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*Progressive Taxation and Unemployment:
Evidence from OECD countries³*

1. *Introduction*

For most OECD countries, the legacy of the Great Crisis is given by a higher public debt and a slower rate of growth compared to the pre-crisis period. Countries are confronted with limited action for fiscal policy and the need to combine fiscal consolidation measures with policies to curb unemployment. While there is a vast literature showing the negative effect of the tax wedge on labour income and unemployment, less is known about the role of tax progressivity. In this chapter, we argue that, for a given level of average labour income taxation, a more progressive tax schedule has beneficial effects on both aggregate employment and unemployment, whilst it reduces average labour productivity.

We first review the mechanisms that operate under unemployment-reducing effect of tax progressivity. One channel by which tax progressivity may affect unemployment is through a ‘wage moderation effect’, since any increase in pre-tax earnings leads to a reduced gain in after-tax earnings, which triggers a reduction in labour cost and a rise in labour demand. A further channel works through a ‘composition effect’, as a more progressive

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tax schedule – by reducing the tax burden on low-skilled relative to high-skilled workers – has positive effect on the employment of low-skilled workers relative to high-skilled workers. In other words, even if tax progressivity may reduce the incentive to work and lower labour productivity, the overall cumulative effect on employment may still be positive. We test the above proposition using data for 21 OECD countries over 1998-2008 period. We measure the overall level of labour income taxation using both the average tax-wedge for a single worker and a tax progressivity indicator comparing the coefficients of residual income progression (CRIP) at 67% and 167% of the average wage.

We find that higher average labour taxation has a detrimental effect on unemployment, while tax progressivity reduces the unemployment rate and increases the employment rate. We also show that the effect on the employment rate holds even in the presence of labour supply responses.

The rest of the chapter is organized as follows. In section 2, we review the literature on taxation and unemployment. Stylized facts and the data used in the empirical analysis are presented in section 3. In section 4 we outline the empirical strategy, and in section 5 we describe the main set of results. Finally, section 6 concludes and discusses the policy implications.

2. Literature Review

The extensive literature on the relationship between labour taxation and employment performance starts with Bean *et al.* (1986), who do not find any significant correlation – in the mid-1980s – between European unemployment and labour taxes. A number of subsequent studies – towards the end of the 1990s – argued that the lack of correlation reported in Bean *et al.* (1986) was driven by the use of cross-sectional data. Evidence from studies using panel data, however, remains mixed. Nickell and Layard (1999), using data for 20 OECD countries over the five-years periods 1983-1988 and 1989-1994, find a short-run tax elasticity of 0.2, which disappears in the long run. The authors interpret the long-run results as evidence of a shift of the tax burden on workers in the long-run. Blanchard and Wolfers (2000), using data for the EU15 for the period 1960-1995, do not find any statistically significant impact of labour taxation on unemployment. Daveri and Tabellini (2000), using data for 14 OECD countries over the period 1965-1995, shows that the tax elasticity is likely to differ according to the prevailing type of welfare model. In particular, the tax elasticity to unemployment

is close to 0.5 in Continental European countries, while little evidence of positive statistically significant tax elasticity is found in Anglo-Saxon and Nordic countries. Some more recent papers try to address a number of methodological problems (such as panel unit roots, heterogeneous-cross sectional correlation, etc.) to improve the precision and consistency of the estimates, still the evidence remains mostly inconclusive (see e.g. Planas *et al.*, 2007; Berger and Everaert, 2010; Berger and Heylen, 2009).

Related strands of the literature suggest that the ambiguity of the estimated impact of labour taxation on labour costs and unemployment in unionized markets may be explained by the underlying heterogeneity in the labour tax wedge measure used in empirical studies. One dimension of heterogeneity in the effects of the tax wedge on employment and unemployment outcomes concerns its composition and, in particular, the relative weight of personal income taxes, employers' and employees' social security contributions. An alternative dimension concerns its measured impact on pre-tax wages along the earnings distribution which is related to the degree of progressivity of the system of labour income taxation in each country. Most empirical studies reviewed above assume the 'invariance of incidence proposition' (IIP), suggesting that any change in the composition of the tax wedge should not affect labour costs since the switch is supposed to leave the wedge between the producer costs and the net take-home wage unchanged. A remarkable exception in this literature is the paper by Arpaia and Carone (2004), who investigate the impact of both level and composition of labour taxes on labour costs using a balanced panel of 15 EU countries for the period 1979-2000. In line with results of Nickell and Layard (1999), they find a positive tax elasticity (in the short run) and show that the elasticity is driven by employers' social security contributions and personal income taxes and not by employees' social security contributions which is in contrast with the IIP hypothesis. However, Arpaia and Carone (2004) find that in the long-run the 'IIP' is re-established.

The literature on the impact of tax progressivity on pre-tax wages generally distinguishes a 'wage moderation' effect and a 'labor supply' effect. The wage moderation effect occurs because, at a given level of the average tax rate, when the marginal tax rate increases, the price in terms of foregone employment of a higher take-home pay goes up. This allows the union to buy more employment through wage moderation, since any given reduction in the pre-tax wage leads to a smaller change in the after-tax wage. Conversely, tax progressivity may reinforce the income effect over the substitution effect via a labour supply effect, and thus increase

leisure lowering labour supply. Increased progressivity translates into lower unemployment if, and only if, the wage moderation effect prevails over the labour supply effect. Malcomson and Sartor (1987), Holmlund and Kolm (1995) and Lockwood and Manning (1993) provide empirical evidence consistent with such hypothesis showing the prevalence of the wage moderation effect for Italy, Sweden and the UK. Newell and Symons (1993), conversely report that the change in unemployment – occurred between the 1970s and the 1980s in OECD countries – is an increasing function of the change in marginal tax rates over the same period. Other papers in the literature find that wage moderation and labour supply effect balance differently depending on workers' characteristics. Hansen, Pedersen, and Sløk (2000) present empirical evidence, for Danish blue-collar and white-collar workers, which is consistent with a reduction of tax progressivity that raises blue-collar pre-tax wages, while it is statistically insignificant for white-collar wages. Lockwood, Sløk, and Tranaes (2000) obtain somewhat different results as they find that unskilled workers' pre-tax wages are more sensitive to an increase in tax progressivity, as long as there are strong unions and labour supply is sufficiently inelastic. The opposite holds true for skilled workers since they show a more elastic labor supply and are less likely to be unionized. Sørensen (1999) uses a simulation model of the effects of a tax cut on low income earners and shows that tax cuts for low-paid workers are more likely to raise employment and welfare if they are financed through a higher marginal income tax rate. Finally, Sonedda (2009), using Italian data for the period 1974-1995 shows that not only do changes in an individual's supply of working hours matter, but also that changes in the aggregate labor-force participation decisions play a significant role in explaining the relationship between the dynamics of unemployment and labor tax progressivity. The unemployment rate could then be reduced, at least in the short run, by either increasing the marginal payroll tax rate or lowering the marginal personal income tax rate faced by the representative agent.

Other contributions, both theoretical and empirical, investigate the effects of tax progressivity in the presence of different types of labour market imperfections. Brunello and Sonedda (2007) assess the interdependence of union wage claims and argue that a unions' strategic interaction effect reinforces the labour supply effect (against the wage moderation effect) when the degree of centralization of the wage bargain is intermediate – as in the case of industry-level bargaining – while it is irrelevant under decentralized

and fully centralized bargaining. Under the hypothesis of collective wage bargaining, Koskela and Schöb (2007) also show that while a higher tax progression leads to wage moderation, a revenue-neutral increase in tax progressivity has a negative effect on employment when the individual effort is imperfectly observable. Within an efficiency-wage framework, Koskela and Schöb (2009) show instead that an increase in tax progressivity generated by a revenue-neutral tax reform moderates the wages and workers' efforts but has an ambiguous effect on employment that depends on the magnitude of the pre-reform total tax wedge.

3. *Data and stylized facts*

In this study, we rely on country level panel data to test the existence of an employment-enhancing effect of tax progressivity. In practice, we use information drawn from different data sources, for the period 1997-2008 covering 21 OECD countries⁴. The data set combines information on taxation, labour market institutions, indicators of labour market performance and other socio-economic characteristics. Our indicator of labor market performance is the harmonized unemployment rate (UNR) drawn from the OECD economic outlook⁵. The first measure of labour taxation we use is the 'average tax rate' (ATR) for a single individual measured at different points of the earnings distribution, namely: 67% of the average wage, the average wage (i.e. 100%) and 167% of the average wage, provided by the OECD tax database⁶. These encompass income taxation by central and local governments and employers and employees social security contributions. From the above information, we compute tax retention rates (in percentage points) as follows,

$$\text{ret}_{j,i,t} = 1 - \frac{T(j \times AW_{i,t})}{j \times AW_{i,t}} = 1 - \text{ATR}_{j,i,t} \quad \text{for } j \in \{67\%, 100\%, 167\%\} \quad (1)$$

where $AW_{i,t}$ is the average wage in country i and year t . The first measure of taxation we consider is the natural logarithm of the retention rate at the

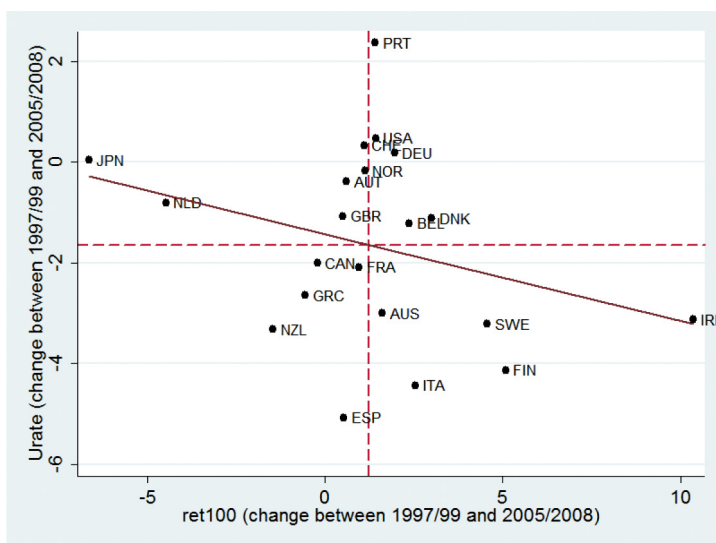
⁴The countries we consider are: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Netherlands, Norway, New Zealand, Portugal, Spain, Sweden, Switzerland, United Kingdom and the United States.

⁵The OECD harmonized unemployment rate is defined as the number of unemployed persons divided by the labour force.

⁶Notice that these indicators are harmonised over time and across OECD countries.

average wage, $\ln(\text{ret}100)$, which we use as proxy of the average tax burden on labour. To get an idea of the relationship between the average burden of taxation on labour and the unemployment, in Figure 1 we plot the change in the retention rate ($\text{ret}100$) against the change in the unemployment rate ($Urate$) between the 1997-1999 and the 2005-2008 sub-periods. The figure shows a negative correlation between tax retention rates and unemployment rates, which is consistent with the positive relationship found in empirical studies between labour taxation and unemployment (see e.g. Layard and Nickell, 1999). In other words, countries that reduced their labour taxation (i.e. increasing the average retention rate) – such as Sweden, Finland, or Ireland in the sample period considered – experienced a significant reduction in unemployment. Conversely, unemployment is found to be persistent in countries that did not reduce, or even increased, their labor taxes (e.g. Japan, Netherlands, or some Mediterranean countries).

Fig. 1 – Average taxation and unemployment



Note: tax retention rate at the average wage ($\text{ret}100$) and unemployment rate ($Urate$) by country. Changes over the 1997-2008 periods.

(Sources: OECD Tax Database, OECD Taxing wages and authors' calculation)

The second measure we use is the tax progressivity indicator, based on the global ‘coefficient of residual income progression’ (CRIP) as defined by Lehmann *et al.* (2015). In practice we measure tax progressivity, as follows:

$$\Psi_{w_0}^{w_1} \equiv \ln \left(\frac{1 - \frac{T(w_1)}{w_1}}{1 - \frac{T(w_0)}{w_0}} \right) \quad (2)$$

Where $T(w_1)$ and $T(w_0)$ are the average tax rates at wage levels w_1 and w_0 , respectively. Accordingly, this global CRIP is equal to the (log of) the ratio of the retention rates at wages levels w_1 and w_0 with $w_1 > w_0$. As discussed in Lehmann *et al.* (2015), the choice of the global CRIP is robust to a number of measurement issues (e.g. wage measurement error that may cause shifts between tax brackets), which may arise using a local CRIP definition, as the latter mainly captures progressivity in the neighbourhood of a given wage level.

In our case w_0 and w_1 are measured at 67% and 167% of the average wage, respectively, and we define the tax progressivity indicator as the logarithm of the ratio of retention rates at 67% and 167% of the average wage, $\ln(\text{ret}67i,t/\text{ret}167i,t)$. This tax progressivity indicator is the inverse of the global CRIP, as in (2)⁷.

Table 1 reports country means and standard deviations of the average retention rate, $\text{ret}100$, in column [1], and the tax progressivity indicator, $\text{ret}67/\text{ret}167$ in column [2]⁸. In column [3], we use the tax progressivity indicator to rank countries in our sample according to the intensity of redistributive labor taxation in column. Generally speaking, Continental and Nordic European countries stand out for the high intensity of redistributive labor taxation, with low average retention rates (below the OECD average of 62%), and high propensity to redistribute (above the OECD average). Conversely, Anglo-Saxon, Mediterranean European, and non EU countries display relatively low intensity of redistributive taxation, with large retention rates (well above 60%) and low levels of progressivity.

⁷ Notice that, as discussed in Lehmann *et al.* (2015), there are no theoretical reasons for choosing an inverse, instead of a direct CRIP measure for the tax progressivity indicator. However, since a rise in the global CRIP is associated with a less progressive tax schedule, the interpretation of empirical results is more straightforward when the inverse CRIP measure is used.

⁸ We computed an aggregate index, which is increasing in the average level of taxation (thus decreasing with $\text{ret}100$) and increasing in the tax progressivity index.

Table 1 – *Intensity of redistributive taxation in OECD countries*

Country	average retention rate [1]	progressivity index [2]	country ranking [3]
Australia	71.3 (0.97)	1.175 (0.029)	13
Austria	54.8 (0.47)	1.214 (0.025)	5
Belgium	44.7 (1.07)	1.312 (0.014)	1
Canada	68.2 (0.59)	1.097 (0.019)	18
Denmark	57.2 (1.39)	1.214 (0.006)	6
Finland	54.6 (2.22)	1.223 (0.004)	4
France	52.2 (0.62)	1.287 (0.078)	2
Germany	48.9 (0.91)	1.204 (0.027)	3
Greece	64.3 (0.85)	1.101 (0.018)	15
Ireland	73.5 (4.38)	1.316 (0.028)	7
Italy	53.2 (1.62)	1.155 (0.022)	9
Japan	74.3 (3.21)	1.052 (0.005)	21
Netherlands	56.1 (4.86)	1.071 (0.029)	12
New Zealand	79.3 (1.05)	1.098 (0.019)	20
Norway	63.2 (0.48)	1.167 (0.013)	10
Portugal	67.2 (0.64)	1.139 (0.003)	14
Spain	62 (0.57)	1.137 (0.013)	11
Sweden	51.9 (2.07)	1.147 (0.019)	8
Switzerland	70.7 (0.49)	1.104 (0.004)	19
UK	69.1 (0.86)	1.114 (0.017)	16
United States	69.9 (0.69)	1.118 (0.004)	17
Total	62.2 (9.56)	1.164 (0.078)	

Notes: country means and standard deviations in parenthesis. Progressivity index in column [2] is defined as $ret67/ret167$. Ranking in column [3] is based on an aggregate indicator of redistributive taxation computed as a decreasing function of $ret100$ and an increasing function of the progressivity index.

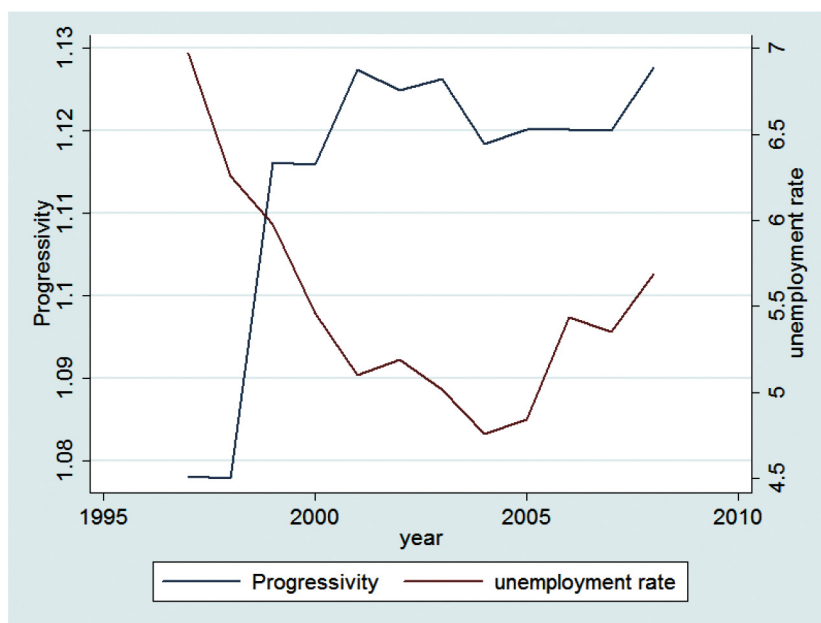
Before turning to the empirical analysis, we discuss a number of case studies selecting countries that experienced substantial tax reforms over the sample period considered.

3.1 Case studies

The United Kingdom

In the UK, the Blair government in the late nineties reformed the National Insurance Contributions (NICs) and the Income Tax. In fact, until April 1999, below a low earning limit, no NICs were due, implying that there was a jump in contributions at that level (called the 'entry rate'). In April 1999, the 'entry rate' was abolished and the starting rate of the income tax was cut from 20% to 10%. According to Adam *et al.* (2010), in 2000-2001 nearly 3 million people were liable for the income tax at this reduced rate. These reforms induced a particular rise of the retention rate at the 67% level which, as can be seen in [Figure 2](#), led to a sharp increase in the progressivity index. The 10% starting rate band was increased above indexation starting from April 2001, which led to a further rise in the progressivity index. In 2003, the government raised NICs and froze personal allowance, which led to a small decrease in progressivity. Overall, the reforms led to a persistent increase in progressivity over the sample period, such an increase in progressivity was associated to a steady decrease in the unemployment rate of about 1.5 percentage points (i.e. from 7% in 1997 to about 5.5% in 2008).

Fig. 2 – Tax progressivity and unemployment: the case of UK



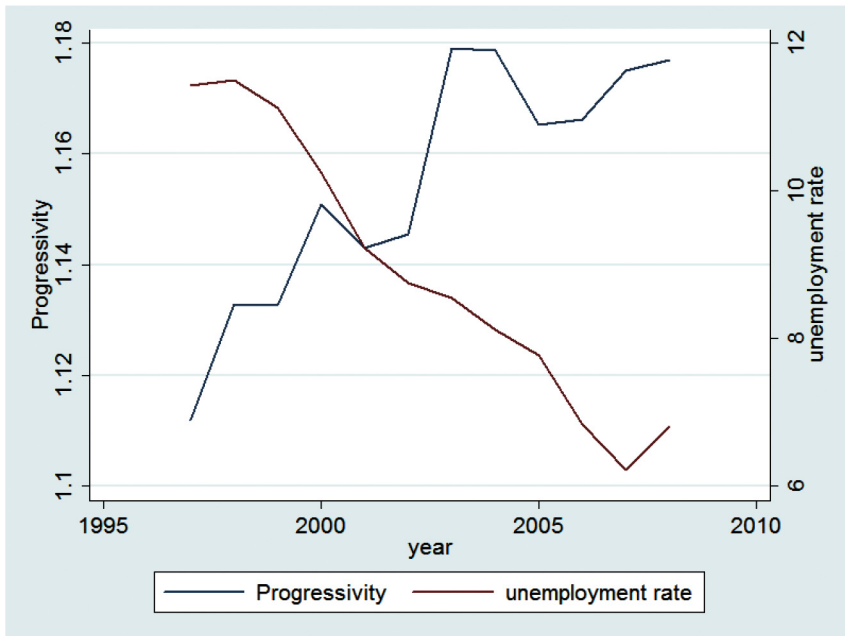
(Notes: authors' calculations on OECD data)

Italy

In Italy, a steady increase in tax progressivity occurred over the sample period. This was the result of successive reforms introduced by governments of different political colours, – i.e. the consecutive left-wing governments by Prodi, D'Alema and Amato, the right-wing Berlusconi government, and the second Prodi government (Baldini *et al.* 2006). In 1998-2000, the Prodi and D'Alema governments engaged in a comprehensive reorganisation of the Personal Income Tax (PIT) system. They reduced the number of tax brackets from 7 to 5, changed the tax rates and introduced a set of progressive tax credits. During the 2001-2006 legislature, the Berlusconi government carried out a structural reform of PIT, balancing progressivity and neutrality objectives. In 2003, it reduced the statutory tax rates on medium and low incomes, replaced tax credits with a 'no-tax area' and protection clauses for specific tax payer categories. In 2006, the new Prodi government partly restored the old system – i.e. increased the number of tax brackets from 4 to 5, and replaced the 'no-tax area' by the progressive tax

credits. The government also put special effort in the reduction of employer's Social Security Contributions. Overall, reforms carried out during this period increased the retention rate at the 67% of the average wage and decreased the retention rate at the 167% of the average wage, inducing a steady increase in the progressivity⁹. As shown in Figure 3, the increase in tax progressivity also resulted in a reduction in unemployment of about 5 percentage points, from about 12% in 1997 to 7% in 2008.

Fig. 3 – Tax progressivity and unemployment: the case of Italy



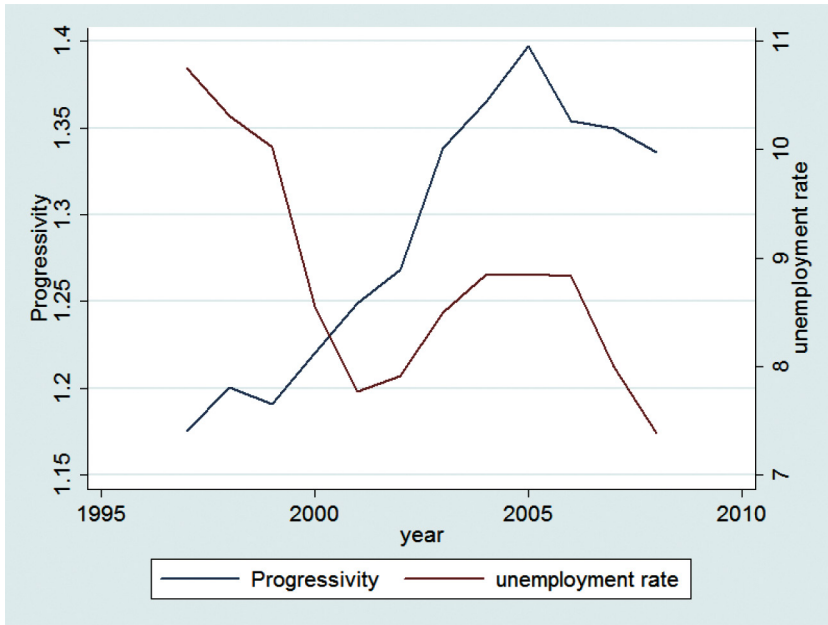
(Notes: authors' calculations on OECD data)

⁹ Some minor reforms carried out during the period went in the opposite direction: in 2001, the Amato government introduced tax credits for medium-high incomes, which considerably increased retention rates at 167% of the average wage (Baldini *et al.* 2006, Tondani and Mancini 2006). In 2005, the Berlusconi government further reduced the number of tax brackets from 5 to 4, revised the tax rates and introduced new exemptions for medium and high incomes. These amendments reduced the retention rates at 67% of the average wage and increased retention rates at 167% of the average wage, which reduced the degree of progressivity with respect to 2004 (see also Tondani and Mancini, 2006).

France

France also experienced a considerable increase in progressivity over the sample period. This trend, however, was mainly the consequence of substantial cuts on employers social security contributions for workers paid at the minimum wage: a policy implemented in France since 1993 (see Kramarz and Philippon 2001, Bunel and L'Horty 2012, Lehmann *et al.* 2013, for an overview and evaluations of these reforms). While the employers' social security contributions rate is typically around 40% of the posted wage in France, this rate was only 22% in 1997 and 14% since 2005 for workers paid at the minimum wage level, while it progressively vanishes at 1.6 times the minimum wage. France also implemented a working tax credit targeted at low income earners called the *Prime pour l'emploi* (PPE). The PPE was launched in 2001 and progressively extended through the period (Lehmann *et al.* 2013). Unlike the EITC in the US or the WFTC in the UK, the French PPE was also generous for singles without kids. These reforms resulted in a rise of tax progressivity, mostly triggered by larger retention rates for singles paid 67% of the average wage. As shown in [Figure 4](#) during the same period France also experienced a 3.5 percentage points reduction in the unemployment rate, from about 11% in 1997 to 7.5% in 2008.

Fig. 4 – Tax progressivity and unemployment: the case of France



(Notes: authors' calculations on OECD data)

4. The Empirical strategy

We use information drawn from different data sources, over the period 1997-2008 and for 21 OECD countries. As discussed above, our measures of labour taxation are based on average tax rates (ATR) of single individuals at different points of the earnings distribution, namely: 67% of the average wage, the average wage (i.e. 100%) and 167% of the average wage, provided by the OECD tax database¹⁰. They encompass income taxation by central and local governments and employers and employees social security contributions. From the above information, we compute the tax retention rates – as shown in (1) –, and the tax progressivity indicator $\ln(\text{ret}67/\text{ret}167)$ – i.e. the inverse of the global CRIP measure as in

¹⁰ These indicators are harmonized over time and across OECD countries and constructed using information drawn from the OECD Tax database and extended the relevant time series back to 1997 using information from OECD Taxing Wages. Details on the two database and their harmonization are given in Lehmann *et al.* (2015).

(2) above. In practice, we adopt the following specification:

$$U_{it} = b \ln(\text{ret}100_{i,t-1}) + c \ln(\text{ret}67_{i,t-1}/\text{ret}167_{i,t-1}) + \mathbf{d} \mathbf{Z}_{i,t-1} + \mathbf{e} \mathbf{X}_{i,t-1} + \delta_i + \lambda_t + \varepsilon_{it}. \quad (3)$$

where U_{it} is the unemployment rate of country i and year t . The vector includes a baseline set of labour market institutions, namely, the average unemployment benefits replacement rate, union density, and an index of the degree of coordination in wage bargaining. The vector includes cyclical control variables, such as the output gap, the degree of trade openness, and the long-term interest rate on government's bonds. Finally, δ_i and λ_t indicate, respectively, country and time fixed effects, while ε_{it} is the error term. Our parameters of interest are the estimates of coefficients b and c on our tax indicators. As tax reforms take time to produce their effects, we enter the tax indicators with a one-year lag. According to our theoretical predictions we expect both a rise in the retention rate (a decrease in the average tax rate) and a more progressive tax schedule to reduce the unemployment rate (i.e. $b < 0$, and $c < 0$).

Table 2 – *Labour taxation, progressivity and the unemployment rate*

	[1]	[2]	[3]	[4]
ln(ret100)	-1.96 (2.27)	-4.06* (2.29)	-4.96* (2.54)	-6.31** (2.65)
ln(ret67/ret167)				-6.23** (2.61)
Output gap		-0.41*** (0.07)	-0.42*** (0.07)	-0.42*** (0.06)
Trade-to-GDP ratio		0.04*** (0.01)	0.04*** (0.01)	0.04*** (0.01)
Long-term interest rate		-0.21 (0.15)	-0.24* (0.13)	-0.29** (0.13)
Replacement rate			0.04 (0.02)	0.05* (0.03)
Union density			0.10* (0.06)	0.12** (0.06)
Wage coordination			-0.45** (0.19)	-0.46** (0.19)
Constant	15.32 (9.66)	24.17** (9.88)	25.50** (11.22)	31.58*** (11.72)
R sq.	0.86	0.89	0.89	0.90
N	231	231	231	231

Notes: OLS Estimates. The dependent variable is the standardised unemployment rate.

All specifications also include country-fixed effects, and time-fixed effects.

Robust standard errors in parentheses. Significance levels: *, 10%, **, 5%, ***, 1%

5. Results

Table 2 presents the econometric results. Estimates are performed by Ordinary Least Squares with robust standard errors in parentheses. Specification in column [1] includes only the average retention rate, plus country and time fixed effects. In column [2], we also add the output gap and the long-term interest rate on government bonds to control for the confounding effect of the business and the economic cycle, and the trade-to-GDP ratio to account for

the changing patterns of countries' exposure to international trade and degree of competitiveness. In column [3], the specification further includes a set of labor market institutions, such as the unemployment benefits' replacement rate, union density and an aggregate indicator of coordination in wage bargaining. These are typically regarded as factors that affect workers' outside option and bargaining power, respectively, thus determining labor market rigidities that induce unemployment in the economy. Estimates in this column, are in line with the baseline specification adopted in the unemployment literature (Nickell and Layard, 1999; Bassanini and Duval, 2009. See Arpaia and Mourre, 2010 for a review) and suggest a positive association between labour taxation and unemployment, statistically significant at conventional levels. Note that estimates in column [3] may hide an unemployment effect triggered by the shift of the tax burden along the wage distribution, thus in column [4] we also include the tax progressivity indicator to account for this effect. This is our preferred specification, which we will use to assess the association of taxation with unemployment. Results show that both the average retention rate and the progressivity index are negatively associated with the unemployment rate, in line with our theoretical priors, and the coefficients are statistically significant. In terms of economic magnitude, our results imply that a one percentage point increase in the average retention rate (i.e. one percentage point reduction in the average tax wedge on labour) implies a reduction in the unemployment rate – for the average OECD country – between 0.07 (Column 2) and 0.12 (Column 5) percentage points (i.e. an order of magnitude that is in line with the estimates reported in the literature, see Arpaia and Mourre, 2010).

As far as progressivity is concerned, to get a sense of an increase in progressivity we consider the effect of a half-percentage point decrease in the average tax rate at 67% of the average wage, jointly with a half-percentage point increase in the average tax rate at 167% of the average wage. Such a tax reform in our data implies a rise in the tax progressivity indicator by 0.016 points, which is associated to a reduction in unemployment of approximately 0.095 percentage points (Column 4)¹¹.

These results suggest that one percentage point decrease in the labour tax wedge has an impact on unemployment, whose order of magnitude is on the lower bound of the range identified by previous findings which are

¹¹ The mean of *ret100* over the sample is 62.19%. So, from estimates in column [4], when *ret100* rises by one percentage point, the change in the unemployment rate amounts to $-6.31/62.19 * 1 = 0.101$ percentage points. The mean of *ret67* and *ret167* over the sample are respectively 66.35%, and 57.42%. The combined effect of a 0.5 percentage points shift from 67% to 167% of average wage on unemployment is $-6.23 * (0.5/57.4 + 0.5/66.4) = -0.099$.

between 0.1 (Nickell *et al.*, 2005) and 0.5 (Daveri and Tabellini (2000) for Continental-European countries). Also, these estimates suggest that a similar favourable effect may be obtained by keeping the average tax wedge on labour constant, and shifting the tax burden from lower to higher incomes.

In [Table 3](#), we perform a number of sensitivity exercises on our preferred specification (i.e. [Table 2](#), column [4]). In Row 1, we include in the set of institutional controls the OECD Index of Employment Protection Legislation (EPL), as this is likely to affect workers' flows in/out of unemployment. In Row 2, we include the OECD indicator of Active Labor Market Policies (ALMP), which may affect the extent of workers' participation, and their probability of finding a job. In Row 3, we add a control for the change in inflation, while in Row 4 we replace the time dummies with a time trend. In row 5, we exclude from the analysis some countries which show, over the sample period, large changes in the structure of taxation, namely: the Netherlands, Japan, and Ireland. Finally, to capture the medium-run effects and to partially smooth the year-to-year variations, we replicate the estimation using three years averages, which implies a fall in the number of observations from 231 to 84. All these robustness checks confirm the baseline set of results, even though in some cases the coefficients are estimated with a lower precision.

Table 3 – *Sensitivity analysis*

	Unemployment rate			
	ln(ret100)	ln(ret67/ret167)	R ²	Observations
1. control for EPL	-7.35*** (2.74)	-6.17** (2.56)	0.90	231
2. control for ALMP	-6.30** (2.67)	-6.14** (2.58)	0.90	231
3. control change in inflation	-6.84** (2.72)	-6.15** (2.58)	0.90	231
4. include time trend	-5.85** (2.70)	-6.80** (2.97)	0.88	231
5. exclude Netherlands, Ireland, Japan	-6.31** (2.65)	-6.23** (2.61)	0.90	231
6. Three years averages	-8.94* (4.53)	-7.08 (4.63)	0.93	84

Notes: OLS Estimates. The dependant variable is the standardised unemployment rate.

All specifications also include country-fixed effects, and time-fixed effects.

Robust standard errors in parentheses. Significance levels: *: 10%, **: 5%, ***: 1%

6. *Conclusions and policy implications*

In this paper we have investigated the association between labour income taxation and unemployment. While theoretical models in the literature are consistent in the prediction that tax progressivity increases employment and reduces unemployment, there are only few empirical studies that have investigated the issue of progressivity and consensus on the likely effects on labour market performance is lacking. The expected effect of progressivity on employment, in theoretical models, comes from a ‘wage moderating effect’ that boosts the labour demand and from a ‘composition effect’ since it shifts the tax burden away from groups of workers whose employment is the most responsive to taxation. Our empirical analysis was conducted using a panel data of 21 OECD countries for the 1997–2008 period. Two indicators of labour income taxation are at the core of the empirical analysis: a standard measure of income tax wedge computed for a single individual

at the average wage, and a new measure of global tax progressivity based on a comparison between the fiscal wedges at 67 and 167% of the average wage. The main finding is that, while the average tax burden is negatively correlated with labour market performance, tax progressivity can be beneficial for both employment and unemployment, increasing the former and reducing the latter. The above evidence suggest that governments when designing fiscal consolidation policies should take into account the efficiency gains of a more progressive tax schedule – particularly in countries with low tax progressivity – on labour market performance *via* a positive effect on employment and a reduction in unemployment. This is likely to be particularly relevant for countries with high public debt to GDP ratio and high unemployment rates, such it is the case for many European countries after the financial crisis, that are likely to be constrained in the implementation of fiscal policies by the EU fiscal compact.

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Robert Waldmann

*Discussion of Claudio Lucifora and Simone Moriconi,
Progressive Taxation and Unemployment:
Evidence from OECD countries¹*

Theory

Based partly on their work presented in Lehmann, Lucifora, Moriconi and Van der Linden (2014) Claudio Lucifora and Simone Moriconi argue that progressive taxation can lead to higher employment by causing workers to moderate their wage demands when bargaining over wages and effort. The intuition is that, with more progressive wage taxation, firms and workers find it advantageous to agree to lower effort and lower wages. This intuition is confirmed by rigorous analysis of a Diamond-Mortensen-Pissarides search model (Diamond 1982; Mortensen and Pissarides 1999) with endogenous observable effort.

I think the theoretical analysis can be extended in two ways: consideration of a variable capital labour ratio and consideration of on-the-job search.

As is standard in the literature, each firm is assumed to hire no more than one worker – the firms in the model are jobs not enterprises. This extreme assumption is generally considered to be innocuous because it is assumed that, even if one enterprise hires many workers, the interaction with each worker can be considered separately. Two issues are raised: how do non labour costs depend on work effort and how does collective bargaining cause effects of policy different from those found in the model with individual bargaining.

¹ I would like to thank Marco Fioramanti and Elena Granaglia for helpful comments.

Costs other than labour costs are modelled as a flow of search costs paid by firms with job vacancies – this includes not only the cost of search as such but also the user cost of capital which is idle because no worker is employed. When a (realistic) firm with multiple employees is considered, it is implicitly assumed that the amount of capital required depends only on the number of workers and not on work effort. If work effort includes hours worked (and not just a variable pace of work) this might not be a valid assumption.

Another way of putting this is that progressive taxation will encourage job sharing, with more workers each working fewer hours, if this is technologically feasible. In the extreme implausible case, which is standard in macroeconomic models, the average and marginal products of labour depend only on the ratio of total hours worked. In the matching model, this would require identification of work effort with hours worked and the assumption that the cost of creating a vacancy (both the capital investment and the firm's search costs) is proportional to the amount a newly hired worker will work.

In this case, this alternative model is interesting, because the basic conclusion – that progressive taxation causes higher employment and lower effort, is markedly strengthened. Any increase in non labour costs caused by increased work effort increases the effect of work effort on employment.

Interestingly in the (larger) empirical section, Lucifora and Moriconi note that wage bargaining in almost all of the 21 OECD countries they consider is principally collective and include union density and an index of coordination in wage bargaining as control. It is certainly possible to analyze the effects of progressive taxation in models of collective bargaining. In fact the classic MacDonald Solow (1981) article can be interpreted as an analysis of progressive taxation (although they described it as a model of tax based incomes policies). The logic is similar to the logic of this paper, but the analysis is different. I don't think that a modified MacDonald Solow model with endogenous effort would be qualitatively different from the search model with endogenous effort. It is clear that progressive taxation causes higher output for a wider range of parameters (for the reasons mentioned in the paragraph above).

I think a more interesting modification of the model would be consideration of on-the-job search. As is standard in the literature, it is assumed that workers do not seek alternative jobs, so each worker matches with only one firm. In some countries, there is a high rate of employment to employment transitions (Akerlof, Rose and Yellen, 1988). This is a fairly important issue with fairly clear implications for the effects of tax progressivity.

First consider a model in which workers have the same productivity in any job. For even greater simplicity, assume that work effort is exogenous (so aside from on the job search the model is a standard search model).

In this case, on the job search is pure rent seeking – production can't be increased if a worker finds a second job. It is necessary to model bargaining in the case in which a worker is choosing between two potential employers (the current employer and an alternative employer). The natural simplest model is that of the so called glove game in which the worker extracts the entire surplus due to the matches. Even if the firms make take it or leave it offers, the only Nash equilibrium occurs when each offers the worker the entire surplus.

This means that the risk to a firm that a worker will find an alternative job offer is identical to the risk of an exogenous separation. Even if the worker ends up staying with the current employer, the employer will earn zero profits. This means that it is easy to calculate the effect of on the job search on the value to the firm of a match and on equilibrium market tightness.

Assume that workers can choose different intensities of on the job search with a cost of search effort and a matching probability. Assume that the probability of matching is concave in effort and satisfies the Inada condition so there is an internal solution. Since the purpose of on the job search is to obtain a higher wage, the intensity of on the job search declines in the marginal tax rate (averaged over the range from the Nash bargained wage to the entire surplus). The result of lower effort and lower wages also holds for on the job search effort. However, the effects on output, employment and welfare are completely different.

In the model sketched above, on the job search is pure rent seeking. An increase in the progressivity of the tax will unambiguously cause higher employment and will not affect output per employed worker. This means that in the simplest model with on the job search, increased tax progressivity unambiguously causes increased output.

Were endogenous work effort to be reintroduced, tax progressivity would cause both lower work effort and lower on the job search effort. This means the overall impact on output is ambiguous.

In a more sophisticated model of on the job search, workers' productivity differs at different firms depending on the quality of the match. In this case on the job search is not pure rent seeking. It causes improved matches and higher output. Again, this makes the sign of the effect of tax progressivity on output ambiguous.

Finally (and somewhat tangentially) on the job search reduces the duration of employment relationships. This complicates the hold-up problem

which causes lower than optimal investment in training (Ricci and Waldmann 2015). This is another mechanism through which progressive taxation can cause increased production.

The result of both the rigorous theoretical section of ‘Tax Wedge, Tax Progressivity and the Impact on Unemployment’ and the informal theoretical discussion here is, as usual, that theory gives only modest guidance to the econometrician – there is no clear presumption about the sign of the effect of tax progressivity on GDP.

Empirics

As the Lucifora and Moricone note, it is odd that such a vast majority of empirical work on taxation and employment is based on individual micro-data. The general equilibrium issues raised by the theoretical section of the paper can’t be addressed using only micro data. To address these issues, it is necessary to use the many fewer aggregate data points which are available – the paper uses data on 21 OECD countries from 1997 through 2008.

The empirical section of the paper adds an index of progressivity – the logarithm of the ratio of retention rates at 67% and 167% of the average wage, to a fairly standard model of aggregate unemployment which includes the retention rate at average income (that is the tax wedge). As expected given earlier research, a lower tax wedge is associated with lower unemployment and higher employment. As predicted given the theoretical model, given the tax wedge higher progressivity is associated with lower unemployment and higher employment. These results are quite robust.

Lucifora and Moriconi stress the possible bias in the OLS results due to endogenous tax rates. They instrument the tax variables with three instruments: a measure of fiscal consolidation estimated by Devries et al. (2011) (taxconsol) a standard index of left/right orientation of governments (leftism) and the share of people who report no trust in the civil service (notrustcivil).

There are reasons for concern about each of these instruments, even though tests of over identifying restrictions do not reject the null that they are valid instruments. It is reassuring that the sign and significance of OLS and IV estimates are the same. However, the IV estimated coefficients are much larger than the OLS coefficients. The absence of a plausible explanation of why OLS estimates would be biased towards zero must increase concern about the instruments.

Taxconsol is not available for four countries – Greece, New Zealand,

Norway and Switzerland. Except for a robustness check, the variable is set to zero. Since other countries enacted tax increases, this could be a problem. The variables are imputed for those four countries in a reassuring robustness check. I think an additional robustness check of comparing OLS and IV for the subset of 17 countries would be worth reporting.

OLS and IV regressions including the tax wedge but not tax progressivity show much larger coefficients when the tax wedge is instrumented by *taxconsol* and *leftism*. Tax consolidation itself is endogenous. An important point is that approaching the Maastricht treaty deadline is strongly associated with tax consolidation but should not have caused high unemployment or low employment. However, disappointing growth causes persistent deficits and eventually tax consolidation. Importantly disappointing growth may be chronic, not a recession, and may not be captured by the output gap control variable. The fact that instrumenting with *taxconsol* and *leftism* causes a much larger coefficient on the tax wedge seems to me to cast more doubt on the IV than on the OLS estimates. Here it is very important to know how good an instrument *leftism* is – the tests of overidentifying restrictions rely on the difference between the reduced form regression coefficient of the dependent variable on *taxconsol* and *leftism*. Both must be strong instruments for the test to have reasonable power.

The progressivity index is included in a regression in which the tax wedge is instrumented, then there is a regression in which both are instrumented and *notrustcivil* is added to the list of instruments.

Again it is striking that the coefficient on progressivity is much larger when the variable is instrumented. Again it isn't obvious which estimate is more trustworthy.

Taxconsol is obviously correlated with the tax wedge. It may also be correlated with the progressivity index (first state coefficients are not reported). If it is, there has to be concern about whether the association depends on the exact form of the progressivity index; given the actual history of tax systems, it is clear that identification would be achieved in large part by the choice of the levels 67% and 167%. For this reason, it would be interesting to see how important correlation of *taxconsol* and the progressivity index is to the results. This can be done by instrumenting only tax progressivity and instrumenting it only with *leftism* and *notrustcivil*.

Leftism (of the majority coalition) may be correlated with *leftism* in industrial relations and increased union militancy should cause higher unemployment according to the model which focuses on wage bargaining.

This would be a much greater concern if the data set included more 20th century observations. I tend to guess that this isn't an important issue in the sample period – I am more concerned that the centre left and centre right were so similar in those years that the variable is a weak instrument. However, it seems fairly easy to include the ratio of hours of work lost due to strikes to total hours as an additional control variable.

It is also conceivable that leftism is correlated with higher employment through the Keynesian effects of higher government expenditures. The inclusion of the output gap as a control variable is reassuring. The magnitude of the coefficient on progressivity increases by roughly one standard error when the output gap is excluded from the regression. This is a statistically insignificant hint that the conceivable problem is a problem.

No trust civil may be correlated with measurement error. It is almost certainly correlated with the scale of the underground economy and so might be correlated with overestimates of unemployment and underestimates of unemployment. If this is a problem, the IV estimates of coefficients on tax progressivity will be biased more than the OLS estimates. The J-tests of overidentifying restrictions could detect this problem, but, again they depend on leftism being highly partially correlated with the tax variables.

In general, the highly novel conclusion that tax progressivity causes lower unemployment and higher employment is strongly supported by the empirical work. It is easy to think of objections to each single regression but the robust pattern over many different specifications is quite convincing.

The data contain some evidence that, as expected, higher tax progressivity corresponds to lower effort. The OLS and IV coefficients of GDP per employed worker on tax progressivity is negative and the IV coefficient is statistically significant. All concerns about the instruments discussed above are relevant to this regression too.

One aspect of the theoretical model is that effort is an abstract concept which doesn't correspond to an observable variable. Clearly at least one aspect of work effort – hours worked – can be measured. The model has a fairly clear implication that, across countries, more progressive taxation should be correlated with lower average hours worked. In fact, this is observed (Prescott 2004).

If it is assumed that effort is observable, it is easy to generalize the model to separate total effort into hours worked and effort per hour as this division matters for worker welfare but not output. Firms and workers would agree on the efficient pace of work which minimizes worker disutility per

unit of output. The effect of tax progressivity on output per hour worked is, in general, ambiguous. However, for the most obvious utility functions, increased progressivity causes lower output per hour. This weak suggestion of a slightly more general model can be tested given available data. It seems potentially worth the effort (barely).

The data correspond to the non implication that the effect of tax progressivity on output is ambiguous – the OLS and IV estimates of the effect have opposite signs and neither is statistically significant. This empirical result is reminiscent of the conclusions of a related literature. There are larger data sets of the top marginal tax rate on labour income. Top rates increase both in the average tax wedge and in progressivity. They are not correlated with the growth of GDP per capita in standard growth regressions. It happens to be true that higher top marginal tax rates within the range observed in OECD countries in the 21st century are (weakly) partially correlated with higher per capita GDP growth (Milasi 2013). This corresponds to the sign of the statistically insignificant coefficient on tax progressivity.

The weaker empirical results on productivity and output correspond both to the theoretical model and to the related empirical literature.

In sum there is a simple theoretical argument, which is actually strengthened when some key assumptions are relaxed, that higher tax progressivity causes lower unemployment and higher employment. This prediction is strongly supported by empirical analysis of aggregate data.

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