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Employment and productivity: The role of the tax wedge

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Abstract. After the economic crisis, many countries aim at reducing unemployment and foster productivity. To address these issues one of the most common policy indications recommends lowering the tax wedge on labour in order to increase employment and growth. As a consequence, a review of the empirical studies focused on the relation between tax wedge, employment and productivity is an useful and demanding exercise, especially in those European countries where the topic is on the front page of the domestic policy debate because the productivity growth is low and the tax wedge on labour is high.

Keywords: tax wedge, employment, productivity.

1 Introduction

The economic and sovereign debt crisis has caused unemployment and low productivity in many countries, and notably in Europe where there is the need to boost employment and restore macroeconomic performance. To this end, one of the most common policy indications recommends lowering the tax wedge on labour, especially in those countries in which is higher.

The relationship between tax wedge, employment and productivity can be described in the following way: the more elastic is the labour supply curve the more negative is the impact of the tax wedge on labour market and then on productivity growth. Vice versa, by assuming a vertical labour supply curve, an increase of the tax wedge would result in decreasing real wages without employment consequences. In other words, workers would accept real wages decrease entirely, given the real labour cost borne by firms. Instead, in case of a horizontal, perfectly elastic labour supply, they cannot accept any decrease in the real wage and thus an increase of the tax wedge would be fully paid by the firms, with reduction of labour demand and negative employment consequences.

The underlying mechanism is easily synthesized. Workers tend to protect their living standard and firms cannot shift onto net earnings the high labour taxation. Therefore, a high labour taxation measured by the tax wedge may result in reducing labour demand and increasing unemployment, with slow productivity growth also because workers are less motivated to increase their working effort. This might induce workers to reduce their level of education as well, with negative consequences in terms of human capital accumulation, despite it is difficult to disentangle the negative effect of labour taxes on productivity and employment from the positive effect on welfare expenditure derived from labour taxation. In fact, it is well-known that taxation has also positive effects. With the cash-flow generated from taxation, policymakers can direct (redistribute) some public expenditure to improve productivity, for example through public education, active policies in the labour market and so on, promoting employment and development.

The goal of this paper is to investigate the implications of the tax wedge on productivity as well as on

employment. To this end it is critically reviewed the debate across this topic – with a special regard to Europe – by analysing recent and selected literature. The structure of the paper is the following. Section 2 illustrates the theoretical framework related to the impact of the tax wedge on labour market. Section 3 analyses the impact of the tax wedge on productivity and employment through a selection of recent empirical contributions, highlighting main findings and debated issues. Section 4 concludes.

2 Theoretical framework

The tax wedge is the difference between gross labour income and net wage paid to workers. In particular, it is the difference between what is paid by the firms, i.e. the real labour cost (RLC) and the real consumption wage of the worker (RCW). The illustration presented by the European commission (2004) synthesizes the four determinants of the tax wedge. First of all, let us consider the real labour cost as the following equality:

$$RLC = W(1+\tau_f)/P \quad (1)$$

On the other hand, the real consumption wage (RCW) received by the worker has the following expression:

$$RCW = W(1-\tau_w)(1-t_i)/P(1+t_c) \quad (2)$$

where W stands for nominal gross wage, P is the GDP deflator, τ_f is the social security contribution rate (SSC) paid by the firm, τ_w is the SSC rate paid by the worker, t_i is the tax rate on labour income and t_c is the consumption rate on goods and services (for simplicity it is assumed to be the same across all types of goods). Simple algebra leads to a reformulation of equation (1) and (2) to extract the following measure of tax wedge:

$$Tax\ wedge = (1+\tau_f)(1+t_c)/(1-\tau_w)(1-t_i) \quad (3)$$

or, equivalently:

$$RLC = \lambda * RWC \quad (4)$$

where $\lambda = (1+\tau_f)(1+t_c)/(1-\tau_w)(1-t_i)$

Eq. (3) shows the determinants of the tax wedge. In fact, according to the above definition, an increase of personal income taxes, consumption taxes and social security contributions paid by the firm or by the worker leads to an increase in the tax wedge. It should be highlighted that some economists do *not* include in the determinants of the tax wedge the consumption tax rate (for instance: Alesina and Perotti , 1997; Anspal and Võrk, 2007; Bassanini and Duval, 2006; European Commission, 2005; Gora *et al.*, 2006; Vork *et al.*, 2008.

To sum up, an increase in labour taxation might be shifted onto labour cost, given the real consumption wage. By contrast, it could affect the real consumption wage, given the labour cost. Moreover, it could result in a mixed effect on labour cost as well as on real consumption wage. In general, it is important to disentangle the substitution and income effect of the tax wedge. The substitution effect is the reduction of employment and/or the number of working hours as the income effect leads the firms simply to shift the labour taxation on workers' net earnings without employment consequences. However, according to Gora *et al.* (2006), there is a way to summarize the link between tax wedge and employment when substitution effect prevails. Figure 1 illustrates how works the relationship in case of increasing labour taxation.

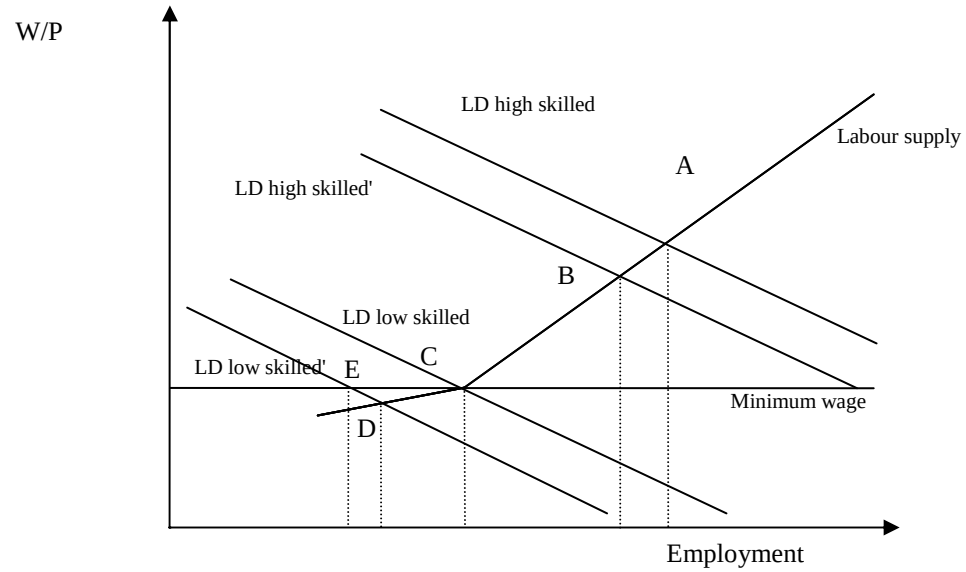

Figure 1. The effect of the tax wedge on labour market

Figure 1 represents a stylized effect of the tax wedge on labour market. It distinguishes the labour demand of high and low skilled workers, respectively. It shows that, after an increase in the labour taxation, the demand of high skilled workers shifts from point A to B, with a loss of employment for well-paid workers equal to the difference (A-B).

The situation in the labour market of low skilled workers is slightly different. In absence of a minimum wage legislation, an increase in the tax wedge leads the labour demand of the unskilled workers from point C to D. however, if it is present a minimum wage set by the law, the labour demand shifts until point E, with a loss of employment equal to the segment C-E, more pronounced to the previous one (C-D in Figure 1).

It should be noted that theoretically this reasoning is applicable to payroll taxes increase only, i.e. labour taxes paid by firms. On the other hand, any increase in labour taxation to be paid by workers would result in a shift onto labour supply. Nevertheless, in the above wage-employment framework the theoretical results remain unchanged.

To summarize, in point D there is less employment reduction than in point E, but a more pronounced cut in the net wage for the remaining workers. On the other hand, in point E there is more employment loss due to the existence of a minimum wage legislation that protects workers' net wage; *i.e.* they maintain their living standard with a more pronounced social cost in terms of unemployment.

Furthermore, an increase in the tax wedge is not only limited to a negative employment effect, but it is also linked to changes in productivity growth rates. The effect of an increase in the tax wedge on productivity, assuming a convex relationship between productivity and wages, lies on the assumption that the higher is the productivity of the worker, the higher is the wage earned and *viceversa*, but with a lower bottom in case of minimum wage legislation. The existence of wage rigidity for unskilled/low productive workers leads wages not to be affected by changes in the required productivity.

Loosely speaking, after an increase in the tax wedge a worker can increase the level of productivity to maintain the same net wage; *i.e.* the worker shifts its productivity effort without loss in the net wage. On the other hand, if he or she does not increase the working effort the consequence is a decrease in the net wage or, even worse, unemployment. This may happen for a number of reasons (low skilled

workers unable to increase their productivity level, high labour taxes that increase the value of time spent in leisure activities, etc.). In general, the effect of a change in the tax wedge is mixed and one should bring in mind that any change needs time, so the overall effect of a change in the tax wedge is long-lasting and other factors may play a role. Furthermore, a high labour taxation could affect productivity *via* a modification of relative input prices as well. A firm experimenting an increase in the tax wedge could react in a manner that differ from the most technological efficient. This may have, at least in the short-run, negative consequences on employment as well as on productivity.

3 Revisiting recent literature

Tax wedge and productivity.

The goal of this section is to provide for an overview of the empirical research on the link between tax wedge and productivity, with a special look to Europe. It should be noted that despite the amount of contributions on the impact of the tax wedge on employment or growth, there are few studies focused on this issue.

Ding's work is one of these. In his paper he studies the relation between tax wedge and productivity using macro panel data for 28 OECD countries from 1991 to 2004 (excluding 1992). He considers as measure of productivity the labour productivity. The way Ding H. (2008) measures the labour productivity is double. He first considers the growth rate of GDP per hour worked and then the log of value added per hour worked for total manufacturing industry in 1997. To this end, he uses two distinct data sources, OECD Fact Book 2006 – which covers 28 OECD countries – for the GDP growth rate per hour worked and O'Mahony and Van Ark (2003)'s Manufacturing Productivity and Unit Labor Cost Level Database – which covers 15 OECD countries from 1991 to 2001 – for the log of value added per hour worked for total manufacturing industry in 1997. The tax wedge is the ratio of labour taxes to gross wages and is computed as the sum of personal income taxes and social security contributions paid both from workers and firms. The data on the tax wedge come from OECD Fact Book 2006.

The methodology adopted by the author is a two-stage least square (TSLS) estimation strategy. He uses fixed effect model for panel data in order to eliminate fixed time and country effect. Moreover, the TSLS estimation method allows also to mitigate the omitted variable issue as well as simultaneous causality bias. The author controls for serial correlation by using heteroschedasticity and autocorrelation-consistent standard errors (clustered standard errors). The main regression uses as dependent variable the GDP growth rate per hour worked as a measure of productivity growth, as independent variable the tax wedge and, as a relevant and exogenous instrument, the hours worked due to the fact that they have negative correlation with the tax wedge and cannot have any effect on productivity other than via its impact on the tax wedge. Thus hours worked do not directly affect productivity measured by the growth rate of GDP per hour worked nor by value added per hour worked for total manufacturing in 1997 US dollar. The actual hours worked cannot be correlated with the GDP growth rate per hour worked and with the log of value added per hour worked because these variables have eliminated the time effect and, at the same time, hours worked are correlated to tax wedge. So the hours worked seem to be a good instrument in the analysis. The estimation results show that the tax wedge has a negative impact on productivity measured both using as dependent variable the GDP growth rate per hour worked or the log value added per hour worked for total manufacturing industry. More precisely, a tax wedge increase of 1% can lead to a reduction of productivity of about 0.09. Ding H. (2008) suggests that, although the tax wedge is a determinant of modern welfare state, especially in Europe, policy-makers should reconsider its social impact because in the long-run can

lead to productivity decrease. It should be noted that in the specification using the growth rate of GDP per hour worked as dependent variable there is no time fixed effect nor country fixed effect, and probably this is due to a problem of multicollinearity that weakens the results. Furthermore, the coefficient of the tax wedge takes both positive and negative values depending on the econometric specification. Therefore the empirical results should be taken with caution.

Aspal and Vork (2007) analyze a panel of new EU member states to check whether labour taxation affects productivity. The authors use a panel data set and a sample of European countries, plus US, Japan, New Zealand, Canada and Australia. The data are five-years averaged because the authors are interested in longer-run relationship between institutional variables and productivity growth. The data cover the period 1970-1999. Data from labour market institutions come from Belot and Van Ours (2004). Data on GDP and TFP come from AMECO database. Data on tax wedge come from European Commission (2005), OECD Employment Outlook. The European Commission (2005) uses annual data for the period 1980-2000 taken from OECD *Taxing Wages* publication to construct the tax wedge (overall and its components: income tax, SSC born both by employees and employers). The tax wedge is calculated through a micro-simulation of national tax legislation. The main advantage of using micro-data to construct a measure of tax wedge on labour is that it is possible to disentangle the behavior of different kind of taxpayers to a given tax distortion represented by the tax wedge. A proxy of the tax burden on labour for a representative agent is adopted. The representative agent is a single worker in the manufacturing sector at the average wage level (that is, 100% of the Average Production Worker wage level). The drawback of this method is that the average income of the stylized worker does not represent the average income of all workers. The tax wedge is the difference between the after-tax and the before-tax labour costs as a percentage of total before-tax labour costs. The dependent variable is the differenced real GDP per worker (in logs). However, GDP per hour worked is used as a robustness check. The RHS variables contain the (t-1) lagged dependent variable and a set of exogenous variables as investment share in GDP, implicit tax rates, tax wedge, an index of employment protection, unemployment benefits replacement rates, union density, the degree of centralization of collective bargaining, passive and active labour market policy expenditures. The empirical specification controls for country-specific fixed effect. The specification which includes eight new member states show a coefficient of the tax wedge equal to zero. In other specifications, the coefficient of the tax rate variable is sometimes positives and sometimes negative, often insignificant, especially as regard to the model with the log differenced of real GDP per worker as dependent variable. Thus the results should be taken with caution.

As regards to productivity, it is possible to measure it as Total Factor Productivity (TFP) even if there are a number of limitations and criticism in its use first showed by Abramovitz (1956). The limitations consist in the fact that TFP is a residual of a fundamental equation of growth potentially incorporating not only technological changes and improvements in productivity, but also a number of possible errors arising from aggregation, incorrect specification of the model, omitted variables. This is why TFP is also considered a "measure of ignorance" (Solow, 1957). Other criticisms arise by denying the possibility of using aggregate measures of capital and the tendency to equality between the rate of return on capital and marginal productivity. However, TFP is econometrically dependent not only from the variable included in the production function (and their possible measurement errors) but also from what variables are used as output and their grossness. In particular, TFP calculated on value added is less precise then TFP calculated on industry-based output, and industry-based output is a measure of TFP less precise then those obtained as gross production. Hence the latter would be better than the others. However, detailed measures of gross production of firms are rarely available and one has to consider more imprecise measures of TFP. Despite these well-known limitations, TFP is widely used in empirical analysis (Hulten, 2001) and appears most important than labour or investment as a

driver of growth.

Vartia (2008) analyses at industry level the impact of taxation on investment and productivity growth using, as dependent variable, the TFP growth and a dataset of 13 countries – 11 EU states plus Japan and US – covering the period 1981-2001 as well as 21 two-digit industries restricted to manufacturing and business services. The data on hours worked and labour compensation come from the EUKLEMS database (March 2007 release) while the data on tax wedge are drawn from OECD Tax Database. The tax wedge is proxied by the social security contributions paid by employer or by total security contributions (SSCs). For each industry and year, the estimation method allows for the possibility of technology transfer from a country at the frontier (that is, with the highest productivity) to countries behind it using an error correction mechanism (ECM) derived from an autoregressive Distributed Lag ADL (1.1) of the following form:

$$\Delta lnTFP_{cit} = \beta_1 \Delta\, lnTFP_{Fit} - \beta_2 ln(TFP_c/TFP_F)_{it-1} + \phi HK_{cit-1} + \tau(TaxRate_{ct-1} * INDfactor_i) + \lambda_x W_{cit-1} + \gamma_{ct} + \gamma_i + \varepsilon_{cit} \quad (5)$$

The dependent variable is the TFP growth in country c, industry i and year t. The RHS variables include TFP growth at the frontier, TFP relative to the frontier, human capital, the interaction between labour intensity (the labour-capital ratio) and tax wedge. *W* includes policy variables as anti-competitive regulation impact, job turnover and employment protection legislation, γ_{ct} is the industry-specific fixed effect, γ_i is the country-year fixed effect, ε_{cit} is the residual. TFP is measured using a superlative index number in the following way:

$$TFP_{cit} = A_{cit}/\underline{A}_{cit}\, x(\underline{L}_{it}/L_{cit})^{\alpha}\, x\, (\underline{K}_{it}/K_{cit})^{1-\alpha} \quad (6)$$

Where A is the value added, L is total employment adjusted by adopting data on hours worked at industry level, K is the capital stock computed using the perpetual inventory method, α is the average of the labour share and the *bar* is a geometric average over all the countries *c*, for each industry i and year *t*. The measure obtained is corrected for the purchasing power parity condition to establish a comparison of productivity levels across countries.

The author finds that the social security contributions (SSCs) – a proxy for the tax wedge – have a negative impact on productivity. The benefit of using SSCs as proxy for the tax wedge is the availability. The drawback is that SSCs do not consider the whole tax wedge since personal income taxes are not taken into account. As regards to the results, the negative effect is more relevant when the analysis is restricted to high labour intensity sectors. Vartia (2008) suggests that this may happen because of two factors; first, the tax wedge might distort factor prices (labour and capital) leading to slow productivity growth. On the other hand, the tax wedge could modify the accumulation of factors *via* a modification of the capital-labour ratio induced by the tax wedge itself. However, the main findings show that the impact is small. Moreover, she failed to find evidence that the impact is partly due to distortions in factor prices.

To sum up, despite the amount of research on labour taxation, there is little empirical research on the link between tax wedge and productivity. In general, as a proxy for productivity growth, measures of labour productivity as well as TFP are adopted in many empirical studies because of their availability. However, it does not exist a standard measure of productivity to be preferred. By contrast, the tax wedge as computed by OECD is widely accepted even if it does not consider the whole tax wedge since consumption taxes are not taken into account. However, some authors (for example, Vartia, 2008), use the SSCs as a proxy for the tax wedge on labour. As regards to the empirical results, it should be highlighted that the recent literature did not find yet robust evidence on the link between tax wedge and productivity, no matter the econometric methodologies as well as the data and control

variables used. At present, there are no widely accepted results and thus there is room for further research in order to obtain agreed answers on these issues.

Tax wedge and employment.

Unlike the previous section, there is plenty of research referred to the link between tax wedge and employment/unemployment. Because the amount of these studies, the aim of this section is to provide a critical and detailed overview, with a special look for Europe, through a *selection* of recent contributions in order to illustrate main findings as well as still unanswered questions or disputed issues.

The analysis starts with an influential work that investigates at aggregated level the impact of the tax wedge on unemployment, presented by Daveri and Tabellini (2000). The authors find a link between these two variables and suggest that if labour cost is high firms will tend to decrease their labour demand (which eventually means increasing unemployment) and replace labour with capital. In the long run this could lead to a reduction in the marginal product of capital. This reduction could induce firms to invest less and, amongst other, could affect productivity growth leading the system to a new steady-state with the same capital-labour ratio, but with permanent less output per capita, employment and growth. Daveri and Tabellini (2000) distinguish between different labour market institutions to understand whether the negative effect of the tax wedge is more significant depending on exogenous considerations. In particular, the authors distinguish three subgroups of European countries depending to the level of collective bargaining; the first group includes the continental European countries that are more influenced by *decentralized* trade unions, the second group includes the Scandinavian countries that are characterized by powerful *centralized* trade unions, the third group includes the Anglo-Saxon countries that have more flexible labour markets. These distinctions are relevant if one wishes to measure the potential different impact of labour taxes on unemployment rates. To test this hypothesis the authors use five-year averaged data on 14 countries between 1965 and 1995 to remove any cyclical fluctuations, then they divide the countries into the above mentioned three subgroups according to the level of collective bargaining and the result is a three-block, one containing the Anglo-Saxons countries, one the European countries excluding transition and post-socialist economies, and the last group collecting the Nordic countries. The dependent variable is the standardized unemployment rate proposed by OECD National Accounts or the change in unemployment rates. In some regressions the dependent variable is substituted by the complement to one of the employment rates. In the empirical specifications the control variables include the level of initial per capita GDP, the PPP-adjusted growth rate per capita GDP and the tax wedge computed as the effective tax rate on labour income. In particular, the tax wedge is the ratio between total taxes on labour income – that is, SSCs plus payroll taxes plus taxes on wages from personal income tax – and the labour tax base – that is, wages plus employers' SSCs (main dataset: OECD National Accounts). These so-called *tax ratios* have the benefit of a larger database and are easy to compute but are limited because do not measure marginal tax rates. In fact, they are *average* tax rates which might seem less relevant in investigating the impact of labour taxation. On the other hand, marginal and average tax rates are correlated and this should allow using the latter even if they convey limited information. It should also be underlined that in the empirical specifications the tax wedge includes consumption taxes. Other independent variables are the effective tax rate on capital income computed as the ratio between total taxes on capital income and its tax base, the effective tax rate on total spending on consumption, measured as the ratio between total taxes on consumer spending and its tax base (OECD National Accounts, OECD Revenue Statistics), the time-varying employment protection, the duration of the unemployment benefits in years, the domestic investment as a share of GDP at constant prices. In the basic model the authors estimate the unemployment in level by OLS with fixed effects, then they re-estimate the equation with first differences. In particular, they first compute the five year

average for each variable, then they take the first difference of this average. To correct for possible endogeneity of the RHS variables, they estimate the differenced dependent variable by replacing the current levels of tax wedge and unemployment benefits with their lagged values, with results unchanged. Moreover, to control for possible omitted variables the authors put – one at a time – in the main specification time-invariant institutional variables (i.e. union coverage, indicator of active labour policies, etc.), with results unaltered. In particular, Daveri and Tabellini (2000) find that a 10% increase of the tax wedge can boost the unemployment rate up to 4%. They find that the characteristics of the labour market play also a crucial role in this respect. However, these findings suffer from the fact that there are few controls for other labour market institutions and do not explain whether the effect is temporary or permanent. In fact, at least in the long-run, the tax wedge should pass onto labour itself and high labour taxation should be compensated by low real wages without effect on employment.

Differently from Daveri and Tabellini (2000), Nickell and Nunziata (2000) support the view of a limited effect of the tax wedge on labour market performance. In their paper they use aggregate data from twenty OECD countries dividing the period of observation between 1983-1988 and 1989-1994. The reason for these two subgroups is to control for cyclical fluctuations in the data by taking the averages of the employment-population ratios to be used as dependent variable. The independent variables include features of the labour market as union density, union coverage, union coordination, employment protection indexes mainly drawn from OECD Employment Outlook (1994), a proxy for mobility barriers (the percentage of households who are owner-occupiers) and the tax wedge computed as the sum of payroll tax rate, personal income tax rate and consumption tax rate. Hence, accordingly with Daveri and Tabellini (2000), in their study the consumption tax rate is included in the calculation of the tax wedge. The authors use cross-country regressions and the results show a limited effect of the tax wedge on employment. In particular, a 10% increase in the tax wedge reduces the employment rates by less than 2%.

A study of the European commission (2004) tries to distinguish between short and long-run effect. The tax wedge is computed through the mechanism developed by OECD *Taxing Wages* based on micro simulations of some stylized individual or families subject to labour taxes, whose income lies between a range centred on the average production worker. This measure is available for six family types of workers and due to the strong correlation across countries between the 6 stylized families, the tax wedge for a single worker without children working in the manufacturing sector earning an average wage was the preferred approximation of the population overall tax wedge. The tax wedge is the sum of personal income tax and all SSCs as a percentage of total labour cost. This measure of tax wedge does not combine labour and consumption tax rate; that is, it does *not* incorporate consumption taxes. This is the same measure adopted by, among others, Anspel and Vork (2007) with the limitations already illustrated. Obviously, the higher is the tax wedge, the larger is the difference between total real labour cost (RLC) and real wage consumption (RWC). Because the tax wedge could affect the real labour cost in both short and long-run, static models are not appropriate. Therefore the adopted methodology is a dynamic model using a GMM estimator and a balanced panel of 15 EU Member States over the period 1979-2000. In the robustness check, they use OLS fixed effect (within group), with results unaltered. To control for possible endogeneity they use the first-difference GMM estimator. in particular, the authors use the one-step estimator with standard errors corrected for the heteroschedasticity because the two step estimator gives standard errors biased downwards in samples with small T. The dependent variable is the real labour cost (in logs) and the independent variables are the lagged dependent variable, the labour productivity, the average income tax and the consumption income tax, the SSCs paid by firms and workers, the unemployment rate, the gross replacement rate. The authors investigate the effect of different components of the tax wedge (in the analysis restricted

to the short-run), and the effect of the overall tax wedge in the analysis focused on the long-run by assuming that its composition matters only in the short-run. The results show that the unemployment rates are affected only in the short-run. In fact, a 1% increase in the tax wedge leads to an increase in the real labour costs by 0.1%. On the contrary, in the long-run the tax wedge is fully shifted onto net wages leaving unemployment unchanged. As previous research, the analysis fail to quantify *how long* is the short-run in which the tax wedge has a negative effect on employment.

Following this line of research, Bassanini and Duval (2006) investigate the effect of the tax wedge, as well as other policies, on employment and unemployment using a sample of 21 OECD countries and a macro panel data covering the period 1983-2003. As a robustness check, the authors re-estimate the coefficients using 5-year averages with main findings unaltered. The authors estimate a static log-linear model with country and time fixed effect in which the dependent variable is the unemployment (employment) rate as share of the working-age population in percentage. The set of explanatory variables include the tax wedge as derived from OECD *Taxing Wages*, an OECD measure of the output gap between actual and potential output as a percentage of potential output (OECD, Employment Outlook 2004); the unemployment benefit duration as a ratio of average to initial unemployment benefit replacement rate; a measure of employment protection legislation (an indicator of stringency of EPL calculated by OECD); the degree of corporatism, that is an indicator which takes the value of 1 for decentralized bargaining processes and 2 or 3 for intermediate and centralized ones; the union density rate, *i.e.* the share of workers affiliated to a trade union in percentage; a product market regulation indicator covering seven non-manufacturing industries computed by OECD. The authors, as well as Anspal and Võrk (2007) and European Commission (2005), use the tax wedge as computed by OECD *Taxing Wages*; that is, a measure of tax wedge which does not include consumption tax rates differently from the measure of tax wedge used by Daveri and Tabellini (2000) or Nickell and Nunziata (2000). Because the latter could suffer from endogeneity problems, does not include family benefits and is less comparable due to differences in population structure (for instance: income distribution or demographics), the authors adopt it as a robustness check, with results unchanged.

To address the risk of endogeneity of policies and institutions used as independent variables, the authors estimate the baseline equation also with two-stage least squares (IV) or GMM in which the lagged levels of the explanatory variables are used as instruments, with main results unaltered. Moreover, the authors include fixed effects in the baseline equation because they assume that institutions are correlated with country effects and the Hausman test confirms this assumption. On the other hand, to allow for systemic interactions the authors estimate a compact specification of the baseline model *via* Non-linear Least Squares where the institutional variables are interacted, one at a time, with the institutional framework, that is, the sum of the direct unemployment effects of the institutions at the sample average for a country with an average mix of policies and institutions (the "average" OECD country).

The results show that the tax wedge, as well as unemployment benefits and stringent anti-competitive product market regulation (PMR), increases unemployment and lowers employment rates. In particular, a 10 percentage points reduction of the tax wedge in the average OECD country would reduce unemployment by almost 2.8% and boost the employment rate by more than 3%. Moreover, highly centralized wage bargaining systems reduce unemployment rates. On the contrary, EPL and union density do not have a significant impact on unemployment.

Gora *et al.* (2006) use a macro panel data of 27 OECD countries to estimate a simple linear regression model in which the dependent variable is the male employment rate. In the study the authors distinguish between low and high-skilled workers. To do so they consider as a low-skilled worker a

person with at most a lower-secondary education and as a high-skilled worker a person with at least a tertiary education. The model uses few explanatory variables and only two years (1997 and 2003). Obviously, this limits the reliability of the results. The explanatory variables are the relative supply of high and low-skilled workers, the aggregate employment rate as a proxy for overall labour market characteristics and the tax wedge as calculated by OECD *Taxing Wages*. As regards to low-skilled workers, the results show a negative impact of the tax wedge on employment. On the contrary, the authors do not find a significant effect of the tax wedge for the high-skilled employment rates. Moreover, Gora *et al.* (2006) investigate the impact of the tax wedge on employment restricting the analysis to eight EU new member states by using aggregate data for the period 1996-2003 (Eurostat database). The authors estimate a linear model with fixed effect in which the dependent variable is the employment growth rate and the explanatory variables are the GDP growth rate and the tax wedge. The results suggest that a 1% increase in the tax wedge could decrease the employment rate by about 0.5%. By contrast, the analysis focused to 14 OECD countries for the same period does not find any significant impact of the tax wedge on employment. However, all these findings should be taken with caution because the time period available is limited and there are few explanatory variables. Thus, the empirical specification does not address the omitted variables problem in the right manner.

Vork *et al.* (2008) use a macro panel data of eight post socialist European economies observed for the period 1996-2004. The main specification is a simple OLS model with fixed effect and includes, one at a time, different measures of labour market outcome as dependent variable (employment/unemployment as well as labour supply rates for different categories of workers). The explanatory variables are: GDP growth rates, openness computed as the sum of import and export over GDP, inflation, tax wedge and marginal effective tax rates (METRs) as computed by OECD series *Benefits and Wages*, 2004. The METRs do not consider indirect taxes and compare the state of working and receiving a wage with the state of not working and receiving unemployment benefits, thus the more is the marginal effective tax indicator the more is the incentive to not move from unemployment to employment state or to move from temporary work to full work. There are two measures of METRs adopted in the study: the unemployment trap and low-wage trap. The first one considers the move from short-term unemployment to employment with a wage equal to 67% of the wage of APW for a single person. The second one considers the move from 33% of APW wage to 67% APW wage for a single person, and a one-earner couple with two children. Because of their correlation, these variables are used one at a time. The tax wedge is calculated as the share of taxes for a single person receiving 67 per cent of APW wage. All countries are considered small transition economies and are thought as sharing a similar political and social history. The authors find that the tax wedge has a negative effect on employment especially for low-skilled and elderly workers. It should be clear that the study is based on short time period (from 4 to maximum 9 years) and limited cross sectional dimension. Hence, it is not possible to control for other possible omitted variables nor using dynamic specifications with lagged endogenous variables. The model does not include variables on labour market characteristics as union coverage, unemployment benefits or EPL even if previous studies (for instance, Daveri and Tabellini, 2000) show that they play a significant role. The results should be interpreted with caution even because the presence of coefficients with unexpected sing that arises concerns about the reliability of the estimates.

The overall framework arising from these studies suggests that the tax wedge does have an impact on labour market performance even if its magnitude depends on dataset and methodology used. It should be underlined that some authors (for instance, Nickell and Nunziata, 2000), show a limited effect on employment. To control for possible omitted variables, some control variables have become standard in the literature, namely institutional variables as union density, EPL, indicators of active labour policies, etc. As regards to the tax wedge, the majority of these selected studies adopt the tax wedge

computed as the sum of personal income tax and all SSCs as a percentage of total labour cost. Furthermore, most of these studies do *not* include consumption tax rates in the computation of the tax wedge (for instance: Anspal and Võrk, 2007; Bassanini and Duval, 2006; European Commission, 2005; Gora *et al.*, 2006; Vork *et al.*, 2008), even if other influential papers do include it (Daveri and Tabellini, 2000; Nickell and Nunziata, 2000). In general, these studies find that the tax wedge affects the unemployment/employment rates even if with different magnitude. The big question that still remains unanswered, despite the amount of recent contributions, is to clarify *how long* the tax wedge should affect the labour market performance, given the fact that in the long run the tax wedge on labour is fully shifted onto net wages leaving unemployment/employment unaltered. Hence future contributions could expand the existing research by investigating this issue.

4 Conclusion

The aim of this overview is to underscore the role of the tax wedge on employment and productivity. A cut in the tax wedge on labour is a policy tool at the front page of the economic debate in Europe, especially in those countries where the labour taxation is high and productivity growth is inadequate. As regards to the link between tax wedge and productivity, the existing research generally fails to find robust evidence even because there are few studies that investigate this potential link. Therefore, there are no widely accepted results and further research is needed. One way to extent the existing literature might be through empirical works which use firm-level (micro) data to obtain new findings in understanding the channels through which this link may happen.

With regard to productivity, there are different methods to measure it. Some authors use the labour productivity, other economists the TFP growth or measures of GDP growth rate per hour worked. Because all these measures have benefits and drawbacks, the final choice often is affected by data availability and methodology. By contrast, in most of these papers the tax wedge is calculated as the sum of personal income tax and all SSCs as a percentage of total labour cost and does not include consumption tax rates. This variable is to be considered standard in the literature for both the contributions looking at the analysis of the impact of the tax wedge on productivity as well as on employment/unemployment. Other control variables which are standard in the literature are those related to the labour market institutional characteristics.

In contrast to the analysis on the link between tax wedge and productivity, there is abundant macroeconomic research focused on the effect of the tax wedge on employment (unemployment). Although these works do find robust evidence on this link it is possible to further extend the existing research in order to obtain agreed answers on how long the tax wedge on labour affects the employment (unemployment) rates before being fully absorbed by net wages with no longer effects on employment, provided that in the long run the tax wedge should not have real effect on labour market performance.

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