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Wage Bargaining Coordination, Taxation and Labor Costs: 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 20 OECD countries, members of the European Union, over the period between 2001 and 2013. Our results show that fiscal devaluation reduces real labor costs, as suggested in the literature on fiscal devaluations. The effects turn out to be the strongest, and statistically significant, for countries with low and intermediate degrees of wage bargaining coordination, stressing the importance of labor market institutions. For these countries, we find that both, value added tax hikes, as well as the cuts in employers' contributions contribute to real labor cost reduction. Countries with a high level 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 are possible even without implementation of fiscal devaluations.

Keywords: fiscal devaluation, taxes, tax structure, labor costs, tax incidence

JEL codes: H20; H22; J30; J31; J38; J50

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1 Introduction

The effects of taxes on labor costs have been an important topic in economic studies that has been examined within a broader area of research on institutions and labor markets. This research often analyzed the impact of a broad measure of labor taxes defined as the total tax wedge between real product wages and real consumption wages thus comprising employers' and employees' social security contributions, personal income tax and consumption taxes. Thereby, 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, though, analyzed the effects of single segments of the total tax wedge and examined whether shifts between different single parts of the tax burden on labor had effects on labor costs and unemployment. Our contribution specifically explores the effects of a fiscal devaluation, i.e. of a tax shift from employers' contributions (SCR) to value added tax (VAT) on real labor costs.

Fiscal devaluations have been at the forefront of the policy discussions following the outbreak of the 2008 crisis (see e.g. Koske, 2013; or IMF, 2011), which intensified the need for restoring the external competitiveness of some euro area member states. Without the possibility of using nominal exchange rate devaluations within the currency union, some countries relied on the adjustment of prices and wages, which turned out to be a protracted, and socially and politically painful process, related to increasing unemployment (IMF, 2012; IMF 2015; Kang and Shambaugh, 2016).[1] Fiscal devaluation was expected to speed up the process of adjustment, and possibly to mitigate the undesirable social consequences of high unemployment (IMF, 2011). A large body of research on the effects of this policy option was conducted following the outbreak of the crisis, largely consisting of model simulation studies (such as Engler et al., 2017; Gomes et al., 2016; or EC, 2013). Simulations assume different parameters in modelling 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. The few empirical studies were mostly concerned with the impact of such a tax shift on the trade balance (De Mooij and Keen, 2013; Holzner et al., 2018), but the empirical research on the specific channels of fiscal devaluation effects through which it is expected to improve the trade balance of a devaluing country has been exceptionally rare. To our knowledge, it has been restricted only to the analysis of the fiscal devaluation impact on real exchange rates defined via consumer prices and unit labor costs (Tkalec et al., 2018). However, the effect on real exchange rates based on the latter, depends on the impact of a tax shift on labor costs.

While earlier research on taxation and labor costs does provide guidance on the mechanism of this relationship, we specifically test the effects of a fiscal devaluation on real labor costs assumed in the related research of such a tax shift. We do so for the sample of countries and over the period (to the extent possible given data availability) in which the significant short-run impact of fiscal devaluation on

[1] The same holds true for non-euro countries with fixed exchange rate policy if they decide to maintain fixed exchange rate regimes, as documented in IMF (2015) for some trade deficit non-euro area countries in the EU.

trade balances and real exchange rates was confirmed (Holzner et al., 2018; De Mooij and Keen, 2013). We use a rather standard empirical approach, controlling for the influence of other macroeconomic and institutional variables. As earlier research such as Daveri and Tabellini (2000) implied there may be differences in the effects of taxation on labor costs depending on the intensity of coordination in wage bargaining, we allow for the heterogeneous impact that fiscal devaluation may exhibit on the real labor costs across countries with different wage bargaining systems. Consequently, policy implications regarding the effectiveness of fiscal devaluation, i.e. its potential to reduce real labor costs, may differ substantially across countries with different wage bargaining systems.

Our study is structured in a way that it first provides a selective overview of related research in the next section, comprising a more detailed description of the fiscal devaluation literature, and a review of both theoretical and empirical literature on the incidence of labor taxation. Thereafter, we present our sample and the empirical approach, which is followed by the section with the results of our econometric work. The last section summarizes the results and emphasizes the main conclusions.

2 Related research

2.1 Fiscal devaluation

Fiscal devaluations have been a widely discussed topic in economic policy circles after the outbreak of the global financial and economic crisis a decade ago. They are defined as a (budget neutral) tax shift from payroll taxation or SCR, to consumption taxation, most notably the VAT. Discussions were 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). Numerous studies on the effects of fiscal devaluation emerged, mostly finding a positive short-run effect on trade balances which vanishes over time.[2]

An important assumption in the analysis of fiscal devaluation is nominal wage rigidity, which impedes immediate wage adjustment following the tax reform. The 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

[2] Relevant theoretical and simulation studies include e.g. Farhi et al. (2014), Engler et al. (2017), EC (2013), or Gomes et al. (2016). Farhi et al. (2014) show that, in theory, fiscal devaluation as defined above can, under certain assumptions, replicate the real allocations created under nominal exchange rate devaluation. Econometric evidence of the short-run effectiveness of fiscal devaluation is provided in De Mooij and Keen (2013) and Holzner et al. (2018).

(equal to 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 country goods, both home and abroad. Both, VAT hike, and SCR cut, should have an improving effect on 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 also can put an upward pressure on contractual wages and diminish the initial decline in labor costs. The effects are likely to vary across countries given their 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.[3]

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

2.2 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. Nickell and Layard, 1999; OECD, 1990; or Arpaia and Carone, 2004).[4] Without any labor taxation, real product wage equals real consumption wage in a competitive equilibrium of labor demand and supply. In the simple setup neglecting the price changes, real values equal nominal values. If labor taxation is introduced, assuming that it is paid by workers, real consumption wage decreases inducing a decline in labor supply unless the latter is completely unresponsive to changes in wages. At lower labor supply, employers are willing to offer higher real product wages, 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 decline after the introduction of labor taxation. Analogous adjustments emerge for the introduction of labor tax paid by the employer. Thus, in competitive classical 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 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.[5]

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 classical theoretical models with fully competitive markets which always imply an equilibrium between labor supply and demand (even in the short run), and thus, cannot explain involuntary unemployment. Naturally, 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 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.[6] 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

[4] Such a broad definition often includes types of income in the tax base, other than labor income.
[5] A change in tax wedge composition may be relevant for labor costs and unemployment in few exceptional cases noted by Nickell and Layard (1999).
[6] See chapter 8 in Cahuc and Zylberberg, (2004) for a review of standard macroeconomic theory.

relationship between the level of wages and the unemployment rate, which can now be durable (see Blanchard and 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 single segments of the tax wedge may have a varying impact on labor costs depending 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.

2.3 Tax incidence of labor taxation – empirical evidence

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.[7] 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 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 accompanied by stronger increases in the price level and stronger reductions in real

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

wages, which lowers incentives for nominal wage increases in the first place (Calmfors and Driffill, 1988, p. 33-34).

The conclusion from Daveri and Tabellini (2000), however, is not completely supported by the results of a meta-analysis of 52 empirical studies by Melguizo and González-Páramo (2013), which find no important differences between effects in countries with intermediate and low centralization levels of wage bargaining.[8] 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).[9] 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.[10] 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.[11] The estimates for the tax paid by employees, and for the indirect tax rate, on the other hand, yield positive, but statistically not significant 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.

[8] 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.
[9] 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.
[10] Evidence from some early studies is summarized in Layard et al. (2005, p. 210).
[11] Gruber (1997) provides the micro-level evidence of the same effect.

3 Empirical approach

We perform our empirical analysis on a set of 20 OECD countries, also members of the European Union (EU) for which sufficient data was available. Eight EU countries were left out from the sample mostly due to unavailability of data capturing the institutional variables. The lack of this data constraints our sample for the more recent years, while the consistently defined data on SCR rates represents an obstacle for including the years before 2000. The time period under study, after considering lags and first differences, is between 2001 and 2013. 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:

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

where rlc_{it} stands for (natural logarithm of) average real labor costs in country i and year t.[12] 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; $\boldsymbol{z}_{it}$ is the vector of institutional 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 $\boldsymbol{\gamma}$ captures the impact of institutional variables. The latter set includes 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.

As noted above, the effects of taxation on real labor costs may vary across countries due to differences in the degree of centralization or coordination in their wage bargaining systems. For this reason, in the

[12] 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. 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 closest available substitute. 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).

next step of our empirical investigation, we account for potential panel heterogeneity by introducing controls for the degree of wage bargaining coordination in our model.[13] We first classify countries into different 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), and obtain three groups of countries: 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:

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

In our main approach 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. As a robustness check for our results we also run the same regressions using differently defined tax variables, i.e. the standard VAT statutory rate and the effective 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 dependent variable and our tax variables defined as revenue shares in GDP. This source of potential endogeneity is, however, only one of the issues contributing to complexity in empirical estimations of aggregate wage equations. There may also 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 in this case: '…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 inclusion of the labor

[13] 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.

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 in order 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.[14]

Our estimation strategy consists of first estimating the model in equation (1) using an ordinary least squares (OLS) estimator and then testing 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 proceed with the estimation using a generalized least squares (GLS) estimator, allowing for heteroskedastic errors and first-order serial correlation. Nunziata (2005) also uses this approach, but includes country fixed effect 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. However, in the next step we re-estimate 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, and accounts for potential endogeneity issues described above.

It is important to note how expected findings for the tax variables in our model relate to 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 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 real labor cost increasing effects following the increase in the SCR rate.

[14] 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.

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 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, possibly attenuating the impact of a VAT hike on real labor costs i.e. effectively preventing the complete forward shifting of 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 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).

4 Results

Table 1 presents the results of regressions using the generalized least squares (GLS) estimator, allowing for heteroskedastic errors and first-order serial correlation. We used three alterations of our empirical

model, depending on the inclusion of variables related to productivity, given our discussion in the previous section. 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). These three variations are then re-estimated allowing for the time effects (models M1TE-M3TE). 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. The coefficient of the unemployment rate variable is negative and highly 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. 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. The acceleration in total factor productivity does not turn out to be significant at the usual levels of statistical significance.

Table 1: GLS estimates

	Dependent variable: natural logarithm of real hourly labor costs: rlc_{it}					
	Without time effects			With time effects		
	M1	M2	M3	M1TE	M2TE	M3TE
rlc_{it-1}	0.949***	0.986***	0.951***	0.948***	0.984***	0.948***
	(0.014)	(0.003)	(0.013)	(0.012)	(0.003)	(0.012)
scr_{it}	0.025	0.025	0.031	0.052	0.039	0.052
	(0.041)	(0.043)	(0.041)	(0.041)	(0.043)	(0.041)
vat_{it}	0.061	0.004	0.035	-0.005	-0.057	-0.007
	(0.116)	(0.120)	(0.115)	(0.112)	(0.121)	(0.112)
ur_{it}	-0.122***	-0.114***	-0.128***	-0.208***	-0.187***	-0.206***
	(0.039)	(0.038)	(0.039)	(0.041)	(0.042)	(0.042)
$prod_{it}$	0.043***	-	0.040***	0.043***	-	0.043***
	(0.016)		(0.015)	(0.015)		(0.015)
$\Delta^2 tfp_{it}$	-	0.012	0.003	-	-0.044	-0.052
		(0.031)	(0.031)		(0.062)	(0.061)
rir_{it}	0.287***	0.288***	0.306***	0.511***	0.519***	0.526***
	(0.063)	(0.067)	(0.065)	(0.083)	(0.088)	(0.084)
$ubrr_{it}$	0.030*	0.019	0.030**	0.029**	0.018	0.030**
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
epl_{it}	-0.008*	-0.006	-0.008**	-0.008**	-0.005	-0.008**
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Δud_{it}	0.013	0.065***	0.019	0.032	0.083***	0.032
	(0.117)	(0.125)	(0.123)	(0.126)	(0.130)	(0.128)
constant	0.013	0.065	0.019	0.032	0.083	0.032
	(0.027)	(0.019)	(0.025)	(0.025)	(0.020)	(0.025)
N	234	234	234	234	234	234

Notes: ***, ** 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.

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. The same holds true with a negative sign for the employment protection legislation variable. 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 positive, but statistically significant only in specifications omitting trend

productivity. Coefficients of tax variables turn out not to be statistically significant. The signs for both tax variables are positive, except for the VAT variable if time effects are included.

In the next step, we re-estimate our model allowing for heterogeneity in the effects of tax variables across countries with a different institutional setting in wage bargaining, as presented in equation (2). Results of these GLS regressions are presented in Table 2. While the estimated coefficients for all other variables mostly do not change much, 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 2: GLS estimates differentiating across different wage bargaining systems

	Dependent variable: natural logarithm of real hourly labor costs: rlc_{it}					
	Without time effects			With time effects		
	M1	M2	M3	M1TE	M2TE	M3TE
rlc_{it-1}	0.954***	0.983***	0.958***	0.958***	0.981***	0.959***
	(0.014)	(0.003)	(0.013)	(0.013)	(0.003)	(0.013)
scr_h_{it}	-0.010	-0.020	-0.006	-0.007	-0.024	-0.008
	(0.047)	(0.048)	(0.048)	(0.046)	(0.047)	(0.047)
scr_m_{it}	0.217**	0.208**	0.213**	0.244**	0.221**	0.232**
	(0.105)	(0.099)	(0.100)	(0.096)	(0.094)	(0.096)
scr_l_{it}	0.304	0.285	0.300	0.378	0.407	0.406
	(0.265)	(0.269)	(0.258)	(0.245)	(0.262)	(0.248)
vat_h_{it}	-0.015	-0.066	-0.038	-0.147	-0.203*	-0.152
	(0.125)	(0.123)	(0.124)	(0.120)	(0.121)	(0.121)
vat_m_{it}	-0.341*	-0.398**	-0.359**	-0.501***	-0.552***	-0.491***
	(0.188)	(0.175)	(0.183)	(0.181)	(0.174)	(0.181)
vat_l_{it}	-0.331	-0.437	-0.364	-0.595**	-0.743**	-0.619**
	(0.312)	(0.300)	(0.301)	(0.295)	(0.300)	(0.297)
ur_{it}	-0.106***	-0.098***	-0.108***	-0.183***	-0.171***	-0.180***
	(0.036)	(0.034)	(0.036)	(0.037)	(0.036)	(0.037)
$prod_{it}$	0.035**	-	0.029*	0.027*	-	0.027*
	(0.017)		(0.016)	(0.015)		(0.015)
$\Delta^2 tfp_{it}$	-	0.018	0.002	-	-0.060	-0.067
		(0.032)	(0.032)		(0.062)	(0.061)
rir_{it}	0.286***	0.277***	0.295***	0.521***	0.547***	0.537***
	(0.063)	(0.065)	(0.065)	(0.081)	(0.083)	(0.082)
$ubrr_{it}$	0.026	0.014	0.025	0.019	0.008	0.019
	(0.017)	(0.015)	(0.017)	(0.016)	(0.015)	(0.016)
epl_{it}	-0.012***	-0.011***	-0.012***	-0.014***	-0.013***	-0.014***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Δud_{it}	0.148	0.106	0.115	-0.067	-0.057	-0.052
	(0.116)	(0.125)	(0.124)	(0.124)	(0.127)	(0.127)
constant	0.050	0.100***	0.060*	0.095***	0.138***	0.096***
	(0.035)	(0.024)	(0.033)	(0.034)	(0.025)	(0.034)
N	234	234	234	234	234	234

Notes: ***, ** 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.

Strong and statistically significant effects are found for the group of countries with intermediate coordination. This is true for both, SCR and VAT effects. However, while the SCR increases are found to raise labor costs, VAT hikes have a real labor costs reducing effect (in estimations with and without time effects), which is likely due to the forward shifting of additional VAT tax burden. This is different from regressions presented in Table 1, without time effects. Highly coordinated countries experience

the smallest effects on real labor costs, while the estimated coefficients for countries with low degree of coordination in wage bargaining turn largest (in absolute value, in most of regressions), but statistically significant only for VAT in regressions with time effects.

Keeping the specification that allows for parameter heterogeneity across subsamples with different wage bargaining coordination systems, and in order to check whether results are affected by the potential simultaneous shocks to tax variables (despite cyclical adjustment) and our dependent variable, we re-estimated the above models using an alternative definition of the tax variables.

Specifically, we use tax rates, i.e. the standard VAT rate, and the effective SCR rate for a single person with average earnings, instead of variables defined in terms of the cyclically adjusted shares of tax revenues in GDP. Results are displayed in Table 3.

Table 3: GLS estimates differentiating across different wage bargaining systems - tax rates

	Dependent variable: natural logarithm of real hourly labor costs: rlc_{it}					
	Without time effects			With time effects		
	M1	M2	M3	M1TE	M2TE	M3TE
rlc_{it-1}	0.953***	0.986***	0.956***	0.955***	0.984***	0.956***
	(0.012)	(0.003)	(0.012)	(0.011)	(0.003)	(0.011)
scr_h_{it}	0.012	0.013	0.011	0.013	0.016	0.013
	(0.015)	(0.016)	(0.015)	(0.014)	(0.015)	(0.014)
scr_m_{it}	0.048	0.063*	0.047	0.061*	0.071**	0.057*
	(0.035)	(0.033)	(0.034)	(0.033)	(0.033)	(0.034)
scr_l_{it}	0.119	0.139*	0.120	0.152**	0.178**	0.160**
	(0.077)	(0.082)	(0.075)	(0.072)	(0.080)	(0.072)
vat_h_{it}	0.023	0.020	0.014	-0.018	-0.020	-0.018
	(0.038)	(0.040)	(0.039)	(0.037)	(0.039)	(0.038)
vat_m_{it}	-0.036	-0.055	-0.044	-0.085	-0.097*	-0.079
	(0.054)	(0.055)	(0.055)	(0.054)	(0.055)	(0.055)
vat_l_{it}	-0.065	-0.106	-0.082	-0.155*	-0.196**	-0.158**
	(0.081)	(0.083)	(0.080)	(0.079)	(0.083)	(0.080)
ur_{it}	-0.117***	-0.099***	-0.120***	-0.212***	-0.190***	-0.211***
	(0.034)	(0.033)	(0.034)	(0.038)	(0.037)	(0.038)
$prod_{it}$	0.039***	-	0.035***	0.032**	-	0.032**
	(0.014)		(0.013)	(0.013)		(0.013)
$\Delta^2 tfp_{it}$	-	0.016	0.005	-	-0.088	-0.098*
		(0.029)	(0.030)		(0.058)	(0.057)
rir_{it}	0.281***	0.279***	0.293***	0.528***	0.565***	0.550***
	(0.059)	(0.061)	(0.061)	(0.078)	(0.081)	(0.079)
$ubrr_{it}$	0.026	0.004	0.024	0.015	-0.005	0.015
	(0.018)	(0.015)	(0.017)	(0.017)	(0.014)	(0.017)
epl_{it}	-0.010***	-0.009***	-0.011***	-0.010***	-0.009***	-0.010***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Δud_{it}	0.159	0.148	0.133	0.010	0.046	0.033
	(0.107)	(0.114)	(0.114)	(0.114)	(0.117)	(0.115)
constant	0.027	0.078***	0.038	0.071**	0.112***	0.071**
	(0.028)	(0.021)	(0.027)	(0.029)	(0.023)	(0.029)
N	246	246	246	246	246	246

Notes: ***, ** 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. The sample additionally includes data for Portugal.

The (absolute value of the) size of the tax variable coefficients is now generally smaller, which reflects the fact that a 1 percentage point change in any of the two tax rates corresponds to a smaller change in tax revenue shares in GDP. This is because the tax base for single tax forms are only a fraction of the

GDP. The positive and statistically significant impact of SCR is confirmed in the alternative approach for countries with intermediate and low levels of wage bargaining coordination (in regressions with time effects), with the corresponding coefficients for the subsample with low coordination being larger again. The coefficients of the VAT variables are statistically mostly not significant, except for the country groups with low coordination in regressions with time effects. There is a negative sign of coefficients for intermediate and low coordination groups of wage bargaining, while the sign of coefficients for highly coordinated systems changes depending on the inclusion of the time effects. That the results for the VAT variable are not completely confirmed may be due to the use of the standard VAT rate only, without the possibility to account for reduced rates or changes in the tax base. There is also less variation in tax variables defined as rates, which may impede more precise estimation of their effects. Results on other variables mainly display a similar picture as before.

In the last step, given the other potential endogeneity issues in the empirical estimation of wage equations outlined in the previous section, we also used the dynamic panel data system generalized method of moments (DPD-GMM) estimator by Arellano and Bover (1995) and Blundell and Bond (1998), again with the original definition of tax variables. Such an estimation approach also allows us to control for the countries' fixed effects without biasing the estimates. We treat all variables as endogenous except for employment protection legislation and union density. This choice reflects our belief that, unlike unemployment benefits replacement ratio, the other two institutional variables cannot be that quickly influenced by a policy responding to potentially unsatisfactory developments in labor costs. We further add a political variable as an excluded instrument to describe the strength of left wing parties (see Appendix A).[15] We try to restrict the number of instruments and thus, include time effects in the instruments set only in the last three specifications. In all specifications, Arellano–Bond tests for serial correlation in the first-differenced errors always reject the null hypothesis of no serial correlation at order 1, but never reject the same hypothesis at order 2, thus, implying no indication of misspecification. Hansen *J* statistic is never rejected indicating that instruments are valid. However, the latter test may be weakened by using a considerable number of instruments, especially in the last three regressions. The results are presented in Table 4.

The estimates of the tax variable coefficients confirm the comparatively stronger impact of tax reform on real labor costs in countries with low and intermediate degree of coordination in wage bargaining, although these are mostly not statistically significant with an exception of the coefficients for the first group of countries in the regressions without time effects. The absolute size of these coefficients is considerably larger than for the GLS estimator in Table 2. While the coefficients of the unemployment rate turn out negative again, and of similar magnitude as before, they miss the usual significance levels

[15] Similar political variables have been used by Nunziata (2005) as instruments in his tests of labor market institutions endogeneity, and by Lehmann et al. (2016) who emphasize that left-wing politicians may be more inclined to support higher taxes in general.

in regressions without time effects. Shocks in total factor productivity, on the other hand, turn positive and significant at the 10% level in specifications M2TE and M3TE. The size of the estimated coefficients for trend productivity variable is larger than for the GLS estimates. Results for other covariates are similar as above.

Table 4: DPD-GMM estimates differentiating across different wage bargaining systems

	Dependent variable: natural logarithm of real hourly labor costs: rlc_{it}					
	Without time effects			With time effects in instruments set		
	M1	M2	M3	M1TE	M2TE	M3TE
rlc_{it-1}	0.847***	0.984***	0.863***	0.864***	0.982***	0.877***
	(0.068)	(0.010)	(0.054)	(0.073)	(0.011)	(0.056)
scr_h_{it}	0.492	-0.042	0.291	0.491	0.033	0.349
	(0.439)	(0.282)	(0.360)	(0.439)	(0.280)	(0.356)
scr_m_{it}	0.929	0.635**	0.861	0.670	0.522**	0.687
	(0.649)	(0.263)	(0.561)	(0.465)	(0.247)	(0.435)
scr_l_{it}	1.030**	0.528	1.002**	0.783	0.324	0.760
	(0.468)	(0.391)	(0.425)	(0.508)	(0.430)	(0.474)
vat_h_{it}	-0.393	-0.525	-0.507	-0.236	-0.490	-0.613
	(0.734)	(0.675)	(0.798)	(0.719)	(0.602)	(0.672)
vat_m_{it}	-0.910	-1.224*	-1.178	-0.469	-0.910	-0.928
	(0.772)	(0.640)	(0.827)	(0.794)	(0.661)	(0.781)
vat_l_{it}	-1.183	-1.235*	-1.425*	-0.791	-0.842	-1.085
	(0.815)	(0.715)	(0.809)	(0.729)	(0.681)	(0.735)
ur_{it}	-0.139	-0.127	-0.125	-0.206*	-0.258***	-0.263**
	(0.123)	(0.139)	(0.149)	(0.113)	(0.097)	(0.114)
$prod_{it}$	0.156**	-	0.137**	0.132	-	0.120*
	(0.079)		(0.063)	(0.084)		(0.066)
$\Delta^2 tfp_{it}$	-	-0.007	-0.010	-	0.145*	0.136*
		(0.083)	(0.081)		(0.077)	(0.072)
rir_{it}	0.445***	0.371**	0.388**	0.293*	0.305*	0.289
	(0.139)	(0.170)	(0.164)	(0.158)	(0.164)	(0.176)
$ubrr_{it}$	-0.013	0.001	0.014	0.022	0.027	0.042
	(0.086)	(0.069)	(0.075)	(0.061)	(0.070)	(0.050)
epl_{it}	-0.037*	-0.021*	-0.037**	-0.034**	-0.018	-0.033**
	(0.020)	(0.011)	(0.017)	(0.015)	(0.012)	(0.013)
Δud_{it}	-0.006	0.051	0.006	0.117	0.083	0.040
	(0.228)	(0.233)	(0.226)	(0.255)	(0.268)	(0.247)
constant	0.009	0.162**	0.037	0.018	0.148**	0.040
	(0.109)	(0.080)	(0.102)	(0.112)	(0.071)	(0.105)
N	234	234	234	234	234	234
no. of instruments	37	37	40	49	49	52
AB AR1	-2.19**	-2.41**	-2.36**	-2.27**	-2.46**	-2.50**
AB AR2	0.02	0.04	0.18	-0.08	-0.43	-0.27
Hansen J	10.18	8.02	7.03	8.81	7.46	8.36

Notes: Heteroskedasticity-robust standard errors in the parenthesis. ***, ** and * denote statistical significance at the 1, 5 and 10 percent level, respectively. Instruments for first differences equation: first differences of exogenous variables and excluded instruments, and 2nd and 3rd lags of other variables. Instruments for level equation: exogenous variables and excluded instruments, and lagged first differences of other variables. Difference-in-Hansen tests of instrument subsets never reject the null hypothesis that GMM-type or IV-type instruments are valid.

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 5 summarizes the effects of such a fiscal devaluation, using the estimates of models M3 and M3TE from Tables 2 and 4, and differentiating across the three groups of wage bargaining systems. As noted above, estimated coefficients using DPD-GMM estimator are always larger in magnitude than those from GLS estimations. It should be reminded that estimates for single tax forms are mostly statistically significant

only for subsamples with an intermediate and low degrees of coordination in wage bargaining. The effects of a fiscal devaluation for countries with low degree of coordination (denoted with fd_l) are the largest in magnitude and imply a reduction in labor costs between 0.66 and 2.43%. The corresponding range for the subsample with a intermediate coordination degree in wage setting (fd_m) is between 0.57 and 2.04%, while the real labor costs reduction is the smallest (and never statistically significant) for the highly coordinated wage bargaining systems (fd_h) and lies between 0.03 and 0.96%.

Table 5: Effects of a fiscal devaluation equal to 1% of GDP in size

	GLS estimates (Table 2)		DPD-GMM estimates (Table 4)	
	Without time effects	With time effects	Without time effects	With time effects
fd_h	-0.03	-0.14	-0.80	-0.96
fd_m	-0.57**	-0.71***	-2.04*	-1.62
fd_l	-0.66	-1.03**	-2.43**	-1.84*

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

The above estimates compare to a simulated short-run decline in real producer wages one year following a fiscal devaluation equal to 1% of GDP, by around 0.7% in simulations for France; by 1% for Italy; and by 0.6% for Spain and Austria (EC, 2013, using National Institute Global Econometric Model). In the simulations, taxes affect real wages only indirectly through trend labor productivity and unemployment rate. It is worth noting that over the period of our study, France and Italy are classified as countries with an intermediate degree of coordination in wage bargaining, Spain has moved from the high to the intermediate group after 2008, while Austria has been considered a country with a high degree of coordination throughout the period considered. However, these simulation results stem from stronger effects of an SCR cut leading to 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. This partial effect is mostly stronger than that from an SCR cut. It is consistent with 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. (2018), 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, positive VAT effect on prices exceeds the positive effect on labor costs. If forward shifting to prices is taken into account in calculating the real labor costs, as with our labor costs deflator, the net effect on labor costs is negative. Finally, we note that we also re-estimated the regressions from tables 2 and 4 in which real labor costs variable was calculated using the (implicit) GDP deflator, instead of the implicit GVA deflator at basic prices. The results (available

at request) were quite similar, which is not surprising given the very high simple correlation coefficient between the two deflators in our sample.

5 Conclusions

Fiscal devaluation has been an important topic in policy circles over the last decade or so. It 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. 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 did not explore the functioning of the proposed mechanisms of fiscal devaluation except for its effects on real exchange rates. However, the latter impact depends on the effects of a fiscal devaluation on labor costs, which has not been explicitly studied empirically so far.

We fill this gap in the 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. 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 0.57 and 2.04% for countries with intermediate wage bargaining coordination. The corresponding range for the subsample with low coordination is between 0.66 and 2.43%, while the real labor costs reduction is the smallest for the highly coordinated bargaining systems and lies between 0.03 and 0.96%. While the intervals of the magnitude of fiscal devaluation effects are broadly consistent with results from model simulations, in our study we find that both VAT hikes and cuts in SCR contribute to real labor cost decline. This is different from simulation studies where VAT hikes increase consumption prices, causing pressures for nominal contractual wage increases, which, in turn, also increase real labor costs. The likely reason for different findings regarding the impact of VAT is that, in our study, forward shifting to prices directly impacts our real labor costs variable through deflator we use in calculating the real labor costs. 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 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 in the first place. If adjustments are still needed, because e.g. income 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.

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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 hours of work of employees. 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). In 2010 Euro; source: Eurostat.

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, Value Added type taxes (D.2111).

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, Compulsory employers' actual social contributions (D.611C).

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

Employers' social security rate (wedge) (SCR rate): tax wedge of SCR for a single person at average level of earnings, as proportion of total labor costs (range 0–1); sources: European Commission, Tax and benefits database and OECD.

Unemployment rate (UR): registered unemployment rate, in % divided by 100 (range 0–1); source: IMF International Financial Statistics.

Trend productivity (PROD): natural logarithm of Hodrick Prescott trend of real gross value added per hour worked, in 2010 Euro; source: Eurostat.

Unemployment benefits replacement ratio (UBRR): average of the net replacement rates for six family types: initial phase of unemployment, in % divided by 100 (range 0–1); source: OECD.

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): employment protection legislation strictness (individual and collective dismissals), 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: Visser, J. 2015. Data Base on Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pacts, 1960–2014 (ICTWSS) Version 5.0, University of Amsterdam, Amsterdam Institute for Advanced Labour Studies.

Acceleration in total factor productivity (Δ^2TFP): twice differenced natural logarithm of total factor productivity index, 2010=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: Visser, J. 2015. Data Base on Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pacts, 1960–2014 (ICTWSS) Version 5.0, University of Amsterdam, Amsterdam Institute for Advanced Labour Studies.

Strength of left parties (GLEFT): Government support: parliamentary seat share of social democratic and other left parties in government. Weighted by the number of days in office in a given year; in % divided by 100 (range 0–1); source: Armingeon, K., Isler, C., Knöpfel, L., Weisstanner, D. and Engler, S. 2016. Comparative Political Data Set, 1960-2014. Bern: Institute of Political Science, University of Berne.

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

Appendix B: Cyclical adjustment

Cyclically adjusted tax variables (VAT and SCR) have originally been calculated in Holzner et al. (2018), 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 the total wage bill for SCR.

2) In the second step the elasticity of the budgetary item with respect to the aggregate base is estimated. We use two specifications. If the budgetary item and aggregate base are not cointegrated, the following expression is estimated:

$$\Delta lnB_t^j = \alpha + \delta t + \beta_1 \Delta lnV_t^j + A + \vartheta, \quad \text{(B1)}$$

where B_t^j represents the budgetary item in current prices, V_t^j is the appropriate aggregate base in constant prices, while β_1 measures the elasticity of B_t^j with respect to V_t^j. If the budgetary item and the aggregate base are cointegrated, the following error-correction specification is used:

$$\Delta lnB_t^j = \alpha + \delta\left(lnB_{t-1}^j - \gamma lnV_{t-1}^j + \varphi + \cdots\right) + \beta_1 \Delta lnV_t^j + \beta_2 \Delta lnV_{t-1}^j + \delta t + \vartheta, \quad \text{(B2)}$$

where δ is the loading factor, and parameters β_1 and β_2 short-run elasticities of the budgetary item with respect to the aggregate base. In both specifications, α represents the trend change in fiscal ratios, while δt captures a change in this trend. Both δt and ΔlnV_{t-1}^j are kept in the specification only when they were statistically significant. Engle-Granger model is used in order to establish cointegration and specify the error-correction term, as estimates from the Johansen model proved to be too volatile.

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. In order to calculate the cyclical component of the analyzed budgetary item the following formula is applied:

$$B_{c,t}^j = B_t^j * \beta_1 * m_{c,t}^j, \quad \text{(B3)}$$

where $B_{c,t}^j$ is the cyclical component of the budgetary item, while $m_{c,t}^j$ stands for the aggregate base gap, i.e. the share of the cyclical component in the trend value of the aggregate base.