Workshop on
"Changes in Labor Market Dynamics"

JORDI GALÍ and THIJS VAN RENS, organizers
CREI, Mercè Rodoreda Bldg., c/ Wellington Ramon Turró, room 23.S05
Ciutadella Campus, Pompeu Fabra University (UPF) | Barcelona (Spain)

5-6 November, 2010

Do Labor Market Institutions Matter for Business Cycles? Yes They Do

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The organization of the conference has received funding from the European Research Council under the European Union's Seventh Framework Programme (FP7/2007-2013) / ERC grant agreement nº 229650

Do labor market rigidities matter for business cycles? An Empirical Assessment Incomplete

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November 2, 2010

Abstract

We study whether labor market institutions affect the volatility and correlations of macroeconomic variables for a sample of 20 OECD countries. Labor market rigidities are characterized with a number of indicators; volatilities and correlations are computed in several ways. Union coverage and replacement ratios in the first year of unemployment are the labor market rigidities that most significantly affect business cycle statistics. Active labor market policies are effective in reducing unemployment volatility in countries with heavily regulated labor markets.

JEL classification numbers: E32, E6, J01, J08

Key words: Labor market institutions, Business cycles, OECD countries, rank sum test, active labor market policies

*We would like to thank Alessia Campolmi, Fabio Canova, Jordi Gali, Christian Hefke, Thijs Van Rens and participants of the 6th ECB/CEPR Labour Market Workshop: European Labour Market Adjustment for useful comments and suggestions. The financial support from the Spanish Ministry of Science and Innovation through grant ECO2009-09847, the Generalitat of Catalonia through grant SGR2009-00350, and the Barcelona Graduate School Research Network are greatfully aknowledged.Mailing address: Universitat Autonoma de Barcelona, Departament d'Economia i d'Historia Economica, Edifici-B, Campus de la UAB, 08193 Bellaterra, Barcelona, SPAIN, email: evi.pappa@uab.es, stefano.gnocchi@uab.es

1 Introduction

This paper studies how labor market institutions affect the macroeconomy using data from 20 OECD countries. We look at the volatility and the cross-correlations of the main macroeconomic variables and we investigate whether and how labor market institutions shape those business cycle statistics. We find that institutions do matter.

A rapidly growing strand of theoretical literature attributes a crucial role to labor market institutions in explaining the behavior of macro variables over the cycle. Business Cycle models have been recently augmented with labor market frictions in order to match important empirical facts. Two broad categories of rigidities have been considered: on the one hand, frictions limiting flows in and out of unemployment, such as hiring costs, labor hoarding and matching technology, employment protection legislation, wage bargaining institutions, unemployment benefits and tax wedges; on the other hand, rigidities preventing the adjustment of real wages to economic fluctuations. Many economists have argued that institutional rigidities affect the short run movements of macro variables in response to macroeconomic shocks, because of imperfect adjustments of employment and the real wage[1]. Yet the empirical literature on the topic is rather scant. Very few Business Cycle models relate labor market institutions indicators, structural parameters and the volatility of macro variables[2]. Our study intends to cover this gap.

We use the CEP-OECD Institutions Data Set (Nickell (2006)) to construct labor market institutions indicators for the OECD countries in our sample. The data covers a sufficiently long span of time to include both expansionary and recessionary periods. We have information about employment protection legislation, union density, union coverage, coordination and centralization of the wage bargaining process, replacement rates, employment benefit duration and tax wedges. These are the usual suspects for institutional rigidities set out in Oswald´s (1997) quote: benefits, trade union power, taxes and wage "inflexibility." We divide the countries into two groups, "strictly" versus "loosely" regulated, according to their position relative to the mean (or the median) of the various labor market indices and non-parametrically test whether the two samples of observations have similar distributional features. We control for a number of variables that could potentially

[1] Among them, a sample includes Walsh (2005), Trigari (2006), Campolmi and Faia (2006), Krause and Lubik (2007), Blanchard and Gali (forthcoming), Thomas (2008) and Gali and van Rens (2008).

[2] With a focus on inflation volatility, Tomas and Zanetti (2008) and Krause, Lopez-Salido and Lubik (2008) structurally estimate a NK model with labor market matching frictions for the Euro Area and the Unites States, respectively and find that hiring and firing costs are not quantitatively relevant for inflation dynamics. Christoffel, Kuester and Linzert (2006) structurally estimate a NK model with labor market frictions and real wage rigidities with German data and provide evidence that both efficiency in the matching process and real wage rigidity matter.

affect business cycle statistics other than labor market institutions, such as the size of the government, the degree of openness of the economies, the monetary policy stance and the exchange rate regime. We also study whether the "Great Moderation" episode changes the relationship between business cycle statistics and labor market institutions by splitting the sample at the beginning of the 1980s.

We find that business cycle statistics are affected by the degree of labor market regulations. Differences in volatilities and correlations of macro variables at business cycle frequencies between loosely and strictly regulated labor markets are statistically significant and, often, economically important. Our results hold regardless of how we define "loose" or "strict", or the way we construct business cycle statistics and, to a large extent, the sample we consider. We conclude that the emphasis the theoretical literature is placing on the role of labor market institutions seems to be supported by the data.

Union coverage and replacement rates are the labor market indices that affect most business cycle statistics. In countries where the number of workers covered by collective agreements is relatively higher, the volatility of the real wage is significantly lower, while the volatility of unemployment is significantly higher. Union coverage also affects the structure of economic relationships. In fact, the correlation of employment with labor productivity is negative and further decreases in countries where the fraction of contracts negotiated through collective wage bargaining is higher than average, while the correlation of output with inflation, which is negative on average, decreases when the degree of union coverage increases.

High replacement ratios make employment more volatile and increase the correlation of the real wage with labor productivity. In addition, countries with generous benefits display lower negative correlation of the labor input with labor productivity. This outcome may be regarded as coherent with the greater real wage flexibility that high replacement ratios may imply. Interestingly, employment protection and unemployment benefits´ duration are the labor market indicators which least impact on macroeconomic performance. Employment protection only reduces the correlation of employment with labor productivity while duration appears to have no significant cyclical effects.

We also perform an analysis which allows for interactions between labor market institutions so as to investigate marginal and joint effects of institutions. Most of our baseline results hold. However, keeping constant other institutions, the marginal effect of coverage is to dampen unemployment fluctuations. That is, the data suggest that unions may play a role that is usually attributed to employment protection. In addition, employment protection significantly affects business cycle

fluctuations when interacted with other institutions, such as union coverage and replacement rates.

We find that active labor market policies make little difference for the volatility of macro variables for the full sample of countries. However, we document that conditional on labor market rigidities, active policies are effective in countries characterized by relatively strict labor market institutions. Thus, the assessment of labor market policies cannot abstract from institutions.

Many empirical studies[3] built on the seminal papers by Layard, Nickell and Jackman (1991) and Nickell and Layard (1999) on institutions and labor market performance study the effect of institutions and their interaction with shocks on unemployment. However, none of them systematically investigates the impact of institutions on business cycles. Exceptions are Nunziata (2003), who studies the effect of labor market institutions on cyclical adjustment of employment and hours worked, Nunziata and Bowdler (2005), who analyze the effects of institutions on inflation dynamics, Fonseca et al. (2007) who look at how international comovements relate to institutions. Our contribution is mostly related to a recent paper by Rumler and Scharler (2009) who use fixed-effect panel regressions for a sample of 20 OECD countries to assess the importance of institutions for the variability of the output gap and inflation. Our results are not comparable though due to the different econometric methodology employed for their derivation.

The rest of the paper is organized as follows. The next section presents the indicators capturing labor market institutions and describes how they are constructed. Section 3 presents the data and highlights some methodological issues. Section 4 presents the results. Section 5 investigates the role of active labor market policies and section 6 concludes.

2 Characterizing labor market rigidities

We rank countries looking at 9 indicators capturing different aspects of labor market rigidities. They are: (i) EPL, the strictness of employment protection legislation; (ii) RR_S, the replacement rate, defined as the ratio of disposable income when unemployed to expected disposable income, if beginning to work during the first year of unemployment; (iii) RR_L, the replacement rate averaged across the first five years of unemployment; (iv) DU, the duration of unemployment benefits; (v) UD, union density, measured as the percentage of workers affiliated to a union; (vi) UC, union coverage, measured as the percentage of contracts negotiated by unions, (vii) COOD, the degree of coordination in the bargaining process, both on workers' and firms' side; (viii) CEN, the degree

[3] See for instance Blanchard and Wolfers (2000), Nickell, Nunziata and Ochel (2005) and Costain and Reiter (2008).

of bargaining centralization; (ix) TAX, the tax wedge. Centralization refers to the predominant level where bargaining takes place (e.g. firm level, industry level and nation wide). Coordination, as defined by Kenworthy (2001), refers to the degree to which minor bargaining units follow along with major players' decisions, where major players may include union confederations (Norway, Netherlands and Italy), leading unions and its employer counterpart (such as IG Metall in Germany) and confederations of large firms (as in Japan). Indices of coordination take into account the presence of coordinating activity by the major players. Examples of those activities, in addition to confederations of firms and of unions, are state-sponsored or state-imposed coordination.

We have chosen those indices since they approximate well for rigidities that can affect both labor market and real wage adjustments. Employment protection, replacement rates and benefit duration are typically regarded as important determinants of the incentives driving job creation and job destruction and, as a consequence, of labor market adjustments. Density, coverage, coordination and centralization affect the power of unions and their importance in wage adjustment. Tax wedges may also have an impact on the responsiveness of the real wage to changes in macroeconomic conditions.

We group countries into two groups according to the tightness of the indices. The time series for the indicators run from 1960 to 2004. However, we restrict our analysis according to the starting periods of the macroeconomic series for the countries we consider. The average value of the index is assigned to each country and grouping is performed according to the country's position relative to the cross-country mean (and/or the median). Since the temporal coverage of these data differs across series and countries and there are more than one series for some indicators, grouping countries according to their position relative to the mean results in a robust classification. Also, the absence of considerable time variations in the indicators' series rationalizes our choice of using the mean value, rather than trying to take advantage of the time series dimension of the indicators.

The indicators we use come from the CEP-OECD Institutions Data Set (see Nickell (2006)). For employment protection legislation we use the series constructed by the OECD. Replacement ratios are from the OECD and we have one observation every two years for each country. For both replacement rates series, RR_S and RR_L, the data are averaged over three family situations and two earnings levels and the benefits are measured as a percentage of average before tax earnings. Duration is an index capturing the level of benefits available in the later years of unemployment spells, relatively to the first year. Our rankings of union coverage coincide for the two available indices, the one produced by the OECD and the one of Ochel (2001). Tax wedges are constructed

as the sum of employment, direct and indirect tax rates.

Table 1 summarizes the information we have available. A score of 1 is given to countries with an index higher than the cross-country average and 0 to countries with index below the cross-sectional average. In general, the nine indicators have a great deal of overlap. For example, countries with high degree of coordination in the bargaining process also have a high degree of centralization (the exception is Japan). Also, the degree of coordination is related to the percentage of union covered employment: the two indicators differ only for Italy, Ireland and Japan. The US features the most unrestricted labor market; it is classified as "loose" along all the dimensions we consider. On the other hand, Finland and Norway are always ranked as "strict", independently of the index used. All European countries are highly rigid, with the exception of Switzerland, Ireland and the UK.

Table 1: Labor market Characteristics of OECD countries

COUNTRY	EPL	RR_S	RR_L	DU	UD	UC	COOD	CEN	TAX
Australia	0	0	0	1	1	1	1	1	0
Austria	1	0	1	1	1	1	1	1	1
Belgium	1	0	1	1	1	1	1	1	1
Canada	0	1	0	0	0	0	0	0	0
Denmark	0	1	1	1	1	1	1	0	1
Finland	1	1	1	1	1	1	1	1	1
France	1	1	1	0	0	1	0	0	1
Germany	1	0	0	1	0	1	1	1	1
Ireland	0	0	1	1	0	0	1	1	0
Italy	1	0	0	0	0	1	0	0	1
Japan	0	0	0	0	0	0	1	0	0
Netherlands	1	1	1	1	0	1	1	1	1
Norway	1	1	1	1	1	1	1	1	1
New Zealand	0	0	0	1	0	0	0	0	0
Portugal	1	1	0	0	0	1	1	1	0
Spain	1	1	1	0	0	1	1	1	0
Sweden	1	1	0	0	1	1	0	1	1
Switzerland	0	1	0	0	0	1	1	0	0
UK	0	0	0	1	1	0	0	0	0
US	0	0	0	0	0	0	0	0	0

3 The macroeconomic data and the methodology

We use quarterly data in the exercise. The source is the OECD and the International Financial Statistics (IFS) of the IMF. The sample mostly covers the period 1971:1-2009:4. The maximum time period covered for our twenty OECD countries is: Australia (1971:1-2009:4), Austria (1971:1-2009:4), Belgium (1981:1-2009:4), Canada (1971:1-2009:4), Denmark (1978:1-2009:4), Fin-

land (1971:1-2009:4), France (1971:1-2009:4), Germany (1971:1-2009:4), Ireland (1973:1-2009:4), Italy (1972:1-2009:4), Japan (1971:1-2009:4), Netherlands (1978:1-2009:4), New Zealand (1971:1-2009:4), Norway (1976:1-2009:4), Portugal (1971:1-2009:4)[4], Spain (1975:1-2009:4), Sweden (1981:1-2009:4), Switzerland (1971:1-2009:4), United Kingdom (1971:1-2009:4) and the United States (1971:1-2009:4). We use series for gross domestic product (GDP) measured in constant 2000 prices. Employment measures total full and part time employment in thousands, while the unemployment rate measures average yearly rates. For real wages we use both the series on the relative unit labor costs adjusted for the real exchange rate, or series for hourly earnings divided by the GDP deflator, or the CPI index. Labor productivity is computed as the ratio between output and total employment and the GDP deflator is used to construct the inflation series.

We measure volatilities and correlations in a number of ways. In the business cycle literature, it is common to filter out long and short frequencies fluctuations and concentrate on fluctuations which, on average, last between 2 to 6 years. In cross country studies, however, one has to worry about the fact that cycles may have different length in different units, or that trends may not be common. For that reason, in cross sectional comparisons, it is more typical to compute statistics using growth rates of the variables, or scaling variables by appropriate averages. As a benchmark, we compute statistics obtained by forth differencing the log of the raw data. We check the robustness of our conclusions by using three alternative ways of eliminating trends: Hodrick-Prescott filtering, Band pass (BP) filtering and VAR filtering.

In a study like ours, besides spurious trend effects, one should also worry about the presence of measurement error. As long as this error is uncorrelated with labor market rigidities, no systematic bias should be present. However, measurement error may artificially increase the volatility of macro variables and reduce the power of our tests. While there is little in principle one can do to take care of this problem, comparing alternative detrending procedures should help to quantify the importance of measurement error. In fact, while HP or BP filtering are likely to leave the importance of high frequency measurement errors unchanged, taking growth rates magnifies its importance. Hence, considering a number of filtering methods should help us to assess the robustness of our conclusions.

We analyze the relevance of labor market institutions for the business cycle characteristics by testing differences in the average moments of filtered data in strictly versus loosely regulated countries, for each of the indicators we consider. To detect differences, we use the Mann–Whitney

[4]We were unable to collect time series for wages in Portugal and in Switzerland.

U-test, a nonparametric rank sum test. A non-parametric methodology has several advantages.

First, while the t-test is the standard method for testing the difference between population means in two non-paired samples, it is not valid for populations that are non-normal, particularly for small samples. Our test can be applied when distributional assumptions are suspect. When the cross section is large our test is equivalent to an F-test used to assess the significance of the β coefficient in the regression $x_i = \alpha + \beta D_i + e_i$, where x_i are estimated business cycle moments and D_i one of our labor market indicators, once standard errors are adjusted to take into account the fact that x_i are estimated. In addition, the test examines the entire cross sectional distribution instead of its first moments only. Thus, it provides a more reliable picture of the statistical significance of the differences. Second, our non-parametric approach does not suffer from error-in-variable problems which make standard regression analysis unreliable. In fact, failing to correct for the fact that business cycle moments are estimated may give a biased view of the importance of the restrictions and artificially produce significant effects even when the "true" ones are negligible. Finally, the U-test is a small sample test. This is particularly important, since for some classifications we have groups with very few countries and small sample biases may be severe. With our approach, such biases are of no concern, as critical values of the test have been tabulated for groups with as little as three units (see e.g. Hoel (1993)).

4 The results

In this section we examine whether basic business cycle statistics are affected by the presence of labor market institutions. We summarize cyclical information with 16 measures, 8 volatilities and 8 correlations: the volatility of the annual growth rate of real GDP, Y, real GDP per capita, y, employment, N, employment per capita, n, real wages, w, labor productivity, y/n, annual unemployment and inflation rates, u and π; the correlations of GDP (and GDP per capita) with employment, inflation and labor productivity and the correlations of employment (and employment per capita) and the real wage with labor productivity.

Table 2 reports the p-values of the nonparametric rank sum test. Since we have nine indicators capturing labor market restrictions, different columns report the results obtained with different classifications [5]. In boldface are the p-values smaller than 0.05.

Certain institutional restrictions in the labor market matter for business cycle fluctuations in

[5] Results obtained when ranking countries according to their position relative to the cross-sectional median rather the mean are identical.

output, employment and the real wage, for example, the short run replacement ratios and union coverage. However, other indicators such as union density, employment protection and the duration of unemployment benefits seem to make very little difference for business cycle statistics. Overall, volatilities are typically insignificantly different across all groups, except when countries are grouped using the short run replacement ratio, union coverage and coordination. Correlations differ more often across groups and the correlation which looks most unstable is the one between employment and labor productivity.

Table 2: Business Cycle statistics, forth differences

Index	EPL	RR_S	RR_L	DU	UD	UC	COOD	CEN	TAX
Var(Y)	0.15	0.10	0.59	0.82	0.64	0.94	0.13	0.70	0.88
Var(y)	0.82	**0.01**	0.32	0.98	0.08	0.48	0.11	0.32	0.94
Var(N)	0.08	0.20	0.70	0.94	0.22	0.87	0.69	0.72	0.88
Var(n)	0.65	**0.00**	0.25	0.08	0.94	0.53	0.69	0.15	0.11
Var(u)	0.59	0.17	0.11	0.94	0.54	**0.01**	0.43	0.70	0.60
Var(w)	0.83	0.55	0.76	0.49	0.59	**0.01**	0.18	0.29	0.20
Var(y/n)	0.11	**0.01**	0.75	0.88	0.44	0.27	**0.03**	0.45	0.42
Var(π)	0.99	0.54	0.70	0.36	0.53	0.10	0.08	0.59	0.41
cor(y,n)	0.45	0.65	0.49	0.45	0.64	0.87	0.75	0.36	**0.01**
cor(Y,N)	0.88	0.99	0.22	0.20	0.35	0.75	0.15	0.22	0.76
cor(Y,y/n)	0.40	0.36	**0.02**	0.25	0.11	0.08	0.53	0.76	0.76
cor(N,y/n)	**0.02**	**0.00**	0.22	**0.03**	0.54	**0.00**	0.43	0.54	0.82
cor(w,y/n)	0.59	**0.00**	0.65	0.94	0.28	0.48	0.38	0.54	**0.01**
cor(y,y/n)	0.40	0.45	0.76	0.36	0.70	0.87	**0.01**	**0.02**	0.74
cor(n,y/n)	0.13	0.29	0.20	0.15	0.28	0.10	0.30	**0.05**	0.11
cor(y,π)	0.88	0.76	**0.04**	0.70	0.32	**0.00**	0.69	0.94	0.82

P-values are useful summary statistics but may hide important information. To give some visual content to the numbers presented in table 2, we plot the values of the estimated statistics that appear to be different across groups. A vertical bar in each graph cuts off the countries with loose labor market institutions (an index equal to zero) from those with strict ones (an index equal to one).

a. Employment protection

Employement protection affects significantly only the correlation of employment with labor productivity.

Gali (1999) documents a striking empirical regularity in industrialized economies: a permanent increase in total factor productivity reduces employment; and a temporary increase in aggregate demand increases both employment and labor productivity. In other words, following permanent technology shocks employment is negatively correlated with labor productivity, and following transitory shocks to demand employment is positively correlated with labor productivity.

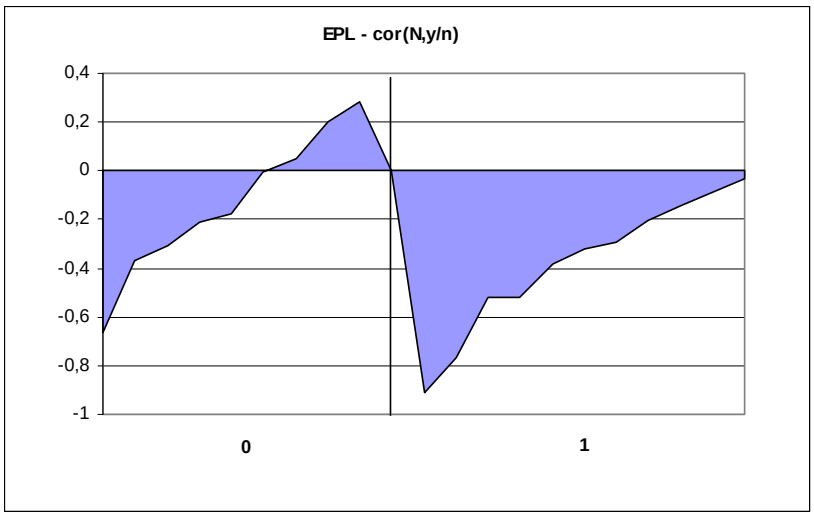


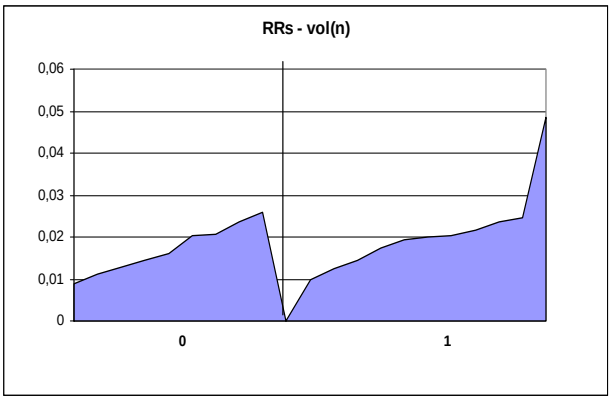
Figure 1: The employment protection legislation index

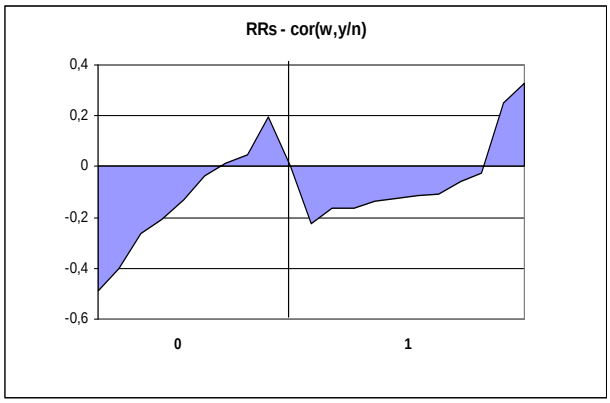
A bar divides states with loose EPL indices from those with strict EPL indices.

The unconditional correlations between employment and labor productivity in the sample of our countries for the period considered are mostly negative, and in countries with stricter employment protection legislation they are significantly more negative than in countries with looser EPL. If stricter EPL implies higher firing costs and, in turn, higher firing costs make the employment adjustments costlier than the price adjustments, output fluctuations should be damped in response to either supply or demand shocks. Therefore, both the positive comovement between employment and labor productivity in response to transitory shocks and the negative comovement between employment and labor productivity in response to permanent shocks should be dampened. The data suggest that strict EPL results in a more negative correlation between employment and labor productivity and this is difficult to reconcile with any of the existing business cycle models.

b. Replacement rates and duration

Except for the volatility of employment, the correlation of real wages with labor productivity and the correlation of labor input with labor productivity, the differences in the means across groups classified using the RR_S indicator are economically unimportant.





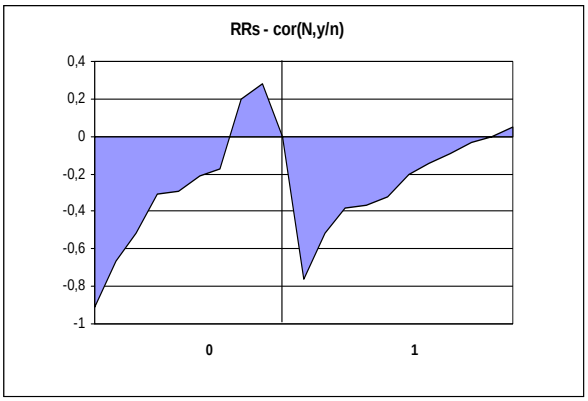


Figure 2: Replacement rates

A bar divides states with low replacement rates from those with high ones.

Without a structural model, it is hard to provide an explanation for the observed pattern. However, our findings may be reconciled with a model featuring labor market matching frictions and real wage rigidities. In countries with more generous benefits, workers have a higher threat point in wage negotiations. Hence, profits get smaller on average and more sensitive to productivity changes. Therefore, as in Hall (2005), Shimer (2005), Costain and Reiter (2008) and Hagedorn and Manovskii (2008), hiring and employment become more volatile. On the other hand, the bargaining set shrinks so that firms are more likely to reward productivity changes to prevent matches from being destroyed. Thus, the correlation of real wages with labor productivity could be higher. Greater wage flexibility may also explain the lower, in absolute value, correlation of employment with labor productivity.

c. The importance of labor unions

When considering the grouping according to the union coverage, our test detects a significant negative relationship between union coverage and real wage volatility. This evidence is consistent with the recent findings by Holden and Wulfsberg (2009) who suggest that unionization increases downward nominal wage rigidity. To the extent that prices are also sticky, countries with more powerful unions should display lower volatility of the real wage. This is in line with Du Caju et al. (2010) and Fabiani et al. (2009) documenting that also real wage rigidities correlate with union coverage across countries. As a consequence, it is reasonable to expect more volatile hiring activity and unemployment in countries where real wages are less flexible. The data partially confirms this intuition, as unemployment volatility is higher in countries with a coverage significantly higher than the average.

The data also suggests that high coverage and wage setting centralization are associated with stronger negative co-movements of labor input and productivity. One can argue that, if coverage and centralization proxy for real wage rigidities, then such institutions make the real wage stickier. As a result, quantities should move more than prices, and employment should adjust to changes in supply or demand, more than wages. In environments with both real wage and nominal rigidities, employment should increase more after a negative shock to productivity in countries where both prices and real wages are sticky.

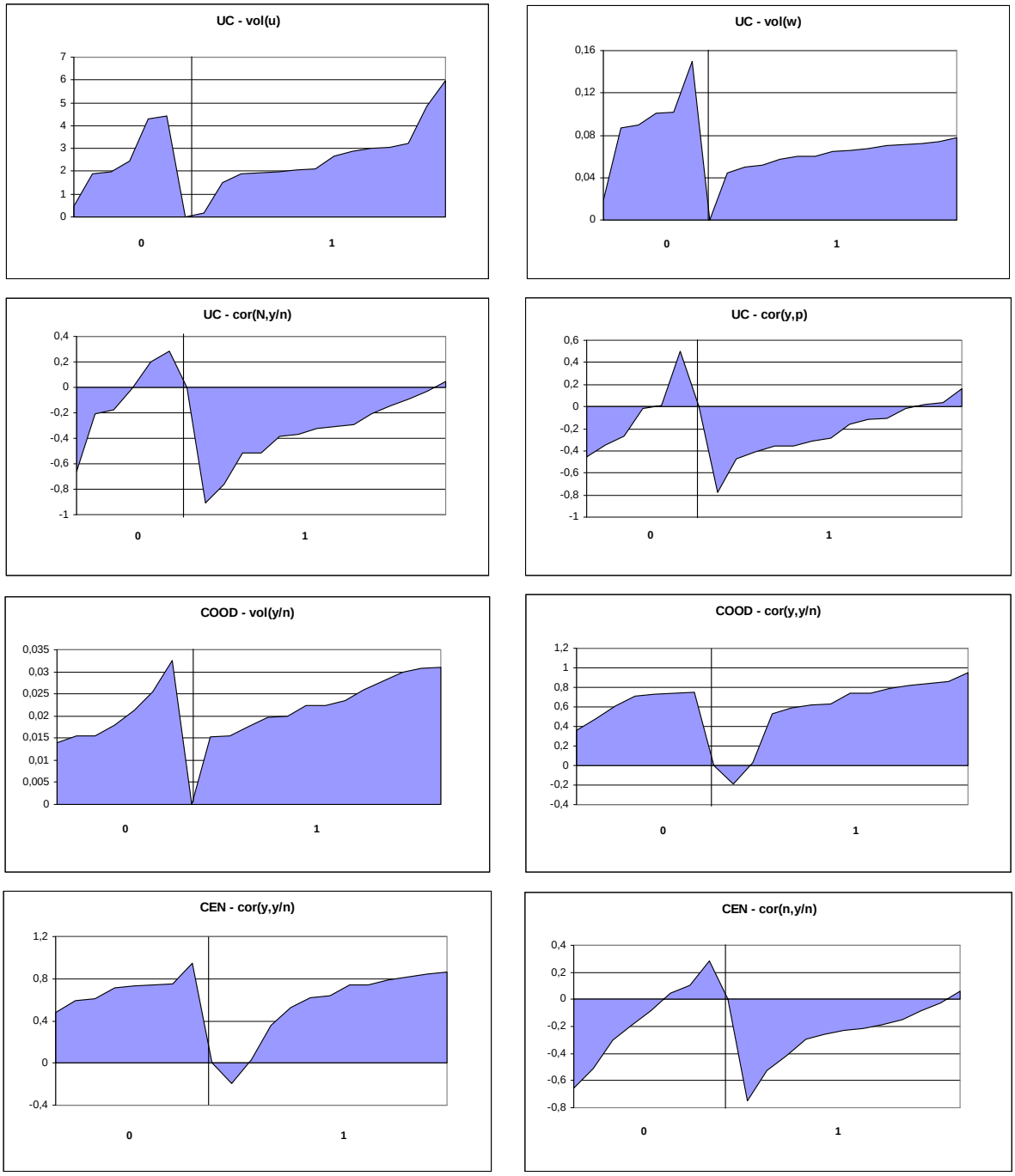


Figure 3: Labor Union indices

A bar divides countries with low indicators from those with high ones.

It is also clear from figure 3 that the labor market structure seems to change the distribution of the correlation between output and inflation. Higher coverage indeed reduces the correlation of output and inflation and pushes its mean value from –0.09 to –0.22, making harder the joint stabilization of both inflation and output. Keeping in mind that the output gap, rather than output per se, is driving monetary policy trade-offs, this finding may indicate a change in the costs and the benefits of inflation stabilization between the two groups of countries.

Labor productivity is on average positively correlated with output per-capita and less so in countries with centralized and coordinated bargaining systems.

Coordinated bargaining boosts the volatility of productivity. This fact may be regarded as consistent with the recent contribution of Gali and Van Rens (2008). Their model with hiring costs and endogenous labor effort would account for higher volatility of labor productivity in countries where hiring costs are higher. This is because to the extent that labor market frictions prevent the adjustment of employment to productivity shocks, labor productivity has to be more volatile than in a frictionless model. We do not observe in our data a measure of hiring costs. Hence, we cannot directly compare our results with theirs. Still, as long as coordinated wage bargaining correlates positively with hiring costs, this evidence lends some support to their model.

Rumler and Scharler (2009) find that union density matters for the volatility of output and that the degree of coordination of the wage bargaining system is important for the volatility of inflation. The p-values for these statistics are both equal to 0.08 in Table 2, which is hardly significant. The main reason for the difference in the significance level is the econometric methodology used: in fact while we use a non-parametric approach, they use a standard two-step regression. The estimated importance of labor market rigidities in two-step regressions might be overstated because the analysis neglects the fact that the left hand side variables of the second regression are estimated and not the true ones. Since estimates of standard errors are downward biased, differences across groups may become artificially significant.

d. The tax wedge

Higher tax wedges significantly reduce the correlation between output and employment. Intuitively, given the distortions induced by taxes, firms may want to adjust other available margins, such as effort or capital, in order to respond more efficiently to changes in productivity. On the other hand, the correlation of the real wage and labor productivity does not seem to be economically affected by the size of the tax wedge.

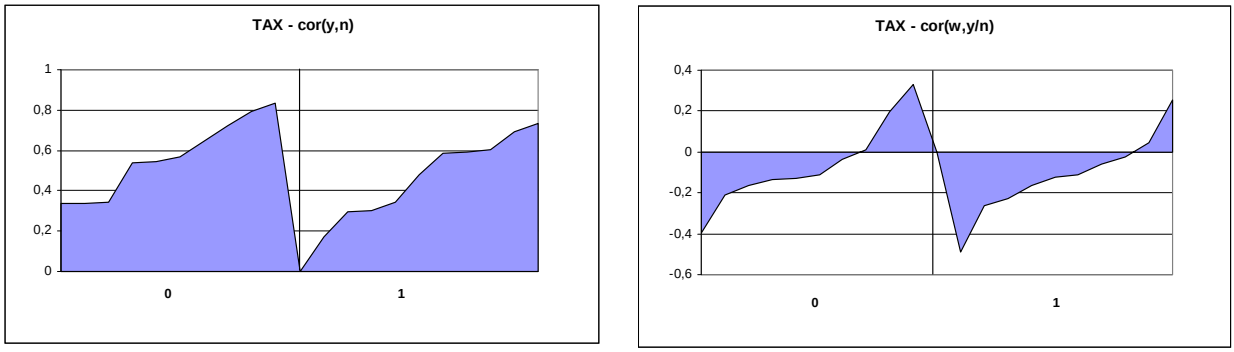


Figure 4: The tax wedge

A bar divides countries with low tax wedges from those with high ones.

e. Robustness

We first check whether the filtering or measurement errors may affect the conclusions we reach. Table 3 reports the p-values of the tests when we detrend the raw data with an HP filter[6]. It is evident that results are broadly unchanged, despite the relative short size of the sample.

Table 3: Business Cycle statistics, HP filtered data

Index	EPL	RR_S	RR_L	DU	UD	UC	COOD	CEN	TAX
Var(Y)	0.11	0.10	0.61	0.82	0.64	0.94	0.13	0.70	0.88
Var(y)	0.76	**0.01**	0.32	0.99	0.08	0.48	0.11	0.32	0.94
Var(N)	0.70	0.21	0.70	0.94	0.22	0.87	0.69	0.70	0.88
Var(n)	0.76	**0.01**	0.25	0.08	0.94	0.53	0.69	0.15	0.11
Var(u)	0.20	0.17	0.11	0.94	0.54	**0.01**	0.43	0.70	0.60
Var(w)	0.76	0.54	0.76	0.49	0.59	**0.01**	0.18	0.28	0.20
Var(y/n)	0.65	**0.01**	0.76	0.88	0.44	0.27	**0.03**	0.45	0.41
Var(π)	0.23	0.54	0.70	0.36	0.54	0.10	0.08	0.59	0.41
cor(y,n)	0.22	0.65	0.49	0.45	0.64	0.87	0.75	0.36	**0.01**
cor(Y,N)	**0.03**	0.99	0.22	0.20	0.35	0.75	0.15	0.22	0.76
cor(Y,y/n)	0.25	0.65	**0.02**	0.25	0.10	0.08	0.53	0.76	0.76
cor(N,y/n)	0.87	**0.01**	0.22	**0.03**	0.54	**0.00**	0.43	0.54	0.82
cor(w,y/n)	0.59	**0.01**	0.64	0.94	0.28	0.48	0.38	0.54	**0.01**
cor(y,y/n)	0.60	0.45	0.76	0.36	0.70	0.87	**0.01**	**0.02**	0.76
cor(n,y/n)	0.32	0.29	0.19	0.15	0.28	0.10	0.30	**0.05**	0.11
cor(y,π)	0.40	0.79	**0.05**	0.70	0.32	**0.01**	0.69	0.94	0.82

[6] Band-Pass and VAR filtering deliver similar results that we do not present here for economy of space.

As we mentioned, measurement error could also be an issue and comparing across filtering methods which emphasize or de-emphasize high frequency measurement error could help us to assess its importance. Comparing tables 2 and 3, one can see that p-values are roughly unchanged. Hence, measurement error does not drive our results.

Second, we want to make sure that our results are not driven by omitted variables that may correlate with labor market institutions. In fact, conditioning on factors such as size, openness, population density, etc., labor market restrictions may not matter for business cycles, even though they are significant unconditionally. These variables are typically thought to have an impact on business cycle fluctuations. Some of them may also correlate with labor market institutions. For example, consider openness. More open countries are likely to be more prone to external shocks, therefore they tend to be more volatile. However, they may also develop less rigid institutions, through competition with foreign countries on goods markets, or more rigid institutions if unions get more aggressive so as to better insure workers against unemployment fluctuations. We want to avoid that our statistics capture such effects, rather than the direct effect of institutions on economic fluctuations. Hence, we investigate whether our conclusions hold, once we control for these potentially relevant cross sectional variables.

In table 4 we report p-values of the test for the equality of selected macroeconomic statistics when we condition on a) the degree of openness, grouping the countries by the share of exports or imports to GDP; b) the economic size of the countries, grouping the countries by their real GDP per capita; c) the size of the government, measured as the share of government expenditure to GDP; d) the exchange rate regime, grouping countries according to the number of years they are subject to some fixed or semi-fixed exchange rate arrangement and e) population density. For the sake of space we only present results referring to replacement ratios and union coverage, since they are the ones that matter the most in Table 2.

Table 4 makes clear that labor market institutions that matter unconditionally also matter conditionally. For example, the exchange rate regime and the population density do not affect the importance of replacement ratios. Similarly, conditioning on country size does not affect the significance of union coverage. In general, while the p-values change relative to table 2 the main message of our analysis is unchanged: labor market institutions are important for business cycle statistics. Replacement ratios robustly matter for the volatility of output per capita and the correlations of employment and the real wage with labor productivity, while union coverage makes a difference for the volatility of the real wage and the correlation of output with inflation.

Table 4: P-values Rank Sum Test: forth differences								
Variable	vol(y)	vol(n)	vol(y/n)	vol(w)	vol(u)	corr(N,y/n)	corr(w,y/n)	corr(π, y)
Unconditional								
RR_S	**0.01**	**0.00**	**0.01**	0.55	0.17	**0.00**	**0.00**	0.76
UC	0.48	0.53	0.27	**0.01**	**0.01**	**0.00**	0.48	**0.00**
Openness								
RR_S	**0.03**	0.51	0.32	0.03	0.0	**0.03**	**0.09**	0.00
UC	0.98	0.72	0.17	0.60	0.86	**0.09**	0.30	**0.09**
Size								
RR_S	0.36	0.95	0.99	0.13	0.36	**0.03**	0.36	0.09
UC	0.37	0.23	0.36	**0.03**	**0.03**	**0.03**	0.37	**0.03**
Government size								
RR_S	**0.02**	**0.09**	0.68	0.98	0.41	0.54	0.99	0.68
UC	0.85	0.36	0.27	**0.06**	**0.09**	0.27	0.71	**0.04**
Fix exchange rate regime								
RR_S	**0.08**	**0.00**	**0.08**	0.00	0.00	**0.00**	**0.08**	0.00
UC	0.14	0.85	0.46	0.36	0.86	**0.09**	0.46	0.58
Population density								
RR_S	**0.08**	**0.01**	**0.08**	0.83	0.20	**0.01**	**0.09**	0.83
UC	0.52	0.03	0.53	**0.09**	0.83	0.39	0.39	**0.03**

Not only our results on the importance of replacement ratios and union coverage do not change, but other labor market indicators become significant when we condition our analysis. In Table 5 we present the p-values for these indicators. In particular, conditionally on openness, replacement rates in the first five years of unemployment become significant in explaining differences in the variability of output, employment per capita and the real wage, as well as in the correlation of output and employment with labor productivity between the two groups of countries. Also, union density becomes significant for explaining differences in the variability of output per capita and unemployment and the correlation of real wages with labor productivity, as well as the correlation of output with inflation. Conditionally on size, coordination appears to be significant and if we condition on government size, duration gains importance too. Thus, controlling for possibly relevant omitted variables makes our point even stronger.

Table 5: Conditional analysis				
Factor	openness		Size	G/Y
Index	RR_L	UD	COOD	DU
Rank sum test				
Var(Y)	0.19	0.87	0.25	0.86
Var(N)	0.62	0.25	0.56	0.72
var(y)	**0.04**	**0.07**	0.25	0.58
Var(n)	**0.03**	0.86	0.56	0.46
Var(w)	**0.06**	0.51	**0.02**	**0.04**
Var(u)	0.62	**0.00**	**0.02**	0.09
Var(y/n)	0.10	0.19	0.99	0.14
Var(π)	0.74	0.41	0.97	0.47
cor(y,n)	0.51	0.87	0.25	0.58
cor(Y,N)	0.25	0.25	0.56	0.97
cor(Y,y/n)	**0.00**	0.41	0.98	**0.05**
cor(N,y/n)	**0.00**	0.51	**0.02**	**0.00**
cor(w,y/n)	0.19	**0.05**	0.25	0.85
cor(y,y/n)	0.62	0.86	0.56	0.71
cor(n,y/n)	0.64	0.19	0.99	0.47
cor(y,π)	0.06	**0.00**	**0.02**	**0.04**

In order to ensure that our results are not driven by cross country differences in the time period covered we repeat our analysis for the period 1994:1 - 2007:4. Table 6 suggests that the period differences do not affect substantially our results. Replacement rates are still a significant determinant for the variability of employment and labor productivity and for the correlation of employment with labor productivity, but differences in the volatility of output and the correlation of real wages with labor productivity do not appear do be significant for countries with different replacement rates, as it is the case in the full sample analysis. Also, union coverage is still important for explaining differences in the volatility of the real wages and unemployment and the correlation of output with labor productivity and with inflation in countries with different union coverage, and it also becomes important for explaining differences in the volatility of labor productivity in the restricted sample.

Table 6: P-values Rank Sum Test: forth differences								
Variable	vol(y)	vol(n)	vol(y/n)	vol(w)	vol(u)	corr(N,y/n)	corr(w,y/n)	corr(π, y)
Full sample								
RR_S	**0.01**	**0.00**	**0.01**	0.55	0.17	**0.00**	**0.00**	0.76
UC	0.48	0.53	0.27	**0.01**	**0.01**	**0.00**	0.48	**0.00**
common sample period								
RR_S	0.45	**0.05**	**0.04**	0.65	0.45	**0.06**	0.22	0.88
UC	0.14	0.07	**0.05**	**0.04**	**0.02**	**0.05**	0.46	**0.03**

Our results, however, are not robust to the presence of potential structural breaks. In Table 7 we report the p-values for the tests when we repeat our analysis for each of the two subsamples 1971:4-1979:4 and 1981:1-2007:4 for the eleven countries for which data are available. Results differ across samples. Both replacement rates and union coverage are not at all important in explaining differences in business cycle statistics in the first subsample. Only union coverage seems to matter (hardly) for differences in the trade off between inflation and output stabilization in the pre 1980s period. This negative result is probably due to the very little observations available for analysis in the first subsample, because and it is clear from the table, results change and become similar with the ones of the baseline analysis when one considers the second subsample. After the 1980s, replacement rates become a significant factor for explaining differences in the volatility of employment and labor productivity and the correlation of labor productivity with employment and with the real wage and union coverage remains significant for accounting for differences in the volatility of the real wage and the correlation of employment with labor productivity and output with inflation.

Table 7: P-values Rank Sum Test: forth differences

Variable	vol(y)	vol(n)	vol(y/n)	vol(w)	vol(u)	corr(N,y/n)	corr(w,y/n)	corr(π, y)
Before 1980								
RR_S	0.86	0.08	0.27	0.36	0.20	0.47	0.36	0.10
UC	0.71	0.67	0.45	0.26	0.58	0.34	0.35	**0.05**
After 1980								
RR_S	0.47	**0.04**	**0.05**	0.72	0.14	**0.03**	*0.06*	0.86
UC	0.19	0.13	**0.04**	**0.03**	0.21	**0.05**	0.25	**0.05**

In sum, all the evidence we have collected indicates that business cycle statistics are significantly affected by the presence of labor markets rigidities. Replacement ratios and union coverage appear to be the indicators that robustly affect macroeconomic outcomes the most. The conclusions are robust to country classification, to the procedure used to calculate business cycle statistics, to the presence of conditioning variables and, to a large extent, to the sample.

f. Labor market institutions interactions

Our analysis so far has considered each institution separately abstracting from net or marginal effects. In what follows we analyze how combinations of different rigidities in the labor market might affect macroeconomic outcomes at business cycle frequencies. Studying the interactions between institutions is potentially interesting since many studies suggest that certain labor market

institutions cannot be studied in isolation from each other. For example, Du Caju et al. (2010) and Fabiani et al. (2009) suggest that the combination of union coverage and centralization might be very important for macroeconomic outcomes.

In this section we investigate whether the combination of rigidities in the labor market might change our results. To that end, we consider two labor market institutions at a time and study the following possibilities (when the data gives us enough units for comparisons): (a) the joint effect and (b) the marginal effect of institutions. The joint effect is studied by looking at countries characterized by low versus high degrees for both indexes. The marginal effect, instead, is studied comparing countries that have one index commonly high (or low) and the other index different. For example, take the case of UC and CEN. When we examine the joint effect of UC and CEN, according to Table 1, we compare the business cycle statistics in Australia, Austria, Belgium, Finland, Germany, the Netherlands, Norway, Portugal and Spain with those in Canada, Japan, New Zealand, the UK and the US. On the other hand, when we examine the marginal effect of CEN for high degrees of UC, we compare the business cycle statistics in Denmark, France, Italy and Switzerland with the ones in Australia, Austria, Belgium, Canada, Germany, the Netherlands, Norway, Portugal, Spain and Sweden. Since all these countries are characterized by high degrees of union coverage but in the former centralization is relatively low, we can investigate how changes in the degree of centralization for given coverage affect business cycle statistics. The fact that our test is well defined for very small samples is crucial for performing this analysis.

Table 8 displays the p-values associated to the experiments we believe are yielding the most interesting results[7]. The rows of table 8 describe different case studies. When we consider marginal effects we index the institution that is fixed by a zero or a one, instead when we examine joint effects the institutions are not classified. For example, the case $RR_S = 0, UC$ is the one in which we compare countries with different degrees of union coverage but which are characterized as loose according to the replacement rates index. On the other hand, the case CEN, UC is the one in which we compare countries that are both characterized as loose in terms of CEN and UC with countries that are both characterized as strict in terms of CEN and UC.

The analysis of labor market institutions interactions confirms some of our baseline results:

- Union coverage still dampens the volatility of the real wage when it is combined with high

[7] Other possible interactions have been considered, for instance the marginal effect of employment protection when replacement rates in the short run are held constant at low levels. However, the data do not suggest any significant differences in the business cycle moments for those cases.

degrees of centralization, while the volatility of the real wage is not significantly different in countries with different degrees of centralization in the wage setting process, given union coverage. The argument that union coverage is responsible for real wage rigidity as well as that wage bargaining decentralization allows to gain some flexibility are recurrent in the literature[8]. We do not find evidence in favor of the latter argument, while the former seems to be confirmed.

Table 8: Multivariate Analysis

Volatilities								
Cases/Variables	Y	y	N	n	u	w	y/n	π
$RR_S = 0, UC$	0.28	0.28	1	0.52	**0.00**	0.66	*0.08*	0.52
$CEN = 0, UC$	**0.06**	0.61	0.45	0.80	0.21	0.80	1	*0.08*
CEN, UC	0.53	0.80	0.13	0.71	0.62	**0.03**	0.62	0.26
EPL, UC	0.61	0.54	0.76	0.54	0.22	0.91	**0.04**	0.54
$EPL = 1, DU$	0.10	0.58	**0.04**	0.58	0.71	0.98	*0.06*	0.58
$UC = 1, RR_S$	**0.04**	0.78	0.34	0.50	0.28	0.42	0.89	0.78
$EPL = 1, RR_S = 1$	0.18	0.46	0.14	0.30	0.10	0.55	**0.04**	0.77
Correlations								
Cases/Variables	y,n	Y,N	Y,y/n	N,y/n	w,y/n	y,y/n	n,y/n	y,π
$RR_S = 0, UC$	0.39	0.66	0.20	0.66	0.20	0.14	0.29	**0.01**
RR_S, UC	**0.03**	0.22	0.06	0.22	0.98	0.08	0.80	**0.05**
$CEN = 0, UC$	0.80	0.21	1	0.80	0.45	0.59	0.13	**0.04**
CEN, UC	0.32	**0.04**	*0.08*	0.80	0.32	0.32	0.39	0.54
UC, DU	*0.06*	1	0.41	0.22	0.41	0.22	0.15	0.54
EPL, UC	0.61	0.42	0.15	0.42	0.26	0.76	*0.06*	0.23
$UC = 1, EPL$	0.75	*0.08*	**0.01**	0.87	0.27	0.98	0.27	0.43
EPL, DU	0.66	0.39	1	0.18	**0.02**	0.39	0.09	0.29
$UC = 1, DU$	0.89	0.79	0.89	0.89	0.60	0.44	0.44	*0.07*
$UC = 0, DU$	*0.07*	0.37	0.65	0.65	0.37	1	1	0.37

- The output inflation trade off is robustly magnified by union coverage. In fact, the correlation of inflation and output, which is negative, decreases significantly in countries with high union coverage. This holds true also when we condition for countries with low replacement rates and low centralization, as well as, for countries where replacement rates vary similarly with

[8] See for instance Du Caju et al. (2010) and Fabiani et al. (2009)

coverage.

- In countries with high union coverage, higher replacement rates are associated with higher volatility of output, though we do not find a significant effect on employment.

- When focusing on the interaction of different labor market institutions, some of our baseline results need to be qualified. Union coverage reduces the volatility of unemployment and labor productivity in countries with low replacement rates. This finding, though not in line with the conclusion delivered by a business cycle model augmented with real wage rigidity, is intuitive and suggests that coverage limits quantity adjustments, working as employment protection would be expected to do. Coherently, the volatility of output and the correlation of output and labor input are also decreasing in union coverage when conditioning on countries with low degrees of centralization, or when we consider countries with high coverage and either high centralization or high replacement rates.

  In addition, more regularities emerge when we study the interactions between institutions:

- Although employment protection matters little when examined separately from other indices in the previous section, it becomes significant in explaining business cycle statistics when examined together with coverage, duration and replacement rates. For instance, in countries in which both employment protection and coverage are high, the volatility of productivity and the correlation between productivity and employment reduces. This fact can be explained by referring to unobservable (to the econometrician) labor effort as an additional margin, similarly to the argument proposed by Gali and Van Rens (2008). High employment protection may reduce responsiveness of effort to shocks, leading to lower volatility and procyclicality of labor productivity. This correlation displays the same pattern when comparing countries where replacement rates and employment protection are both high with countries classified as loose according to these criteria. Finally, the correlation of the real wage with labor productivity and the correlation of employment with productivity are significantly lower in countries that are jointly characterized as strict according to the employment protection and duration indices.

- Duration is also (barely) significant when interacted with employment protection and union coverage. The marginal effect of duration, given high employment protection, is to dampen the volatility of labor productivity and employment. This is again coherent with the hypothesis

that workers' protection induce shirking to a greater extent. When conditioning on high union coverage, duration worsens monetary policy trade offs, while when conditioning on low union coverage duration reduces the correlation of output and labor input.

The analysis of interactions bewteen labor market institutions uncovers further empirical regularities. It lends some support to the view that workers' protection may significantly alter their incentives to exert effort and, through this channel, may have important consequences for business cycle moments.

5 Active labor market policies

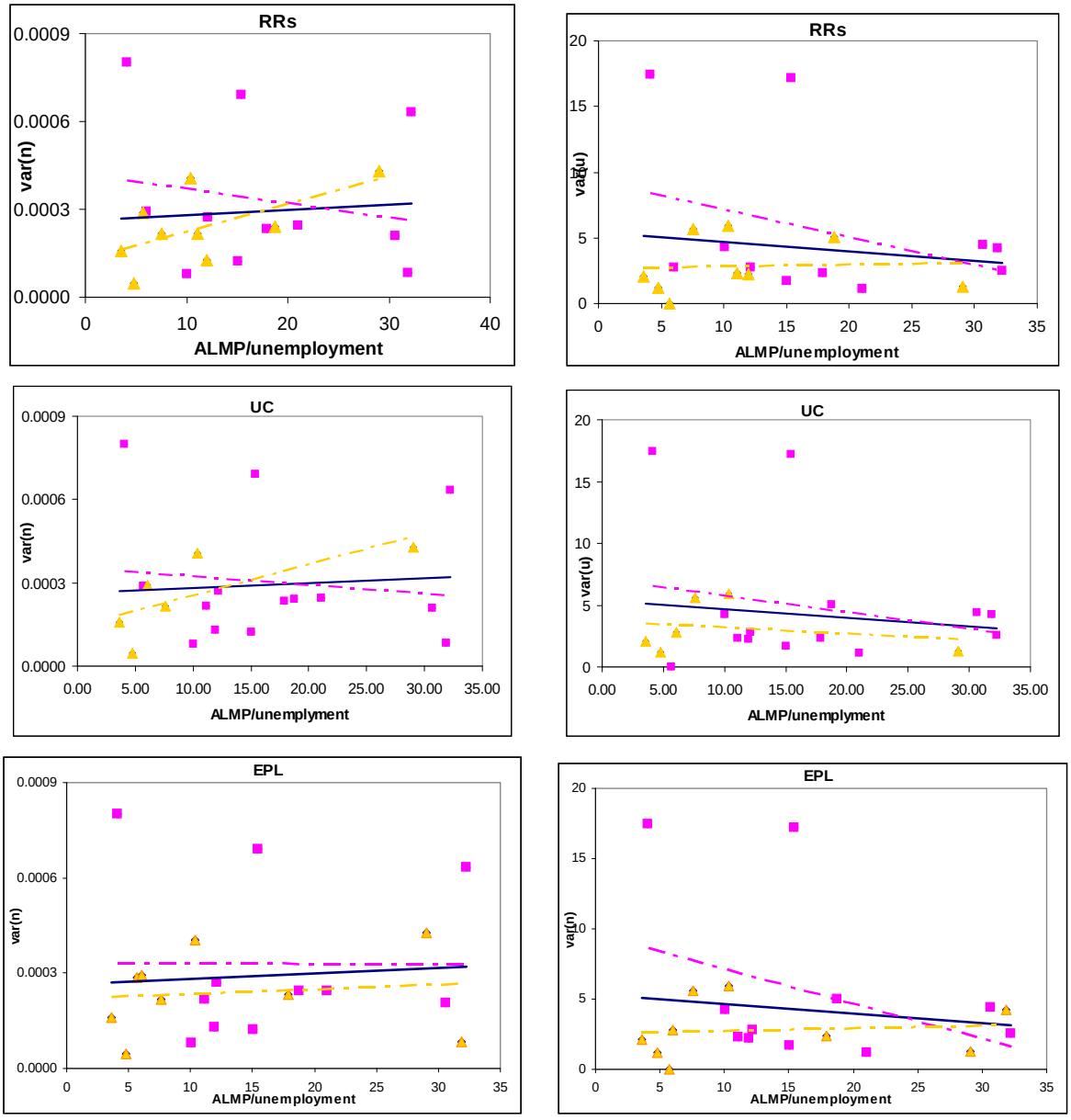
Active labor market policies have evolved significantly since the early 1960s and cover a range of objectives and programmes both of economic and of social nature. In most of OECD countries, a sizeable fraction of government expenditure is allocated to those programs, that are expected to generate a variety of economic and social consequences. In particular, active labor market policies might exert a stabilizing role in the economy. We explore whether this is true in the data.

We measure active labor market policies as the ratio of expenditure devoted to those policies to the unemployment rate. This can be rewritten as expenditure per unemployed individual, normalized on GDP per member of the labor force.

Following the same methodology used to study the role of labor market institutions, we assess whether active labor market policies significantly alter business cycle statistics. Interestingly, they do not appear to matter when looking unconditionally at the data, neither for the variability of output and employment, nor for the variability of unemployment. However, when we condition our analysis on labor market institutions, we find that labor market policies are effective in stabilizing unemployment in countries with heavily regulated labor markets. This is an interesting result showing that the assessment of labor market policies cannot abstract from institutions.

To illustrate this point, we present in Figure 5 scatter plots of active labor market policies against unemployment and employment volatility when countries are grouped according to replacement ratios, union coverage and employment protection. Forth differences are used to filter the data before variabilities and correlations are computed. Countries without labor market restrictions appear with a triangle; countries with labor market restrictions with a square.

Figure 5: Active labor market policies and labor market institutions



Take, for example, the relationship between the variability of employment and the size of active labor market policies when the replacement rates are used to classify the countries. For the whole sample the slope of the relationship is negligible (0.08); for the sample of countries with relatively strict labor market institutions the slope is -0.32 and for the sample of countries with loose restrictions it is 0.54. The slopes for the two different groups of countries are significantly different from

zero and significantly different from each other. This is also true if we classify the countries using the UC, UD, DEN, COOD, or DU classifications, but it is not so when we look at the remaining indicators. For example, when we condition the analysis using the EPL classification the effect of active labor market programs is positive but hardly significant for the full sample of countries and is similar in the two groups.

6 Labor markets reforms and business cycles

In the first part of the paper we take advantage of the cross-sectional variation in the data, so as to test whether differences across countries in labor markets indicators are systematically associated to differences in the business cycle moments of major macro variables. However, our methodology does not allow to exploit the information we have about changes over time of both institutional and business cycle characteristics, within each country. As we argued above, our choice has been motivated by the considerably limited time series variation of labor market indicators. Still, over the last four decades, countries have witnessed significant labor market reforms. Hence, in this section of the paper, we test how structural changes in the labor markets have affected the business cycle by looking at single reform episodes.

6.1 The Data

We gather information about major reforms implemented in the countries in our sample and we classify them according to the labor market indicators we use in the first part of the paper. For instance, Italy passed in 1991 a law making faster and easier the dismissal of workers for firms with more than fifteen employees and experiencing a surge in their accounting losses. We classify this law as a weakening of employment protection legislation. We proceed in a similar manner for all the countries in our sample by using several data sources. Most of reforms have been identified through the FRDB data set which is covering all the European countries since the 1970 until 2009. The data set reports the date the bill was passed, a detailed description of the law and the scope of the reform, i.e. whether the law marginally affected the system already in place or whether the law produced a structural change in the regulatory environment. Also, the measure is qualified as two-tier whenever it is targeting a particular segment of the labor market, such as the young unemployed or temporary workers, while it is defined as complete if it affects the whole labor force. We restrict our attention to structural and complete reforms. Tables 9-10 provide a description of

the episodes we consider. Finally, we complement the FRDB data set with information from the OECD and the DICE[9].

Table 9. Treatment group: countries reducing EPL

Country	Date	Reform
Austria	2002	Reform of the severance pay system: right to a severance pay upon contract termination after three years with the same employer replaced by retirement accounts, removing the specific costs of dismissals.
Finland	1991	The notice period was shortened from 2 months to 1-2 weeks
Finland	2001	The employer has the right to dismiss an employee with notice if the work in question has decreased substantially and permanently for economic and production-related reasons.
France	1986	The administrative authorization in case of individual dismissal for economic reasons is abolished.
Italy	1991	Law on collective redundancies establishing weaker standards related to notice and union consultation. It concerns companies with more than 15 employees.
Japan	1986	Private temporary staffing agency activity was partially legalized in 1986 with the advent of the Worker Dispatching Law (WDL).
Portugal	1991	Several restriction on lay-off legislation are phased out. Dismissals for unsuitability are authorized
Portugal	2003	Employers now have the right to oppose the reinstatement of workers in dismissal cases under certain conditions, such as in cases where it would harm or disrupt business activity.
Spain	1984	Restrictions for fixed-term contracts are substantially relaxed. Legal norms establishing the conditions under which a fixed term contract can be stipulated are overridden by the principle of promoting employment through the extension of contracts between 6 months and 3 years.
Spain	2002	The employer is allowed to immediately deposit in court an amount equal to unfair dismissal severance payment in order to avoid paying interim wages. in order to avoid paying interim wages.
Sweden	1993	Time work agencies were permitted. The last-in-first-out rule was relaxed: employers may retain two workers of their own choice in redundancy situations

[9]Further details of the data sources are postponed to the appendix

Table 10. Treatment group: countries reducing RR and/or DU

Country	Date	Reform
Austria	1995	Unemployment benefits have been reduced. As alternative to benefits, early retirement is allowed for women from the age of 54 and for men from the age of 59.
Austria	2000	Replacement rates are lowered and eligibility criteria are stricter.
Belgium	1992	Duty to actively seek for a job is enforced. Eligibility for long-term unemployed is made stricter.
Denmark	1994	Duty to actively seek for a job is enforced after 6 months of unemployment. Duration is reduced. Possibility to combine benefits with wage income.
Denmark	2003	Duty to actively seek for a job and accept an offer, if received, are introduced immediately after the first day of unemployment
Finland	2001	Duty to actively seek for a job is enforced for unemployed receiving social assistance.
France	1991-93	Contribution required to be eligible for unemployment insurance is raised and duration of benefits is lowered.
Spain	1992-93	Contribution rates and period required to be eligible for benefits is raised. Duration is reduced.
Spain	2000	Duty to actively seek for a job is enforced. Unemployed rejecting three suitable job offers loose the benefit. An offer is suitable if job is identical to previous jobs. After 12 months, unemployed must accept any another job after retraining.
Sweden	2000	Duty to actively seek for a job is enforced. Unemployed rejecting three job offers loose the benefit.
New Zealand	1989-92	Reduction of benefits and stricter eligibility
Canada	1996	Contribution rates required to be eligible for benefits is raised. RR lowered for unemployed with higher income during contribution period prior to dismissal.

Table 11. Treatment group: countries reducing Union Power

Country	Date	Reform
UK	1980-86	Thatcherite reforms: industrial relations laws that weakened union power
New Zealand	1987,91	87: Decentralization of bargaining 91:Abolished compulsory unionism and decentralization.
Denmark	1994	The management of the labor market has been delegated to regional labour market councils
Australia	1996	Deregulation and decentralization with Workplace Relations Act 1996, introducing significant reforms to the content of awards through the Award simplification process.

6.2 The Methodology

In order to test the effect of reforms, we follow the methodology by Ball and Sheridan (2003). They investigate the importance of inflation targeting for the volatility of output and inflation by comparing OECD countries that adopted an inflation target to countries that have not. To that end, they perform diff-in-diff regressions and include a dummy for countries that implemented an inflation targeting regime. We apply their methodology to study the impact of labor market reforms.

As well as in the first part of the paper, after detrending the original series, we compute standard deviations and cross-correlations of the major macro variables. Suppose X is the business cycle moment we are interested in and we want to investigate the impact on X of changes in the labor market regulation along a particular dimension, such as replacement rates or employment protection. Then, we proceed as follows.

First, after identifying the dates when changes have taken place for each country in the sample, we divide countries in two groups, a treatment group and a control group, where only in the former a new law reducing employment protection, the generosity of benefits or unions' power has been passed. We classify as belonging to the control group all other countries for which we have data and that did not implement any reform or did implement one of opposite sign, relative to the treatment group. Then, the sample is split into two sub-samples, the pre-reform period and the post-reform period. When more waves of reforms were introduced, we repeat the same procedure for each wave in such a way that the post-reform period of one particular regulatory change does not overlap with the post-reform period of the subsequent one. For example, in the case of employment protection, we find three important waves of reforms, in the 80's, in the 90's and in the 2000's. Consider the 90's wave. Italy, Finland and Portugal reduced employment protection in 1991 and Sweden reduced it in 1993. Hence, we label Italy, Finland, Portugal and Sweden as the treatment group, while Australia, Austria, Canada, Ireland, New Zealand, Switzerland and the US are the control group. The 1970Q1-1989Q1 period is defined as the pre-reform period for the treatment group and the post-reform period starts in 1994[10]. However, only for Italy and Sweden the post-reform period runs until the end of the sample, since they are the only countries of the group that did not pass subsequently other major employment protection reforms. In contrast, for Finland and Portugal we only consider up to 2001 and 2003 respectively, since further regulatory changes affected labor market institutions after those dates. In a similar way we define the pre and post periods for

[10] We leave some years between pre and post-reform periods to allow the reforms to produce some effect.

countries belonging to the control group. We consider a post-reform period for the control group as starting at the mean of the start dates for the countries in the treatment group. A detailed description of groups and samples for all reforms is provided in Tables **12-14**.

Table 12. EPL reforms, samples

Countries	Samples	EPL1	EPL2	EPL3
Australia, Canada	Pre-sample	71:1-84:4	71:1-92:4	71:1-01:4
Ireland, New Zealand	Post-sample	85:1-09:4	93:1-09:4	02:1-09:04
Switzerland, US	Group	Controls	Controls	Controls
	Pre-sample	76:1-84:4	76:1-92:4	76:1-01:4
Norway	Post-sample	85:1-09:4	93:1-09:4	02:1-09:04
	Group	Control	Control	Control
	Pre-sample	71:1-84:4	71:1-92:4	71:1-01:4
Austria	Post-sample	85:1-01:4	93:1-01:4	02:1-09:04
	Group	Control	Control	Treatment
	Pre-sample		71:1-91:4	91:1-01:4
Finland	Post-sample		94:1-01:4	02:1-09:04
	Group		Treatment	Treatment
	Pre-sample	71:1-86:4		
France	Post-sample	89:1-09:4		
	Group	Treatment		
	Pre-sample		71:1-91:4	
Italy	Post-sample		94:1-09:4	
	Group		Treatment	
	Pre-sample	71:1-86:4		
Japan	Post-sample	89:1-09:4		
	Group	Treatment		
	Pre-sample		71:1-91:4	91:1-03:4
Portugal	Post-sample		94:1-03:4	05:1-09:04
	Group		Treatment	Treatment
	Pre-sample	71:1-84:4		84:1-02:4
Spain	Post-sample	87:1-02:4		03:1-09:04
	Group	Treatment		Treatment
	Pre-sample		71:1-93:4	
Sweden	Post-sample		96:1-09:4	
	Group		Treatment	
	Pre-sample	71:1-80:4		
UK	Post-sample	87:1-09:4		
	Group	Treatment		

Table 13. Replacement rates and duration reforms, samples

Countries	Samples	RR1	RR2
Australia, UK Japan, US	Pre-sample	71:1-93:4	71:1-02:4
	Post-sample	94:1-09:4	03:1-09:4
	Group	Controls 2	Controls 2
Ireland, UK Italy	Pre-sample	71:1-93:4	71:1-02:4
	Post-sample	94:1-09:4	03:1-09:4
	Group	Controls 1	Controls 1
Netherlands	Pre-sample	77:1-93:4	77:1-02:4
	Post-sample	94:1-09:4	03:1-09:4
	Group	Control 1	Control 1
Norway	Pre-sample	76:1-93:4	76:1-02:4
	Post-sample	94:1-09:4	03:1-09:4
	Group	Control 1	Control 1
Portugal	Pre-sample	76:1-93:4	76:1-02:4
	Post-sample	94:1-07:1	03:1-07:1
	Group	Control 1	Control 1
Austria	Pre-sample	71:1-93:4	95:1-00:4
	Post-sample	95:1-00:4	02:1-09:4
	Group	Treatment	Treatment
Belgium	Pre-sample	81:1-91:4	
	Post-sample	94:1-09:4	
	Group	Treatment	
Denmark	Pre-sample	77:1-93:4	98:1-03:4
	Post-sample	98:1-03:4	05:1-09:4
	Group	Treatment	Treatment
Canada	Pre-sample	71:1-91:4	
	Post-sample	97:1-09:4	
	Group	Treatment	
France	Pre-sample	71:1-91:4	
	Post-sample	95:1-09:4	
	Group	Treatment	
New Zealand	Pre-sample	71:1-88:4	
	Post-sample	98:1-09:4	
	Group	Treatment	
Spain	Pre-sample	74:1-91:4	
	Post-sample	97:1-09:4	
	Group	Treatment	

Table 14. Union power reforms, samples

Countries	Samples	Union 1	Union 2
Austria, Italy	Pre-sample	71:1-80:4	71:1-91:4
Japan, US	Post-sample	86:1-09:4	96:1-09:4
Switzerland	Group	Controls 1	Controls 1
France, Portugal	Pre-sample	71:1-80:4	71:1-91:4
Finland, Spain	Post-sample	86:1-09:4	96:1-09:4
	Group	Controls 2	Controls 2
Norway	Pre-sample	76:1-80:4	76:1-91:4
	Post-sample	86:1-09:4	96:1-09:4
	Group	Control 2	Control 2
UK	Pre-sample	71:1-80:4	
	Post-sample	86:1-09:4	
	Group	Treatment	
New Zealand	Pre-sample		71:1-86:4
	Post-sample		94:1-09:4
	Group		Treatment
Denmark	Pre-sample		77:1-91:4
	Post-sample		96:1-09:4
	Group		Treatment
Australia	Pre-sample		71:1-91:4
	Post-sample		96:1-09:4
	Group		Treatment

Second, we investigate the impact of reforms by using a difference in difference approach controlling for initial conditions, i.e. we run a regression of the form

$$X_{i,post} - X_{i,pre} = \alpha_0 + \alpha_1 D_i + \alpha_2 X_{i,pre} + \varepsilon_{i,t} \tag{1}$$

$X_{i,post} - X_{i,pre}$ is the change in the business cycle moment across the two periods in a given country i and D_i is equal to one only if country i belongs to the treatment group while it is zero otherwise. As showed by Ball and Sheridan (2003) the inclusion of the initial condition is necessary to obtain unbiased estimates of α_1. The intuition is straightforward[11]. We are implicitly assuming that $X_{i,t}$ depends on a country effect, μ_i, a period effect, η_t and a labor market reforms effect captured by a dummy $Q_{i,t}$ taking value one if the reform under consideration has been passed and is in place in country i at time t

$$X_{i,t} = \kappa + \beta Q_{i,t} + \mu_i + \eta_t + \nu_{i,t} \tag{2}$$

[11] See Ball and Sheridan (2003) for details.

Defining $Q_{i,post} - Q_{i,pre} = D_i$, differencing equation (2) over time and estimating it via OLS, we find a standard differences estimator which is unbiased if the dummy is not correlated with the residual. Nevertheless, it may be the case that $X_{i,pre}$ correlates with the dummy: for instance, countries with high standard deviation of unemployment could make reforms so as to contain indeed such volatility. It is easy to show that, was this the case, the dummy would be negatively correlated with the error, thus inducing a downward bias in the OLS estimator. As a consequence, it would result that employment protection legislation reduces the volatility of unemployment even when there is no true effect and the causal flow is rather going the opposite direction. However, since the correlation works through $X_{i,pre}$ only, controlling for the initial condition eliminates the bias. These considerations motivate our regression analysis which is based on equation (1).

6.3 The results

We report below the outcome of our analysis. The picture is broadly in line with the results we find in the first paper of the paper, with some qualifications. First, when looking at the time series dimension, employment protection legislation appears to significantly affect business cycle moments. In particular, a fall in employment protection increases the variability of the real wage and the correlation of output with inflation, thus reducing the trade-offs faced by monetary policy makers. Second, similarly to the previous analysis, a decrease of the replacement rates lowers the volatility of the employment rate. Moreover, reforms affecting unions' power do not seem to have a significant impact on business cycle moments. Instead, the results suggest a considerable importance of the initial condition and this is consistent with the view that institutional reforms have been triggered by business cycle fluctuations, rather than being a source of change in business cycle moments.

statistics	vol(y)	vol(n)	vol(u)	vol(w)	vol(y/n)	vol(π)
EPL1						
D_i	0.002 (0.002)	−0.000 (0.003)	−0.43 (0.65)	−0.004 (0.001)	−0.000 (0.002)	−0.005 (0.002)
$X_{i,pre}$	−0.15 (0.30)	−0.69 (0.72)	−0.38 (0.23)	−0.80 (0.06)	−0.02 (0.18)	−0.51 (0.28)
EPL2						
D_i	−0.002 (0.003)	0.001 (0.003)	0.07 (0.72)	−0.003 (0.003)	−0.004 (0.004)	−0.001 (0.0008)
$X_{i,pre}$	0.03 (0.54)	−0.66 (1.05)	−0.76 (0.23)	−0.87 (0.12)	−0.18 (0.43)	−0.79 (0.07)
EPL3						
D_i	0.001 (0.001)	0.0005 (0.003)	0.08 (0.47)	−0.003 (0.005)	0.001 (0.005)	0.002 (0.002)
$X_{i,pre}$	0.39 (0.16)	−0.44 (0.38)	−0.41 (0.25)	−0.86 (0.21)	−0.48 (0.19)	−0.71 (0.18)

statistics	cor(y,n)	cor(w,y/n)	cor(y,y/n)	cor(n,y/n)	cor(y,π)
EPL1					
D_i	0.26 (0.08)	0.11 (0.12)	−0.03 (0.16)	0.34 (0.20)	0.29 (0.12)
$X_{i,pre}$	−0.37 (0.12)	−0.65 (0.20)	0.12 (0.49)	−0.33 (0.36)	−1.17 (0.24)
EPL2					
D_i	−0.12 (0.11)	−0.24 (0.15)	−0.05 (0.15)	−0.23 (0.22)	0.14 (0.17)
$X_{i,pre}$	−0.51 (0.17)	−0.81 (0.41)	−1.02 (0.41)	−0.61 (0.53)	−1.15 (0.37)
EPL3					
D_i	−0.14 (0.26)	0.23 (0.20)	−0.79 (0.44)	0.47 (0.24)	0.58 (0.26)
$X_{i,pre}$	−0.30 (0.43)	−0.04 (0.49)	−1.18 (0.80)	0.17 (0.43)	−0.99 (0.69)

statistics	vol(y)	vol(n)	vol(u)	vol(w)	vol(y/n)	vol(π)
RR1						
D_i	-0.001 (0.002)	-0.000 (0.005)	0.17 (0.65)	-0.001 (0.006)	-0.000 (0.007)	-0.001 (0.005)
$X_{i,pre}$	1.15 (0.85)	0.32 (0.95)	-0.47 (0.06)	-0.89 (0.06)	0.32 (0.49)	-0.96 (0.03)
RR2						
D_i	0.001 (0.0001)	-0.002 (0.003)	-1.07 (0.98)	-0.002 (0.0015)	0.0001 (0.0002)	-0.001 (0.003)
$X_{i,pre}$	0.34 (0.24)	-0.08 (0.25)	-0.83 (0.07)	-0.84 (0.11)	-0.75 (0.12)	-0.97 (0.04)
UNION1						
D_i	0.004 (0.14)	-0.003 (0.003)	0.80 (0.44)	-0.001 (0.005)	0.001 (0.005)	-0.001 (0.001)
$X_{i,pre}$	-0.89 (0.10)	-0.85 (0.38)	-0.28 (0.25)	-0.94 (0.04)	-0.86 (0.04)	-0.76 (0.07)
UNION2						
D_i	-0.003 (0.003)	-0.004 (0.004)	-0.42 (1.44)	-0.003 (0.008)	-0.001 (0.002)	0.003 (0.006)
$X_{i,pre}$	-0.96 (0.20)	-0.48 (0.80)	-0.45 (0.22)	-0.91 (0.05)	-0.66 (0.08)	-0.99 (0.01)

statistics	cor(y,n)	cor(w,y/n)	cor(y,y/n)	cor(n,y/n)	cor(y,π)
RR1					
D_i	-0.02 (0.13)	0.29 (0.10)	0.15 (0.11)	0.17 (0.19)	-0.03 (0.14)
$X_{i,pre}$	-0.71 (0.18)	-0.67 (0.24)	-0.07 (0.22)	-0.49 (0.42)	-2.13 (0.39)
RR2					
D_i	0.09 (0.12)	-0.26 (0.18)	0.19 (0.11)	0.22 (0.19)	0.23 (0.24)
$X_{i,pre}$	-1.06 (0.17)	0.34 (0.43)	-0.44 (0.35)	-1.02 (0.39)	-1.59 (0.69)
UNION1					
D_i	-0.14 (0.15)	-0.31 (0.20)	0.22 (0.18)	0.13 (0.21)	-0.02 (0.16)
$X_{i,pre}$	-0.70 (0.16)	-0.38 (0.20)	0.45 (0.53)	-0.53 (0.24)	-1.09 (0.18)
UNION2					
D_i	-0.12 (0.14)	0.10 (0.20)	0.35 (0.27)	-0.05 (0.25)	-0.34 (0.18)
$X_{i,pre}$	-0.76 (0.20)	-0.33 (0.33)	0.41 (0.89)	-0.53 (0.60)	-1.03 (0.25)

7 Conclusions

This paper analyzed whether labor market rigidities affect the macroeconomic performance of 20 OECD countries. Our conclusion is that the macroeconomic consequences of labor market institutions are important. In particular, union coverage and replacement rates have a significant impact on volatilities and cross correlations of macro variables when they examined separately or in combination with other institutions. Our results are robust to a number of controls we perform such as the detrending method, the sample considered, and omitted variables. We do find that institutions did not seem to matter in the pre 1980 era, but our data sample in this time period is small to take this result at face value.

In addition, we show that active labor market policies are effective in reducing unemployment fluctuations in countries featuring rigid labor markets and that studying the effects of the former without conditioning on institutions might be misleading.

Unfortunately, it is very difficult to access the importance of our results without a theoretical model. Yet, our exercise was meant to be empirical. We looked at the data without being oriented by any theory. Nonetheless, our conclusions have important implications for the recent macroeconomic literature. Many papers, in fact, made a strong theoretical case for the role of labor market rigidities in explaining macroeconomics fluctuations. However, the empirical evidence in this respect is still scant. This paper shows that indeed labor markets institutions are important for economic fluctuations and that union coverage and unemployment insurance are the most important rigidities shaping business cycles in the real world.

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