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WHAT DO UNIONS DO AT THE LARGE SCALE? MACRO-ECONOMIC EVIDENCE FROM A PANEL OF OECD COUNTRIES

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This paper investigates the long-run relationship between trade unionism and productivity using a panel data set comprising of 18 OECD economies. Much of the existing evidence on this issue derives from micro-economic studies, with limited attention paid to long-run dynamics and economy-wide effects. Using the mean group and pooled mean group estimation techniques on cross-country panel data, the paper offers support to the "productivity-increasing face of unionism" hypothesis, revealing a positive relationship between trade union density and per worker output.

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Key words: Trade unions, productivity growth, panel data econometrics

I. Introduction

Research on the productivity effects of unionism over the last two decades has been lively, offering new insights to the theoretical and empirical relationship between these two labor market aggregates. Partly inspired by the controversial work of Freeman and Medoff (1979 and 1984), numerous empirical studies have examined the extent and direction of the union

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productivity effects, mainly for the cases of the UK and the USA (e.g., Clark, 1980 and 1984; Hirsch and Link, 1984; Addison and Hirsch, 1989; Nickell et al., 1992; Denny, 1997; Chezum and Garen, 1998). There is a rather widespread consensus in the literature about unionism having a negative impact on productivity and output, although a number of authors have estimated positive union productivity differentials (Brown and Medoff, 1978; Clark, 1980; Nickell et al., 1992).

It is standard in this literature to investigate productivity differentials between unionized vis-à-vis non-unionized firms using industry or firm level data. Consequently, there is little attention on the economy-wide and dynamic effects of unionism, while other sources of productivity differentials, like management strategies and production efficiency, are difficult to be accounted for and distinguished from the direct union effects.[1] There is comparatively little research on the issue using aggregate national data. Among the few studies, the OECD (1997) has found evidence of negligible effects of unionism and the structure of wage bargaining on productivity and productivity growth. Nickell and Layard (1998) have estimated a negative union effect on growth for a panel of OECD countries. A negative impact on output or productivity has also been found by earlier economy-wide studies (deFina, 1983; Lovell et al., 1988).

In this paper we investigate the economy-wide effects of unionism on productivity at an aggregate level, for a large panel of data. A long time-series (1960-1992) for 18 OECD countries allows us to investigate the short- and long-run dynamics of unionism within an economic growth framework, while controlling for country-specific effects. The source of the data is the Comparative Welfare States Data Set (Huber et al., 1997), which includes data from various sources.[2] In addition to traditional panel data techniques, we utilize relatively new econometric methods for the estimation of dynamic

[1] In a panel study such factors are partly controlled for technically, through the fixed effects (as factors like managerial strategies and efficiency differentials cannot be taken to have significant year-to-year variation). In addition to that, estimating productivity effects at the firm level (and, thus, almost certainly using value-added data) generates problems of endogeneity and identification, as it is difficult to distinguish between actual productivity effects and those artificially created due to the known impact that unions have on wages (see on that Addison and Hirsch, 1989).

[2] This dataset was collected by a project entitled “The Welfare State in Comparative Perspective: Determinants, Program Characteristics, and Outcomes,” with the financial

panel models. Having a set of 576 observations, we use an auto-regressive distributed lags (ARDL) specification to identify a common-across-countries long-run coefficient for the union productivity effects, while allowing different short-run dynamics for each country. Hence, our estimates are largely unbiased from any business cycle and country-specific effects. Apart from the relative novelty of the applied econometric methodology, our investigation of union productivity effects based on a large panel of data and controlling for short-run dynamics and country-specific effects is to our knowledge unique.

In the next section we make some theoretical considerations and derive an estimating model. Sections III and IV present the empirical results. In section III we apply traditional econometric techniques, while in section IV we briefly present and consequently apply the dynamic panel data methodologies. The final section summarizes the results and concludes.

II. A Model of Changes in Unionization Rates and Productivity Growth

Union productivity differentials can arise through a variety of mechanisms. At a firm-level, unionism can affect the organization and efficiency of production, the pace of technological innovation and capital accumulation, training and manning levels and so forth (Metcalf, 1988; Machin and Wadhwani, 1991a). At a wider level, it can impact upon average wages and wage inflation, with further effects on inflation, interest rates, investment and output growth, as well as on national comparative advantages and international trade (OECD, 1995).

support from the Center for Urban Affairs and Policy Research (now Institute for Policy Research) at Northwestern University in 1989-90, the National Science Foundation in 1990-92, and the support in 1992-97 by the Institute for Policy Research at Northwestern University and by the Institute for Research in the Social Sciences, the Department of Political Science, and the Morehead Alumni Chair held by Evelyne Huber, University of North Carolina. No follow-up study to update this dataset has been designed to date. The original data sources are: for employment, OECD Labour Force Statistics (various years); for union membership figures, Visser (1996); and for GDP and investment, Penn World Tables (Mark 5.6). The sample countries are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Netherlands, Norway, New Zealand, Sweden, Switzerland, UK and USA.

Theoretically, negative union productivity effects can be assumed if unions impose rigidities in the introduction of new technologies and working practices, or if they reduce investment (Pencavel, 1977; Addison and Hirsch, 1989; Machin and Wadhwani, 1991b). On the other hand, unions can increase workers' participation and involvement and, hence, production efficiency while, by putting upward pressures on labor costs, they can foster innovation and quality-based competition from the side of management (Booth and Chatterji, 1998). Traditionally, however, a more direct effect of unionism is assumed, as the latter can impact directly upon the productivity of the individual workers. In this case it is the marginal product of labor that differs between unionized vis-à-vis non-unionized workers. It must be noted, however, that in a production-function approach like the one employed here and despite their theoretical distance, all these mechanisms exhibit some practical equivalence, both in technical and empirical terms.

In building our model we follow Brown and Medoff (1978) assuming that both unionized and non-unionized labor has the same coefficient in the production function, with the coefficient for unionized labor being discounted by a factor ϕ which reflects productivity differences:

$$Y = A^t K^\alpha (L_n + \phi\, L_u)^\beta \qquad (1)$$

where the standard notation is used with the exception that L_u is unionized labor and L_n is non-unionized labor.[3] The coefficient ϕ can be greater or smaller than unity, implying higher or smaller productivity of unionized labor, respectively. By adding and subtracting L_u in (1) and further manipulating, we get:

$$Y = A^t K^\alpha \{L[1-(L_u / L)(\phi - 1)]\}^\beta \qquad (2)$$

or, taking logs and using $log(1+x) \approx x$,

$$(y-l) = ta + \alpha k + (\beta - 1)l + \gamma TUD \qquad (3)$$

[3] In this model, total factor productivity (TFP) is a function of time of the form $A(t)=A(0)e^{gt}$, where g is the growth rate of TFP.

where lower case letters denote logarithms, $\gamma = \beta(\phi -1)$ and $TUD = L_u/L$ is trade union density. Thus, productivity growth will be a function of changes in union density:

$$\Delta(y-l) = a + \alpha\Delta k + (\beta - 1)\Delta l + \gamma\Delta TUD \tag{4}$$

Equation (4) associates productivity growth with changes in trade union density. According to our theoretical model, this relationship derives directly from the level of efficiency of unionized labor (the coefficient ϕ, which can have any sign) and is thus not conditioned on either union strength or any scale effects (e.g., firm size or capital intensity). This is an important observation, especially concerning the interpretation of the results and their policy implications.

In our empirical analysis we proxy capital growth with the share of investment to GDP.[4] With this modification, (4) is our main estimating model, relating productivity growth to the share of investment to GDP, employment growth and changes in union density.[5] In the traditional panel estimation techniques (section III) the one- and two-way error component (de-meaned) and dummy variables (DVLS) transformations of this specification are used (see Baltagi, 1995, for a detailed exposition of these methods). In section IV we estimate the above specification using the Mean Group (MG) and Pooled Mean Group (PMG) estimators with a dynamic ECM equation that has (4) as a long-run solution.

The model specification and estimation methods help wipe out influences that are not of direct interest. More precisely, both the traditional and dynamic panel data specifications control for constant-over-time factors (like country-specific differences in managerial strategies), while the dynamic specification of (4) helps remove much of the influence of factors that exhibit temporal persistence (like country differences in production efficiency).

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[4] Data availability was the reason for using this approximation, since using the capital series available would shorten significantly the time-dimension of our sample and, hence, generate problems in the application of the MG and PMG estimations on the ARLD specification.

[5] We focus on the dynamic specification given in (4) because of the non-stationarity of the data. As we discuss in section IV, our series are all difference-stationary (I(1)).

III. Trade Unionism and Productivity

Our empirical investigation uses the production-function model developed above to measure the long-run relationship between union density and productivity. Before presenting our econometric analysis, it is useful to look at some stylized facts.

A. Stylized Facts

Country differences in unionization rates are quite remarkable, exhibiting a range of over 60% in the 1980s and 1990s. Such differences clearly reflect country differences in labor market institutions, historical traditions and cultural characteristics, attitudes towards specific aspects of work and so forth.[6] In our sample, unionization rates vary from 7% in France and 14% in the USA in 1992, to 88% in Switzerland and 81% in Finland in the same year.[7]

However, and although cross-country differences in unionization rates are very large, substantial within-countries temporal variations also exist and should not go unnoticed, as many countries have experienced significant trends in unionization rates. For example, unionization in the UK dropped from around 50% in the 1960s to just over a third in 1992. On the other hand, in Finland and Italy unionization rates more than doubled in the 32-year period of our sample, while significant and almost linear increases were experienced also in Denmark and Sweden. In some countries (France, Ireland, Holland, UK and USA) a structural break can be observed, possibly related

[6] We do not want to enter into a discussion of the determinants of unionization and union formation, as these constitute an almost separate body of literature. Specifically for a literature on the economic history of trade unions see Booth (1995) and references given there.

[7] It must be noted that for many countries union densities do not reflect the same conditions in labor relations. Thus, although French union densities are comparable to those of the USA, union coverage in France is as high as 80%, and thus France has a more rigid wage bargaining system. Although such factors should be kept in mind when considering the stylized facts, they do not influence the econometric analysis and are thus not reflected in the conclusions drawn.

to significant political and economic events (e.g., the oil shocks of the 1970s in the USA, or Thatcher governments in the UK).[8]

Thus, overall, a wealthy degree of variation in unionization rates exists in both dimensions of our sample. In the same manner, a significant cross-country and temporal variation is evident in the case of labor productivity, as there are notable country differences in both the timing of the business cycle and in their study-state productivity levels. However, an interesting trend seems to be noticeable regarding the productivity-unionization country-specific experiences. Among the nine of our sample countries that experienced an overall decline in union densities between the years 1962 and 1992, only two (Austria and France) did not have below-average rates of long-run productivity growth. In contrast, five out of the seven countries that experienced prolonged periods of union growth (Belgium, Denmark, Finland, Ireland, Italy, Japan and Sweden) also had above-average rates of productivity growth (annualized average growth rates over the 32-year period).

It is possible that temporal evolutions in productivity and union densities are interrelated due to the effect of external shocks, as is for example the oil shocks of the 1970s.[9] In such a case, spurious results could be obtained due to prima facie causality. Although our error correction panel data methodology helps avoid the problems related to the possible presence of deterministic shifts and persistent country differences, we examined the extent to which external shocks could be influencing our results by splitting our sample into three characteristic periods: the 1960s up to the oil shocks; the 1970s up to the start of the Reagan/Thatcher era; and the 1980s up to the collapse of the socialist states.[10]

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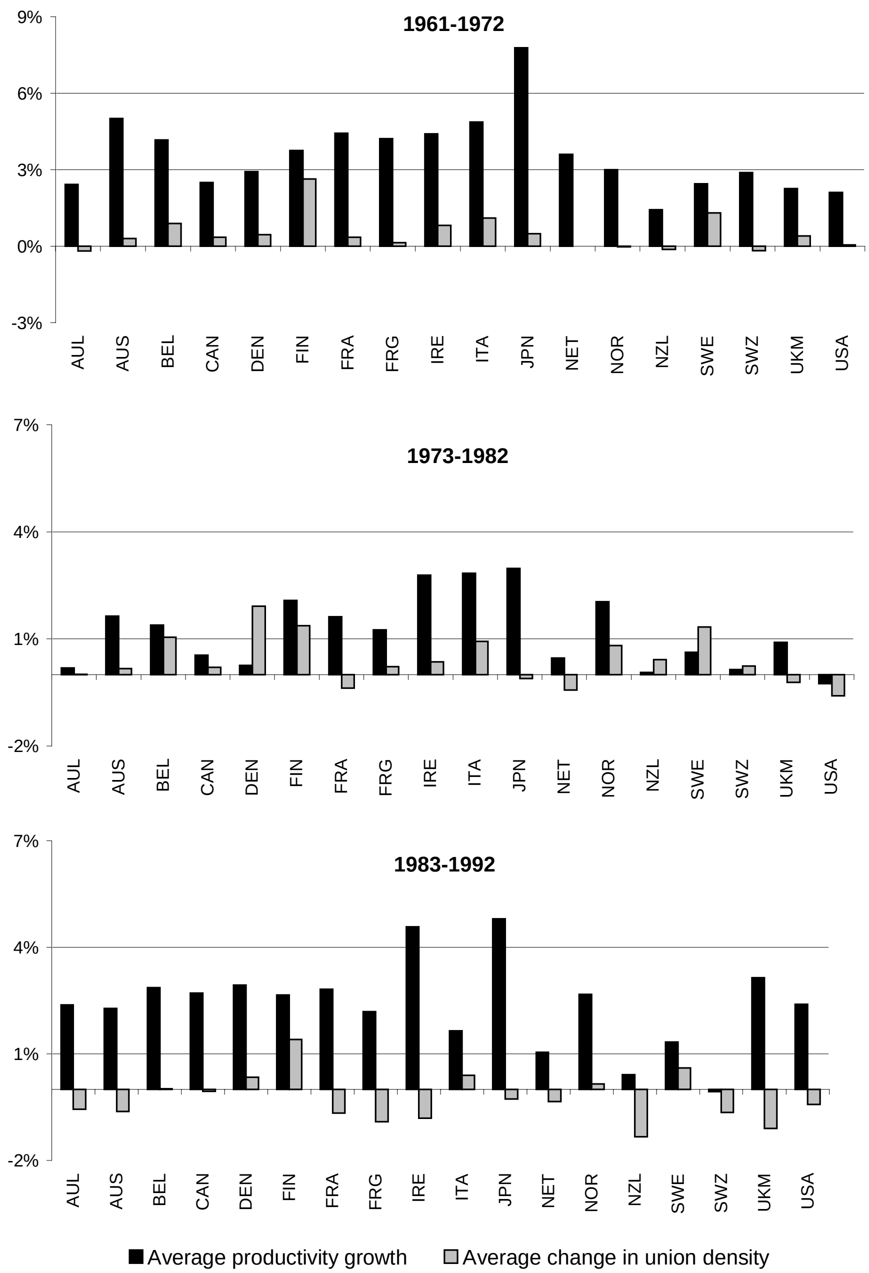
[8] These cross-country differences and within-country evolutions in unionization lead to a particularly low persistence figure (especially when considering that unionism is primarily a social phenomenon), with a Spearman rank correlation coefficient for our sample countries between 1962 and 1992 just above 60%.

[9] For example, that union densities declined after the productivity slowdown that followed the oil shocks. We are thankful to an anonymous referee for drawing our attention to this.

[10] As another robustness check of the stylized facts, a preliminary single-dimensional analysis (i.e., either cross-country or time-series regressions) was undertaken. Based on the model given in (4), we run one regression for each cross-sectional layer (year) and for each time-series layer (country) of our sample. The coefficients obtained for the unionization variable

Figure 1. Change in Union Density and Productivity Growth



In the three panels of Figure 1 we present the average change in union density and the average productivity growth across our sample countries for these three periods. As can be seen, there is significant cross-country variation in both productivity and union densities in all sub-periods under consideration. Moreover, the decline in productivity growth in the 1970s (middle panel) is not accompanied by an equally dramatic decline in union growth. In contrast, union growth declined much faster in the 1980s (bottom panel), when productivity growth was recovering in almost all our sample countries. Thus, it seems that the factors determining long-run shifts in productivity and union densities are not identical, especially as the latter are more directly influenced by shifts in the dominant political ideology.

B. Traditional Panel Data Analysis

Our traditional panel data analysis examined a range of alternative econometric specifications, allowing for fixed, random, country- and time-specific effects and using both one- and two-way error component specifications. The results are presented in Table 1. The union coefficient is significant in all cases with the exception of the time random effects model (second last column), which performs very poorly (implying that the time effects are fixed and not random). However, all specification tests show both time and country effects to be significant, thus suggesting a two-way error component model (last column).

This last model suggests that the net effect of unionism on productivity, controlling for time and country specific effects, has been positive in the three decades and for the 18 countries of our sample. The interpretation of the theoretical model in (4) suggests that unionized labor has -other things equal- been by around 19.2% (= 0.214/1.115) more productive than non-unionized labor.[11] The coefficients on the capital and labor variables have the

were quite stable in the cross-country regressions (over the years), but less so in the time-series regressions (among countries). Overall, the results obtained were rather poor, thus our interest to the panel dimension of our sample.

[11] We also experimented with a slightly simpler model, where the capital growth variable was dropped, in order to derive some estimates for the total union-productivity effect (i.e.,

Table 1. Pooled Regressions on Productivity Growth

Model	NE	CFE (1)	CFE (2)	TFE	CRE	TRE	(C/T)FE
Investment share	0.145*	0.171*	0.171*	0.127*	0.157*	0.135**	0.129*
Employment growth	0.149**	0.222*	0.222*	0.034	0.201*	-0.774***	0.115**
Change in union density	0.166***	0.191**	0.191**	0.168**	0.186**	-0.428	0.214*
Brausch-Pagan test	---	---	4.19*	---	59.17*	---	---
Hausman test	---	---	---	---	11.07**	---	---
F-test (year dummies)	---	---	---	7.14*	---	---	7.60*
F-test (country dummies)	---	4.28*	---	---	---	---	5.29*
F-test (y + c dummies)	---	---	---	---	---	---	7.13*
R-squared	0.08	0.18	0.08	0.35	0.08	0.00	0.44

Notes: *, **, and *** indicate significance at 1%, 5% and 10%, respectively. The Brausch-Pagan and Hausman tests are χ^2 tests for the significance of random effects (against no effects and fixed effects, respectively). The abbreviations in the head of the Table are as follows (estimation method in parenthesis): NE, pooled regressions with no controls for any effects (OLS); CFE (1), country fixed effects (DVLS); CFE (2), country fixed effects (GLS); TFE, time fixed effects (DVLS); CRE, country random effects (GLS); TRE, time random effects (GLS); and (C/T)FE, two-way error component model with both time and country fixed effects (DVLS). Instead of the B-P test, an F-test for zero variance of the random effects is used in the CFE (2) model.

expected signs and are significant. Moreover, the results are very stable across the different specifications. The results from the traditional analysis on the panel seem to suggest that unionism enhances labor productivity.[12]

IV. Robustness of the Empirical Findings

The positive relationship between unionism and productivity identified above requires further investigation, since the data used here have complex dynamics and are characterized by strong trends and non-stationarity. This relationship could be governed by country-specific long- or short-run dynamics, which the traditional pooled estimators cannot estimate. Therefore, these methods might not be appropriate in our case. New estimation techniques are now available in the literature, that allow such effects to be controlled for and measured.

A. The MG and PMG Estimation Methodology

It has become conventional to view long-run parameters as reflecting cointegrating relationships among a set of I(1) variables. The standard methodology in such cases first establishes the order of integration of the variables in question, and then - having established that the variables are of

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the effect operating through investment, in addition to the direct productivity effect). The two-way error component model in this specification returned a figure only slightly different (ϕ = 0.235/1.149 = 20%).

[12] On the other hand, the country-specific effects are always highly significant, suggesting large cross-country differences in productivity growth. It is interesting to investigate further these differences, in order to examine an alternative route via which unionism can impact on productivity. One plausible hypothesis is that unexplained productivity growth differentials might be due to differences in the strategies employed nationally by trade unions and in the structure of wage bargaining (centralization and co-ordination) in each country. To test for that, we examined the relationship between the estimated country fixed effects and some indicators of union co-ordination and centralization of wage bargaining, produced by the OECD (1997). Correlation analysis between these variables returned a statistically significant correlation coefficient of 0.34, suggesting that after controlling for cross-country differences in unionism and factor inputs, productivity growth is lower in countries with more rigid wage bargaining structures.

the same order of integration - tests whether there is at least one linear relationship among these variables.

Our analysis follows a different approach. This can be justified by two facts. First, there are only a few (and even fewer statistically satisfactory) tests of cointegration in a panel data context, while it is also well known that tests of order of integration in panel data do not reliably distinguish between series that contain a unit root and those that are stationary with a near-unit root. Second, long-run parameters may be consistently estimated using the traditional autoregressive-distributed lag (ARDL) approach (Pesaran and Shin, 1998). Moreover, as Pesaran, Shin and Smith (1999) have shown, this approach yields consistent and asymptotically normal estimates of the long-run coefficients irrespective of whether the underlying regressors are I(1) or I(0).[13] Further, it compares favorably in Monte Carlo experiments with conventional methods of cointegration analysis.

Therefore, our estimates were obtained using two recently developed methods for the statistical analysis of dynamic panel data: the Mean Group (MG) and the Pooled Mean Group (PMG) estimation. These methods are particularly suited to the analysis of panels with large time and cross-section dimensions. MG estimation derives the long-run parameters for the panel from an average of the long-run parameters from ARDL models for individual countries. For example, if the ARDL is the following

$$a_i(L)y_{it} = b_i(L)x_{it} + d_i z_{it} + e_{it} \tag{5}$$

for country $i = 1,\ldots,N$, then the long-run parameter for country i is

$$\theta_i = \frac{b_i(1)}{d_i(1)} \tag{6}$$

and the MG estimator for the whole panel will be given by

[13] In our analysis the GDP, Investment, Employment and Union Density variables are clearly trended for all countries and can be assumed to be I(1), hence become stationary after first differencing (productivity and employment growth, changes in union density) or taking their ratio (investment share).

$$\theta = \frac{1}{N}\sum_{i=1}^{N}\hat{\theta}_i \tag{7}$$

It can be shown that MG estimation with sufficiently high lag orders yields super-consistent estimators of the long-run parameters even when the regressors are I(1) (see Pesaran, Shin and Smith, 1999).

The PMG method of estimation, introduced by Pesaran, Shin and Smith (1999) occupies an intermediate position between the MG method, in which both the slopes and the intercepts are allowed to differ across country, and the standard fixed effects method, in which the slopes are fixed and the intercepts are allowed to vary. In PMG estimation, only the long-run coefficients are constrained to be the same across countries, while the short-run coefficients are allowed to vary.

Setting this out more precisely, the unrestricted specification for the ARDL system of equations for $t = 1,2,\ldots T$ time periods and $i = 1,2,\ldots N$ countries for the dependent variable y is

$$y_{it} = \sum_{j=1}^{m}\lambda_{ij}y_{i,t-j} + \sum_{j=0}^{n}\delta'_{ij}x_{i,t-j} + \mu_i + \varepsilon_{it} \tag{8}$$

where x_{ij} is the $(k\times1)$ vector of explanatory variables for group i and μ_i represents the fixed effects. In principle the panel can be unbalanced and m and n may vary across countries. This model can be re-parameterized as a VECM system

$$\Delta y_{it} = \theta_i(y_{i,t-1} - \beta'_i x_{i,t-1}) + \sum_{j=1}^{m-1}\gamma_{ij}\Delta y_{i,t-j} + \sum_{j=0}^{n-1}\gamma'_{ij}x_{i,t-j} + \mu_i + \varepsilon_{it} \tag{9}$$

where β_i s are the long-run parameters and θ_i s are the error correction parameters. The pooled group restriction is that the elements of β are common across countries, so that

$$\Delta y_{it} = \theta_i(y_{i,t-1} - \beta' x_{i,t-1}) + \sum_{j=1}^{m-1}\gamma_{ij}\Delta y_{i,t-j} + \sum_{j=0}^{n-1}\gamma'_{ij}x_{i,t-j} + \mu_i + \varepsilon_{it} \tag{10}$$

All the dynamics and the ECM terms are free to vary. Estimation of this model is by maximum likelihood. Again it is proved that under some regularity assumptions, the parameter estimates of this model are consistent and asymptotically normal for both stationary and non-stationary I(1) regressors. Both MG and PMG estimations require selecting the appropriate lag length for the individual country equations. This selection was made using the Schwarz Bayesian Criterion.

B. The MG and PMG Estimation Results

Initially we estimated the model given in (4) assuming that all of the long run coefficients are the same across countries. The estimation results from the MG and PMG methods are presented in Table 2. The PMG estimates provide further supportive evidence to our previous finding of a strong positive relationship between changes in unionization and productivity growth, while the MG results are in the same line but less strongly so. The investment share has the expected sign, which for the PMG model is highly significant. The growth of employment has again a positive estimated effect, but this is insignificant in the PMG estimation, with the implication that labor productivity is constant across different employment levels. Although the Hausman test for the poolability of this coefficient is rejected, for both the unionism variable and investment as a share of GDP the pooling restrictions cannot be rejected (the p-value is 0.32 for both cases). Moreover, the joint Hausman test suggests that the PMG results are more appropriate than the MG ones.

Overall, the results obtained from the ARDL specifications are highly consistent to the ones derived from the more traditional methods. The estimated effect of unionization changes on productivity growth suggests that the discount factor for unionized labor, ϕ, is equal to 1.21, or that unionized labor is 21% more productive than non-unionized labor. This result is very similar to the one obtained from the two-way error component model of Table 1. The estimated returns to capital are also very similar to the ones obtained earlier. Further, restricting the coefficient of unionism to be the same in all countries but removing this restriction for the other two coefficients does not affect significantly our main conclusions (Table 3). Again the unionism coefficient is positive and significant for the PMG estimates (which are again approved by the Hausman test for poolability), while now both coefficients for

Table 2. Pooled Mean Group and Mean Group Estimates (Restricted)

Model	PMG Estimates	MG Estimates	Hausman Test
Investment share	0.143 *	0.066	0.93
Employment growth	0.025	0.233 *	4.26 **
Change in union density	0.214 **	0.317 ***	1.02
Error correction coefficient	-0.999 *	-0.988 *	---
Joint Hausman test	---	---	5.33

Notes: *, **, and *** indicate significance at 1%, 5% and 10%, respectively. Short-run coefficients not reported for economy of space. The maximum number of time periods and countries are 32 and 18, respectively. SBC (Schwarz) has been used to select the lag orders for each group. All the long-run parameters have been restricted to be the same across groups. The mean group estimates have been used as initial estimate(s) of the long-run parameter(s) for the pooled maximum likelihood estimation.

investment share and employment growth become insignificant. Alternative estimates -not reported here for economy of space- restricting subsets of the long-run coefficients gave similar results to those initially obtained.[14] The employment growth coefficient verifies the constant returns to scale long run effect of employment on labor productivity, which was not captured in the traditional estimation methods that did not control for the short-run dynamics. For capital growth, the insignificant result strengthens our earlier conclusion about the poolability of this coefficient. Further, this time the union productivity effect is again equal to 19%.

It need to be noted here that our results were very stable also across different subsets of our sample, which we investigated in order to control for country differences in the regulatory framework of unionism and for a possible structural break in the relationship under investigation around the 1970s. In particular, we re-run equation (4) for the following sub-samples. First, we excluded France and Italy (two countries with a large disparity between union density and union coverage) in order to assure that our results are not sensitive

[14] Tables and results are available from authors upon request.

Table 3. Pooled Mean Group and Mean Group Estimates (Unrestricted)

Model	PMG Estimates	MG Estimates	Hausman Test
	Unrestricted long-run coefficients		
Investment share	0.056	0.057	---
Employment growth	0.132	0.248 **	---
Restricted coefficient (long-run coefficient same across countries)			
Change in union density	0.214 *	0.417 **	0.71
Error correction coefficient	-0.999 *	-0.988 *	---

Notes: * and ** indicate significance at 1% and 5% respectively. Short-run coefficients not reported for economy of space. The maximum number of time periods and countries are 32 and 18, respectively. SBC (Schwarz) has been used to select the lag orders for each group. The mean group estimates have been used as initial estimate(s) of the long-run parameter(s) for the pooled maximum likelihood estimation.

to such disparities. The union effect remained statistically significant, increasing only slightly, to 19.7%. Second, we split our sample into two groups (one including Central European and Scandinavian countries and one including all the rest), to examine the impact of country differences in union co-ordination regimes. The results were again very stable, with the union effect at 22.0% (albeit marginally insignificant) in the Scandinavian sub-sample and at 18.8% in the remaining group. Finally, despite the restrictions induced by the estimating method, we also split the sample into two sub-periods (overlapping 1961-1979 and 1975-1992). Again the results were very stable, with a union effect of 14.1% in the 1970s and of 17.2% (albeit marginally insignificant) in the 1980s.

Admittedly, productivity differentials of magnitude close to 20% are at the margin of plausibility if one assumes that the union productivity effects are solely activated through workers' performance (Brown and Medoff, 1978). Hence, an explanation suggesting that union productivity effects are activated through a number of plausible mediating factors (production efficiency, capacity utilization and the extent of labor hoarding being but a few) cannot be ruled out. More significantly, one cannot rule out the possibility that part of the estimated effect is due to union-imposed wage increases, as institutionally set wages can have a spurious effect on the estimation of the marginal product of labor in a production-function approach. However, it must be noted that the empirical literature suggests union/non-union wage differentials in the area of 10% (Blanchflower, 1984; Wilson and Cable, 1991; Blackaby et al., 1999), half of our estimated union productivity effect.[15] In any case, the overall productivity effect of unionism is robustly found to have been significantly non-negative in the three decades and for the 18 countries of our sample.

V. Conclusions

The productivity effect of unionism is an issue extensively studied, especially at the micro-level, using firm and industry data. Despite the theoretical controversy on the issue, most micro-economic studies have provided evidence of a negative productivity effect of unionism, although exceptions do exist. Time-series analysis on the issue is rather scarce, with the implication that the dynamics of the relationship at question have been relatively overlooked. This is not a minor problem, as it is possible for the union effects to be significantly different at different economic levels, in the sense that what holds for an individual firm might not be true for the economy as a whole, especially if there are dynamics operating at scales wider than the firm or the industry (e.g., multiplier effects and agglomeration economies). Additionally, most of the empirical evidence is based on Anglo-Saxon data, with few international (cross-country) studies.

Attempting to partially fill this gap, in this paper we examined the long- and short-run relationship between unionism and productivity using a panel of 18 OECD countries over a 32-year period. Our empirical investigation

[15] Another possibility for spurious results is if unionized workers have more human capital, a factor not controlled for in the empirical analysis. Although there is little evidence in either direction regarding this possibility, tentatively one has to assume that unionized labor is at least not more human-capital-abundant than non-unionized labor. Empirical evidence suggests that returns to human capital are higher in non-unionized environments, which could imply a direct motivation for high-skill workers not to unionize, or a disincentive for unionized workers to invest in skills acquisition (Battu et al., 2002).

was based on a standard theoretical model, which at the individual level identifies unionized workers as a separate factor of production and thus at the aggregate level it associates union density with productivity through the difference in the marginal product of unionized and non-unionized labor. Our results provide robust evidence of a positive impact of union status on individual workers' productivity and thus of union density on aggregate labor productivity.

Preliminary time-series and cross-country analyses revealed that the relationship under investigation has been different among countries and over time. Controlling for possible time and country-specific effects, the panel data analyses allowed the estimation of a common across countries long-run coefficient. The good performance of our regressions and the stability of our results, we interpret as evidence in support of the appropriateness of the econometric approach employed. Both the long- and short-run effects are positive and statistically significant (and they remain so across a number of alternative specifications and for different subsets of our two-dimensional sample), although we also show that residual productivity growth might be adversely affected by centralized wage bargaining structures.[16]

The disparity between the macroeconomic results presented here and the findings obtained from microeconomic studies elsewhere in the literature forces us to conclude that the economy-wide effects of unionism are structurally different to its firm-level effects. Further research along the lines of this paper would undoubtedly be useful in providing additional evidence on this, as such an assumption has significant implications for labor market and national economic policies.

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[16] Similarly to our analysis of the country fixed-effects, we also performed a correlation analysis of the impact of the wage bargaining structure on the short-run dynamics obtained here. This analysis returned a significant correlation coefficient of -0.45, which implied that in countries with more rigid wage bargaining structures unionism had a further positive short-run effect.

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