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# Unemployment and the coverage extension of collective wage agreements<sup>☆</sup>

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## ABSTRACT

This paper examines how the extension of collective wage bargaining agreements to non-unionized firms affects unemployment. Testing a large number of econometric specifications on data from 15 OECD countries observed between 1965 and 2007, we find a positive, significant and robust interaction between the tax wedge and the degree of coverage extension of collective wage bargaining agreements. More specifically, our results suggest that the tax wedge has a larger positive effect on unemployment than any other labour market policy in countries with wide extension of collective wage agreements' coverage such as France or Spain. Conversely, in countries where coverage extension is close to zero as in Nordic countries, unemployment is essentially insensitive to changes in the tax wedge.

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## 1. Introduction

Why has unemployment been persistently higher in France and Spain than in other OECD countries over the last decades? A large number of labour economic studies would point at a set of common labour market policies less conducive to employment such as stringent employment protection and product market regulation, high labour costs and generous unemployment benefits (for an overview see [Layard et al., 1991](#); [Blanchard and Wolfers, 2000](#), or [Bassanini and Duval, 2009](#)). In this paper, we seek to shed light on an original channel that arises from the interaction between taxes and one specificity of collective wage bargaining systems observed in the latter two countries, namely the extension of collective wage agreements to non-unionized firms.

The main purpose of coverage extensions is to allow for effective collective bargaining in an industry or group of industries by setting up a level playing field among firms. This raises two potential concerns related to its consequences for unemployment. First, coverage extension may raise the bargained collective wage, hinder competitiveness of the sector and reduce employment. Second, to the extent that unionized and non-unionized firms are systematically different, for example because unionized firms tend to be larger (as one would expect when there is a fixed cost to unionization) and more productive, there are concerns of representativeness over the wage agreements that are being extended. Indeed, negotiated

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wage agreements may result in wages that are appropriate in unionised firms but too high for non-unionized firms, raising the risk that such agreements drive non-unionized firms out of the market and thereby increase unemployment.<sup>1</sup>

Defining “coverage extension” as the difference between the administrative coverage of union agreements and union density, we find no evidence of an effect of coverage extensions on unemployment on average, but we do find that coverage extensions have a tendency to amplify the adverse effects of the tax wedge<sup>2</sup> on unemployment. Indeed, we find a positive, highly significant and large effect of the tax wedge on unemployment in countries with large coverage extension, such as France and Spain. In those countries, the influence of the tax wedge dwarfs that of any other labour market policy. Moreover, we decompose the latter unemployment effect into the respective contributions of unemployment turnover rates, namely the unemployment inflow and outflow rates. Using a SURE estimation framework, we find a significant effect operating through the unemployment outflow rate, but no evidence of any influence on the unemployment inflow rates.

Our empirical results are robust to the wide variety of different specifications, including the procedure to address the potential endogeneity of labour market reforms with respect to unemployment. Endogeneity is addressed by using long lags of labour market policies as instruments for their current levels, thus assuming labour market policies to be weakly exogenous variables as in a GMM setting. The results are also robust to use of various time periods and time frequencies, the inclusion of additional explanatory variables such as higher education, demographic variables, public social services or controlling for country-specific trends. We also test for any competing interactions with the tax wedge. In most of the regressions pertaining to the unemployment outflow rate or to the unemployment rate, the tax wedge and its interaction with coverage extension were both found to be significant at the 1% confidence level, a statistical performance that is matched by none of the other labour market policies and institutions.

This paper complements previous studies that have focused respectively on the labour wedge and on wage bargaining systems. Among the first category, [Daveri and Tabellini \(2000\)](#) argue that the labour wedge displays an adverse effect on employment only in countries with “strong and decentralized unions”.<sup>3</sup> As regards wage bargaining systems, [Calmfors and Driffill \(1988\)](#) provide empirical evidence that intermediate, sectoral wage bargaining systems – in which mandatory coverage extensions can play an important role are detrimental to employment relative to either centralized or decentralized systems operating at the national or firm levels respectively.<sup>4</sup> We build on these two studies by showing that the key institutional driver of the tax wedge (semi-) elasticity of unemployment<sup>5</sup> is the degree of coverage extension rather than the degree of wage bargaining centralization *per se*, which is found to have only a small or no impact on unemployment.

Moreover, we describe the empirical relationships between labour market policies and institutions and unemployment turnover rates. The joint dynamics of job creation and job destruction along the business cycle have been examined theoretically by [Mortensen \(1986\)](#), [Pissarides \(1990\)](#) and [Mortensen and Pissarides \(1994\)](#). On the empirical front, job and worker flow data have been described in different settings (see [Davis and Haltiwanger, 1992](#); [Davis et al., 2006](#); [Jolivet et al., 2006](#); [Shimer, 2007, 2008](#); [Elsby et al., 2008, 2009](#); [Petrongolo and Pissarides, 2008](#); [Robin, 2011](#)). In particular, some microeconomic studies have looked at how specific institutions (e.g. unemployment insurance, employment protection, two-tier wage contracts) may affect the flows of workers in and out of unemployment as well as the distribution of wages ([Cahuc and Postel-Vinay, 2002](#); [Cahuc et al., 2006](#); [Postel-Vinay and Robin, 2002](#); [Bentolila et al., 2010](#); [Murtin and Robin, forthcoming](#)). As a result, we find that the tax wedge is a major determinant of the unemployment outflow rate in countries with large coverage extension, but we find little impact on unemployment inflow rates.

Finally, our findings help to explain why structural unemployment has been persistently high over the last decades in countries such as France, which are characterized by important mandatory coverage extensions and high labour taxes. Conversely, our findings explain why high taxes and low unemployment have co-existed in Nordic countries, which display virtually no coverage extension by consequence of having high union density. As in [Daveri and Tabellini \(2000\)](#), we find that the tax elasticity of unemployment is found to be non-significant in the latter countries. The next section offers some background on the degree of coverage extension of wage bargaining systems. [Section 3](#) presents the empirical framework and [Section 4](#) the data. We describe the main results with respect to the unemployment rate in [Section 5](#) and those with respect to unemployment turnover in [Section 6](#). Endogeneity concerns and further robustness checks are addressed in [Section 7](#). The final section concludes.

## 2. Stylized facts on the coverage extension of collective wage agreements

In the following, we will focus on the extensions of collective wage agreements to non-unionized firms. In some countries, collective wage agreements concluded at the industry level are extended (at least partially) to non-unionized

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<sup>1</sup> An interesting question is whether bargained wages that cover non-unionized sectors are indeed binding or whether they act as non-binding minimum wages. [Blanchflower and Bryson \(2002\)](#) shed some light on this issue. They find essentially no wage differential between unionized and non-unionized firms in France and Germany – two countries where coverage extension is high – and a modest wage differential in Spain, where coverage extensions also prevail. We interpret this finding as suggesting that union-negotiated wages are indeed binding in these economies.

<sup>2</sup> The tax wedge is formally defined as the difference between the gross labour cost to the employer and the net take-home pay of the employee net of income taxes.

<sup>3</sup> See also [Prescott \(2004\)](#), [Rogerson \(2007\)](#) and [Shimer \(2009\)](#) on the labour tax wedge.

<sup>4</sup> [Magruder \(2012\)](#) analyses the role of extending collective wage agreements in South Africa and finds similarly to us that it increases unemployment.

<sup>5</sup> The tax wedge (semi-) elasticity of unemployment is the coefficient on the tax wedge variable estimated from a regression of log unemployment on the tax wedge and other variables.

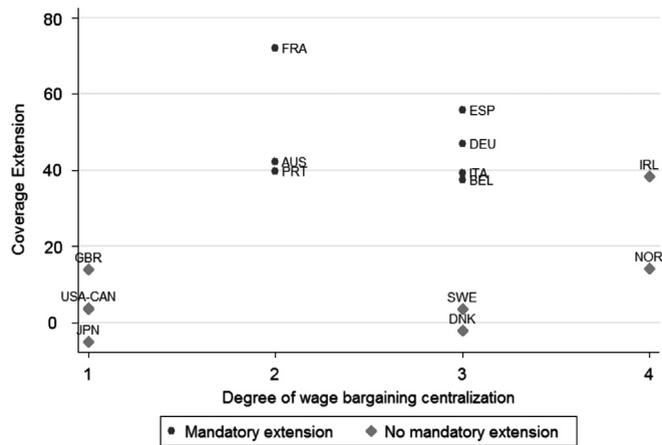


Fig. 1. Coverage extension and the degree of wage bargaining centralization.

firms. We describe below the importance of the latter aspect of collective wage bargaining, which has received little attention in the economics literature so far.

For empirical purposes, we define “coverage extension” as the difference between the share of the workforce that is effectively covered by collective wage agreements (the coverage rate) and the share that is member of a trade union (trade union density). This measure allows us to empirically examine the labour market effects of coverage extensions. Compared with other indices that have been used to study different aspects of collective bargaining that tend to be subjective and categorical (e.g. coordination, corporatism), our measure of coverage extension also has the advantage that it is outcome-based and continuous.<sup>6</sup>

Coverage extension mainly derives from the mandatory extension of collective agreements at the industry level to non-unionized firms in the same industry. In practice, this implies that coverage extensions tend to be quantitatively important in countries: (i) characterized by intermediate level of collective wage bargaining; and (ii) where legal provisions for the mandatory extension of collective wage agreements to firms in the same sector are available.<sup>7</sup> This is illustrated in Fig. 1 by relating coverage extension to the degree of centralization in collective bargaining separately for countries with and without legal provisions for mandatory extensions. The latter two variables are drawn from Visser (2009) database on institutional characteristics of trade unions.

It is clear that in countries with decentralized systems in place, such as Canada, Japan, the United Kingdom and the United States, coverage extension tends to be limited. Higher levels of coverage extension are observed at the other end of the spectrum, in countries with centralized bargaining systems, such as Ireland and Norway. Moreover, countries with decentralized or centralized systems do not tend to have legal provisions for the mandatory extension of collective agreements to non-unionized firms. The largest levels of coverage extension are observed in countries such as France, Spain, Germany and Australia, which are characterized by intermediate wage bargaining systems operating at the sectoral or industry level and have legal provisions for the mandatory extension of agreements to non-unionized firms. It is interesting to note that such provisions do not exist in Denmark and Sweden, two countries characterized by virtually zero coverage extension. With unions representing up to respectively 75% and 81% of the workforce covered by collective agreements (highest among OECD countries), maybe the adoption of such provisions has not been seen as warranted given the limited concerns about “unfair” competition from non-unionized firms.<sup>8</sup>

Fig. 1 also helps in refining the analysis by Calmfors and Driffill (1988) on the relationship between unemployment and the degree of wage bargaining centralization. The latter study argues that intermediate, sectoral bargaining systems are more likely to generate high unemployment. We refine their argument by showing in the empirical analysis that coverage extension matters relatively more than intermediate coordination *per se*, although the latter two variables are positively and significantly correlated with each other as shown on the graph.<sup>9</sup>

To our knowledge, there is no theoretical model that fully reflects the effects of coverage extension on unemployment that are described in this paper. Magruder (2012) presents a simple theoretical model that discusses the role of bargaining

<sup>6</sup> This measure of coverage extension may be seen as a broad measure since it captures both extensions within and between firms and both voluntary and mandatory extensions. The concern of representativeness is primarily related to mandated coverage extensions across firms. The role of within-firm extensions and voluntary extensions across firms explain why the empirical measure of coverage extension is not zero in countries where there is no legal provision for mandatory coverage extension.

<sup>7</sup> Mandatory extensions can be either automatic as in Australia, Italy and Spain or subject to a decision by a public body such as in Finland, France and Germany (Du Caju et al., 2008).

<sup>8</sup> It is worth noting that while trade union density has tended to decline in most countries during the past 30 years, the importance of coverage extensions has increased (Du Caju et al., 2008). This is due to the fact that coverage have been largely stable despite the decline in trade union density.

<sup>9</sup> There is a 0.51 correlation between coverage extension and a dummy taking value 1 when centralization equals 2 or 3 as described in Fig. 1.

councils in South Africa, which extend arbitration agreements negotiated by unionized firms to non-unionized firms in the same industry and administrative geographical entity. [Jimeno and Thomas \(2013\)](#) present a search and matching model of the labour market to discuss the role of firm- and sectoral-level bargaining in the context of firm heterogeneity. Unemployment is shown to be lower under firm-level bargaining and sectoral-level bargaining with opting-out than under sectoral-level bargaining without opting-out. They do not explicitly discuss the role of mandatory extensions and therefore do not need to explain why in practice certain firms tend to be unionized while others are not. [Boeri and Burda \(2009\)](#) develop a search-and-matching model of the labour market in which collective bargaining arises endogenously in the presence of firing costs.

In sum, more research is needed to fully understand the mechanism through which coverage extension affects wages and unemployment. Our premise is that coverage extensions prevent the cost of higher payroll taxes from being rapidly and fully shifted to employees via downward adjustments in net wages, which are set by collective agreements. The persistent wedge between labour costs and productivity that this generates is gradually resorbed through labour shedding (or slower hiring), resulting in rising unemployment. Under this mechanism, coverage extension magnifies the impact of rising taxes on total labour costs, labour demand and hence unemployment. The latter thus depends on the interaction between coverage extension and the tax wedge, as the volume of payroll taxes is equal to the product of net wages times the tax rate. As shown subsequently in the analysis, this mechanism receives empirical support as the interaction of coverage extension with the tax wedge turns out positive and highly significant in all unemployment regressions. The tax wedge entered separately in level also comes out positively and significantly in most regressions whereas coverage extension is generally not significant.

### 3. Econometric framework

This section describes the empirical framework used in the paper. We start by describing the relationship between the rate of unemployment, the tax wedge and coverage extension, and then introduce unemployment turnover in the analysis.

The basic econometric framework is one where the log rate of unemployment  $U$  is regressed on the tax wedge  $T$ , coverage extension  $E$  and their interaction. For the latter term, coverage extension is averaged within countries and centred around its cross-country and cross-time grand average as done in [Bassanini and Duval \(2009\)](#), who look more specifically at interaction effects between labour market policies. This means that the coefficient on the tax wedge captures its average marginal effect rather than its effect when coverage extension is zero. We systematically include time and country dummies,<sup>10</sup> as well as other labour market policies and institutions and a proxy for cyclical labour demand. Formally, the model can be written as follows:

$$\log U_{it} = \tau^u T_{it} + \pi^u T_{it} \tilde{E}_i + \mu^u E_{it} + \sum_j \beta_j^u X_{it}^j + \alpha_i + t + \phi Z_{it} + \varepsilon_{it} \quad (1)$$

where  $X$  denote other labour market policies and  $Z$  a measure of business cycle effects. This simple model of log unemployment will be assessed to shed light on the average effect of the tax wedge  $T$  with coefficient  $\tau^u$  and on its interaction with coverage extension in deviation from its sample mean ( $\tilde{E}_i = E_{i..} - E_{..}$ ) with coefficient  $\pi^u$ .

Going deeper into the analysis, it is possible to explain the flow origin of the coefficients. Indeed, it is interesting to know whether the labour market policy effects described in the unemployment equation (1) stem rather from an impact on unemployment inflows or outflows. This insight will unveil the underlying dynamics of the rate of unemployment.

To start with, consider the following system of two equations that describes the relationship between unemployment turnover rates (*i.e.* unemployment inflow and outflow rates), the tax wedge and coverage extension as well as other labour market policies and institutions:

$$\begin{cases} \log s_{it} = \tau^s T_{it} + \pi^s T_{it} \tilde{E}_i + \mu^s E_{it} + \sum_j \beta_j^s X_{it}^j + \phi^s Z_{it} + \alpha_i^s + \lambda_t^s + \varepsilon_{it}^s \\ \log f_{it} = \tau^f T_{it} + \pi^f T_{it} \tilde{E}_i + \mu^f E_{it} + \sum_j \beta_j^f X_{it}^j + \phi^f Z_{it} + \alpha_i^f + \lambda_t^f + \varepsilon_{it}^f \end{cases} \quad (2)$$

where  $s$  is the unemployment inflow rate, and  $f$  the unemployment outflow rate,  $X_{it}^j$  a set of policy and institutional variables,  $Z_{it}$  a proxy for economic shocks capturing business cycle conditions,  $\alpha$  country fixed-effects and  $\lambda$  time effects. The above system is estimated via a SURE methodology to account for the contemporaneous correlation between residuals  $\varepsilon^s$  and  $\varepsilon^f$ , that is to say for any unobserved factor that affects *simultaneously* the unemployment inflow and outflow rates.

As shown in [Appendix A](#), the empirical relationship between the rate of unemployment and its two turnover components can be approximated in the following simple way:

$$\log U_{it} \approx \log s_{it} - \log f_{it} \quad (3)$$

<sup>10</sup> Following [Bassanini and Duval \(2009\)](#) among others, we introduce different country dummies for Germany before and after reunification and for Sweden before and after the 1991 banking crisis.

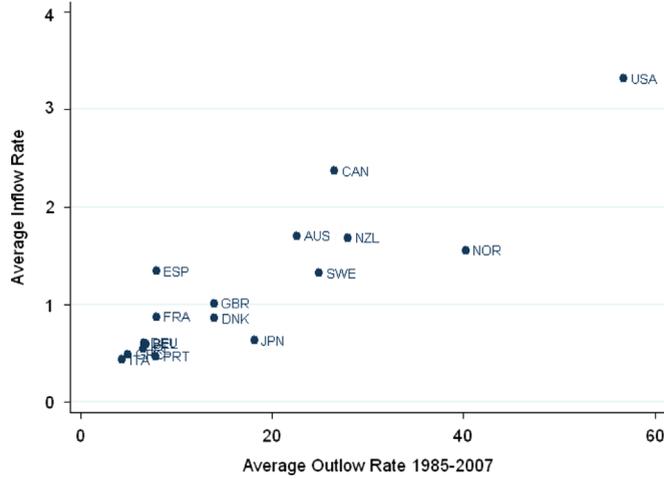


Fig. 2. Average inflow and outflow rates – 1985–2007.

which immediately yields a correspondence between coefficients estimated from the unemployment equation (1) and those derived from system (2) as

$$\begin{aligned} \log U_{it} &= (\tau^s - \tau^f)T_{it} + (\pi^s - \pi^f)T_{it}\tilde{E}_i + (\mu^s - \mu^f)E_{it} + \sum_j (\beta_j^s - \beta_j^f)X_{it}^j + (\phi^s - \phi^f)Z_{it} + \alpha_i + \lambda_t + \varepsilon_{it} \\ &\equiv \tau^u T_{it} + \pi^u T_{it}\tilde{E}_i + \mu^u E_{it} + \sum_j \beta_j^u X_{it}^j + \phi^u Z_{it} + \alpha_i + \lambda_t + \varepsilon_{it} \end{aligned}$$

Hence, policy coefficients estimated from the unemployment regression (1) should be equal to the difference of the corresponding coefficients drawn from the unemployment inflow and outflow equations (2). This provides a means of evaluating the internal consistency of the empirical framework.

## 4. The data

### 4.1. Unemployment, unemployment inflows and unemployment outflows

The constructed dataset covers 15 OECD countries over the period 1965–2007, while a richer set of variables is available over the period 1985–2007. The unemployment turnover data are broadly similar to those used in [Elsby et al. \(2013\)](#).

Fig. 2 provides a scatter diagram of the average unemployment inflow and outflow rates by country. It can be seen: (i) that the average flow variables are strongly and positively correlated; and (ii) that average worker flows are much larger in most English-speaking and Nordic countries than in other countries. This is particularly the case for the United States which comes out as an outlier in terms of the magnitude of inflow and outflow rates.<sup>11,12</sup>

### 4.2. Coverage extension, the tax wedge and other labour market policies and institutions

The database on unemployment turnover is complemented by a set of labour market policy and institutional variables, whose average values are reported for each country in [Table 1](#) for the period 1985–2007 (see [Appendix B](#) for details on data construction). The two main series we will focus on are the tax wedge and coverage extension, which are available as early as 1965 for some countries. The tax wedge is a summary index of labour and personal income taxes built by the OECD and routinely used in economic studies ([Prescott, 2004](#); [Shimer, 2009](#); [Bassanini and Duval, 2009](#)). It is equal to the difference between the labour cost to the employer and the corresponding net take-home pay of the employee. This measure was preferred to a simple payroll tax index as the latter series is affected by a break in the late 1990s. However, our main results are largely unaffected if we replace the tax wedge by payroll taxes (see robustness analysis below).

Other labour market policies and institutions include: the initial (first-year) replacement rate of unemployment benefits; the average duration of unemployment benefits proxied by the ratio of the average replacement rates over 5 years and

<sup>11</sup> Moreover, there is generally a positive association between the coefficients of variation of the inflow and outflow rates. Among high-turnover countries, Nordic countries display much more volatility in unemployment turnover than English-speaking countries such as Australia, Canada, New Zealand and the United States.

<sup>12</sup> A closer look at the variation in inflow and outflow rates over time reveals diverging trends. In some countries such as Canada, Denmark, Ireland, Italy, the United Kingdom and Spain, there has been a clear upward trend in outflow rates. Conversely, there seems to have been a downward trend in outflow rates in Belgium, Japan and Portugal since the early 1990s. In the US, there is a downward trend before 1985 and no apparent trend afterwards once a correction is made to account for a break in the CPS around 1993 as in [Shimer \(2007\)](#) and [Elsby et al. \(2013\)](#).

**Table 1**  
Descriptive statistics (1985–2007 averages).

	AUS	BEL	CAN	DEU	DNK	ESP	FRA	GBR	IRL	ITA	JPN	NOR	PRT	SWE	USA	OECD
<b>Unemployment and turnover</b>																
Unemployment rate	7.5	8.6	8.6	8.0	6.3	16.5	10.2	7.4	10.7	7.3	3.9	4.1	6.2	5.8	5.7	7.8
Inflow rate	1.7	0.6	2.4	0.6	0.9	1.3	0.9	1.0	0.5	0.6	0.7	1.6	0.5	1.3	3.3	1.2
Outflow rate	22.6	6.8	26.5	6.6	14.3	7.9	7.9	13.9	6.5	8.0	17.7	40.2	7.8	24.9	56.7	17.9
<b>Tax wedge and coverage extension</b>																
Tax wedge	28.1	41.3	26.3	35.4	46.2	30.0	41.4	29.0	27.6	39.8	22.8	49.7	26.8	52.2	23.6	34.7
Coverage extension of union agreements <sup>a</sup>	48.3	37.0	4.3	47.8	−0.9	56.7	78.5	8.8	42.2	46.4	−4.2	13.9	48.5	1.5	4.2	28.9
Union density	31.7	53.0	31.4	28.0	74.5	14.6	9.3	34.3	42.8	33.6	22.0	56.1	25.3	81.0	14.2	36.8
<b>Other labour market policies</b>																
Initial replacement rate	24.4	47.0	50.0	38.0	68.8	66.6	59.6	20.8	40.3	55.5	34.8	62.4	65.7	82.2	27.7	49.6
Benefits duration <sup>b</sup>	1.0	0.9	0.3	0.7	0.8	0.5	0.6	0.8	0.8	0.6	0.3	0.6	0.6	0.4	0.5	0.6
EPL regular contracts	1.3	1.7	1.3	2.7	1.7	3.1	2.4	1.0	1.6	1.8	1.9	2.3	4.4	2.9	0.2	2.0
Product market regulation	2.8	3.8	2.6	3.3	3.3	3.6	4.4	2.1	4.3	2.2	3.0	3.5	4.1	3.4	2.2	3.2
PES and administration <sup>c</sup>	2.4	2.2	2.4	3.0	3.4	0.8	1.9	3.4	2.1	1.2	6.9	3.4	2.2	5.4	0.8	2.8
Employment incentives <sup>c</sup>	0.5	1.5	0.1	0.9	6.6	1.5	1.5	0.2	0.9	2.6	0.6	1.3	2.3	10.1	0.0	2.0
Training and others <sup>c</sup>	2.5	10.1	2.8	10.4	17.6	2.8	7.2	2.7	8.4	3.3	1.0	14.1	5.3	25.8	2.2	7.8

<sup>a</sup> Representativeness of collective union agreements minus share of unionized labour force.

<sup>b</sup> Calculated as average replacement rate divided by initial replacement rate.

<sup>c</sup> Amount per person unemployed divided by GDP per worker, smoothed with Hodrick-Prescott filter and expressed in %.

initial replacement rates; the OECD index of employment protection for regular contracts; the OECD index of product market regulation; the volume of active labour market policies (ALMPs) per unemployed worker normalized by GDP per worker,<sup>13</sup> and its three main sub-components (public employment services denoted as PES, employment incentives and training); and union density defined as the share of workers that are members of a union.

Finally, a measure of the output gap constructed by the OECD is used as a proxy business cycle conditions.

## 5. Coverage extension and the tax wedge as Determinants of the unemployment rate

This section describes basic results obtained from the estimation of the unemployment equation (1) over the longest time period 1965–2007. Table 2 reports a string of regressions where the set of explanatory variables is gradually expanding. The tax wedge, the output gap, country and time dummies are included in all regressions. The interaction between the tax wedge and coverage extension is introduced from Column (2) onwards. We make use of annual data in Columns (1)–(5) and 5-year time spans in following columns. With country fixed-effects being included, a longer time span helps improving the signal-to-noise ratio at the cost of reducing the number of observations.

As a main result, the interaction of the tax wedge with coverage extension is positive and significant at the 1% confidence level in regressions (2)–(5) and at a 5% confidence level in columns (7)–(10). Similar results can be found when the estimation is run over the two sub-periods 1965–1985 and 1985–2007. Interestingly, the tax wedge itself is significant only when the interaction with coverage extension is included and when the time span is annual. Coverage extension is never statistically significant suggesting that it does not have an effect on unemployment on average.

The magnitude of the interaction effect is large. The tax wedge estimate is about 0.01, implying that raising the tax wedge by 10 percentage points may increase unemployment by an average 10% across all countries. However, in countries where coverage extension is 20 percentage points above (respectively below) OECD average, the tax wedge elasticity is estimated at  $0.01 + 0.2 \times 0.06 = 0.022$  (resp.  $0.01 - 0.2 \times 0.06 = -0.002$ ). In other words, unemployment is highly (respectively not) sensitive to the tax wedge in countries with large (resp. low) coverage extension.

Similar results can be found over the more recent 1985–2007 period when controlling for more policy and institutional settings. Actually, the effects associated with the tax wedge and its interaction with coverage extension are even larger as shown on Table 3. Indeed, the level effect of the tax wedge is always significant and comprised between 0.016 and 0.047, while the coefficient on the interaction effect is at least 50% larger than that displayed in Table 2.<sup>14</sup> To give an example, calculations suggest that unemployment would be lower by 2.6 (respectively 2.5) percentage points in France (resp. Spain) if

<sup>13</sup> In order to remove cyclical variations in ALMPs that result from cyclical unemployment variations, we apply a HP filter to the constructed series and use only the trend series in subsequent regressions. This procedure corrects for the endogeneity that arises from the fact that ALMP spending has traditionally been relatively insensitive to cyclical changes in the unemployment rate (OECD, 2009). It does not address the endogeneity problem that may arise when the variation in ALMP spending falls short of the variation in the structural rate of unemployment. This may be less of a problem since ALMP spending has traditionally been more responsive to changes in the structural unemployment rate. If ALMP spending nevertheless falls short of the variation in structural unemployment, this will bias the estimated impact of ALMP spending on unemployment downward.

<sup>14</sup> Most of labour market policies and institutions display coefficients with plausible signs, except maybe average benefits duration for which a negative relationship with unemployment is observed instead of the positive relationship that one would expect under the assumption that longer benefits duration discourages job search. However, recent studies have found little or no such “moral hazard” effects from the US extensions (Rothstein, 2011). This is consistent with the non-significant coefficient of average benefits duration in columns (9) and (10).

**Table 2**

The unemployment effect of the tax wedge and coverage extension 1965–2007.

Dependent variable	Log unemployment rate									
	Annual time span					5-year time span				
Time span										
Procedure	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Tax wedge	0.004 (0.004)	0.012*** (0.004)	0.013*** (0.005)	0.012** (0.005)	0.013** (0.005)	0.003 (0.010)	0.009 (0.010)	0.011 (0.012)	0.007 (0.013)	0.008 (0.013)
Tax wedge × coverage extension		0.057*** (0.010)	0.061*** (0.014)	0.064*** (0.014)	0.062*** (0.014)		0.061** (0.025)	0.068** (0.033)	0.077** (0.033)	0.075** (0.032)
Coverage extension			−0.176 (0.275)	−0.102 (0.272)	−0.201 (0.286)			−0.287 (0.675)	−0.173 (0.636)	−0.365 (0.681)
Union density				0.558 (0.409)	0.783* (0.399)				1.498 (1.069)	1.826 (1.126)
Tax wedge × union density					−0.026 (0.016)					−0.038 (0.047)
Output gap	−0.072*** (0.007)	−0.067*** (0.007)	−0.072*** (0.007)	−0.072*** (0.007)	−0.071*** (0.007)	−0.081*** (0.018)	−0.078*** (0.019)	−0.078*** (0.019)	−0.078*** (0.019)	−0.076*** (0.019)
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R <sup>2</sup>	0.84	0.85	0.85	0.85	0.86	0.83	0.84	0.84	0.85	0.85
N	484	484	484	484	484	99	99	99	99	99

Note: Robust standard errors in OLS regressions. The excess coverage interacted with the tax wedge is centred and time constant.

\*Denotes significance at a 10% confidence level.

\*\*\* Denotes significance at a 1% confidence level.

\*\* Denotes significance at a 5% confidence level.

union density were 10 percentage points higher and coverage extension 10 percentage points lower.<sup>15</sup> These results suggest that coverage extension has a quantitatively larger adverse impact on unemployment than union density, presumably because unionized and non-unionized firms are systematically different and extending wage agreements to non-unionized firms disproportionately lowers employment in such firms.

The existence of a significant interaction effect between the tax wedge and coverage extension receives a simple graphical illustration in Fig. 3, which displays the annual changes in unemployment and in the tax wedge for countries above and below the OECD average of coverage extension. While the tax elasticity of unemployment is positive and significant in the former group of countries, it is nil in the latter group.

The finding that the tax elasticity of the unemployment rate depends on coverage extension helps to refine the results from former economic studies. In particular, Daveri and Tabellini (2000) argue that increases in labour taxes are shifted onto higher labour cost in countries with “strong and decentralized trade unions”, entailing a rise in unemployment and a slowdown in investment and economic growth. Importantly, they find different tax elasticities of unemployment across groups of countries, and point at the role of wage bargaining systems to explain these differences. However, they do not provide any specific empirical evidence on the latter aspect, and present their statistically non-significant tax elasticity in Nordic countries as “an unresolved puzzle” (p. 80). In contrast, Calmfors and Driffill (1988) clearly identify intermediate wage bargaining systems as a factor driving up the aggregate real wage and unemployment, but do not confront this issue with a panel data analysis.

Column (7) combines the insights from the two latter studies by regressing unemployment on the tax wedge, a dummy for intermediate wage bargaining systems (as defined by Visser, 2009), their interaction as well as other labour market policy variables. In support of the views from the latter authors, we find a positive and (weakly) significant effect of intermediate wage bargaining on the tax elasticity of unemployment. However, its magnitude is small, as shifting to an intermediate regime increases the tax elasticity from 0.036 to 0.040, meaning that a 10 percentage-points increase in the tax wedge would increase unemployment by 40% instead of 36%. Moreover, the dummy for intermediate wage-bargaining systems displays a negative and significant coefficient.

In comparison, the magnitude of the coverage extension interaction is much larger as discussed above. In particular, Column (8) shows that the latter interaction is immune to the introduction of the dummy for intermediate wage bargaining systems and its tax wedge interaction. Against this background, we refine the findings from the latter authors by suggesting

<sup>15</sup> This calculation, based on estimates from Table 3 Column (6), assumes that the overall degree of coverage of wage agreements is constant. Indeed, Traxler and Behrens (2002) observe that the institutional stability of administrative extensions is striking given the trends towards deregulation. This is likely to reflect the difficulty of reforming such institutional arrangements from a political economy perspective. One politically feasible way of reducing coverage extension may be to promote the broadening of union membership to the covered, non-unionized, sector. Another may be for governments to encourage the wider use of opting-out clauses and firm-level bargaining, as has been done in a number of countries for instance in Germany in the early 2000s and, more recently, Spain.

**Table 3**

The unemployment effect of the tax wedge and coverage extension 1985–2007.

Dependent variable	log u									
Procedure	OLS									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
<b>Tax wedge and coverage extension</b>										
Tax wedge	0.036*** (0.007)	0.046*** (0.006)	0.047*** (0.006)	0.033*** (0.005)	0.034*** (0.005)	0.034*** (0.005)	0.016*** (0.006)	0.029*** (0.006)	0.013** (0.006)	0.016*** (0.005)
Tax wedge × coverage extension		0.098*** (0.022)	0.101*** (0.018)	0.090*** (0.018)	0.162*** (0.019)	0.167*** (0.021)		0.165*** (0.021)		0.232*** (0.042)
Coverage extension			−0.256 (0.240)	0.176 (0.219)	−0.168 (0.192)	0.114 (0.166)		0.194 (0.167)		0.092 (0.321)
Tax wedge × intermediate system							0.006* (0.003)	0.006** (0.003)		
Intermediate system							−0.221* (0.114)	−0.234** (0.099)		
Tax wedge × minimum wage									0.325*** (0.060)	−0.190* (0.106)
Minimum wage									1.064** (0.444)	1.159*** (0.423)
<b>Other policies and institutions</b>										
Initial gross				0.008*** (0.002)	0.003 (0.002)	0.005** (0.002)	0.007*** (0.003)	0.005** (0.002)	0.014*** (0.003)	0.012*** (0.003)
Replacement rate				−0.934***	−0.538***	−0.500***	−0.833***	−0.489***	0.048	−0.082
Average benefits				(0.210)	(0.185)	(0.170)	(0.209)	(0.173)	(0.588)	(0.487)
Duration				−0.012 (0.043)	0.011 (0.040)	0.136*** (0.046)	−0.011 (0.043)	0.122*** (0.046)	0.032 (0.054)	0.014 (0.047)
EPL regular				0.011 (0.023)	−0.030 (0.020)	−0.017 (0.018)	−0.037* (0.022)	−0.024 (0.017)	0.047* (0.026)	0.007 (0.031)
PMR				−1.782*** (0.325)						
Active ALMP normalized						−8.817*** (1.099)	−7.605*** (1.011)	−5.151*** (1.024)	−6.945*** (1.060)	−8.172*** (1.440)
PES and administration normalized						−6.547*** (1.388)	−6.373*** (1.132)	−4.978*** (1.545)	−6.247*** (1.237)	1.524 (2.543)
Employment incentives normalized						0.611* (0.369)	0.306 (0.317)	−0.427 (0.424)	−0.040 (0.357)	−5.673** (2.361)
Training and other active measures							1.979*** (0.326)		2.030*** (0.331)	−0.591 (0.446)
Union density									−0.591 (0.446)	−0.005 (0.417)
<b>Output gap</b>	−0.090*** (0.008)	−0.089*** (0.008)	−0.087*** (0.008)	−0.075*** (0.006)	−0.070*** (0.005)	−0.070*** (0.005)	−0.069*** (0.006)	−0.068*** (0.005)	−0.065*** (0.007)	−0.066*** (0.006)
Time effects	Yes									
Country fixed-effects	Yes									
R <sup>2</sup>	0.88	0.89	0.92	0.95	0.94	0.95	0.94	0.95	0.94	0.95
N	315	315	315	315	315	315	315	315	194	194

Note: Robust standard errors in OLS regressions. The excess coverage interacted with the tax wedge is centred and time constant.

that it is not so much intermediate systems *per se* that display adverse effects on unemployment, but rather their largely shared property of having high coverage extension. In doing so, we explain why Denmark and Sweden, two countries with intermediate wage bargaining systems and the highest tax wedges in the OECD, have experienced the lowest unemployment rates in the OECD along with Japan, Norway and the United States over past decades: these two countries have zero coverage extension (due to high union density), and hence have a very low tax elasticity of unemployment. This provides an explanation to [Daveri and Tabellini \(2000\)](#)'s “unresolved puzzle”.

It is interesting to note that a similar case can be made with the minimum wage. With a high minimum wage, the cost of payroll taxes (or social security contributions) cannot be passed on to employees via corresponding downward adjustments in wages. Hence the effects of the minimum wage and of the tax wedge should reinforce each other. As shown in Column (9), this mechanism receives empirical support as the interaction of the minimum wage and the tax wedge turns out positive and highly significant.<sup>16</sup> However, when we add coverage extension and its tax interaction inside the regression as in Column (10), the tax–minimum wage interaction becomes negative.

<sup>16</sup> The minimum wage is expressed as a fraction of the median wage, as calculated from the OECD Employment Labour and Social Affairs Directorate Database. In its interaction with the tax wedge, we subtract the grand average of the minimum wage from country-specific averages as in Eq. (8).

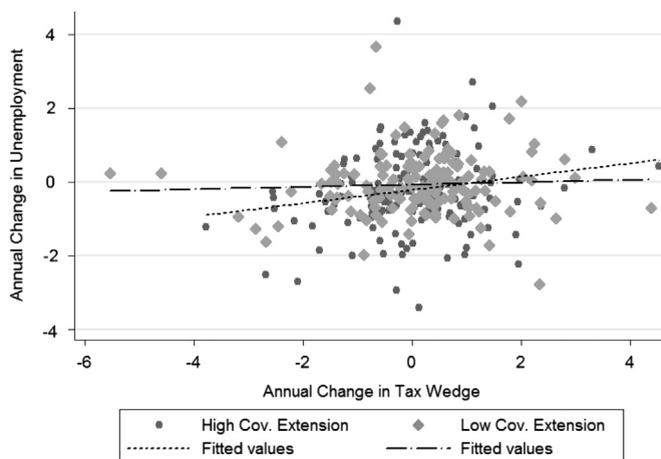


Fig. 3. Changes in unemployment and tax wedge in high and low extension countries.

Which policy or institutional setting drives the tax elasticity of the unemployment rate? The above set of regressions clearly identifies coverage extension, rather than intermediate centralization or the minimum wage, as the most prominent factor.

## 6. Coverage extension, the tax wedge and unemployment turnover

This section seeks to identify the flow origin of the unemployment effect described in the previous section. Does the tax wedge foster unemployment inflows or does it reduce unemployment outflows in countries with large coverage extension?

Table 4 describes the results obtained by focusing on unemployment inflow and outflows rates instead of the unemployment rate, while using a SURE estimator as described by system (7). For the sake of brevity, we only report the coefficients on the tax wedge and the interaction term of the tax wedge with coverage extension, while signalling when other policies and institutions are controlled for.

Columns (1)–(6) provide an unambiguous answer to the question of how the tax wedge and coverage extensions affect the two margins of unemployment. The tax wedge and its interaction with coverage extension are positive and significant at the 1% confidence level in outflow regressions (3) and (6), and never significant in inflow regressions (2) and (5). Hence, the interaction effect of the tax wedge and coverage extension on unemployment appears to run exclusively through the unemployment outflow margin. One possible explanation for this finding could be that much of the coverage extension effect applies to hiring wages rather than stayer wages, but this is left for future research.<sup>17</sup> Interestingly, we do find qualitatively the same results for any age group as shown in Appendix C.

It is interesting to note that the semi-elasticities of the policy variables with respect to unemployment derived from the unemployment regressions (columns (1) and (4)) are never significantly different from the difference between the corresponding semi-elasticities with respect to the unemployment inflow and outflow rates (columns (2), (3), (5) and (6)). This provides an indication of the overall consistency of our empirical framework: the relationship between coverage extension, the tax wedge (as well as other labour market policies) and the rate of unemployment can effectively be decomposed into the respective contributions of unemployment inflows and outflows.

Next, we run counterfactual simulations of policy reforms to evaluate the magnitude of the estimated coefficients. Details on the Monte-Carlo simulations are provided in Appendix D. In this calculation, each policy variable is raised by one standard deviation. As before, we only report the results pertaining to the tax wedge and coverage extension, and we use the estimated coefficients and asymptotic standard errors from Table 4 columns (4)–(6) as a benchmark. To account for the interaction effect between the tax wedge and excess coverage, three different simulations are conducted. The first one takes place in a country with low excess coverage (4%, corresponding to a Nordic country or the United States), the second one uses the average level of coverage extension (28.9%), the third one involves a country with large excess coverage (48%, corresponding to the third quartile or a country like Italy or Portugal).

Table 5 reports the results and highlights the degree of significance using asterisks. In countries characterized by large coverage extension, the effect of a one standard deviation increase in the tax wedge on the unemployment outflow rate and on the unemployment rate dwarfs that of any other labour market policy reform.

<sup>17</sup> It is somehow surprising to find an effect on outflows and none on inflows as the two variables jointly determine equilibrium unemployment in the Mortensen and Pissarides model.

**Table 4**

The decomposition of log-unemployment into turnover variables 1985–2007.

Dependent variable Procedure	log <i>u</i>	log <i>s</i>	log <i>f</i>	log <i>u</i>	log <i>s</i>	log <i>f</i>
	OLS	SURE		OLS	SURE	
	(1)	(2)	(3)	(4)	(5)	(6)
<b>Tax wedge and coverage extension</b>						
Tax wedge	0.046*** (0.006)	0.002 (0.006)	−0.053*** (0.006)	0.034*** (0.005)	−0.001 (0.006)	−0.043*** (0.006)
Tax wedge × coverage extension	0.098*** (0.022)	−0.023 (0.025)	−0.151*** (0.026)	0.167*** (0.021)	0.013 (0.027)	−0.181*** (0.026)
Coverage extension				0.114 (0.166)	−0.110 (0.231)	−0.320 (0.226)
<b>Output gap</b>						
	−0.089*** (0.008)	−0.016** (0.007)	0.087*** (0.007)	−0.070*** (0.005)	−0.003 (0.007)	0.080*** (0.007)
Other policies and institutions	No	No	No	Yes	Yes	Yes
Time effects	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes
<i>R</i> <sup>2</sup>	0.89	0.9	0.94	0.95	0.92	0.95
<i>N</i>	315	315	315	315	315	315

Note: Robust standard errors in OLS regressions. The excess coverage interacted with the tax wedge is centred and time constant.

**Table 5**

Monte-Carlo simulation of unemployment variation following an increase in each variable by one standard variation.

	Inflow contribution	Outflow contribution	Interaction term	Total effect	Total effect based on unemployment regression
<b>Tax wedge and coverage extension</b>					
Average tax wedge effect	−0.1	3.4***	0.0	3.3***	2.7***
Tax wedge in low-extension coverage country	−0.4	−0.1	0.0	−0.5	−0.5
Tax wedge in high-extension coverage country	0.1	6.2***	−0.1	6.2***	5.2***
Coverage extension	−0.2	0.7	0.0	0.5	0.2
<b>Output gap</b>					
	−0.1	−1.3***	0.0	−1.3***	−1.1***

Note: A Monte-Carlo experiment is run to take into account uncertainty on model's estimates. Following the increase in each institution by one standard deviation, the resulting change in inflow, outflow and unemployment rates are calculated while assuming that the coefficient of the institution is a normal variable of mean and variance drawn from the estimation.

\*Denotes significance at a 10% confidence level.

\*\*Denotes significance at a 5% confidence level.

\*\*\* Denotes significance at a 1% confidence level.

Indeed, raising the tax wedge by 10 percentage points (one standard deviation) increases unemployment by about 5.2–6.2 percentage points in high excess coverage countries, by *circa* 3 percentage points in an average country, and does not have any significant impact on low excess coverage countries. In comparison, a rise of one standard deviation in the output gap entails an approximately 1.3 percentage point decrease in unemployment, channelled by lower unemployment outflows.<sup>18</sup>

## 7. Robustness analysis

This section addresses endogeneity concerns and examines the robustness of the results to different econometric specifications. We account for unemployment sluggishness by considering longer time spans and persistence effects, we include other factors in the analysis such as demographic variables, public social spending, different wage bargaining systems or tax wedge variables, as well as different sorts of interactions between the tax wedge and policy variables.

<sup>18</sup> We also find that an increase in union density (admittedly more an institution than a policy variable) by 20 percentage points (one standard deviation) yields a 3.5 points increase in unemployment, mostly channelled by inflows. Stronger employment protection has a positive and significant impact on unemployment, although the flow contributions are not significant. Blanchard and Wolfers (2000) similarly find significant effects of union density and employment protection on unemployment. In addition, we find that raising PES and employment incentives by one standard deviation has a significant pay-off as unemployment decreases by 1.2–1.5 points, equally split between a decline in inflows and a boost of outflows. As argued above, we are cautious with any finding pertaining to ALMPs.

**Table 6**  
Unemployment turnover with instrumented policy and institutional variables 1985–2007.

Lagged variables as instruments	1 year			3 years			5 years		
	log <i>u</i>	log <i>s</i>	log <i>f</i>	log <i>u</i>	log <i>s</i>	log <i>f</i>	log <i>u</i>	log <i>s</i>	log <i>f</i>
Dependent variable	IV	SURE/IV		IV	SURE/IV		IV	SURE/IV	
Procedure	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
<b>Tax wedge and coverage extension</b>									
Tax wedge	0.042*** (0.006)	-0.006 (0.007)	-0.051*** (0.007)	0.055*** (0.011)	-0.023* (0.013)	-0.074*** (0.014)	0.092*** (0.019)	-0.011 (0.020)	-0.101*** (0.023)
Tax wedge × coverage extension	0.189*** (0.024)	0.011 (0.033)	-0.193*** (0.034)	0.252*** (0.049)	-0.016 (0.065)	-0.254*** (0.069)	0.317** (0.135)	-0.193 (0.139)	-0.429*** (0.165)
Coverage extension	0.020 (0.209)	-0.093 (0.275)	-0.297 (0.276)	-0.070 (0.353)	0.548 (0.432)	0.326 (0.465)	-0.205 (0.939)	1.620* (0.924)	1.828* (1.099)
<b>Output gap</b>	-0.074*** (0.005)	-0.009 (0.008)	0.081*** (0.008)	-0.080*** (0.007)	-0.013 (0.008)	0.082*** (0.009)	-0.091*** (0.008)	-0.015* (0.009)	0.092*** (0.011)
Other policies and institutions	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R <sup>2</sup>	0.95	0.92	0.95	0.92	0.92	0.94	0.9	0.93	0.94
N	300	300	300	270	270	270	241	241	241

Note: Robust standard errors in IV regressions. The excess coverage interacted with the tax wedge is centred and time constant.

### 7.1. Endogeneity

While the SURE methodology controls for the fact that inflow and outflow rates are simultaneously determined, it does not address the possible endogeneity of policy and institutional variables, including the tax wedge. For instance, reverse causality may undermine the causal interpretation of the estimates discussed so far if changes in policies arise in reaction to variations in unemployment. In particular, high unemployment may trigger reductions in the tax wedge, which would create a downward bias on the OLS estimate of the tax wedge's effect.

To address this potential problem, we instrument policy and institutional variables by their lags, using 1, 3 and 5 years lags respectively. In statistical terms, we assume that policies are *weakly exogenous* variables, namely that their current level is potentially correlated with the current error terms of the unemployment rate and turnover equations, but not with the lags of the error term. The same assumption is routinely used in GMM estimation (see discussion below). As before, we do not report the estimates pertaining to policies other than the tax wedge and coverage extension, although we continue to control for them.

As shown in Table 6, the tax wedge and its interaction with coverage extension is statistically significant across econometric specifications. Hence, the tax-coverage extension interaction effect that we have identified does not appear to be driven by reverse causality. On the contrary, the IV estimates of the tax wedge and of its interaction with coverage extension are always larger than the OLS coefficients, which suggests that reverse causality going from high unemployment to a lower tax wedge reduction reduces, rather than inflates, the magnitude of the tax wedge's effect.

### 7.2. Unemployment persistence

Another potential concern arises from the annual frequency of observations we considered so far. The effect described above has been identified on the basis of tax and unemployment annual changes. However, it is well known that unemployment variables display some sluggishness and adjust slowly over time. Hence, the effect of labour market policy reforms may be better identified by considering longer time spans.

Table 7 considers a 3-year time span on Columns (1)–(3) and a 5-year time span on Columns (4)–(6). Our main result is largely unchanged when using long-distant changes in the tax wedge and unemployment variables, as the tax wedge and the coverage extension interaction are still highly significant in unemployment rate and outflow regressions. This result contrasts with other labour market policies, which often display inconsistent estimates.

Another way of addressing unemployment persistence is to make use of dynamic panel model that includes a lagged dependent variable. As well-known, the use of a “dynamic fixed effects estimator” yields biased estimates in short panels, and more precisely an underestimation of the autocorrelation coefficient. Other econometric techniques have been proposed to deal with this problem, in particular the Arellano and Bond (1991) and Blundell-Bond (1998) GMM estimators. The use of such estimators is problematic within a database of 15 countries, as GMM are typically designed for “large N, small T” panels. In particular, Roodman (2009) advises to use fewer instruments than the number of countries to avoid upward bias in the Hansen test of instruments' joint exogeneity, a condition that cannot be met in our study. So we abstract from presenting GMM estimates that are plausibly inaccurate, and simply display dynamic fixed effects estimates on

**Table 7**  
Accounting for unemployment sluggishness 1985–2007.

Time frequency	3 years			5 years			1 year		
	log u	log s	log f	log u	log s	log f	log u	log s	log f
Dependent variable	OLS	SURE		OLS	SURE		OLS	SURE	
Procedure	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
<b>Lagged dependent variable</b>							0.617*** (0.029)	0.662*** (0.063)	0.539*** (0.051)
<b>Tax wedge and coverage extension</b>									
Tax wedge	0.032*** (0.007)	−0.009 (0.009)	−0.045*** (0.009)	0.038*** (0.009)	−0.016 (0.018)	−0.057*** (0.018)	0.015*** (0.003)	0.000 (0.007)	−0.020*** (0.007)
Tax wedge × coverage extension	0.179*** (0.036)	0.009 (0.041)	−0.192*** (0.040)	0.278*** (0.059)	0.102 (0.082)	−0.181** (0.080)	0.065*** (0.011)	−0.005 (0.020)	−0.091*** (0.022)
Coverage extension	0.129 (0.285)	0.101 (0.350)	−0.097 (0.339)	0.110 (0.338)	0.081 (0.627)	0.062 (0.610)	0.111 (0.092)	−0.010 (0.166)	−0.225 (0.181)
<b>Output gap</b>	−0.064*** (0.008)	−0.007 (0.012)	0.067*** (0.011)	−0.059*** (0.012)	−0.007 (0.023)	0.068*** (0.022)	−0.050*** (0.004)	0.001 (0.008)	0.057*** (0.008)
Other policies and institutions	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R <sup>2</sup>	0.96	0.93	0.96	0.97	0.95	0.97	0.98	0.95	0.97
N	108	108	108	67	67	67	313	313	313

Note: Robust standard errors in OLS regressions. The excess coverage interacted with the tax wedge is centred and time constant.

Columns (7)–(9). Indeed, [Judson and Owen \(1999\)](#) show that the bias is very small in panels with long T as is the case in the current application. Again, it turns out that the tax wedge and the coverage extension interaction are both highly significant, while, for instance, union density loses significance in the unemployment inflow equation.

### 7.3. Other explanatory variables

Finally, [Table 8](#) presents some regressions with additional control variables, such as country-specific time trends (Columns (1), (2), (4), (6)–(9)), higher educational attainment (Columns (3)–(9)), the shares of population aged 15–24 and 55–64 in population 15–64 (Columns (3)–(9)), public social spending in family and housing services as well as its interaction with the tax wedge (Columns (5) and (6)), a dummy for intermediate wage bargaining systems and its interaction with the tax wedge (Column (7)), union concentration at the industry level and its tax interaction (Columns (8) and (9))<sup>19</sup> as well as union density and its tax wedge interaction (Column (10)).

As before, the high significance of the tax wedge and its interaction with coverage extension is unchanged in all regressions. In contrast, additional explanatory variables do not offer much insight. Higher education and demographic variables do not display robust estimates across specifications, and the tax wedge interactions with social spending or wage bargaining settings other than coverage extension are not significant. Hence, our main result appears to be robust when controlling for other factors that have been shown to be important in previous research.<sup>20</sup>

Similarly, we test in [Table 9](#) whether the interaction of the tax wedge and coverage extension is robust to the use of a different measure for the tax wedge, and we do so over the 1965–2007 period. We use alternatively the amount of social security contributions paid by employers (excluding the self-employed) as a share of compensations paid to employees as a proxy for the payroll tax, as well as taxes drawn from personal income (see [Appendix B.2](#) for a decomposition of the tax wedge). Focusing on the 1965–2007 period, we find qualitatively identical results as in both cases the interaction between the specific tax measure and coverage extension appears to be positive and strongly significant.

<sup>19</sup> The inclusion of demographic variables is motivated by [Aaronson et al. \(2010\)](#) who find evidence of demographic effects on the job finding rate. Similarly, [Rogerson \(2007\)](#) argues that the labour market outcome of payroll taxes depends on the public provision for family-related services. The case for intermediate wage bargaining systems has been explained in [Section 5](#). Union concentration at the industry level touches upon an aspect that we have eluded in the theoretical and empirical sections: It is related to the degree of unions coordination and their capacity to represent the unionized sector in an efficient way.

<sup>20</sup> [Appendix E](#) controls for other types of interaction between the tax wedge and policy variables and similarly finds that our main result is qualitatively unchanged.

Table 8

Robustness analysis – the unemployment effect of the tax wedge and coverage extension 1985–2007.

Dependent variable	log u	log u	log u	log u	log u	log u	log u	log u	log u	log u
Procedure	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
<b>Tax wedge and coverage extension</b>										
Tax wedge	0.033*** (0.004)	0.035*** (0.004)	0.036*** (0.005)	0.034*** (0.005)	0.035*** (0.005)	0.025*** (0.005)	0.034*** (0.005)	0.023*** (0.006)	0.031*** (0.005)	0.031*** (0.004)
Tax wedge × coverage extension	0.089*** (0.016)	0.112*** (0.016)	0.150*** (0.019)	0.112*** (0.018)	0.129*** (0.019)	0.090*** (0.018)	0.110*** (0.018)	0.098*** (0.023)	0.130*** (0.019)	0.130*** (0.019)
Coverage extension		0.301 (0.218)	−0.268 (0.186)	0.371 (0.228)	−0.197 (0.196)	0.294 (0.248)	0.371 (0.228)		0.448* (0.247)	0.450* (0.237)
<b>Other policies and institutions</b>										
Initial gross replacement rate		−0.003 (0.003)	0.005** (0.002)	−0.003 (0.003)	0.006** (0.003)	−0.009** (0.004)	−0.003 (0.003)	−0.001 (0.004)	−0.001 (0.003)	−0.002 (0.003)
Average benefits duration		−0.675*** (0.186)	−0.476*** (0.161)	−0.699*** (0.192)	−0.409** (0.186)	−0.769*** (0.202)	−0.724*** (0.195)	−0.832*** (0.240)	−0.702*** (0.221)	−0.662*** (0.196)
EPL regular		−0.171** (0.071)	0.012 (0.047)	−0.174** (0.077)	−0.010 (0.050)	−0.260*** (0.082)	−0.175** (0.076)	−0.224*** (0.067)	−0.204** (0.081)	−0.189** (0.073)
PMR		0.067** (0.026)	−0.028 (0.020)	0.037 (0.033)	−0.029 (0.026)	0.063* (0.033)	0.032 (0.033)	0.111*** (0.034)	0.041 (0.037)	0.038 (0.033)
PES and administration normalized		−12.411*** (1.632)	−9.456*** (1.153)	−12.865*** (1.984)	−6.883*** (1.641)	−8.553*** (2.801)	−12.944*** (1.960)	−13.394*** (2.563)	−12.492*** (2.498)	−10.773*** (2.469)
Employment incentives normalized		−4.743 (3.022)	−5.829*** (1.247)	−5.424* (3.041)	−5.223*** (1.753)	−5.995* (3.515)	−5.042 (3.075)	−0.356 (3.459)	−4.173 (3.455)	−4.468 (3.089)
Training and other active measures		−0.272 (1.119)	1.367*** (0.451)	0.349 (1.171)	0.613 (0.492)	−0.666 (1.209)	0.035 (1.190)	−0.576 (1.540)	0.127 (1.437)	−0.333 (1.234)
Union density		3.549*** (0.516)	2.117*** (0.316)	3.546*** (0.528)	2.512*** (0.425)	3.982*** (0.591)	3.575*** (0.525)	2.344*** (0.703)	3.215*** (0.725)	3.572*** (0.533)
<b>Output gap</b>	−0.077*** (0.005)	−0.057*** (0.004)	−0.069*** (0.004)	−0.057*** (0.004)	−0.060*** (0.005)	−0.050*** (0.004)	−0.056*** (0.004)	−0.056*** (0.005)	−0.055*** (0.005)	−0.058*** (0.004)
<b>Additional explanatory variables</b>										
Mean years of tertiary schooling among population 15–64			−0.639*** (0.179)	−0.185 (0.337)	−0.791*** (0.248)	−0.524 (0.401)	−0.236 (0.337)	−0.439 (0.377)	−0.179 (0.378)	−0.214 (0.325)
Share of 15–24 in 15–64 population			2.582** (1.064)	1.772 (1.446)	3.054** (1.190)	−1.084 (1.497)	1.672 (1.434)	0.745 (1.621)	1.619 (1.618)	1.167 (1.510)
Share of 55–64 in 15–64 population			−0.679 (0.930)	−0.943 (0.947)	−0.556 (1.163)	−1.305 (1.189)	−0.971 (0.954)	0.239 (1.181)	−1.057 (1.112)	−1.385 (0.956)
Tax wedge × public spending in family and housing services					−0.005 (0.004)	−0.001 (0.004)				
Public spending in family and housing services					0.032 (0.034)	0.113*** (0.041)				
Tax wedge × intermediate wage bargaining systems							−0.004 (0.002)			
Intermediate wage bargaining systems							0.141* (0.085)			
Tax wedge × union concentration at industry level								0.180 (0.117)	0.129 (0.112)	
Union concentration at industry level								1.453** (0.635)	1.067* (0.600)	
Tax wedge × union density										0.044 (0.028)
Country-specific trends	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes
Time dummies	No	No	Yes	No	Yes	No	No	No	No	No
Country fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R <sup>2</sup>	0.94	0.96	0.95	0.96	0.96	0.97	0.96	0.96	0.97	0.96
N	315	315	315	315	257	257	315	293	293	315

Note: Robust standard errors in OLS regressions. The excess coverage interacted with the tax wedge is centred and time constant.

## 8. Conclusion

This paper re-examines the policy and institutional determinants of the unemployment rate. We show that the tax elasticity of the unemployment rate is augmented by the extension of collective wage bargaining agreements to non-unionized firms. Coverage extension may increase the collective wage and may also disproportionately hurt non-unionized firms when such firms are less productive than unionized firms. We find that the unemployment effect of coverage extension is driven by its impact on the unemployment outflow rate. Moreover, it is empirically large and robust to a wide range of econometric specifications.

**Table 9**

The unemployment effect of the tax wedge and coverage extension 1965–2007.

Dependent variable	Log unemployment rate									
	Social security contributions <sup>a</sup>					Tax rate on household income				
	Procedure									
Tax variable	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Tax variable	–0.010 (0.011)	–0.014 (0.009)	–0.015 (0.009)	–0.020** (0.010)	–0.018* (0.011)	0.009 (0.007)	0.005 (0.007)	0.004 (0.007)	0.001 (0.007)	0.003 (0.007)
Tax variable × coverage extension		0.104*** (0.018)	0.103*** (0.023)	0.114*** (0.025)	0.107*** (0.028)***		0.099*** (0.022)	0.098*** (0.023)	0.106*** (0.024)	0.102*** (0.023)
Coverage extension			0.023 (0.254)	0.111 (0.260)	0.081 (0.267)			0.076 (0.256)	0.116 (0.270)	0.069 (0.283)
Union density				0.872** (0.393)	0.993*** (0.370)				0.464 (0.311)	0.539* (0.314)
Tax wedge × union density					–0.015 (0.018)					–0.013 (0.017)
Output gap	–0.075*** (0.007)	–0.073*** (0.007)	–0.073*** (0.007)	–0.074*** (0.007)	–0.074*** (0.007)	–0.085*** (0.007)	–0.078*** (0.007)	–0.078*** (0.007)	–0.078*** (0.007)	–0.078*** (0.007)
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R <sup>2</sup>	0.84	0.85	0.85	0.86	0.86	0.87	0.87	0.87	0.87	0.87
N	484	484	484	484	484	484	484	484	484	484

Note: Robust standard errors in OLS regressions. The excess coverage interacted with the tax wedge is centred and time constant.

\*\*\* Denotes significance at a 1% confidence level.

\*\* Denotes significance at a 5% confidence level.

\* Denotes significance at a 10% confidence level.

<sup>a</sup> Excluding self-employed.

In terms of country-specific insights, the amplification of tax elasticity by the extension of collective wage agreements helps explaining why unemployment has been much higher in France and Spain than in most OECD countries over last decades. Those two countries display the highest levels of coverage extension among our data sample. Incidentally, the latter mechanism also provides an explanation to the economic puzzle posed by the co-existence of very low unemployment and very high taxes in Nordic countries. With high union density leading to virtually zero coverage extension, Nordic countries have maintained relatively low levels of aggregate real wage and labour cost, despite high taxes.

## Appendix A. Supplementary material

Supplementary data associated with this article can be found in the online version at: <http://dx.doi.org/10.1016/j.eurocorev.2014.06.010>.

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