactions between consolidation plans and two measures of labour market rigidity. The use of a deterministic relation allows considering the multidimensional character of both labour market structures and consolidation plans.

The evidence indicates that stricter job regulation moderates the negative effect of tax-based plans and turns recessionary the effects of expenditure-based plans. Wage flexibility reduces the depressive effect of tax plans and the expansionary effect of expenditure plans. At the heart of these results is how wages and employment interact with consolidations: wage stability magnifies the wealth effect of spending cuts, while employment flexibility exacerbates the distortionary effect of tax hikes.

These results have crucial policy implications. They recommend that the design of consolidations should also consider the labour market characteristics: countries with different rigidities should also use a different policy mix. For example, expenditure cuts are less costly than tax increases when employment is flexible employment and wages are rigid. This is relevant for fiscally decentralized unions such as the EU, it may be optimal to concentrate consolidations in countries where their cost is lower.

Declaration of competing interest

The author declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary material containing the Appendix and the replication code, can be found online a https://doi.org/10.1016/j.jmacro.2022.103495.

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