Wage Bargaining Coordination, Taxation and Labor Costs: The Effects of Fiscal Devaluation

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Abstract

This study empirically investigates the effects of fiscal devaluation—i.e., a tax shift from employers' social security contributions to value added tax—on real labor costs on a sample of 23 countries, members of the European Union, over the period between 2001 and 2018. Our results show that fiscal devaluation indeed reduces real labor costs, as suggested in the literature on fiscal devaluations. The effects turn out to be the strongest, and mostly statistically significant, for countries with intermediate and low degrees of wage bargaining coordination, stressing the importance of labor market institutions. For these countries, we find that both value added tax hikes and cuts in employers' social security contributions help to reduce real labor costs. Countries with a high degree of wage bargaining coordination, where the impact of fiscal devaluation is weaker, should be able to influence real labor costs via coordinated incomes policy, so that the potentially needed labor costs adjustments can be managed even without the implementation of fiscal devaluations.

Keywords Fiscal devaluation · Taxes · Tax structure · Labor costs · Tax incidence · Policy coordination · Incomes policy

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Introduction

The effect of taxes on labor costs is an important topic in the literature on institutions and labor markets. This research often analyzes the impact of a broad measure of labor taxes, the total tax wedge between real product wages and real consumption wages, which includes personal income tax, employers' and employees' social security contributions and consumption taxes. Thus, real product wages correspond to real labor costs of workers to the employer, while real consumption wages correspond to real net wages of employees. Some studies analyze the effects of single segments of the total tax wedge and examine whether shifts between different parts of the tax burden on labor have effects on labor costs and unemployment. In this paper we explore the effects of a tax shift from employers' social security contributions (SCR) to a value added tax (VAT) on real labor costs. Such a policy is sometimes referred to as *fiscal devaluation*, as it can mimic the effects of a nominal exchange rate devaluation and improve devaluing countries' trade balances by using fiscal instruments.[1] A cut in the SCR rate should enhance cost competitiveness of domestic producers as compared to their competitors abroad. Simultaneously, a VAT hike would reduce domestic real incomes and consumption, and thus, imports, without affecting the price competitiveness of exporters. As fiscal devaluation can be designed in a budget-neutral way, it is an appealing instrument for countries facing both fiscal constraints and competitiveness challenges that do not have an option of implementing a nominal exchange rate devaluation.

Fiscal devaluation as a policy option was discussed particularly during the unfolding of the eurozone crisis since late 2009 for South-European economies with competitiveness problems (see, e.g., Koske 2013; or IMF 2011). It was expected to speed up the socially and politically painful process of adjustment of prices and wages and thus mitigate the undesirable social consequences of high unemployment (IMF 2011; 2015; Kang and Shambaugh, 2016). In particular, former Argentinian Minister of Economy Domingo Cavallo suggested fiscal devaluation lessons from Argentina to Greece, Portugal and Spain (Cavallo and Cottani 2010a, b). Argentina implemented related fiscal policies (Bonvecchi, 2010) with an aim to improve competitiveness back in 2001, when the country was in a comparable situation as for instance Greece during the eurozone crisis. Both the IMF (2011) and the ECB (2011) recommended it as a tool for economic adjustment. The policy was considered for a while in Portugal but has later been put aside (Economist 2011). Croatia actually implemented a fiscal devaluation in 2012, but the cut in the SCR rate

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[1] Besides the tax shift from SCR to VAT, another type of fiscal devaluation, consisting of uniform increases in export subsidies and import tariffs, can replicate the real allocation that emerges under a nominal exchange rate devaluation (Farhi et al. 2014). However, as most countries today are committed to trade liberalization, this other type of fiscal devaluation is of limited policy relevance.

was reversed already in 2014 (Vukšić and Holzner 2016). Spain implemented tax changes during 2010 that are considered by Bernoth et al. (2014) to be a fiscal deval- uation, although it involved a rather small decline in the rate of contributions.[2] Fiscal devaluation was further debated and suggested as part of the necessary policy mix (Shambaugh, 2012 and Economist 2012) to counter the crisis in the peripheral euro area members, but with little success in implementation. Instead of pro-growth poli- cies, the path of austerity and painful internal devaluation has been taken. With the more recent paradigm shift in macroeconomic and fiscal policy discussions and the widely accepted understanding that austerity is not helpful in solving economic cri- ses, policy discussions involving fiscal devaluation might gain again in importance.

While earlier research provides insights on the mechanism of the relationship between taxation and labor costs in general, here we specifically test the effects of a tax shift constituting a fiscal devaluation on real labor costs that are assumed in the related theoretical and simulation studies. We do so for the sample of 23 countries of the European Union (EU) and over the period between 2001 and 2018. The choice of the sample was determined by the intention to perform the study on a sample used in the earlier empirical work that confirmed the impact of fiscal devaluation on the trade balances (in Holzner et al. 2018) and given data availability constraints. We use a rather standard empirical approach, controlling for the influence of other macroeconomic and institutional variables, in particular of different wage bargain- ing systems.

Our results show that some features of wage bargaining system are crucial for the impact of taxes on labor costs. In particular, we find that fiscal devaluation is an effective tool in countries with intermediate and low coordination in the wage- setting process. This institutional characteristic largely correlates with the level of wage bargaining, where a tax shift from SCR to VAT is found to be effective only for countries with a predominantly low level of wage bargaining. Similarly, these groups of countries are often those with lower union density and lower scores in a corporatism index. In other countries, mainly those with highly coordinated wage bargaining systems, there should be less need for fiscal devaluation in the first place, as these countries should be able to influence real labor costs via coordinated incomes policy.

We begin with a selective overview of related research that first provides a more detailed description of the fiscal devaluation literature, which is followed by a review of both theoretical and empirical literature on the incidence of labor taxa- tion. We then present our sample and the empirical approach, which is followed by the results of our econometric work. The last section summarizes the results and the main conclusions.

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[2] In addition, in the euro area after 2000, Bernoth et al. (2014) identify fiscal devaluations in Ireland (2002), Germany (2007), Finland (2010), the Netherlands (2012) and France (2014). Note that in their classification of tax changes as fiscal devaluations, they take into account the change in social contribu- tions in the year of the VAT rate increase, as well as in the year before.

Related Research

Fiscal Devaluation

A fiscal devaluation is a budget neutral tax shift from payroll taxation or SCR, to consumption taxation, usually the VAT. Interest in fiscal devaluation was motivated by low or deteriorating external competitiveness (as measured by the real exchange rates) of the peripheral countries of the euro area, which was reflected in their large trade deficits. These countries needed to adjust without the possibility of using nominal exchange rate devaluations as an instrument, and in the presence of nominal rigidities (which make the adjustment of prices and wages sluggish).

Farhi et al. (2014) showed that in theory, real allocations that emerge under nominal exchange rate devaluation, can be replicated by fiscal devaluation as defined above. Relevant research into the effectiveness of fiscal devaluation, trying to quantify its effects, largely consists of model simulation studies (such as Engler et al. 2017; Gomes et al. 2016; or EC 2013). Simulations assume different parameters in modeling the labor market adjustments following a fiscal devaluation, which affect the results of simulations, i.e., the effects on the trade balance and other macroeconomic variables, such as growth and employment. Econometric evidence that confirms the short-run effectiveness of fiscal devaluation in improving trade balances is provided in De Mooij and Keen (2013) and Holzner et al. (2018). Arachi and Assisi (2020) find a more limited impact of fiscal devaluation on the trade balance in the euro area. However, empirical research on the specific channels of fiscal devaluation effects are rare. A recent study by Cizkowicz et al. (2020) explores the impact of fiscal devaluation on several macroeconomic variables, including on growth of (nominal) labor costs, and finds that the tax shift from SCR to VAT decelerates the labor cost growth. Another related study performs the analysis of the fiscal devaluation impact on real exchange rates via consumer prices and unit labor costs (Tkalec et al. 2019).[3] However, the effect on real exchange rates based on unit labor costs depends on the impact of a tax shift on wages.

An important assumption in the analysis of fiscal devaluation is nominal wage rigidity that impedes immediate wage adjustment following the tax reform. A fiscal devaluation is expected to work as follows (see, e.g., Koske 2013; or EC 2013): higher VAT raises consumer prices in a devaluing country meaning that a tax hike is at least partially passed on to consumers. This reduces domestic real income, including real consumption wages of workers, consumption and imports, while home exports remain exempted from VAT. At the same time, a lower SCR rate does not affect contractual wages on impact (contractual wages equal product wages minus payroll taxes and employers' contributions) but reduces both nominal and real labor costs for producers (i.e., product wages) in a devaluing country. A decline in labor costs is assumed to be passed on in the form of lower producer prices, thus, improving the price competitiveness of domestic producers and shifting demand to home

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[3] Arachi and Assisi (2020) also explore the impact of fiscal devaluation of relative (consumer) prices, but also on the terms of trade.

country goods, both at home and abroad. Both a VAT increase and an SCR cut should have the effect of improving the trade balance while the impact on the government balance should be neutral (at least ex ante).

The longer-term effects, however, depend largely on the adjustments following the tax reform: as a VAT hike increases consumer prices, it lowers workers' real consumption wages possibly giving rise to workers' demands for nominal wage increases. If these demands are met, the real labor costs for producers increase again. Similarly, employers may, other things equal, increase their labor demand at lower labor costs brought about by the SCR cut. This can also put upward pressure on contractual wages and reduce the initial decline in labor costs. These effects are likely to vary across countries given different institutional labor market characteristics. Moreover, since tax changes are usually pre-announced, some of the adjustments may take place even in the short run. A portion of employers may reduce their prices quickly, so that the real decline in labor costs following an SCR cut may be attenuated. The same may hold true for the announced VAT hike which may induce more consumption spending on durable goods before the increase in the tax rate becomes effective (D'Acunto et al. 2016). In such a scenario, producers may want to adjust their prices in advance, anticipating the change in the consumers' behavior.

It is worth noting that some theoretical and simulation studies use different assumptions of the tax pass-through mechanism in order to check for the sensitivity of their results. For example, in their baseline model, Fahri et al. (2014) assume symmetric tax pass-through to prices from a VAT hike and SCR cut, and in one of the model extensions, they analyze the asymmetric case in which the pass-through from an SCR cut is weaker. They conclude that in such a case, the equivalence between real allocations generated under a fiscal devaluation and a devaluation of the nominal exchange rate, requires a short-run overshooting in the SCR cut (i.e., in payroll subsidy as they model it), before it settles at the level of the VAT hike in the longer run. Engler et al. (2017) first assume that the firms set prices regardless of the VAT which is paid by consumers, so that the pass-through of the VAT hike is complete on impact. In an alternative setup, they assume that domestic firms pay the VAT for domestically sold products. This tends to increase their optimal post-fiscal devaluation prices, and attenuates the price reducing effect induced by the SCR cut, leading to an overall stronger impact of a fiscal devaluation on the trade balance than in the baseline case. Thus, the exact details of the tax pass-through design matter for the effectiveness of a fiscal devaluation.[4]

Tax incidence of Labor Taxation—Theoretical Considerations

The labor economics literature on tax incidence often defines labor taxes as total tax wedge between real product wages and real consumption wages, i.e., the sum of payroll taxes (paid by employers and including employers' social contributions), income taxes (including employees' social contributions) and consumption taxes (see, e.g.,

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[4] The same holds true for the alternative parametrizations of price and wage stickiness in these models.

Nickell and Layard 1999; OECD 1990; or Arpaia and Carone 2004).[5] Without any labor taxation, the real product wage equals the real consumption wage in a competitive equilibrium of labor demand and supply. In the simple setup neglecting price changes, real values equal nominal values. If labor taxation is introduced, assuming that it is paid by workers, the real consumption wage decreases inducing a decline in labor supply (movement along the supply curve), unless the latter is completely unresponsive to changes in wages. At lower labor supply, employers are willing to offer higher real product wages (movement along the labor demand curve), unless the labor demand is completely elastic. Thus, the new equilibrium, as well as the division of the tax burden, will depend on the elasticities of the labor demand and supply curves. The resulting real product wages will be higher than in the initial situation, while the real consumption wages will be lower after the introduction of labor taxation. The difference between the new product and consumption wages will equal the amount of the introduced tax. Analogous adjustments emerge for the introduction of labor tax paid by the employer.[6] Thus, in competitive neoclassical models, which are an important reference point, labor taxes increase labor costs unless labor demand is fully responsive and the whole burden is borne by workers. The economic incidence of the tax depends only on the elasticities of labor demand and supply and is not affected by the formal, statutory tax incidence. This result is often referred to as the Invariance of Incidence Proposition—*IIP* (see OECD 1990; or EC, 2015, for a simple layout). It implies that a tax switch from labor tax paid by the employee, to labor tax paid by the employer (or the other way around) affects neither real product wages (i.e., labor costs), nor real consumption wages.[7]

The above result depends on the assumption that adjustments to tax changes are immediate, or that enough time has elapsed for the adjustments to take place. This corresponds to a neoclassical model with fully competitive markets with an equilibrium between labor supply and demand (even in the short run), and thus, cannot explain involuntary unemployment. Certainly, one can expect that the short-run adjustments need not be complete so that the formal, statutory incidence may temporarily be relevant for the economic incidence of taxes. This is analyzed using the assumption of nominal wage rigidities in New Keynesian models, which enables better insights into long- and short-run effects as well as the adjustment process. It also generates a short-run negative macroeconomic relationship between growth in nominal wages and the unemployment rate known as the Phillips curve.[8] As mentioned previously, this is the essential assumption in the model of fiscal devaluation. The more recent theoretical wage-setting models with microeconomic foundations imply that real wages are determined by a markup on the reservation wage. This insight led to the adoption of the negative relationship between the level of wages and the unemployment rate, which can now be durable (see Blanchard and

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[5] Such a broad definition often includes types of income in the tax base, other than labor income.

[6] See EC (2015, p. 49ff) for a more detailed presentation with illustrations.

[7] A change in tax wedge composition may be relevant for labor costs and unemployment in few exceptional cases noted by Nickell and Layard (1999).

[8] See chapter 8 in Cahuc and Zylberberg (2004) for a review of standard macroeconomic theory.

Katz, 1999, for empirical assessment for the US and European countries), since the markup may depend on factors such as market power of firms, or the tax burden on labor (Cahuc and Zylberberg, 2004, p. 484).

Thus, in theory, an increase in labor taxation may raise labor costs and affect the relationship between labor costs and unemployment levels. The effects of particular segments of the tax wedge on labor costs depend on the exact adjustment process of nominal wages taking place after the tax reform and the real rigidities in the model, which may lead to persistence of these effects even in the longer run.

Tax incidence of Labor Taxation—Empirical Evidence

The short review of theory conducted above shows that in general, the effects of taxation on labor costs are an empirical question, as countries are likely to differ in institutional features likely affecting nominal and real labor market rigidities. This subsection provides a brief and selective overview of the relevant empirical literature, also to highlight the factors that may affect the proposed relationship between taxes and wages. There are numerous empirical studies analyzing the impact of the total tax wedge and of single segments of the tax wedge on wages and labor costs, conducted both, at the microeconomic and the macroeconomic level of analysis, with the latter using aggregate data and exploiting variation across countries and/or time.[9] The impact of the total tax wedge on labor costs is largely examined within the analysis of the effects of other institutional factors on labor costs, such as the centralization or coordination of wage bargaining, the generosity of the unemployment benefits system, employment protection regulation, labor union density, etc. (see, e.g., Nickell and Layard, 1999). The evidence on the relationship between the tax wedge and labor costs is generally mixed. Studies which find a positive and statistically significant impact include, among others, Daveri and Tabellini (2000), Nunziata (2005), or Arpaia and Carone (2004). The magnitude of the impact may be related to the type of wage bargaining institutions, with the stronger impact found for the countries with an intermediate centralization of the bargaining process (e.g., in Daveri and Tabellini, 2000), as opposed to decentralized or highly centralized bargaining. This is related to the hypothesis by Calmfors and Driffill (1988) stating that decentralized and highly centralized wage bargaining systems are better able to constrain real wage growth and reduce unemployment than wage bargaining systems with intermediate levels of centralization. In decentralized systems market forces ensure that single firms cannot raise nominal wages since they would be forced out of (competitive) markets. With intermediate levels of centralization, i.e., at industry level, if all firms in a single sector increase nominal wages they may also increase their prices without losing market shares to other competitors in the industry. Higher prices only partly deflate nominal wage increases reducing the effect on real product wages. In highly centralized bargaining systems, nominal wage increases would be

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[9] Our review is very selective and focused on macroeconomic studies that are most closely related to ours. EC (2015) provides a comprehensive recent review of microeconomic and macroeconomic research.

accompanied by stronger increases in the price level and stronger reductions in real wages, which lowers incentives for nominal wage increases in the first place (Calmfors and Driffill, 1988, p. 33–34).

The result from Daveri and Tabellini (2000) that the impact of taxes on labor costs is stronger for countries with an intermediate centralization of the wage bargaining process is not completely supported by the results of a meta-analysis of 52 empirical studies by Melguizo and González-Páramo (2013) who find no important differences between effects in countries with intermediate and low centralization levels of wage bargaining.[10] Their results suggest that workers bear around two thirds of the labor taxation on average (but with a high standard deviation), 43% in the short run and 74% in the long run. Arpaia and Carone (2004) also differentiate between short- and long-run effects of taxation on labor costs and conclude that the positive impact diminishes with time, implying a tendency for workers to bear the whole tax burden. They note, however, that the adjustment is slow-moving. This is similar to OECD (1990) in which the results of cross section regressions imply that in the long-run economic incidence of taxes falls on employees. Time-series analysis finds a significant short-run effect from the change in the total tax wedge, which, given the strong persistence in wages, tends to be long-lived. Examples of studies which find no significant evidence on the effect of the total tax wedge on wages include, e.g., Podrecca (2011) and Camarero et al. (2016).[11] Interestingly, while Podrecca (2011) examines the impact on real labor costs (real product wage), the dependent variable in Camarero et al. (2016) is the real net wage (i.e., real consumption wage).

Similar to empirical tests of the effects of the total tax wedge, the studies exploring whether the composition of the tax wedge matters also provide mixed results.[12] The findings from cross section regressions of the aforementioned study by the OECD (1990) that employers' tax negatively and significantly impacts the contractual (gross) wages are consistent with the hypothesis of complete shifting of the employers' tax to workers.[13] The estimates for the tax paid by employees, and for the indirect tax rate, on the other hand, yield positive, but statistically insignificant effects. The supplementary findings from the time-series approach in the same study show the comparatively lower impact on real product wages from increases of the employees' tax, as compared to employers' and indirect taxes. This is in partial contradiction with the short-run results from Arpaia and Carone (2004), which imply that there are no important differences between the short-run impact of employers' and employees' taxes (the latter being defined as income taxes and employees' portion of social security contributions) on real labor costs. Significant long-run effects are not detected.

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[10] Similar conclusions arise from the analysis in Nunziata (2005) who finds a similar size of the effects for three groups of countries classified according to degree of coordination in wage bargaining, although the coefficient for intermediate countries turns out slightly larger.

[11] More precisely, Camarero et al. (2016) do find a significant effect, but only in the second half of the sample period they cover, in the regression assuming a structural break.

[12] Evidence from some early studies is summarized in Layard et al. (2005, p. 210).

[13] Gruber (1997) provides the micro-level evidence of the same effect.

While the results from the empirical research do not always provide clear answers on the effects from taxation on labor costs, there seems to be prevailing evidence of the significant short-term impact that diminishes over time. Institutional features, in particular the centralization of the wage bargaining system, were found to play a role, as a significant impact of taxes on labor costs was mainly detected for countries with intermediate and low wage bargaining centralization levels.

Empirical Approach

We perform our empirical analysis on 23 members of the European Union (EU) for which sufficient data was available. Five EU countries (Bulgaria, Croatia, Cyprus, Malta and Romania) were left out from the sample mostly due to insufficient availability of data related to the institutional framework. Our sample also includes the United Kingdom, which was an EU member over the examined period. As SCR rates were not consistently defined before 2000, years prior to 2000 were not included in the sample. The time period under study, after considering lags and first differences, is between 2001 and 2018. The panel is unbalanced.

Our empirical approach is closely related to that in Nunziata (2005) whose econometric model has been derived from the theoretical framework developed in Nickell (1998). In the wage setting equation, wages are set as a mark-up on averaged actual and expected prices, depending on the unemployment rate which represents labor market conditions, and on exogenous wage determinants. Allowing for observed and unobserved macroeconomic shocks, for an equilibrium relationship between wages and productivity, and recognizing that persistence in wage dynamics can be expected both on empirical, and theoretical grounds, Nunziata (2005) suggests an estimable equation, similar to our equation below:

$$rlc_{it} = \beta_0 + \beta_1 rlc_{it-1} + \beta_2 scr_{it} + \beta_3 vat_{it} + \beta_4 ur_{it} + \beta_5 prod_{it} + \beta_6 \Delta^2 tfp_{it} + \beta_7 rir_{it} + \gamma' z_{it} + \tau_t + \varepsilon_{it},$$

(1)

where rlc_{it} stands for the (natural logarithm of) average real labor costs in country i and year t.[14] Our tax variables of interest, employers' social security contributions and value added tax, are denoted with scr_{it} and vat_{it}; ur_{it} represents the unemployment rate; trend productivity is denoted with $prod_{it}$; $\Delta^2 tfp_{it}$ captures the shocks in total factor productivity (i.e., its acceleration defined as the second difference in total factor productivity); rir_{it} denotes the real interest rate; z_{it} is the vector of institutional

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[14] While Nunziata (2005), as well as some other related studies, use implicit GDP at factor cost deflator, we deflate labor costs using the implicit gross value added (GVA) at basic prices deflator, calculated from the corresponding GVA series at current and constant prices as well as the GDP deflator. The reason is that the concept of GDP at factor cost has been abandoned (see Lequiller and Blades, 2014, p. 324) and the corresponding series needed for the calculation of this deflator are mostly unavailable. Thus, we use the implicit GVA at basic prices deflator as the available substitute and the GDP deflator as a robustness check. As stated in the System of National Accounts (1993, paragraph 6.206, p. 188) 'The basic price measures the amount retained by the producer and is, therefore, the price most relevant for the producer's decision-taking.' (see the whole section J, p. 187-190 for more details; see also "Appendix A").

variables; τ_t stands for time effects (capturing the unobserved common shocks), while ε_{it} denotes the error term. Coefficients β_0 to β_7 describe the constant term and the effects of tax and non-institutional variables, while the vector of coefficients γ captures the impact of institutional variables. The latter set includes the unemployment benefits replacement ratio ($ubrr_{it}$); employment protection legislation (epl_{it}); and the change in union density (Δud_{it}). Detailed information on variables and sources of data is available in "Appendix A".

We account for potential panel heterogeneity by introducing controls for the degree of wage bargaining coordination in our model.[15] We first classify countries into three categories according to the degree of coordination in wage bargaining (countries can move from one category to another if there are relevant changes over the observed period): those with a high degree of coordination in the wage setting process, those with a medium degree of coordination, and those with wage bargaining systems characterized by a low degree of coordination. For each group we then define a dummy variable and multiply it with our tax variables, so that, e.g., scr_m_{it} denotes the SCR variable in the group of countries with an intermediate degree of coordination in wage bargaining, while, e.g., vat_h_{it} and vat_l_{it} denote the VAT in groups with high and low degrees of coordination, respectively. The details of the definition of different groups are given in "Appendix A", under: Coordination of wage setting (CWS). The estimation equation then has the following form:

$$rlc_{it} = \beta_0 + \beta_1 rlc_{it-1} + \beta_2 scr\_h_{it} + \beta_3 scr\_m_{it} + \beta_4 scr\_l_{it} + \beta_5 vat\_h_{it} + \beta_6 vat\_m_{it}$$
$$+ \beta_7 vat\_l_{it} + \beta_8 ur_{it} + \beta_9 prod_{it} + \beta_{10} \Delta^2 tfp_{it} + \beta_{11} rir_{it} + \gamma' z_{it} + \tau_t + \varepsilon_{it}$$
$$(2)$$

We use two alternative definitions of the tax variables. First, we define the tax variables as shares of cyclically adjusted revenues from SCR and VAT in GDP (details on cyclical adjustment are provided in "Appendix B"). This approach has been applied in related research on the effects of fiscal devaluation on trade balances in De Mooij and Keen (2013) and Holzner et al. (2018). Besides capturing the changes in the relevant tax rates, it also considers changes in the tax base of SCR and VAT. The cyclical adjustment ensures that the effects of business cycles are excluded from relevant tax variables. In addition, the approach with tax variables defined as revenue shares in GDP enables us to directly evaluate the magnitude of the effects of a budget-neutral fiscal devaluation of 1% of GDP in size, which is a case typically examined in the related literature. Second, we define tax variables as the standard VAT statutory rate and the average SCR rate for a single person with average earnings. The latter approach has the advantage of completely avoiding the potential endogeneity possibly arising through simultaneous shocks to the

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[15] See "Appendix A" for definition of wage bargaining coordination variable. Some of the empirical studies differentiate between groups of countries based on the centralization, i.e. the level of wage bargaining. Although centralization may be correlated with degree of coordination, the latter indicator is preferred since it seems to be more comprehensive (Nunziata, 2005), as bargaining can be strongly coordinated even if it is not highly centralized. Still, in one of the additional approaches, we group the countries according to the predominant level of wage bargaining (see also "Appendix A") and discuss the results.

dependent variable and our tax variables defined as revenue shares in GDP. There are additional issues that affect the estimation of aggregate wage equations. There may be a potential endogeneity of other institutional and of unemployment variables. Nunziata (2005) tests for the endogeneity of institutional factors, but the null hypotheses of their independence can never be rejected. As for the unemployment rate, he expects the endogeneity bias: '…if present, to be of conservative kind, as the causal relationships from unemployment to wages and vice versa are in opposite directions' (Nunziata, 2005, p. 447). Another problem is related to the inclusion of the labor productivity variable, which makes the aggregate wage equation of the typical structural model unidentified. Still, there are both theoretical and empirical reasons to include some measure of productivity in the empirical specifications of such equations (see Manning, 1993, for a discussion). Thus, in this matter we follow Nunziata (2005) again and include a productivity trend variable to allow for an equilibrium relationship between labor costs and productivity. We do, however, check for the stability of results if this variable is left out from our specification, and only shocks in total factor productivity are included.[16]

We test OLS estimates of Eq. (1) for heteroskedasticity and serial correlation in the errors. As the null hypotheses of constant variance (in Breusch-Pagan/Cook-Weisberg test for heteroskedasticity), and of no first-order autocorrelation in the error term (Wooldridge test for autocorrelation in panel data) were strongly rejected, we adopt a generalized least squares (GLS) estimator that allows for heteroskedastic errors and first-order serial correlation. Nunziata (2005) also uses this approach but includes country fixed effects to account for unobserved country characteristics. We refrain from including country dummies, as the endogeneity bias arising in dynamic specifications which include fixed effects may be sizable for our sample due to the comparatively short time dimension of our panel.[17] We tested the hypothesis that the time-effects are equal to zero and it was always strongly rejected. Furthermore, our results are largely confirmed using an alternative (Prais–Winsten) estimator and panel-corrected standard errors, robust to heteroskedasticity and autocorrelation.

Before presenting the results, for a better understanding we explicitly state how the expected findings for the tax variables in our model relate to the suggested mechanisms of fiscal devaluations. The formal incidence of both SCR and VAT is on employers, i.e., firms. When the SCR rate is increased, real product wage, i.e., labor costs, should increase on impact, unless (1) employers are able to re-negotiate the contractual wages with their employees quickly, and shift the increased tax burden

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[16] It should be noted that Nunziata (2005) also considers a shock in terms of trade as another observed country specific macroeconomic shock variable, besides the acceleration of total factor productivity. We leave it out of our model, as the mechanism of fiscal devaluation assumes that a reduction in SCR rate should affect (relative international) prices, i.e. terms of trade, by lowering real labor costs.

[17] We mention shortly how the results of regressions including country dummies differ from our main set of results. We also tried estimating our model using the dynamic panel data system generalized method of moments (DPD-GMM) estimator by Arellano and Bover (1995) and Blundell and Bond (1998) which allows for fixed effects in a dynamic specification. The results, however, turned out not to be stable using different sets of instruments, which themselves did not convincingly pass the relevant diagnostic tests.

to workers (backward shifting), thus constraining the labor cost increase; (2) firms raise their prices and completely shift the additional SCR burden to buyers (forward shifting) in which case price increases deflate real labor costs. To the extent that the additional burden on labor induced by the change in the SCR rate is not shifted, it is borne by producers. The pre-condition for fiscal devaluation to have the desired short-run effects of an SCR cut on the trade balance, is that the producers are able to adjust the prices of their products following the cut. Since adjustments take time, one could expect at least some effect on real labor cost following the change in the SCR rate.

Similarly to the effects of changes in SCR, a VAT hike can be shifted forward to purchasers, backward to employees, or not shifted at all, in which case it is borne by firms lowering their profits. The fiscal devaluation literature assumes that it is (at least partially) shifted forward, i.e., that an increase in the VAT increases prices at the home market. This deflates real labor costs unless there are changes in contractual wages. As the consumer price inflation also reduces the real consumption wage of workers, as well as other segments of domestic real income, consumption and imports are reduced, which is another important channel through which fiscal devaluation affects trade balances. However, workers (or trade unions) may initiate wage re-negotiations and demand nominal contractual wage increases, thus attenuating the impact of a VAT hike on real labor costs, i.e., effectively preventing the complete forward shifting of the additional tax burden to workers through prices. Although backward shifting through re-negotiation of contractual wages with workers is generally possible, it does not seem to be very realistic that workers and trade unions would largely accept lower nominal contractual wages, especially if there is at least some forward shifting to consumer prices which lowers their real consumption wages. It is again important to note that wage re-negotiations usually require time. As we use annual data, the adjustment process could partly be reflected in the results of our regressions. Furthermore, as tax reforms are usually announced well ahead of the date at which they become effective, some adjustments are possible even before their implementation.

As for the effects of other variables, the deterioration of labor market conditions, as represented by a higher unemployment rate, is expected to exert a negative relationship to real labor costs (see a discussion in Nickell 1998). There should further be a positive relationship between labor costs and the productivity trend variable, while the impact of the acceleration in total factor productivity can be negative if wages fail to adjust to such (unanticipated) shocks (as in Nunziata 2005). Labor supply is expected to be negatively related to returns on wealth so that higher real interest rates may increase real labor costs. The institutional variables included in our model should also be positively related to real labor costs, as they either increase the bargaining power of insiders, as in the case of union density (see, e.g., Freeman and Medoff 1981) and employment protection legislation, or because they lower labor supply due to increased generosity of unemployment benefits systems. However, for employment protection, empirical findings reveal that firms may be able to shift the higher costs of dismissals onto workers in the form of lower entry wages, thus reducing the labor costs (Leonardi

Table 1 Results with labor costs deflated using the GVA at basic prices deflator

Tax variables:	Dependent variable: natural logarithm of real hourly labor costs:rlc_{it}					
	cyclically-adjusted revenue shares in GDP			tax rates		
	M1	M2	M3	M4	M5	M6
rlc_{it-1}	0.950***	0.983***	0.953***	0.961***	0.983***	0.963***
	(0.011)	(0.003)	(0.011)	(0.011)	(0.002)	(0.010)
scr_{it}	0.057	0.015	0.057	0.027***	0.025**	0.027***
	(0.041)	(0.039)	(0.041)	(0.010)	(0.010)	(0.010)
vat_{it}	0.231**	0.083	0.233**	0.011	0.018	0.012
	(0.109)	(0.096)	(0.107)	(0.041)	(0.040)	(0.041)
ur_{it}	−0.221***	−0.204***	−0.220***	−0.239***	−0.230***	−0.239***
	(0.034)	(0.032)	(0.033)	(0.033)	(0.032)	(0.033)
$prod_{it}$	0.038***	–	0.036***	0.025**	–	0.023**
	(0.013)		(0.013)	(0.012)		(0.011)
$\Delta^2 tfp_{it}$	–	−0.091***	−0.084***	–	−0.090***	−0.085***
		(0.032)	(0.031)		(0.031)	(0.032)
rir_{it}	0.627***	0.628***	0.638***	0.623***	0.637***	0.637***
	(0.069)	(0.067)	(0.067)	(0.070)	(0.068)	(0.068)
$ubrr_{it}$	0.014	0.011	0.015	0.020*	0.014	0.020*
	(0.011)	(0.010)	(0.011)	(0.011)	(0.010)	(0.011)
epl_{it}	−0.005*	−0.006**	−0.005*	−0.009***	−0.009***	−0.009***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Δud_{it}	−0.019	−0.025	−0.015	−0.035	−0.032	−0.029
	(0.067)	(0.072)	(0.069)	(0.067)	(0.071)	(0.069)
constant	−0.308***	−0.026*	−0.291***	−0.201**	−0.021	−0.183**
	(0.097)	(0.013)	(0.095)	(0.085)	(0.015)	(0.082)
N	353	353	353	353	353	353

***, ** and * denote significance at the 1, 5 and 10% levels, respectively. Standard errors are in parentheses, allowing for heteroskedastic errors and first-order serial correlation. Time-effects are included. Estimation by GLS

and Pica 2007), especially for groups of employees with lower bargaining power including young blue collars, low-wage workers, and workers in low-employment regions (Leonardi and Pica 2013).

Results

This section presents the regressions in which tax variables are defined as (cyclically-adjusted) VAT and SCR revenue shares in GDP (models M1–M3), and as the standard VAT tax rate and the average SCR rate for a single person with average earnings (models M4–M6).In the results presented in the main text, labor costs are deflated using GVA at basic prices deflator. Results with the alternative approach,

the GDP deflator, are provided in the Online Appendix. Table 1 presents the results of regressions using the generalized least squares (GLS) estimator, allowing for heteroskedastic errors and first-order serial correlation. We show three specifications of our model, showing different productivity variables, as discussed earlier. The first specification includes only trend productivity, the second only the acceleration of total factor productivity, and the third both of these variables (models M1–M3 and M4–M6, respectively).

Real labor costs are characterized by a high degree of persistence, as reflected in the coefficient of the lagged value of the dependent variable, which is always positive, of large magnitude, and statistically highly significant.

Coefficients of tax variables are always positive, implying that labor costs are increased following a VAT or an SCR hike. The estimates of the SCR coefficients are statistically significant only in the models using tax rates, while the VAT estimates turn out significant, and of large magnitude, in the two specification where tax variables are defined as revenue shares in GDP and trend productivity is included.

The coefficient of the unemployment rate variable is negative and highly statistically significant across all specifications. The latter holds true for the trend productivity and real interest rate variables, which are positively related to real labor costs, and for the acceleration in total factor productivity, which has a negative sign. Perhaps surprisingly, as compared to the results of Nunziata (2005), the size of the trend productivity coefficient is rather small, while that for the real interest rate is comparatively large.

As for the variables capturing the impact of institutions, the unemployment benefits replacement ratio is always positively related to real labor costs, as expected, and is statistically significant if trend productivity is controlled for in the models with tax rates. The employment protection legislation variable is negatively related to real labor costs. This result is consistent with findings by Leonardi and Pica (2007, 2013) and implies that employers shift higher severance costs to workers in form of lower wages. The coefficient of the union density variable is negative, but it is not statistically significant in any of the specifications.

In the next step, we estimate our model allowing for heterogeneity in the effects of tax variables across countries with a different institutional setting in wage bargaining, as shown in Eq. (2). In our main approach, we group the countries according to the degree of coordination in their wage-setting systems. Table 2 shows which countries from our sample had a high, intermediate and low degree of wage bargaining coordination, in most of the years over the observed period. Countries that (mainly) had low coordination in the wage bargaining include the Baltic countries, three countries from Central and Eastern Europe (CEE) and the UK. Note that three Southern-European euro area members with fiscal constraints and in need of restoring external competitiveness following the crisis of 2008 and 2009, Greece, Portugal and Spain, belong to the group with an intermediate degree of wage bargaining coordination. Note also that some countries changed the groups during the period under study.

Results of these GLS regressions are presented in Table 3. While the estimated coefficients for most other variables do not change much (an exception is the lower statistical significance and the varying sign of the unemployment benefits

Table 2 Countries according to wage bargaining coordination

High (N=128)	Medium (N=114)	Low (N=93)
Austria, Belgium, Germany, Denmark, Finland*, Ireland*, the Netherlands, Sweden	Greece*, Spain, France, Italy, Luxembourg, Portugal, Slovenia, Slovakia	Czech Republic, Estonia*, Hungary*, Lithuania, Latvia, Poland, United Kingdom

*Denotes countries that have been switching groups over the analyzed period. While all these observations are taken into account in the regressions, for the purposes of presentation in this table these countries were assigned to wage setting system they had for the majority of years

Table 3 Results for different wage bargaining systems based on degree of bargaining coordination (GVA at basic prices deflator)

Tax variables:	Dependent variable: natural logarithm of real hourly labor costs:rlc_{it}					
	cyclically-adjusted revenue shares in GDP			tax rates		
	M1	M2	M3	M4	M5	M6
rlc_{it-1}	0.956***	0.979***	0.957***	0.955***	0.979***	0.954***
	(0.011)	(0.003)	(0.011)	(0.011)	(0.003)	(0.010)
scr_h_{it}	−0.001	−0.029	−0.003	0.007	0.007	0.007
	(0.043)	(0.041)	(0.043)	(0.011)	(0.011)	(0.011)
scr_m_{it}	0.207***	0.202***	0.229***	0.074***	0.066***	0.081***
	(0.070)	(0.069)	(0.070)	(0.018)	(0.018)	(0.018)
scr_l_{it}	0.243*	0.228*	0.218	0.069**	0.072**	0.061*
	(0.135)	(0.136)	(0.134)	(0.033)	(0.032)	(0.032)
vat_h_{it}	0.150	0.062	0.154	−0.010	−0.012	−0.005
	(0.106)	(0.093)	(0.104)	(0.039)	(0.039)	(0.039)
vat_m_{it}	−0.073	−0.209	−0.107	−0.119**	−0.106**	−0.128**
	(0.144)	(0.129)	(0.143)	(0.051)	(0.050)	(0.050)
vat_l_{it}	−0.183	−0.319*	−0.160	−0.131**	−0.139**	−0.114*
	(0.201)	(0.181)	(0.197)	(0.065)	(0.064)	(0.063)
ur_{it}	−0.225***	−0.215***	−0.224***	−0.235***	−0.225***	−0.231***
	(0.033)	(0.032)	(0.033)	(0.033)	(0.033)	(0.033)
$prod_{it}$	0.028**	–	0.026**	0.027**	–	0.028**
	(0.013)		(0.013)	(0.012)		(0.011)
$\Delta^2 tfp_{it}$	–	−0.101***	−0.095***	–	−0.093***	−0.093***
		(0.033)	(0.032)		(0.032)	(0.029)
rir_{it}	0.647***	0.662***	0.660***	0.678***	0.690***	0.687***
	(0.070)	(0.069)	(0.067)	(0.071)	(0.070)	(0.068)
$ubrr_{it}$	0.001	−0.004	0.002	0.007	−0.003	0.010
	(0.011)	(0.011)	(0.011)	(0.012)	(0.011)	(0.012)
epl_{it}	−0.005*	−0.006**	−0.005*	−0.010***	−0.010***	−0.010***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Δud_{it}	−0.033	−0.049	−0.030	−0.036	−0.040	−0.034
	(0.068)	(0.071)	(0.069)	(0.069)	(0.072)	(0.071)
constant	−0.229**	−0.025*	−0.218**	−0.205**	−0.008	−0.216**
	(0.100)	(0.015)	(0.098)	(0.086)	(0.016)	(0.084)
N	335	335	335	335	335	335

***, ** and * denote significance at the 1, 5 and 10% levels, respectively. Standard errors are in parentheses, allowing for heteroskedastic errors and first-order serial correlation. Time-effects are included. Estimation by GLS

replacement ratio variable), there are important differences in the estimated coefficients of the tax variables depending on the degree of coordination in wage bargaining systems, revealing strong parameter heterogeneity.

Table 4: Effects of a fiscal devaluation equal to 1% of GDP in size

Deflator:	GVA deflator at basic prices		GDP deflator	
Tax variables as	Tax revenues	Tax rates	Tax revenues	Tax rates
fd	0.177*	− 0.068	0.113	− 0.091
fd_h	0.157*	− 0.043	0.102	− 0.047
fd_m	− 0.335*	− 0.687***	− 0.322*	− 0.548***
fd_l	− 0.378	− 0.528**	− 0.357	− 0.410

***, ** and * denote significance at the 1, 5 and 10% levels, respectively

Strong and statistically significant effects are found for the group of countries with intermediate and low degree of coordination in wage bargaining. This is true for both, SCR and VAT effects. However, while in most specifications SCR increases are found to raise labor costs, VAT hikes have a real labor costs reducing effect, which is likely due to the forward shifting of additional VAT tax burden.[18] This is different from regressions presented in Table 1. Highly coordinated countries experience the smallest effects of SCR changes on real labor costs, which also turn out negative in the first three models, although the coefficients are not statistically significant in any specification for this group of countries. Similarly, the VAT effects are the highest for the highly coordinated wage bargaining systems and positive in the first three models, but again never statistically significant.

We additionally performed all the regressions presented above using the dependent variable obtained by deflating the labor costs with the GDP deflator instead of the GVA deflator at basic prices. Results are presented in Tables A1 and A2 in the Online Appendix and correspond qualitatively to the results presented in Tables 1 and 2. Conversely, running all the regressions with fixed-effects included only partly corroborates our findings above. Results are presented in Tables A3–A6 in the Online Appendix. Only the coefficient of unemployment, real interest rates and, in some specifications, the VAT variable turn out statistically significant in the regression that do not distinguish between different wage-setting systems, with the VAT increases leading to lower real labor costs. Accounting for different wage bargaining systems renders also the coefficient of the trend productivity variable positive and statistically significant in some specifications, as well as the SCR for the group of countries with medium degree of coordination, in specifications with tax rates in which the labor costs were deflated using the GDP deflator. VAT effects are again more pronounced for the countries with medium and low wage bargaining coordination.

To evaluate the effects of a fiscal devaluation of 1% of GDP in size on real labor costs, one needs to calculate the difference between the estimated coefficients for VAT and SCR variables. Table 4 summarizes the effects of such a fiscal devaluation,

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[18] An exception are the results for the countries with highly coordinated wage bargaining, in the regressions with tax variables defined as revenue shares in GDP.

using the estimates of models M3 and M6 from Tables 1 and 2, thus also differentiating across the three groups of wage bargaining systems, as well as the estimates of the same models in regressions with GDP-deflated labor costs (Tables A1 and A2 in the Online Appendix).

To gauge the magnitude of the change in the tax rates needed for the fiscal devaluation of 1% of GDP, we follow De Mooij and Keen (2013), which calculate the implied VAT and SCR tax base by dividing the VAT (i.e., SCR) revenue in percent of GDP by the VAT (i.e., SCR) rate. In our sample, average (implied) VAT base equals 35.1%, while that for the SCR amounts to 26.8%. For the whole sample, this implies that a VAT hike by 2.9 pp and SCR cut by 3.7 pp is needed for a budget-neutral tax shift from SCR to VAT in amount of 1% of GDP, with some differences across countries with different wage bargaining coordination systems, which we account for in our evaluation below.

It should be reminded that estimates for single tax forms are mostly statistically significant only for subsamples with an intermediate and low degree of coordination in wage bargaining. Without differentiating between countries based on the degree of coordination of their bargaining systems, the impact of fiscal devaluation (denoted with *fd*) is mostly not statistically significant, except in one specification when the coefficient turns positive and significant at the 10% level. Conversely, the effects of a fiscal devaluation for countries with an intermediate degree of coordination (denoted with *fd_m*) are the largest in magnitude and imply a reduction in labor costs between − 0.32% and − 0.69%. The corresponding range for the subsample with a low coordination degree in wage setting (*fd_l*) is between − 0.36% and − 0.53%. The real labor costs reduction is the smallest (and never statistically significant) for the highly coordinated wage bargaining systems (*fd_h*) at − 0.04%, i.e., real labor costs are estimated to increase with tax variables defined as revenue shares in GDP, by between 0.1% and 0.16%.[19] The impact of the fiscal devaluation is more strongly negative with tax variables defined as tax rates. Also, it seems to be slightly larger in magnitude when the GVA at basic prices deflator is used instead of the GDP deflator.

The above estimates are on average of somewhat smaller magnitude than a simulated short-run decline in real producer wages one year following a fiscal devaluation equal to 1% of GDP, which amounts to 0.7% in simulations for France; 1% for Italy; and 0.6% for Spain and Austria (EC, 2013, using the National Institute Global Econometric Model). In the simulations, taxes affect real wages only indirectly through the trend labor productivity and the unemployment rate. It is worth noting that over the period of our study, France, Italy and Spain are classified as countries with an intermediate degree of coordination in wage bargaining, while Austria has been considered a country with a high degree of coordination throughout the period considered. These simulation results stem from stronger effects of an

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[19] Smaller effect of fiscal devaluation in countries with highly coordinated wage bargaining framework is consistent with the results by Cizkowicz et al. (2020), which find that fiscal devaluation decelerates (nominal) labor cost growth, but the impact is weaker in countries with more coordinated (or more centralised) wage bargaining.

SCR cut leading to a short-run reduction in labor costs. A VAT hike, on the other hand, increases (consumer) prices, reducing the real workers' wages and leading to a (small) increase in real labor costs through (re-negotiated) higher nominal wages. Our own estimates show that also VAT increases reduce real labor costs on impact. It is consistent with a rapid forward shifting of VAT to purchasers' (basic) prices, which is reflected in our labor costs deflator. This effect exceeds the (potential) increase in labor costs due to re-negotiated higher nominal wages, at least in the short term. Our results can be compared to findings in Tkalec et al. (2019), who analyzed, for euro-area countries, the impact of fiscal devaluation on two measures of real exchange rates: relative unit labor costs and relative consumer prices. They find that in the short run, a VAT hike appreciates both real exchange rates measures, i.e., it increases relative unit labor costs and consumer prices. The impact on the latter measure of real exchange rates turns out stronger. Thus, if no short-run effect on labor productivity is assumed, the positive VAT effect on prices exceeds the positive effect on labor costs. If forward shifting to prices is considered in calculating the real labor costs, as with our labor cost deflators, the net effect on labor costs is negative, except in some specifications for countries with highly coordinated wage-setting systems. The latter finding may imply that wage-renegotiation in such systems, following a VAT hike, may be quicker and stronger.

Finally, given that accounting for differences in labor market institutions seems crucial for our conclusions, we shortly report results from additional regressions checking whether other characteristics of the wage bargaining process, or other labor market and institutional factors, affect the relationship between taxation and labor costs. First, instead of the degree of wage bargaining coordination, we define groups of countries based on a correlated, but still different characteristic, the predominant level of wage bargaining (see "Appendix A" for precise definitions). Results are presented in the Online Appendix (see Tables A7-A10) and show that the impact of taxes on labor costs is statistically significant mainly for countries with a predominantly low level of wage bargaining. While this group of countries largely coincides with the group of countries with low coordination of wage bargaining, the group with predominantly intermediate level of bargaining also includes a number of countries with high coordination in wage-setting, likely rendering the impact of taxes in this group mostly statistically insignificant. The next approach adds the interaction terms between the tax variables and the union density (see Tables A11–A13 in the Online Appendix). The estimated coefficients of the interaction terms, which are statistically significant for the SCR variable in specifications M1−M3 and for VAT in M4−M6, imply that the impact of taxes on labor, which is per se mostly found to be statistically significant, is reduced for countries with higher union density. Countries with lower union density, where thus stronger impact of taxes can be expected, are largely those with low coordination and predominantly low level of wage bargaining, but also include France or Spain (see Table A12 in the Online Appendix). The last approach we present includes an interaction term between a corporatism indicator (see "Appendix A") and tax variables (Tables A14–A16 in the Online Appendix). The applied corporatism index captures the cooperation between business, labor and state interest groups. There the respective agreements in industrial relations and economic policy (especially wage bargaining) are classified by

structure (degree of hierarchical centralization), function (degree of concertation with the state) and scope (degree to which agreements encompass broader segments of society). The coefficients of the interaction terms are statistically significant in all models and imply that stronger effects from taxes on labor costs, which are mostly statistically significant, can be expected in countries with a low corporatism score. The group of countries with comparatively low or intermediate corporatism indicator largely overlaps with the group of countries with medium and low coordination in wage bargaining (see Table A15 in the Online Appendix).

Conclusions

Fiscal devaluation was discussed as a policy option expected to speed up the adjustment of prices and wages in restoring external competitiveness of trade deficit countries in the euro area following the outbreak of the global financial crisis (see, e.g., Cavallo and Cottani 2010a, b; ECB 2011; IMF 2011). While model simulation studies, as well as empirical research, found it should have a positive short-run effect on the trade balance of devaluing countries, empirical research exploring the functioning of the proposed mechanisms of fiscal devaluation is very rare. Studies on the effect of a fiscal devaluation on real exchange rates are also relevant in the context of this study, as the latter impact depends on the effects of a fiscal devaluation on labor costs, which has barely been explicitly studied empirically so far.

We add to this literature and empirically estimate a real labor costs equation for countries and periods largely overlapping with the sample used in studies which found a positive short-run effect of fiscal devaluations on the trade balance and a depreciating impact on the real exchange rate based on unit labor costs (Holzner et al. 2018; Tkalec et al. 2019). Our study, thus, also contributes to broader macroeconomic research on wage determinants, and more specifically, on the role of taxation. We use a standard approach from this strand of labor economics literature and estimate a macro-wage equation considering separately the effects of SCR and VAT, while controlling for other potentially important factors, including labor market institutions. We further allow for different effects of taxation across countries (and periods) with a different degree of coordination in wage bargaining.

Our results reveal that the latter differentiation is crucial, as we detect statistically significant effects of both taxation forms mostly for subsamples with low and intermediate degrees of wage bargaining. The coefficients for this group of countries also turn largest in magnitude and imply that a combination of an increase in VAT, and a cut in SCR, should lower real labor costs. More specifically, a budget-neutral fiscal devaluation equal to 1% of GDP in size reduces real labor costs by between 0.32% and 0.69% for countries with intermediate wage bargaining coordination. The corresponding range for the subsample with low coordination is between 0.36 and 0.53%, while the change in real labor costs can be positive up to 0.16% for highly coordinated bargaining systems. We note that statistically significant, and often stronger effects of taxation are found also for the group of countries with predominantly lower level of wage bargaining, in those with lower union density, as well as

in countries with a lower corporatism score. Countries with these characteristics are often those with low and intermediate coordination in wage bargaining. The estimated magnitude of fiscal devaluation effects is less strong than the results from model simulations.

As for the impact of individual tax forms, we find that also VAT hikes contribute to a real labor cost decline, while in the simulations, VAT hikes increase consumption prices causing pressures for nominal contractual wage increases, which, in turn, also increase real labor costs. Our result is consistent with the rapid forward shifting of VAT to purchasers' (basic) prices, which is reflected in our labor costs deflator, which exceeds the (potential) increase in labor costs due to re-negotiated higher nominal wages, at least in the short term, except in some specifications for countries with highly coordinated wage-setting systems. The findings for employers' contributions are consistent with the proposed fiscal devaluation mechanism, as their decline also lowers real labor costs, but only by a fraction of the increase in the SCR rate. This result allows for a partial forward shifting of benefits created by lowering the burden from this labor taxation segment, i.e., the possibility of producers lowering their prices in response to a tax reform and thus, improving their external cost competitiveness.

Overall, the results suggest that a fiscal devaluation can have a modest real wage dampening effect particularly in those countries that have low and intermediate levels of wage bargaining coordination. Countries with a high level of wage bargaining coordination, on the other hand, can influence real wages via coordinated incomes policy, so that they can avoid the loss of competitiveness via wage growth restraint in the first place. If adjustments are still needed, because, e.g., incomes policy has failed to ensure external competitiveness over some period, the highly coordinated systems may be able to re-adjust without the need to implement fiscal devaluations.

Appendix A: Variables and Data Sources

Real labor costs (RLC): natural logarithm of real labor costs calculated as nominal aggregate compensation of employees deflated using the implicit 'GVA at basic prices' deflator (calculated from corresponding series at current and constant prices) and divided by total hours of work. As stated in the System of National Accounts (1993, paragraph 6.206, p. 188) 'The basic price measures the amount retained by the producer and is, therefore, the price most relevant for the producer's decision-taking.' (see section J, p. 187–190, for more details). Alternatively, GDP deflator has been used. Sources: European Commission AMECO database and Eurostat, base year 2015.

Value added tax revenues (VAT): cyclically adjusted (see "Appendix B") revenues from VAT, as a proportion of GDP (range 0–1). Actual revenues from Eurostat: General government, VAT, receivable (D.211REC).

Employers' social security contributions (SCR): cyclically adjusted (see "Appendix B") revenues from SCR as a proportion of GDP (range 0–1). Actual revenues from Eurostat: General government, Employers' actual social contributions, receivable (D.611REC).

Value added tax rate (VAT rate): standard statutory VAT rates, in % divided by 100 (range 0–1). Source: European Commission, Tax and Customs Union.

Average employers' social security rate (SCR rate): average rate for a single person at average level of earnings, as proportion of gross wage earnings (range 0–1). Source: OECD.

Unemployment rate (UR): Unemployed persons as a share of the total active population (labour force).

The labour force is the number of people employed and unemployed. Source: European Commission AMECO database.

Trend productivity (PROD): natural logarithm of Hodrick Prescott trend of real gross value added per hour worked, in 2015 Euro. Source: Eurostat.

Unemployment benefits replacement ratio (UBRR): net replacement rates for earners of average salary, average for four family types, initial phase of unemployment, as proportion (range 0-1). Source: European Commission Tax and benefits indicators database.

Real interest rate (RIR): Real short-term interest rates (GDP deflator), in % divided by 100 (range 0–1). Source: European Commission AMECO database.

Employment protection legislation (EPL): indicator of strictness of employment protection against individual and collective dismissals for workers with a regular contract (version 2), index ranging from 0 to 6, with higher value representing stronger employment protection. Source: OECD.

Union density (UD): net union membership as a proportion of wage and salary earners in employment (some observations have been estimated by interpolation), as a proportion (range 0–1). Source: J. Visser, ICTWSS Data base, version 6.0. Amsterdam: Amsterdam Institute for Advanced Labour Studies AIAS. June 2019.

Acceleration in total factor productivity (Δ^2TFP): twice differenced natural logarithm of total factor productivity index, 2015=100. Source: European Commission AMECO database.

Coordination of wage setting (CWS): five categories: 5 = maximum or minimum wage rates/increases based on (a) centralized bargaining by peak association(s), with or without government involvement, and/or government imposition of wage schedule/freeze, with peace obligation (b) informal centralization of industry-level bargaining by a powerful and monopolistic union confederation (c) extensive, regularized pattern setting and highly synchronized bargaining coupled with coordination of bargaining by influential large firms; 4 = wage norms or guidelines (recommendations) based on a) centralized bargaining by peak associations with or without government involvement (b) informal centralization of industry-level bargaining by a powerful and monopolistic union confederation (c) extensive, regularized pattern setting coupled with high degree of union concentration; 3 = negotiation guidelines based on (a) centralized bargaining by peak associations with or without government involvement (b) informal centralization of industry-level bargaining (c) government arbitration or intervention; 2 = mixed industry and firm-level bargaining, with no or little pattern bargaining and relatively weak elements of government coordination through the setting of minimum wage or wage indexation; 1 = fragmented wage bargaining, confined largely to individual firms or plants. Category 1 is the category of low coordination in wage setting; categories 2 and 3 build together the category of

intermediate coordination degree; while categories 4 and 5 are considered as being highly coordinated. Source: J. Visser, ICTWSS Data base, version 6.0. Amsterdam: Amsterdam Institute for Advanced Labour Studies AIAS. June 2019.

Nominal GDP (GDP): Gross domestic product at market prices (current prices), used as denominator in definitions of tax variables. Source: Eurostat.

Definition of different wage bargaining levels, i.e., the predominant level at which wage bargaining takes place in terms of coverage: 5 = bargaining predominantly takes place at central or cross-industry level negotiated at lower levels; 4 = intermediate or alternating between central and industry bargaining; 3 = bargaining predominantly takes place at the sector or industry level; 2 = intermediate or alternating between sector and company bargaining; 1 = bargaining predominantly takes place at the local or company level. Category 1 is the category with low level of wage bargaining; categories 2 and 3 together are the category of medium level bargaining; and categories 4 and 5 represent systems with high level of wage bargaining. Source: J. Visser, ICTWSS Data base, version 6.0. Amsterdam: Amsterdam Institute for Advanced Labour Studies AIAS. June 2019.

Index of corporatism: To define corporatism, the respective agreements in industrial relations and economic policy (especially wage bargaining) are classified by structure (degree of hierarchical centralisation), function (degree of concertation with the state) and scope (degree to which agreementsencompass broader segments of society). Jahn, Detlef (2016). Changing of the guard: trends in corporatist arrangements in 42 highly industrialized societies from 1960 to 2010, Socio-Economic Review. 14: 47–71. 2019 Update of data available at: https://ipk.uni-greif swald.de/politikwissenschaft/data-download/.

Appendix B: Cyclical Adjustment

Cyclically adjusted tax variables (VAT and SCR) have been calculated by applying the empirical approach of the European Central Bank (ECB) used for the estimation of the cyclically adjusted budget balance set out in Bouthevillain et al. (2001). It is based on the estimation of the cyclical component of individual revenue and expenditure items with respect to relevant macroeconomic bases and it consists of four steps:

(1) The first step identifies relevant aggregate demand components that serve as the natural aggregate base for budgetary items in need of cyclical adjustment. We follow Bouthevillain et al. (2001) who recommend using household consumption for VAT and wages and salaries for SCR.

(2) In the second step the elasticity of the budgetary item with respect to the aggregate base is estimated. Here, we resort to the existing estimates by the OECD, available in Price et al. (2014). Only for Lithuania, we take the elasticities estimates from Holzner et al. (2018), as these are not available from the OECD study. Please see Appendix 2 in Holzner et al. (2018) for details of this step.

(3) In the third step the cyclical component of the aggregate base is estimated, by employing the Hodrick-Prescott filter in order to estimate the trend component of the aggregate bases, whereby the value of lambda was set using the Ravn-Uhlig frequency rule.

(4) In the fourth step the cyclical component of budgetary items is calculated and subtracted from the budgetary item to obtain the cyclically adjusted budget balance.

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