Do labor market rigidities matter for business cycles?

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Abstract

We exploit cross sectional and time variations in labor market indices to study whether labor market institutions affect the volatility and correlations of macroeconomic variables for a sample of 19 OECD countries. Labor market rigidities are characterized with a number of indicators; volatilities and correlations are computed in several ways. In the cross section the indices with the strongest cyclical influence are union coverage and wage rigidity. Specific labor market reforms ease the inflation - output trade off.

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Key words: Labor market institutions, Business cycles, Principal component analysis, difference-in-difference regressions

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1 Introduction

Many economists, including Walsh (2005), Trigari (2006), Campolmi and Faia (forthcoming), Krause and Lubik (2007), Blanchard and Gali (2010), Thomas (2008) and Gali and van Rens (2010), have argued that labor market frictions affect short run movements of macroeconomic variables in response to shocks, because of the imperfect adjustment of employment and the real wage. As a consequence, business cycle models have been recently augmented with a variety of labor market frictions. Two broad categories of rigidities have been used: frictions limiting flows in and out of unemployment, such as hiring costs and employment protection legislation; rigidities preventing the adjustment of real wages to economic fluctuations, such as collective wage bargaining. Despite these theoretical developments, the empirical literature on the relevance of labor market frictions for business cycle fluctuations is rather scant. A number of business cycle models have been structurally estimated, see e.g. Tomas and Zanetti (2009) Krause, Lopez-Salido and Lubik (2008), Christoffel, Kuester and Linzert (2006), but the focus of the investigation has been typically on the effects of labor market rigidities on inflation or the transmission of monetary policy decisions. In general, existing contributions look at the data through the lens of a model, so that the results are specific to the modelling assumptions and to the nature of the shocks included in (and excluded from) the analysis.

In this paper we propose an alternative, yet complementary, approach. We claim that institutional arrangements, such as employment protection, replacement rates, union density and coverage may create and affect, directly or indirectly, labor market frictions. We then test the relationship between labor market institutions (henceforth LMI) and cyclical fluctuations, by-passing the modelling of labor market frictions. We look at the volatility and the cross-correlations of the main macroeconomic variables between 1970 and 2009 using data from 19 OECD countries and investigate whether and how labor market institutions shape these statistics. We find that institutions do matter. Most importantly, indices measuring unions' activity, such as coverage, centralization of the wage bargaining process and density have the strongest influence on cyclical fluctuations.

We use various sources to capture the institutional features of labor markets: the CEP-OECD Institutions Data Set (Nickell (2006)); the ICTWSS Database on Institutional Characteristics of Trade Unions, Wage Setting, State intervention and Social Pacts (Visser, 2009);

the information provided in the "Social Policy Reform Inventory" assembled by the Fondazione Rodolfo DeBenedetti; the information about labor market reforms provided by the OECD, the DICE, national statistical offices, and government and non-governmental agencies. 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 and employment benefit duration.

We look at the data from two different angles. First, motivated by the limited time variation of institutional indicators, we collapse our panel of countries in a cross-sectional data set, by averaging over time the available indices. Further, we collapse the information contained in the set of indicators using principal component analysis. We identify four factors which explain most of the variability of the original data: (a) an "overall rigidity" factor, which is positively and highly correlated with all the institutional indices; (b) a "union" factor, that correlates with union density and union centralization and coordination; (c) a "wage setting" factor, highly correlated with union coverage; (d) a "flow restrictions" factor, positively correlated with employment protection legislation and replacement rates. When we examine the relationship between the volatilities and cross-correlations of major macroeconomic variables and LMI, we find that the union and the wage setting factors matter most and economies with strong unions are, on average, more volatile in terms of output, inflation and labor productivity. In addition, the correlation between GDP and inflation, which is negative on average, is lower in unionized than in non-unionized economies, implying a worse inflation output stabilization trade-off. Our results hold regardless of the way we construct business cycle statistics, the sample we consider and the additional control variables we include in the empirical model.

Second, we look at specific reform episodes in order to take advantage of changes over time in both labor market institutions and cyclical statistics. We believe this exercise is important since it informs us about the importance of the different types of reforms taking into account the endogeneity of institutions, and, to some extent, the heterogeneity of countries. We cluster countries into two groups, reformers and non-reformers, according to the type of labor market reforms we observe. Our sample features two broad categories of reforms: those weakening employment protection and those reducing non-employment benefits. We focus our analysis on the following laws: (i) easing the dismissal of workers, (ii) allowing

for part-time contracts, (iii) reducing the notice period required to fire workers, (iv) making stricter the eligibility criteria for unemployment benefits and (v) enforcing the requirement of actively searching for a job when unemployed and enjoying the benefit. We contrast the macroeconomic performance of reformers and non-reformers using a difference-in-difference approach. Two main results emerge from the investigation. Employment protection and replacement rates are important institutional factors in the time series dimension. In particular, reforms reducing employment protection make output more volatile and weaken the inflation-output trade-off and those that lower benefits increase output volatility. In addition, for many cyclical indicators, we find strong evidence of generic regression to the mean. That is, countries with high inflation, high unemployment, high real wage variability and a high output-inflation trade-off stabilization in the beginning of the sample tend to see these problems diminish independently of whether they have adopted or not reforms. On the other hand, the evidence suggests that reforms are more likely to take place in the worst performing countries, signalling that reforms are endogenous, rather than exogenous, to business cycles.

Taken together these results have important implications for both academic studies and policymakers activities. Modeling unions in business cycle models is crucial to capture the role of institutions in the transmission of shocks and government involvement in wage negotiations seems to be key in understanding cross-country differences in cyclical dynamics. The dynamics of institutions should also be jointly modelled with the dynamics of macroeconomic variables and the probability that institutional changes take place should be related to the turbulence the economy displays. On the other hand, governments should try to improve economic performance by shrewdly selecting labor market reforms. Reforms affecting wage settlements arrangements and the bargaining power of unions appear to be the most effective. Reforms in dismissal and part time work laws, or in unemployed incentives to look for a job primarily ease the inflation-output trade off. On the other hand, reforms that tighten the eligibility criteria for unemployment benefits have negligible effects on cyclical fluctuations.

The literature investigating the relationship between institutions and labor market performance is vast (see, for instance, Layard, Nickell and Jackman (1991) and Nickell and Layard (1999), Blanchard and Wolfers (2000), Nunziata (2003), Nickell, Nunziata and Ochel (2005) and Costain and Reiter (2008)). A few studies, including Nunziata and Bowdler

(2005), Merkl and Schmitz (2010), and Fonseca et al. (2010) have analyzed the effects of certain labor market arrangements on inflation dynamics, or output volatility. However, as far as we know no study has yet systematically investigated the impact of labor market institutions and cyclical fluctuations.[1] Our contribution also relates to recent work by Rumler and Scharler (2009) and Abbritti and Weber (2010). We differ in three important respects. First, we look at a broader set of institutional indices and a larger number of cyclical statistics. Second, we consider reform episodes which help us to boost the limited time series variation of institutional data. Third, by adopting a principal component point of view, we exploit all available information and avoid omitting a potentially important interaction term between institutions.

The rest of the paper is organized as follows. The next section presents the data. Section 3 reports the results of the cross-sectional analysis, while Section 4 focuses on labor market reforms. Section 5 discuss the implications of our work for models of business cycle and for policymaking activities. Section 6 concludes.

2 The data

2.1 The macroeconomic data

We use quarterly data from the OECD and the International Financial Statistics (IFS) of the IMF. The largest time period for the nineteen OECD countries we consider 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), Finland (1971:1-2009:4), France (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), 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). Time series for wages in Portugal and in Switzerland are unavailable for a consistent sample. In the investigation we use time series for gross domestic product, employment, unemployment, real wages, labor productivity, total labor force and inflation. GDP is measured in constant 2000 prices, employment measures total full and part time employment in thousands, while the unemployment rate measures

[1] Canova, Ciccarelli and Ortega (2009) and Altug, Emin and Neyapti (2010) investigate the impact of monetary and fiscal institutions on cyclical fluctuations.

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 a price deflator. Labor productivity is computed as the ratio between output and total employment and the CPI is used to construct the inflation series.

We summarize cyclical information using volatility and correlation measures. In particular, we compute the volatility of the annual growth rate of real GDP per capita, y, of employment per capita, n, of the labor force, LF, of real wages, w, of labor productivity, y/n, of annual unemployment and inflation rates, u and π. In addition, we compute the correlation of GDP per capita with employment, with inflation, with labor productivity and with the labor force and the correlation of employment (or employment per capita) and the real wage with labor productivity.

We measure volatilities and correlations in a number of ways. In the 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. When a cross country point of view is taken, 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. In this study, and as a benchmark, we compute cyclical statistics by forth differencing the log of the raw data. We also check the robustness of our conclusions by filtering the data prior to the computation of cyclical statistics with the Hodrick-Prescott (HP) and Band pass (BP) filters. Besides spurious trend effects, one has also to worry about the presence of measurement error. As long as measurement error is uncorrelated with labor market rigidities, no systematic bias should emerge. However, measurement error may artificially increase the volatility of macro variables and reduce the power of our analysis. While there is little in principle one can do to eliminate this problem, comparing alternative de-trending procedures should help to quantify the importance of measurement error. In fact, while HP filtering leaves the importance of high frequency measurement errors unchanged, BP filtering reduces them while taking growth rates magnifies their importance.

2.2 The labor market institutions data

We consider the following labor market indicators: (i) EPL, the strictness of employment protection legislation; (ii) EPR, employment protection on permanent contracts; (iii) EPT,

employment protection on temporary contracts; (iv) 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; (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) WCOORD, the degree of coordination in the bargaining process, both on workers' and firms' side, measured on a 0-5 scale; (viii) LEVEL, the degree of bargaining centralization, measured on a 0-5 scale, which captures the predominant level where bargaining takes place (e.g. firm level, industry level and nation wide). Coordination refers to the degree to which minor bargaining units follow the decision of major players, where major players may include union confederations (Norway, Netherlands and Italy), leading unions and its employer counterpart (such as IG Metall in Germany) or 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 are state-sponsored or state-imposed coordination. We also have available: (ix) GOVINT, government involvement in wage bargaining, measured on a 0-5 scale; (x) EXT, the extent to which collective agreements are applied to non-unionized workers, measured on a 0-2 scale, where 0 indicates a collective agreement applied only to union members and 2 to more than the 10 percent of non-unionized workers; (xi) MINWAGE, the degree of government intervention in setting the minimum wage, measured on a 0-8 scale; (xii) CONC, average concentration measure (Herfindahl Index) of unionization at national and sectoral level [2]; (xiii) CENT, which measures concentration as CONC, but weights differently the national and the sectoral level according to their importance.

We have chosen those indices since they approximate well rigidities that can affect both quantities and price adjustments. Employment protection is typically regarded as an important determinant of the incentives driving job creation and job destruction and, as a consequence, of labor market adjustments. Replacement rates and the presence of a minimum wage may have a direct impact both on the dynamics of the real wage by affecting workers' outside option, and on labor market flows, by affecting firms's incentives to post

[2]The index is constructed as follows: first the share of workers represented by each union confederation relative to the represented labor force at the national level is computed and then the share of workers represented by each union affiliated to some confederation, relative to the represented labor force, is computed. Herfindahl indices are constructed by summing up the squared shares over confederations and unions respectively. Finally, the two indices are averaged.

vacancies. Indices of density, coverage, coordination, centralization and the concentration affect unions' power and are regarded by the theoretical literature as important constraints on real wage adjustments.

Most of these indicators come from the CEP-OECD Institutions Data Set (see Nickell (2006)). The ICTWSS Database provides information about the main characteristics of wage bargaining systems [3]. For employment protection legislation we use the series constructed by the OECD. Replacement ratios are also from the OECD and we have one observation every two years for each country; the data is averaged over three family situations and two earnings levels and the benefits are measured as a percentage of average before tax earnings. The ranking of countries for the indices produced by the OECD and by Ochel (2001) coincide.

For all countries we compute the average of each of the indicators over the sample period since the indicators do not display significant time variation. To justify our averaging choice Figure 1 shows the index of employment protection legislation and of union coverage for our sample of countries, the latter being the index that varies the most over time. In the left panel, we present the countries for which employment protection and union coverage do not significantly change over time; in the right panel the countries that exhibit more variations. Clearly, a panel regression approach will not be particularly successful with this data. On the other hand, the right column documents that some changes have occurred and they may affect the ranking of countries. We take care of this problem by repeating our analysis for the subperiod period 1994:1-2009:4, where no change in the ranking of countries is observed.

[3] The Database on Institutional Characteristics of Trade Unions, Wage Setting, State intervention and Social Pacts (Visser, 2009) covers 34 countries over the period 1960-2007 and gathers information about unionization, wage bargaining and social pacts. The information is summarized by 90 variables, including union density and coverage, coordination and centralization. The ICTWSS data set is one of the sources used to construct the data published by the OECD.

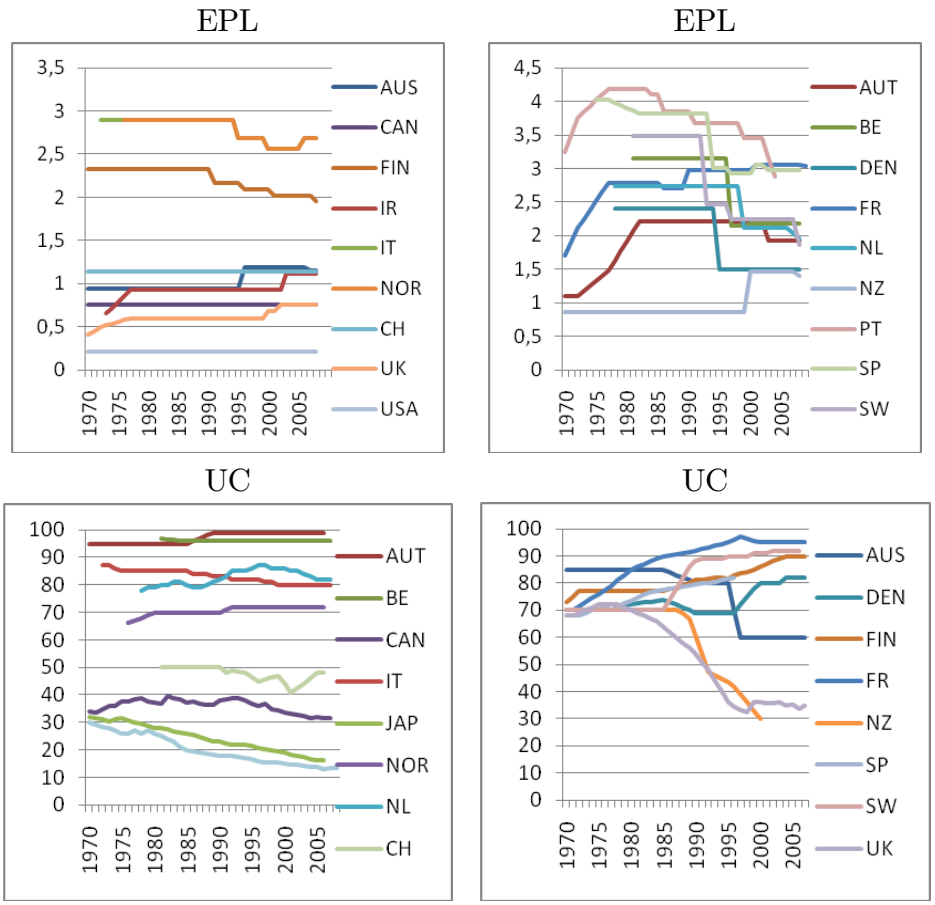

Figure 1: EPL and Union coverage. Changes over time.

Table 1 summarizes the labor market information we have available. In general, the 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). The degree of coordination is related to the percentage of union covered employment, again with Japan being the exception. Furthermore, the US features the most unrestricted labor market, regardless of the dimension we look at; Finland and Norway are instead the most rigid, for most of the indices we use. In general, all European countries, but Switzerland and the UK, are highly rigid.

Table 1: Labor market Characteristics of OECD countries													
	Flow Restrictions			Wage Restrictions									
COUNTRY	EPL	EPR_{v1}	EPT_{v1}	RR	COOD	GOVINT	LEVEL	EXT	MIN_W	UD	UC	CONC	CENT
Australia	1.02	1.26	0.88	23.08	2.76	2.81	2.70	1.81	4.41	38.02	76.08	0.39	0.43
Austria	1.95	2.78	1.50	34.35	4.32	2.05	3.22	2.05	1.03	47.56	97.17	0.56	0.90
Belgium	2.73	1.70	3.63	47.59	4.48	4.63	3.44	2.00	3.89	52.98	96.07	0.27	0.49
Canada	0.75	1.25	0.25	53.24	1.32	1.32	1.00	0	8.00	33.22	36.06	0.25	0.39
Denmark	1.99	1.65	2.11	71.38	3.60	3.40	2.83	0	1.07	75.67	74.09	0.64	0.47
Finland	2.21	2.41	1.87	47.28	3.78	3.86	4.14	1.00	1.76	71.37	81.16	0.25	0.39
France	2.82	2.39	3.52	56.60	2.16	3.16	2.00	2.00	6.00	13.34	88.86	0.12	0.26
Ireland	0.94	1.60	0.35	41.70	3.71	3.43	1.69	3.43	0	53.17	87.00	0.68	0.41
Italy	3.12	1.77	3.99	15.47	3.17	2.89	2.78	1.00	1	40.68	83.00	0.20	0.37
Japan	1.71	1.87	1.42	29.89	4.46	1.00	1.00	0	8	26.97	24.14	0.21	0.25
Netherlands	2.53	3.05	1.88	69.50	4.03	3.03	3.35	1	4.84	26.10	82.60	0.31	0.58
Norway	2.79	2.25	3.24	56.18	4.22	3.56	3.94	0	1.00	56.20	70.68	0.27	0.55
New Zealand	1.00	1.51	0.79	28.29	2.00	2.46	1.46	1.46	7.00	41.19	58.68	0.32	0.35
Portugal	3.78	4.42	3.06	44.46	2.88	3.47	2.00	2.00	6.50	34.02	70.57	0.33	0.43
Spain	3.48	3.07	3.52	67.47	3.58	3.13	3.39	2.00	6.19	16.12	75.69	0.25	0.39
Sweden	2.80	2.87	2.49	82.87	3.56	2.59	3.56	0	1.00	81.16	84.89	0.30	0.56
Switzerland	1.14	1.16	1.13	52.53	3.68	1.00	2.30	0	1.00	25.67	48.26	0.24	0.39
UK	0.62	1.01	0.29	26.27	1.68	1.81	1.57	0	2.11	40.01	53.20	0.41	0.32
US	0.21	0.17	0.25	28.01	1.22	1.41	1.00	0.03	8.00	17.14	19.80	0.31	0.28

2.3 Collapsing labor market information

Given the large number of LMI indicators we have available it will not be feasible to perform an unrestricted analysis of how cyclical statistics are related to labor market frictions - since we are not exploiting the time series dimension of the data, we have 19 data points and 10 LMI indicators making the number of degrees of freedom prohibitively small. For this reason, we resort to a principal component analysis to collapse the information contained in the institutional variables into interpretable factors. Using factors, rather than the original variables, allows to reduce the number of regressors - thus saving degrees of freedom. Several authors have suggested that institutions cannot be studied in isolation from each other and their interaction is crucial for determining macroeconomic outcomes (see, for example, Du Caju et al. (2010) and Fabiani et al. (2010)). By collapsing the LMI information using principal components we consider all possible interactions so that the possibility that omitted

institutional variables affect our conclusions is likely to be small. Later, we check robustness of our conclusion conditioning the analysis on variables that may correlate with labor market frictions, such as size, openness and the share of government expenditure in the GDP.

We compute principal components in three different ways: first, we use all the indicators; second, we consider only the three indicators directly affecting the response of employment flows to shocks, i.e. the overall employment protection index and the two employment protection indices for permanent and temporary contracts; third, we consider all the remaining indicators, which affect the response of wages to macroeconomic shocks. We select as principal components as many factors as needed to capture always at least the eighty percent of the variability of the original data. With this criteria we find that four principal components describe the complete sample of indicators, one principal component describe flow restrictions and four principal components describe wage restrictions.

Table 2 displays the correlation of the factors with the original variables. Some important facts emerge from the Table. When the whole set of indicators is used the first factor is highly correlated with all labor market indicators (with the exception of the minimum wage variable) and, thus, it can be interpreted as an **index of overall rigidity**. The second factor isolates the role of unions, while it excludes what we labelled as "pure flow" restrictions. In fact, the factor is negatively correlated with the employment protection indices and with the replacement rate and highly and positively correlated with union density, concentration and centralization. Hence, this factor is labelled **the union factor**, since it is associated with the presence of unions. Note that the union factor does *not* capture wage bargaining directly - the correlation between the index and union coverage or the level at which bargaining takes place is very low. Rather, it captures other activities that may indirectly affect wages and employment flows such as the power to organize strikes or to represent workers in the organization of the production process. The third factor is labelled the **wage setting factor**, since it positively correlates with variables EXT, $GOVINT$, UC and $CONC$, while it negatively correlates with density and replacement rates and is uncorrelated with employment protection. The wage setting factor is capturing the role of unions and the government in wage bargaining activities. Finally, the last factor correlates with EPL, replacement rates and $CENT$. Hence, this component can be interpreted as residually identifying a **flow restrictions factor**.

Table 2: Correlation between factors and variables									
	All LMI Factors				Flow Factors	Wages Factors			
VARIABLES	F1ALL	F2ALL	F3ALL	F4ALL	F1FLOW	F1WAGE	F2WAGE	F3WAGE	F4WAGE
EPL	0.78	-0.56	-0.05	0.03	0.99				
EPR_{v1}	0.70	-0.39	0.06	**0.44**	0.86				
EPT_{v1}	0.71	-0.58	-0.06	-0.23	0.91				
RR	0.49	-0.10	-0.49	**0.30**		0.42	-0.36	-0.48	-0.01
COOD	0.71	0.12	-0.15	0.12		0.70	-0.11	-0.15	**0.38**
GOVINT	0.78	-0.07	**0.29**	-0.36		0.72	**0.41**	-0.27	-0.39
LEVEL	0.87	0.05	-0.25	-0.13		0.84	-0.13	-0.38	0.04
EXT	0.38	-0.02	**0.88**	0.07		0.36	**0.88**	0.13	0.09
MIN_W	-0.55	-0.62	0.15	0.27		-0.73	0.28	-0.32	0.12
UD	0.51	**0.59**	-0.30	-0.26		0.68	-0.41	**0.23**	-0.43
UC	0.88	0.11	**0.32**	-0.09		0.87	**0.37**	-0.09	-0.02
CONC	0.13	**0.82**	**0.30**	0.22		0.40	0.00	**0.81**	-0.02
CENT	0.60	**0.43**	-0.05	0.48		0.70	-0.15	**0.20**	0.52

The correlation between the single factor we extract from the flow indices is in the fifth column of Table 2. It is immediate to see that the correlation with all the indices is high and that all the cross sectional variations of the employment protection indices are captured well by the factor.

The last columns of Table 2 display the correlation between factors extracted from the indices capturing wage restrictions and the original LMI variables. There are some differences (and similarities) with those extracted from the full set of LMI variables. First, as F1ALL, F1WAGE is an **overall rigidity factor**, with the only difference being that employment protection indices have been excluded here. Second, the union factor is highly and positively correlated with density, concentration and centralization; the wage setting factor is highly and positively correlated with coverage, extension laws and government intervention in collective bargaining. However, contrary to what we had with the overall set of indices, the wage setting factor is uncorrelated or negatively correlated with any measure related to either centralization, concentration or coordination. Concentration and centralization are captured here by the union factor. Finally, the last component is picking up coordination and centralization alone, identifying their role separately from the other rigidities. Therefore, we label this the **coordination factor**.

3 Labor market institutions and business cycles

Tables 3 and 4 present the results of our cross-country analysis. We consider three separate regressions with the regressors being, in turn, the four factors extracted from all institutional variables; the single factor capturing flow restrictions; the four factors capturing wage restrictions. We report the regression coefficients for each statistic and their P-values in parenthesis. For instance, the top panel of Table 3 shows the coefficients in the regression of output per capita volatility on the factors. The first four columns refer to the first regression, the fifth column to the second, while the last four present the results for the third regression. The estimated coefficients can be interpreted as the percentage change in the dependent variable, relative to the sample average, due to a marginal one percent increase of the regressor. It is important to remember that when cross-correlations between macro variables are negative on average, such as the correlation of employment with productivity or of inflation with output, positive coefficients signal a fall of the correlation or, equivalently, an *absolute* increase of the dependent variable. Given our interest in robustifying inference to take into account measurement error and filtering distortions, we report coefficients and p-values when cyclical statistics are computed using fourth differences, the HP filter and the BP filter.

Table 3 focuses on the relationship between volatilities and LMI. The union factor significantly and robustly increases the volatility of output, labor productivity and the real wage. The wage setting factor instead increases the volatility of inflation and reduces the volatility of the real wage, even though marginally so. Interestingly, the overall index of rigidity has hardly any effect on volatilities, and, in particular, in the employment and unemployment statistics. However, more rigid labor markets, either overall, or in terms of union power, increase the volatility of the real wage. Hence, the presence of unions, either through collective agreements, or simply through their impact on the system of industrial relationships seems to be important for macroeconomic volatility. The evidence on the volatility of the labor force is inconclusive: it is dampened by the overall rigidity factor and by the flow factor, but it is magnified by the wage setting factor when macro variables are forth differenced. When HP or BP filtered data are used the effects are insignificant.

Table 3: Regression Coefficients

	F1ALL	F2ALL	F3ALL	F4ALL	F1FLOW	F1WAGE	F2WAGE	F3WAGE	F4WAGE
vol(y)									
4thdiff	−0.01 (0.90)	**0.20** (**0.05**)	0.21 (0.11)	−0.04 (0.78)	−0.10 (0.33)	0.04 (0.53)	0.10 (0.41)	**0.33** (**0.01**)	−0.20 (0.23)
HP	−0.02 (0.68)	**0.18** (**0.04**)	0.13 (0.22)	−0.06 (0.62)	−0.10 (0.21)	0.02 (0.69)	0.03 (0.71)	**0.28** (**0.01**)	**−0.23** (**0.09**)
BP	−0.06 (0.32)	**0.20** (**0.04**)	0.11 (0.34)	−0.05 (0.72)	**−0.15** (**0.10**)	−0.01 (0.80)	−0.004 (0.96)	**0.34** (**0.006**)	−0.19 (0.19)
vol(n)									
4thdiff	0.06 (0.39)	0.01 (0.86)	0.15 (0.29)	0.04 (0.81)	0.06 (0.53)	0.07 (0.38)	0.15 (0.30)	0.02 (0.87)	−0.19 (0.35)
HP	0.03 (0.63)	0.06 (0.55)	0.10 (0.42)	−0.01 (0.92)	0.005 (0.95)	0.05 (0.47)	0.08 (0.50)	0.06 (0.60)	−0.27 (0.11)
BP	0.01 (0.86)	0.16 (0.18)	0.21 (0.16)	−0.01 (0.92)	−0.06 (0.56)	0.05 (0.48)	0.13 (0.32)	0.23 (0.11)	**−0.35** (**0.08**)
vol(π)									
4thdiff	0.01 (0.83)	−0.15 (0.19)	**0.29** (**0.05**)	−0.02 (0.89)	0.16 (0.15)	−0.04 (0.63)	**0.29** (**0.05**)	0.06 (0.68)	−0.23 (0.25)
vol(y/n)									
4thdiff	0.02 (0.83)	**0.25** (**0.10**)	**0.42** (**0.03**)	−0.01 (0.96)	−0.07 (0.66)	0.07 (0.44)	0.27 (0.13)	**0.51** (**0.01**)	−0.28 (0.24)
HP	−0.02 (0.81)	0.22 (0.16)	**0.34** (**0.10**)	−0.04 (0.85)	−0.09 (0.55)	0.02 (0.83)	0.18 (0.30)	**0.49** (**0.01**)	−0.37 (0.15)
BP	−0.04 (0.73)	0.16 (0.39)	0.28 (0.24)	−0.02 (0.92)	−0.05 (0.73)	−0.01 (0.87)	0.14 (0.50)	**0.45** (**0.05**)	−0.36 (0.23)
vol(u)									
4thdiff	−0.11 (0.62)	0.15 (0.66)	−0.56 (0.21)	0.12 (0.81)	−0.24 (0.45)	−0.07 (0.78)	−0.58 (0.18)	−0.05 (0.90)	0.56 (0.35)
HP	0.03 (0.69)	0.04 (0.71)	0.16 (0.29)	−0.04 (0.81)	−0.02 (0.83)	0.05 (0.54)	0.16 (0.27)	−0.0006 (0.99)	−0.28 (0.16)
BP	−0.01 (0.84)	0.10 (0.35)	0.16 (0.27)	−0.05 (0.74)	−0.11 (0.28)	0.02 (0.76)	0.13 (0.36)	0.08 (0.56)	−0.28 (0.16)
vol(w)									
4thdiff	0.11 (0.33)	**0.48** (**0.01**)	0.02 (0.94)	**0.61** (**0.04**)	−0.01 (0.96)	**0.21** (**0.07**)	**−0.33** (**0.11**)	**0.61** (**0.008**)	**0.69** (**0.02**)
vol(LF)									
4thdiff	**−0.09** (**0.03**)	0.006 (0.91)	**0.16** (**0.04**)	**0.16** (**0.10**)	**−0.12** (**0.06**)	**−0.09** (**0.08**)	0.13 (0.12)	0.08 (0.34)	0.09 (0.43)
HP	−0.21 (0.35)	−0.53 (0.13)	0.24 (0.57)	−0.07 (0.88)	−0.06 (0.84)	−0.33 (0.18)	0.46 (0.26)	−0.58 (0.19)	−0.01 (0.97)
BP	0.06 (0.51)	0.03 (0.81)	0.21 (0.30)	0.17 (0.48)	0.10 (0.47)	0.06 (0.56)	0.15 (0.44)	0.15 (0.46)	−0.05 (0.84)

Table 4: Regression Coefficients (continued)

	F1ALL	F2ALL	F3ALL	F4ALL	F1FLOW	F1WAGE	F2WAGE	F3WAGE	F4WAGE
cor(y,n)									
4thdiff	−0.01 (0.84)	−0.10 (0.28)	−0.18 (0.12)	0.08 (0.57)	0.006 (0.94)	−0.03 (0.62)	−0.11 (0.29)	**−0.25** (**0.04**)	0.11 (0.44)
HP	0.007 (0.91)	−0.09 (0.39)	−0.14 (0.33)	0.10 (0.55)	0.02 (0.80)	−0.009 (0.90)	−0.07 (0.59)	−0.23 (0.11)	0.20 (0.28)
BP	−0.001 (0.99)	−0.05 (0.71)	−0.16 (0.40)	0.15 (0.53)	−0.01 (0.90)	−0.004 (0.96)	−0.10 (0.57)	−0.21 (0.27)	−0.21 (0.22)
cor(y,y/n)									
4thdiff	−0.005 (0.87)	0.07 (0.22)	0.01 (0.85)	−0.04 (0.61)	−0.03 (0.51)	0.01 (0.80)	−0.02 (0.74)	0.11 (0.14)	−0.008 (0.92)
HP	−0.007 (0.84)	0.06 (0.26)	0.009 (0.89)	−0.03 (0.71)	−0.03 (0.55)	0.006 (0.87)	−0.02 (0.70)	0.11 (0.14)	−0.005 (0.95)
BP	−0.006 (0.83)	0.01 (0.69)	−0.03 (0.95)	0.0006 (0.99)	−0.004 (0.91)	−0.0047 (0.88)	−0.01 (0.72)	0.05 (0.37)	0.04 (0.55)
cor(n,y/n)									
4thdiff	0.11 (0.24)	0.01 (0.89)	0.27 (0.15)	−0.06 (0.77)	0.14 (0.32)	0.12 (0.25)	0.26 (0.15)	0.08 (0.65)	−0.31 (0.22)
HP	0.09 (0.54)	0.008 (0.97)	0.26 (0.35)	−0.20 (0.56)	0.11 (0.58)	0.09 (0.53)	0.26 (0.31)	0.05 (0.84)	**−0.65** (**0.08**)
BP	0.12 (0.46)	0.11 (0.65)	0.32 (0.30)	−0.42 (0.29)	0.10 (0.67)	0.15 (0.32)	0.28 (0.28)	0.17 (0.53)	**−1.02** (**0.01**)
cor(y,π)									
4thdiff	−0.07 (0.62)	0.35 (0.14)	0.06 (0.82)	0.23 (0.52)	−0.30 (0.16)	0.02 (0.90)	−0.08 (0.78)	0.37 (0.26)	−0.09 (0.82)
HP	−0.10 (0.35)	−0.02 (0.86)	−0.21 (0.30)	−0.10 (0.68)	−0.16 (0.27)	−0.09 (0.42)	−0.16 (0.41)	−0.17 (0.41)	0.25 (0.36)
BP	−0.03 (0.74)	−0.02 (0.87)	−0.28 (0.13)	−0.34 (0.16)	−0.09 (0.50)	−0.02 (0.85)	−0.20 (0.29)	−0.26 (0.21)	−0.05 (0.82)
cor(w,y/n)									
4thdiff	**−0.41** (**0.01**)	−0.27 (0.25)	0.34 (0.27)	−0.002 (0.99)	−0.32 (0.23)	**−0.52** (**0.006**)	0.25 (0.38)	0.25 (0.39)	−0.20 (0.61)
HP	**−0.72** (**0.006**)	0.03 (0.93)	0.49 (0.31)	0.19 (0.73)	**−0.97** (**0.02**)	**−0.81** (**0.009**)	0.14 (0.76)	0.74 (0.14)	−0.18 (0.77)
BP	**−0.93** (**0.02**)	0.72 (0.21)	0.31 (0.66)	−0.63 (0.46)	**−1.45** (**0.01**)	**−0.83** (**0.03**)	−0.64 (0.33)	**1.55** (**0.03**)	−1.25 (0.17)
cor(y,LF)									
4thdiff	0.01 (0.87)	**−0.26** (**0.02**)	−0.01 (0.92)	**0.32** (**0.07**)	0.18 (0.12)	−0.06 (0.46)	0.06 (0.68)	−0.24 (0.16)	0.22 (0.31)
HP	−0.07 (0.49)	0.01 (0.92)	**−0.33** (**0.10**)	−0.20 (0.42)	−0.15 (0.30)	−0.05 (0.66)	−0.28 (0.17)	−0.20 (0.35)	0.09 (0.72)
BP	**−0.48** (**0.05**)	0.28 (0.43)	−0.68 (0.14)	−0.26 (0.64)	**−0.77** (**0.03**)	−0.40 (0.15)	**−0.79** (**0.10**)	0.22 (0.65)	0.29 (0.65)

Table 4, which focuses on the relation between correlations and LMI, suggest that these business cycle statistics are not much affected by labor market institutions. The only exception is the correlation between the real wage and labor productivity, which is significantly

reduced by the index of overall rigidity. The presence of unions appears to increase the (absolute value) of this correlation, but the effect is significant only when BP filtered data is used, suggesting that measurement errors could be important. Finally, the evidence on the pro-cyclicality of labor market participation is inconclusive and different filters deliver different results.

The temporal coverage of the data differs across series and countries and there are more than one series for some indicators. In order to ensure that our results are not driven by differences in the time period covered, we repeat the analysis for the period 1994:1 - 2009:4 - a sample over which all variables are available for all countries. With this exercise we would also want to make sure that the changes in the ranking of countries documented in Figure 1 does not affect our conclusions. Table A1 in the appendix confirms the main message of Tables 3 and 4, with few exceptions. The effect of unionization on the volatility of inflation is now insignificant, while the wage setting factor appears to reduce the volatility of unemployment and increase the volatility of the labor force. Flow restrictions become more significant and positively affect the volatility of inflation. Finally, the presence of wage restrictions, of unions and centralization in collective wage bargaining makes it harder to jointly stabilize inflation and GDP.

To sum up, unions represent a potentially important source of frictions in the adjustment of macroeconomic variables to shocks, while employment protection restrictions seem to matter much less. On average, an economy is more volatile the higher is the power of unions. In addition, for the common sample, the presence of unions makes harder the simultaneous stabilization of inflation and output, since the trade-off between these two variables, which is negative on average, tends to be reduced (deviating further from zero in absolute value) when unions are stronger. Perhaps more surprisingly, rigidities barely affect the dynamics of employment and unemployment but they tend to affect the volatility of output, inflation and the real wage.

3.1 Robustness

It is important to make sure that the results we have presented are not driven by omitted variables that may correlate with labor market institutions. Factors such as size, openness, population density, etc. are typically thought to have an impact on business cycle fluctuations. Some of them may also correlate with labor market institutions making omitted

variables a problem in the analysis. Take openness, for example. More open countries are likely to be more prone to external shocks, and are therefore expected to be more volatile. However, they may also develop less rigid institutions, through goods market competition with foreign countries, or more rigid institutions if unions get more aggressive to better insure workers against unemployment fluctuations. Thus, we want to avoid that our analysis spuriously captures such effects.

In Table 5 we repeat our analysis adding a) the size of the countries in the sample, measured by their real GDP relative to the world GDP; b) the degree of openness, computed as the share of exports plus imports to GDP; c) the size of the government, measured by the share of government expenditure in GDP. To save some space, we report results only for those statistics that are significantly affected by labor market institutions in our baseline analysis.

Table 5: Regression Coefficients, adding controls

	Baseline 4thdiff	Size	Openness	G/Y	All
vol(y), F2ALL	0.20 (0.05)	0.26 (0.003)	0.19 (0.07)	0.19 (0.05)	0.28 (0.005)
vol(π), F3ALL	0.29 (0.05)	0.22 (0.04)	0.31 (0.03)	0.28 (0.06)	0.20 (0.08)
vol(y/n), F3ALL	0.42 (0.03)	0.34 (0.02)	0.42 (0.03)	0.43 (0.03)	0.30 (0.07)
vol(w), F2ALL	0.48 (0.01)	0.96 (0.01)	0.93 (0.02)	0.94 (0.01)	0.96 (0.04)
vol(w), F4ALL	0.61 (0.04)	1.20 (0.04)	1.20 (0.04)	1.21 (0.04)	1.21 (0.06)
cor(y,n), F3WAGE	−0.25 (0.04)	−0.29 (0.007)	−0.24 (0.04)	−0.27 (0.02)	−0.30 (0.01)
cor(w,y/n), F1ALL	−0.41 (0.01)	−1.51 (0.002)	−0.61 (0.20)	−1.01 (0.03)	−1.11 (0.08)

The second column of Table 5 reports our baseline results where business cycle statistics have been computed using fourth differenced data. The third, fourth and fifth columns show the coefficient and the p-value for the same factors when either size, openness or the share of government expenditure in the GDP are included, one at a time. Finally, the last column reports the coefficients and the p-values when all three controls are jointly included. Overall, the Table shows that our baseline results are robust to the inclusion of variables potentially correlated with labor market institutions: the size of the effects is changed but not their significance.

While the results we presented in this section are quite robust to a number of changes in the empirical specification, two important points need to be made. First, our cross-country analysis disregards the potential presence of cross country unobserved heterogeneity, nor it controls for the potential endogeneity of labor market institutions. Clearly, these issues can not be addressed with cross-sectional information. In the next section, we look at specific episodes of labor market reforms with the purpose of exploiting the time series variations to make sure that the two problems above do not drive the results.

Second, our cross-country analysis may suffer from an error-in-variables problem. Failing to correct for the fact that business cycle moments are estimated may give a distorted view of the importance of LMI and artificially produce significant effects even when the "true" ones are negligible. To examine whether this is a problem we looked at the data from a different angle. In particular, we cluster countries into two groups, "strictly" versus "loosely" regulated, according to their factor scores and non-parametrically tested whether the two samples of business cycle statistics have been drawn from the same distribution. As Table A2 in the appendix shows, we found a remarkably similar picture. Thus, error-in-variable problems are likely to be minor.

4 Labor markets reforms and business cycles

As we have mentioned, the analysis we have conducted so far has not exploited the time series information about institutional and business cycle characteristics because of the limited time series variation of labor market indicators. However, over the last two decades, countries have witnessed significant labor market reforms that are not directly reflected in the evolution of our indices and could provide important time series information to measure the effect of LMI on business cycles. In this section, we examine whether and how structural changes in the labor markets have changed the nature of cyclical fluctuations by looking at specific reform episodes. Hopefully, we will be able to find which reforms have the strongest impact on cyclical fluctuations and, therefore, provide useful information for policymakers.

4.1 The labor market reform data

Following Boeri and Garibaldi (2009), we gather information about major labor marker reforms for the countries in our sample by using the information provided in the "Social Policy

Reform Inventory" assembled by the Fondazione Rodolfo DeBenedetti (www.frdb.org), which is covering European countries from the 1970 until 2009. This data set draws on a variety of sources (including country economic reviews by the OECD, Income Data Source studies, EC-MISSOC reports, etc.) and gives information on the nature of the reforms carried out in Europe in the field of non-employment benefits and employment protection. In particular, it 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 (marginal reform), or whether the law produced a structural change in the regulatory environment (structural reform). Quite usefully, the bill is qualified as two-tier, whenever it is targeting a particular segment of the labor market, such as the young unemployed or temporary workers, or complete, if it affects the whole labor force. We restrict our attention to structural and complete reforms and in the sample there have been 25 of them. However, some reforms simply undid previous ones. In Tables 6 and 7 we present the information concerning these reforms.

Since the "Social Policy Reform Inventory" does not include data for the non-European countries, we complement the FRDB data set with information from the OECD, from the DICE and from national sources. For example, for Australia, we have used information from ACTU (Australian Council of Trade Unions) and the Australian Bureau of Statistics; for New Zealand we have used the information provided by the New Zealand Planning Council; for Japan we have used information coming from the Japan Institute for Labour Policy and Training and Neil et al. (2010); finally for the US we obtain information from various OECD Outlooks.

Comparing Figure 1 with Table 6, it is apparent that significant reform activity occurs even when the regulatory indicator exhibits small changes or no variation at all. For instance, the Finnish laws that shortened the notice period from 2 months to 1-2 weeks in 1991, and that gave the right to the employer to dismiss an employee with notice if the demand for labor has decreased substantially and permanently for economic and production-related reasons in 2001, are clearly important but the evolution of the EPL index, shows little variation around those dates.

Table 6: 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

Table 6 includes three types of reforms: (a) reforms that remove or ease the costs of dismissal, (b) reforms that shorten the notice period and (c) reforms that relax restrictions for fixed term contracts. The first type of reforms occurred in Australia in 2002, in Finland in 2001, in Spain in 2002, and in Portugal in 1991 and 2003; the second type of reforms took place in Finland and Italy in 1991; the third type occurred in Spain and Japan in the middle of the 1980s and in Sweden in 1993. Reforms appear to have happened in different waves: some in the middle of the 80s, other in the beginning of the 90s and the rest in the beginning of

the 2000s. We pool reforms of the same type occurring approximately at the same date to control for time effects. We have also performed the analysis looking at waves of reforms without considering the specific nature of the reform. The results are very similar to the ones we present here (See Tables A3 and A4 in the appendix).

The resulting groups are in Table 7. According to the Social Policy Reform Inventory and our own readings there were no significant reforms concerning dismissals in Australia, Canada, Ireland, New Zealand, Norway, Switzerland and the US. Hence, we use those countries as a control group in our analysis. Austria, Finland and Spain have performed reforms that eased dismissal: Finland, Spain Japan and Sweden had reforms that encouraged the creation of part-time contracts: Italy and Finland had undertaken reforms that reduced the notice period. Portugal is excluded from the analysis since the reforms taking place between 1993 and 2003 that have partly undone the effects of the original reform in the beginning of the 90s. Our goal is to measure whether cyclical statistics in the countries undertaking major reforms in these dimensions are different from those of countries where no significant reforms have taken place.

Table 7: Treatment and control groups EPL reforms

Countries	Dismissal	Part-time	Notice
Australia,Canada, Ireland, New Zealand Switzerland, US, Norway	$start - 01:4$ $02:1 - end$	$start - 87:3$ $87:4 - end$	$start - 90:4$ $91:1 - end$
Austria	$start - 01:4$ $03:1 - end$		
Finland	$start - 00:4$ $02:1 - end$		$start - 90:4$ $93:1 - end$
Spain	$84:4 - 01:4$ $03:1 - end$	$start - 83:4$ $86:1 - end$	
Japan		$start - 85:4$ $88:1 - end$	
Sweden		$start - 93:2$ $95:2 - end$	
Italy			$start - 90:4$ $93:1 - end$

As far as non-employment benefits are concerned, there have been two waves of reforms, one in the beginning of the 90s and one in the beginning of the 2000s. These reforms affected

different aspects of benefits and can be divided in three categories: (a) reforms that tighten the eligibility criteria for unemployment benefits, (b) reforms that reduced unemployment benefits and (c) reforms that enforced the duty of unemployed to actively look for a job.

Table 8: 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 priorto dismissal.

Consequently, we consider cyclical statistics of three groups of countries that have reformed non-employment benefits laws and contrast there changes with those present in countries that have not experienced any significant change in their non-employment benefits system. The latter group is composed of Australia, Ireland, Italy, Japan, Portugal, Netherlands, Norway,

the UK and the US. Table 9 presents treatment and control groups for those reforms. Canada, France and Spain in the 1990s have raised the contribution rates required to be eligible for benefits, while Austria and New Zealand have reduced unemployment benefits during the same time period. In addition, Spain, Denmark, Finland and Sweden have enforced the duty to actively look for a job for unemployed at the beginning of the 2000s. Similar measures were also introduced in Belgium and Denmark at the beginning of the 1990s but because of data unavailability, we exclude them from the analysis.

Table 9: Treatment and control groups non-employment benefits reforms

Countries	Eligibility	Benefits	Duty
Australia, Japan Ireland, Italy, Portugal Norway, Netherlands, UK,US	$start - 93:2$ $93:3 - end$	$start - 92:3$ $92:4 - end$	$start - 01:4$ $02:1 - end$
Canada	$start - 95:4$ $98:1 - end$		
France	$start - 90:4$ $93:1 - end$		
Spain	$84:4 - 91:4$ $94:1 - end$		$start - 99:4$ $02:1 - end$
Austria		$start - 94:4$ $97:4 - end$	
New Zealand		$start - 89:4$ $94:1 - end$	
Denmark			$start - 02:4$ $04:1 - end$
Finland			$start - 00:4$ $03:1 - end$
Sweden			$start - 99:4$ $02:1 - end$

4.2 Measuring the impact of labor market reforms

In order to test for the effect of reforms, we filter the raw macroeconomic series to eliminate trends and compute volatilities and cross-correlations measures, as in the previous section. Suppose X is a cyclical indicator and we want to investigate the impact on X of changes in a particular labor market regulation, such as a reform that reduces unemployment benefits, or ease dismissals. We then 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. In the treatment group we include countries where a new law reducing employment protection, or the generosity of benefits or unions' power has been passed. We classify as belonging to the control group all countries for which we have data and that did not implement any reform. Second the sample is split into two sub-samples, the pre-reform period and the post-reform period and examine whether the relation between LMI and business cycles have changed in reformers relative to what has changed in non-reformers. When more than one wave of reforms exist, we repeat the same procedure for each wave in such a way that the post-reform period of a particular regulatory change does not overlap with the post-reform period of the subsequent one. For example, in the case of employment protection, reforms took place in Spain both in 1984 and 2002. In 1984 there have been reforms that encouraged part-time work, while the 2002 reform eased dismissal. In order to avoid overlapping samples, we exclude when testing the 2002 change the period before 1984. To allow for delays in the effects of reforms, we leave some years out of the post-reform sample. We select the post-reform periods for countries in the control group using the mean start date for the countries in the treatment group.
To investigate the impact of reforms we control for initial conditions, i.e. we run a regression of the form

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

where $X_{i,post}$ is the value of the cyclical statistic after the reform in a given country i, $X_{i,pre}$ is its value prior to the reform and D_i is a dummy variable equal to one only if country i has passed a reform. The inclusion of the initial condition is necessary to obtain unbiased estimates of α_1. The intuition for why this is necessary is straightforward. In the analysis, we are implicitly assuming that $X_{i,t}$ depends on a country effect, μ_i, a time period effect, η_t and a labor market reforms effect captured by a dummy $Q_{i,t}$ which takes the value of one if the reform under consideration has been passed and is in place in country i at time t.

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

Defining $Q_{i,post} - Q_{i,pre} = D_i$, time differencing equation (2) and estimating it with OLS, one can easily check that β is unbiased if the dummy is not correlated with the residual.

However, the dummy may correlate with $X_{i,pre}$: for instance, countries with high standard deviation of unemployment could introduce reforms to reduce such volatility. If this the case, the dummy would be negatively correlated with the error, thus inducing a downward bias in the OLS estimator; i.e, employment protection legislation would appear to reduce the volatility of unemployment even when the causal flow is going the opposite direction. However, since the correlation works only through $X_{i,pre}$, controlling for the initial condition eliminates the bias.

4.3 The Results

Table 10 summarizes results for reforms that reduce employment protection when we calculate cyclical statistics forth-differencing the data Results obtained when HP, or BP data are used are similar and reported in the appendix (see Table A5 to A8). The first panel of Table 10 reports estimates of a_1 and a_2. Countries that have passed reforms reducing employment protection display a significant increase in the volatility of output relative to countries that have not introduced the reforms. In addition, in the countries were reforms were passed the correlation of output with inflation has increased significantly, indicating a lower trade-off between output and inflation stabilization. All other statistics have not been significantly affected by the introduction of reforms that eased dismissal.

A similar picture emerges when we look at reforms that encouraged the use of part time contracts. Such contracts increased the variability of output and decreased the variability of labor force, while they increased significantly the correlation of output with inflation. Reforms that shortened the notice period have similar effects: they increase the variability of output and decrease the variability of the labor force. Although these reforms do not seem to affect significantly the correlation of output and inflation, they significantly decrease the variability of inflation.

Table 10: Effects of EPL reforms on business cycles							
Dismissal							
volatilities	vol(y)	vol(n)	vol(u)	vol(w)	vol(y/n)	vol(LF)	vol(π)
D_i	0.63 (0.00)	−0.28 (0.73)	−0.04 (0.75)	−0.34 (0.34)	0.36 (0.25)	0.15 (0.67)	0.009 (0.95)
$X_{i,pre}$	0.64 (0.00)	0.95 (0.19)	−0.99 (0.00)	−0.90 (0.00)	−0.55 (0.00)	−0.13 (0.75)	−0.83 (0.00)
correlations	cor(y,n)	cor(w,y/n)	cor(y,y/n)	cor(n,y/n)	cor(LF,y)	cor(y,π)	
D_i	0.23 (0.15)	−0.25 (0.48)	0.11 (0.63)	0.18 (0.48)	0.22 (0.36)	0.40 (0.05)	
$X_{i,pre}$	−0.89 (0.00)	−0.27 (0.49)	0.59 (0.15)	0.16 (0.74)	0.18 (0.80)	−2.13 (0.00)	
Part time							
volatilities	vol(y)	vol(n)	vol(u)	vol(w)	vol(y/n)	vol(LF)	vol(π)
D_i	0.83 (0.09)	−0.73 (0.57)	−0.24 (0.31)	−0.12 (0.86)	0.54 (0.27)	−0.63 (0.05)	−0.09 (0.12)
$X_{i,pre}$	0.94 (0.05)	−2.40 (0.08)	−0.92 (0.00)	−0.74 (0.00)	0.84 (0.00)	−1.23 (0.01)	−0.95 (0.00)
correlations	cor(y,n)	cor(w,y/n)	cor(y,y/n)	cor(n,y/n)	cor(LF,y)	cor(y,π)	
D_i	0.04 (0.69)	0.09 (0.62)	−0.06 (0.47)	0.16 (0.50)	0.14 (0.36)	0.35 (0.05)	
$X_{i,pre}$	−0.47 (0.03)	−0.53 (0.16)	−0.66 (0.65)	−0.18 (0.74)	−1.10 (0.00)	−1.13 (0.00)	
Notice							
volatilities	vol(y)	vol(n)	vol(u)	vol(w)	vol(y/n)	vol(LF)	vol(π)
D_i	0.54 (0.12)	−2.17 (0.40)	−0.08 (0.30)	−0.61 (0.34)	0.03 (0.97)	−0.84 (0.05)	−0.12 (0.03)
$X_{i,pre}$	1.87 (0.00)	−5.07 (0.17)	−0.91 (0.00)	−1.34 (0.00)	1.44 (0.00)	−1.17 (0.01)	−0.89 (0.00)
correlations	cor(y,n)	cor(w,y/n)	cor(y,y/n)	cor(n,y/n)	cor(LF,y)	cor(y,π)	cor(LF,y)
D_i	0.07 (0.72)	−0.59 (0.02)	−0.36 (0.13)	−0.24 (0.32)	0.06 (0.70)	0.22 (0.23)	
$X_{i,pre}$	−0.45 (0.15)	−0.53 (0.26)	−0.66 (0.65)	−0.63 (0.21)	−1.55 (0.00)	−1.65 (0.02)	

p-values are in parenthesis

Table 11 measures the consequences of reforms that decreased non-employment benefits. Reforms that tightened the eligibility conditions for unemployment benefits have not significantly affected any cyclical statistics. Conversely, reforms that decrease unemployment benefits significantly affect the variability of output and of the real wage. As with EPL reforms, the variability of output increases significantly, while the variability of the real wage is decreasing. This is maybe due to the fact that for a lower outside option, workers are

less willing to negotiate significant wage increases. The reduction of unemployment benefits also significantly increase the correlation between real wages and labor productivity and the correlation of employment with labor productivity (at 10% significance level). Finally, motivating the unemployed to look for a job increases the variability of output and labor productivity and the correlation of output with labor productivity and inflation.

Interestingly, in practically all the regressions we run, initial conditions are important. This result is consistent with the view that institutional reforms may have been triggered by cyclical fluctuations, and as such, they do not constitute an exogenous source of change in business cycle statistics (see also Bonfiglioli and Gancia (2010) for a theoretical mechanism creating such endogeneity and Canova, Ciccarelli and Ortega (2009) for an opposite view). Does such finding speak against the results of the cross country analysis? We believe it does not. Even when one controls for the initial condition, there is still evidence that reforms in institutions do affect cyclical movements in macroeconomic aggregates. In addition, while the cross country analysis shows that it is strong unions and coverage of wage setting agreements that matter the most for differences cyclical characteristics, reforms included in the Social Policy Reform Inventory do not consider changes in these type of institutions.

To summarize, the analysis of structural reforms confirms, to a large extent, the conclusions of the cross-country analysis. However, a few new important facts emerge. First, reforms that decrease employment protection legislation tend to positively affect the variability of output and the correlation of inflation and output. This latter change may seem surprising, but if one takes into account that employment protection legislation deters free movements of workers, then it might be reasonable to find that changing EPL affects the dynamics of prices and the slope of the Phillips curve. Second, flow restrictions, which did not affect cyclical statistics when the analysis focused on average cross country differences, are very important when a time series perspective is taken. Reforms that decrease replacement rates and employment protection increase the variability of output. Reforms requiring stricter eligibility criteria do not have a significant impact on business cycles, while both reforms that shorten unemployment benefits and prompt unemployed to look for a job affect significantly the dynamics of output, the real wage and labor productivity.

Table 11: Effects of RR reforms on business cycles							
Eligibility							
volatilities	vol(y)	vol(n)	vol(u)	vol(w)	vol(y/n)	vol(LF)	vol(π)
D_i	0.20 (0.83)	−0.58 (0.66)	−0.19 (0.60)	−0.13 (0.70)	0.13 (0.25)	0.13 (0.75)	−0.02 (0.62)
$X_{i,pre}$	0.09 (0.88)	0.13 (0.90)	−0.79 (0.01)	−0.69 (0.00)	−0.55 (0.00)	−0.59 (0.20)	−0.95 (0.00)
correlations	cor(y,n)	cor(w,y/n)	cor(y,y/n)	cor(n,y/n)	cor(LF,y)	cor(y,π)	
D_i	0.23 (0.16)	0.09 (0.65)	0.26 (0.21)	0.17 (0.48)	0.06 (0.76)	0.18 (0.41)	
$X_{i,pre}$	−0.76 (0.00)	−0.29 (0.45)	0.59 (0.15)	−0.22 (0.57)	−1.28 (0.00)	−2.00 (0.01)	
Benefits							
volatilities	vol(y)	vol(n)	vol(u)	vol(w)	vol(y/n)	vol(LF)	vol(π)
D_i	0.15 (0.04)	−0.93 (0.73)	−0.31 (0.44)	−0.53 (0.09)	−0.06 (0.96)	0.18 (0.74)	−0.01 (0.86)
$X_{i,pre}$	0.64 (0.00)	0.95 (0.19)	−0.89 (0.00)	−0.82 (0.00)	−0.55 (0.00)	−0.80 (0.22)	−0.83 (0.00)
correlations	cor(y,n)	cor(w,y/n)	cor(y,y/n)	cor(n,y/n)	cor(LF,y)	cor(y,π)	
D_i	0.23 (0.15)	0.49 (0.05)	0.09 (0.61)	0.59 (0.09)	−0.15 (0.67)	−0.17 (0.66)	
$X_{i,pre}$	−0.89 (0.00)	−0.06 (0.48)	0.59 (0.15)	−0.44 (0.23)	−1.30 (0.01)	−1.79 (0.05)	
Duty							
volatilities	vol(y)	vol(n)	vol(u)	vol(w)	vol(y/n)	vol(LF)	vol(π)
D_i	0.86 (0.05)	−0.07 (0.93)	0.79 (0.14)	−0.60 (0.19)	0.41 (0.02)	0.57 (0.25)	−0.02 (0.76)
$X_{i,pre}$	0.09 (0.76)	0.17 (0.77)	−1.51 (0.00)	−0.68 (0.00)	0.35 (0.13)	−0.08 (0.84)	−0.97 (0.00)
correlations	cor(y,n)	cor(w,y/n)	cor(y,y/n)	cor(n,y/n)	cor(LF,y)	cor(y,π)	
D_i	0.17 (0.30)	0.03 (0.98)	0.58 (0.01)	−0.06 (0.77)	0.04 (0.86)	0.25 (0.05)	
$X_{i,pre}$	−1.10 (0.00)	0.35 (0.52)	1.11 (0.01)	−0.66 (0.10)	−0.87 (0.05)	−1.91 (0.01)	

p-values are in parenthesis

The results of this section coupled with the results of the previous one might seem puzzling: the union factor and reforms that reduce employment protection and non-employment benefits increase output volatility. It seems that if welfare is inversely related to output volatility, reforms that decrease the power of unions are good, but reforms that reduce protection and benefits are bad. Table 2 indicates that the union factor is negatively correlated with replacement rates and employment protection, hence, the fact that employment pro-

tection and replacement rates reforms increase the output variability does not contradict previous findings. On the contrary, it confirms Bertola and Rogerson (1997) word of caution: "any reading of the evidence should take into account regulation of both quantity and price aspects of real life markets, and important interactions between them."

5 Implications for theoretical models and policymaking

The results of our investigation have important implications for macroeconomic models displaying labor market frictions and for labor market policies.

The role that labor market frictions and institutions have in altering business cycle dynamics has been examined so far in theory modeling rigidities via firing or hiring costs or wage inflexibilities. While our analysis does not discard the existing modeling choices, it indicates that adding unions to existing models is crucial to realistically represent the role of institutions in the transmission of shocks. Collective wage bargaining and the government involvement in wage negotiations appear to be very important to understand cross-country differences in business cycle dynamics. As far as we know, neither of these features have been introduced in models that compare business cycles across countries.

As far as policy is concerned, our analysis shows that governments can affect directly wage setting, through their involvement in wage negotiations, and, hence, can ease the frictions related to wage settlements arrangements that we have seen significantly affect cyclical statistics. In addition, since union power turns out to be the most important factor for explaining cross country differences in cyclical volatility, policy reforms which affect this power can significantly change the dynamics of cyclical fluctuations. Our analysis of reform episodes also indicates that specific reforms can help the monetary authorities to achieve their goals. In particular, reforms in laws regulating dismissal and part time work, or the incentives of the unemployed to look for a job appear to be quite effective in easing the inflation-output trade off. On the other hand, reforms that tighten the eligibility criteria for unemployment benefits seem to have very little macroeconomic implications.

The investigation we conducted with specific reform episodes indicates that all countries passing reforms performed worse than countries which did not reform in terms of unemployment, real wage and inflation variability prior to the reform (and independently of the

specific reform enacted), implying that reforms may not be exogenous to the business cycle. Reforms appear to occur at times of economic turbulence and, especially, when the volatility of real wages and unemployment is high and the level of labor productivity is low. It, thus, appears that jointly modelling the dynamics of business cycle and of labor market institutions may provide very useful insights about causes of structural changes and direction of causality.

6 Conclusions

This paper analyzed whether labor market rigidities affect the macroeconomic performance of 19 OECD countries. Our main conclusion is that labor market institutional arrangement have important macroeconomic consequences. In particular, union coverage and wage setting agreements have a significant impact on volatilities and cross correlations of macroeconomic variables when they are examined separately or in combination with other institutions. Our results are robust to the inclusion of a number of controls in the analysis and hold true when cyclical statistics are computed over different samples and prefiltering the data with a variety of methods. When we examine specific reforms episodes that changed the nature of labor market institutions, we also find that employment protection and unemployment benefits may have a role. In addition, our results point to the endogeneity of certain institutional changes, such as those concerning employment protection legislation and replacement rates. Future work in the area , both theoretical and empirical, should try to explain this fact.

Clearly, while the paper provides some facts concerning the relationship between labor market institutions and business cycles, it is very difficult to properly interpret our findings without a specific theoretical model which guides us. Nonetheless, our conclusions have important implications for the most recent macroeconomic literature. Many authors have suggested, in theory, that labor market rigidities can explain in part the nature of macroeconomics fluctuations. However, the empirical evidence in this respect is still very limited. This paper shows that indeed labor markets institutions are important for economic fluctuations and indicates which ones are the most important for shaping cyclical fluctuations in the real world.

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Appendix

Table A1: Regression Coefficients, common sample									
	F1ALL	F2ALL	F3ALL	F4ALL	F1FLOW	F1WAGE	F2WAGE	F3WAGE	F4WAGE
vol(y)									
4thdiff	0.02 (0.68)	**0.26** (**0.03**)	0.22 (0.12)	−0.07 (0.67)	−0.10 (0.39)	0.09 (0.23)	0.20 (0.15)	**0.26** (**0.08**)	−0.27 (0.19)
vol(n)									
4thdiff	0.07 (0.33)	0.05 (0.66)	0.22 (0.16)	0.05 (0.76)	0.06 (0.58)	0.09 (0.29)	0.21 (0.18)	0.005 (0.97)	−0.12 (0.57)
vol(π)									
4thdiff	0.07 (0.44)	−0.17 (0.26)	0.31 (0.12)	0.11 (0.64)	**0.25** (**0.07**)	0.01 (0.89)	0.30 (0.15)	−0.08 (0.67)	−0.16 (0.57)
vol(y/n)									
4thdiff	0.06 (0.56)	**0.38** (**0.03**)	**0.49** (**0.03**)	−0.08 (0.76)	−0.11 (0.55)	0.15 (0.19)	**0.46** (**0.04**)	**0.43** (**0.05**)	−0.32 (0.28)
vol(u)									
4thdiff	0.01 (0.90)	0.13 (0.32)	**−0.31** (**0.07**)	0.13 (0.54)	−0.09 (0.49)	0.05 (0.58)	**−0.32** (**0.07**)	0.05 (0.76)	0.17 (0.47)
vol(w)									
4thdiff	0.07 (0.48)	**0.40** (**0.02**)	−0.10 (0.62)	0.16 (0.53)	−0.05 (0.75)	0.15 (0.18)	**0.37** (**0.08**)	**−0.34** (**0.11**)	0.14 (0.63)
vol(LF)									
4thdiff	−0.02 (0.73)	0.05 (0.50)	**0.26** (**0.03**)	0.03 (0.81)	−0.08 (0.36)	0.00 (0.98)	**0.27** (**0.03**)	0.00 (0.98)	0.04 (0.80)
cor(y,n)									
4thdiff	−0.02 (0.49)	−0.08 (0.21)	−0.09 (0.25)	0.08 (0.41)	−0.01 (0.81)	−0.04 (0.31)	−0.09 (0.24)	**−0.13** (**0.11**)	0.12 (0.29)
cor(y,y/n)									
4thdiff	−0.004 (0.91)	0.08 (0.17)	−0.03 (0.68)	−0.05 (0.53)	−0.04 (0.44)	0.01 (0.72)	−0.03 (0.64)	0.11 (0.16)	−0.06 (0.53)
cor(n,y/n)									
4thdiff	0.13 (0.24)	0.02 (0.89)	0.26 (0.23)	0.002 (0.99)	0.18 (0.26)	0.13 (0.29)	0.26 (0.24)	0.02 (0.91)	−0.09 (0.77)
cor(y,π)									
4thdiff	0.14 (0.23)	**0.31** (**0.10**)	0.25 (0.28)	0.41 (0.17)	−0.01 (0.94)	**0.23** (**0.08**)	0.22 (0.33)	0.25 (0.28)	**0.56** (**0.09**)
cor(w,y/n)									
4thdiff	**−1.18** (**0.009**)	−0.46 (0.42)	0.66 (0.42)	0.47 (0.63)	**−1.316** (**0.06**)	**−1.38** (**0.008**)	0.46 (0.56)	0.52 (0.53)	0.009 (0.99)
cor(y,LF)									
4thdiff	−0.004 (0.87)	−0.02 (0.50)	−0.01 (0.89)	0.09 (0.17)	0.01 (0.84)	−0.01 (0.73)	−0.02 (0.61)	−0.01 (0.78)	0.06 (0.26)

Table A2: Rank sum test, p-values									
Business Cycle statistics, forth differences									
Index	F1ALL	F2ALL	F3ALL	F4ALL	F1FLOW	F1WAGE	F2WAGE	F3WAGE	F4WAGE
vol(y)	0.50	**0.02**	0.46	**0.02**	**0.10**	0.46	0.46	**0.09**	**0.04**
vol(n)	0.80	0.93	0.46	0.12	0.57	0.87	0.45	0.25	0.19
vol(π)	0.20	0.87	**0.11**	0.32	0.98	0.51	**0.12**	0.93	0.98
vol(y/n)	0.45	0.37	0.57	0.19	0.93	0.46	0.37	**0.11**	0.86
vol(u)	0.45	0.74	0.81	**0.02**	0.68	0.29	0.81	0.56	0.73
vol(w)	0.74	**0.10**	0.70	**0.00**	0.62	0.41	0.44	**0.07**	0.48
vol(LF)	0.20	0.46	**0.09**	**0.03**	0.93	0.96	**0.09**	0.46	**0.10**
cor(y,n)	0.74	0.46	**0.04**	0.16	**0.00**	0.93	**0.04**	0.46	0.48
cor(y,$\frac{y}{n}$)	0.50	**0.03**	0.87	**0.06**	0.46	0.29	**0.12**	**0.03**	**0.01**
cor(n,$\frac{y}{n}$)	0.11	0.41	0.51	0.33	0.98	0.25	0.51	0.16	0.29
cor(y,π)	0.13	**0.01**	0.256	**0.00**	0.93	0.46	0.25	**0.06**	0.86
cor(w,$\frac{y}{n}$)	**0.10**	0.56	0.57	0.44	0.62	**0.08**	0.58	0.21	0.48
cor(y,LF)	0.31	**0.00**	0.25	**0.06**	0.93	0.27	**0.06**	**0.00**	0.16

Table A3: Effects of EPL reforms on business cycles							
EPL reforms 80s							
volatilities	vol(y)	vol(n)	vol(u)	vol(w)	vol(y/n)	vol(LF)	vol(π)
D_i	1.55 (0.35)	−0.01 (0.98)	−2.47 (0.29)	−0.22 (0.05)	−0.04 (0.81)	0.20 (0.32)	−0.31 (0.09)
$X_{i,pre}$	−0.18 (0.56)	−0.69 (0.36)	−2.63 (0.81)	−0.80 (0.00)	−0.03 (0.89)	−0.34 (0.34)	−0.51 (0.10)
correlations	cor(y,n)	cor(w,y/n)	cor(y,y/n)	cor(n,y/n)	cor(LF,y)	cor(y,π)	
D_i	0.25 (0.02)	0.12 (0.35)	−0.07 (0.70)	0.34 (0.12)	0.30 (0.19)	0.29 (0.04)	
$X_{i,pre}$	−0.37 (0.01)	−0.66 (0.01)	0.12 (0.82)	−0.34 (0.38)	−0.44 (0.56)	−1.17 (0.00)	
EPL reforms 90s							
volatilities	vol(y)	vol(n)	vol(u)	vol(w)	vol(y/n)	vol(LF)	vol(π)
D_i	−0.16 (0.57)	0.21 (0.60)	−0.05 (0.59)	−0.18 (0.36)	−0.42 (0.31)	0.17 (0.68)	−0.06 (0.07)
$X_{i,pre}$	−0.03 (0.95)	−0.67 (0.54)	−0.99 (0.00)	−0.87 (0.00)	−0.19 (0.67)	−0.52 (0.56)	−0.80 (0.00)
correlations	cor(y,n)	cor(w,y/n)	cor(y,y/n)	cor(n,y/n)	cor(LF,y)	cor(y,π)	
D_i	−0.12 (0.31)	−0.24 (0.18)	−0.06 (0.76)	-0.21 (0.34)	0.12 (0.38)	0.14 (0.43)	
$X_{i,pre}$	−0.51 (0.02)	−0.83 (0.07)	−0.95 (0.04)	−0.51 (0.24)	−0.63 (0.01)	−2.15 (0.00)	
EPL reforms 2000s							
volatilities	vol(y)	vol(n)	vol(u)	vol(w)	vol(y/n)	vol(LF)	vol(π)
D_i	0.16 (0.05)	0.01 (0.98)	−0.07 (0.60)	−0.19 (0.56)	0.05 (0.81)	−0.01 (0.85)	0.17 (0.31)
$X_{i,pre}$	0.38 (0.05)	−0.44 (0.37)	−0.99 (0.00)	−0.86 (0.01)	−0.48 (0.04)	−0.43 (0.42)	−0.72 (0.01)
correlations	cor(y,n)	cor(w,y/n)	cor(y,y/n)	cor(n,y/n)	cor(LF,y)	cor(y,π)	cor(LF,y)
D_i	0.22 (0.09)	0.23 (0.28)	−0.79 (0.10)	0.47 (0.08)	−0.15 (0.60)	0.58 (0.05)	
$X_{i,pre}$	−0.66 (0.01)	0.49 (0.93)	−1.18 (0.18)	0.17 (0.69)	−0.31 (0.50)	−0.99 (0.18)	

p-values are in parenthesis

Table A4: Effects of RR reforms on business cycles							
RR reforms 90s							
volatilities	vol(y)	vol(n)	vol(u)	vol(w)	vol(y/n)	vol(LF)	vol(π)
D_i	-0.10 (0.89)	0.05 (0.90)	-0.37 (0.26)	-0.17 (0.30)	0.13 (0.25)	-1.03 (0.45)	-0.04 (0.97)
$X_{i,pre}$	0.17 (0.78)	-0.06 (0.86)	-0.79 (0.01)	-0.89 (0.00)	-0.55 (0.00)	0.46 (0.74)	0.17 (0.38)
correlations	cor(y,n)	cor(w,y/n)	cor(y,y/n)	cor(n,y/n)	cor(LF,y)	cor(y,π)	
D_i	0.14 (0.32)	0.29 (0.03)	0.15 (0.19)	0.17 (0.38)	0.10 (0.66)	0.01 (0.91)	
$X_{i,pre}$	-0.19 (0.00)	-0.67 (0.02)	-0.07 (0.74)	-0.50 (0.26)	-1.18 (0.00)	-2.12 (0.00)	
RR reforms 2000s							
volatilities	vol(y)	vol(n)	vol(u)	vol(w)	vol(y/n)	vol(LF)	vol(π)
D_i	0.81 (0.06)	-0.34 (0.65)	0.50 (0.37)	-0.57 (0.10)	0.38 (0.20)	0.18 (0.74)	-0.03 (0.69)
$X_{i,pre}$	0.06 (0.84)	-0.11 (0.83)	-1.38 (0.01)	-0.84 (0.00)	-0.75 (0.00)	-0.80 (0.22)	-0.98 (0.01)
correlations	cor(y,n)	cor(w,y/n)	cor(y,y/n)	cor(n,y/n)	cor(LF,y)	cor(y,π)	
D_i	0.14 (0.32)	-0.26 (0.18)	0.19 (0.13)	0.22 (0.10)	-0.09 (0.47)	0.23 (0.36)	
$X_{i,pre}$	-1.19 (0.00)	0.34 (0.40)	-0.46 (0.21)	-0.87 (0.01)	-1.07 (0.01)	-1.59 (0.04)	

p-values are in parenthesis

Table A5: Effects of EPL reforms on business cycles (HP filter)							
Dismissal							
volatilities	vol(y)	vol(n)	vol(u)	vol(w)	vol(y/n)	vol(LF)	vol(π)
D_i	0.81 (0.01)	0.24 (0.80)	0.64 (0.50)	−0.34 (0.34)	0.49 (0.14)	−0.22 (0.36)	0.009 (0.93)
$X_{i,pre}$	0.60 (0.03)	0.92 (0.36)	−0.18 (0.76)	−0.90 (0.00)	−0.61 (0.00)	−1.15 (0.23)	−0.83 (0.00)
correlations	cor(y,n)	cor(w,y/n)	cor(y,y/n)	cor(n,y/n)	cor(LF,y)	cor(y,π)	
D_i	0.19 (0.15)	−0.39 (0.14)	0.05 (0.83)	0.19 (0.38)	0.20 (0.36)	0.40 (0.07)	
$X_{i,pre}$	−0.92 (0.00)	−1.97 (0.02)	0.52 (0.27)	0.13 (0.74)	−1.27 (0.02)	−0.60 (0.40)	
Part time							
volatilities	vol(y)	vol(n)	vol(u)	vol(w)	vol(y/n)	vol(LF)	vol(π)
D_i	0.47 (0.13)	−0.68 (0.52)	0.99 (0.25)	−0.12 (0.38)	0.30 (0.41)	−0.08 (0.30)	−0.09 (0.12)
$X_{i,pre}$	−0.14 (0.53)	−2.19 (0.06)	−0.41 (0.37)	−0.74 (0.00)	−0.03 (0.81)	−0.51 (0.26)	−0.95 (0.00)
correlations	cor(y,n)	cor(w,y/n)	cor(y,y/n)	cor(n,y/n)	cor(LF,y)	cor(y,π)	
D_i	0.04 (0.70)	0.08 (0.32)	0.03 (0.82)	0.06 (0.79)	0.20 (0.13)	0.06 (0.61)	
$X_{i,pre}$	−0.69 (0.00)	−0.90 (0.00)	−0.27 (0.72)	−0.39 (0.39)	−1.03 (0.00)	−0.77 (0.00)	
Notice							
volatilities	vol(y)	vol(n)	vol(u)	vol(w)	vol(y/n)	vol(LF)	vol(π)
D_i	0.24 (0.10)	0.34 (0.76)	2.04 (0.08)	−0.28 (0.67)	0.04 (0.90)	−0.22 (0.40)	−0.12 (0.03)
$X_{i,pre}$	−0.06 (0.70)	−0.78 (0.57)	−0.07 (0.74)	−0.41 (0.27)	−0.11 (0.43)	−0.96 (0.03)	−0.89 (0.00)
correlations	cor(y,n)	cor(w,y/n)	cor(y,y/n)	cor(n,y/n)	cor(LF,y)	cor(y,π)	
D_i	0.10 (0.48)	−0.34 (0.06)	−0.05 (0.82)	0.16 (0.51)	0.10 (0.49)	−0.03 (0.88)	
$X_{i,pre}$	−0.73 (0.00)	−0.40 (0.32)	−0.43 (0.52)	−0.86 (0.09)	−0.71 (0.00)	−1.19 (0.01)	

p-values are in parenthesis

Table A6: Effects of EPL reforms on business cycles (BP filter)							
Dismissal							
volatilities	vol(y)	vol(n)	vol(u)	vol(w)	vol(y/n)	vol(LF)	vol(π)
D_i	1.32 (0.00)	0.32 (0.82)	−0.51 (0.44)	−0.35 (0.34)	0.62 (0.03)	−0.03 (0.97)	0.01 (0.93)
$X_{i,pre}$	1.21 (0.00)	1.00 (0.34)	−0.27 (0.50)	−0.90 (0.00)	−0.22 (0.07)	−0.26 (0.72)	−0.83 (0.00)
correlations	cor(y,n)	cor(w,y/n)	cor(y,y/n)	cor(n,y/n)	cor(LF,y)	cor(y,π)	
D_i	0.19 (0.15)	−0.39 (0.14)	−0.10 (0.76)	0.14 (0.60)	0.09 (0.72)	0.36 (0.10)	
$X_{i,pre}$	−0.92 (0.00)	−1.97 (0.02)	0.18 (0.84)	−0.77 (0.09)	−1.32 (0.04)	−1.32 (0.14)	
Part time							
volatilities	vol(y)	vol(n)	vol(u)	vol(w)	vol(y/n)	vol(LF)	vol(π)
D_i	0.50 (0.07)	0.34 (0.78)	0.60 (0.24)	−0.12 (0.38)	0.30 (0.19)	−0.43 (0.24)	−0.09 (0.13)
$X_{i,pre}$	−0.46 (0.01)	−1.04 (0.35)	−0.49 (0.06)	−0.74 (0.00)	−0.38 (0.00)	−2.12 (0.31)	−0.95 (0.00)
correlations	cor(y,n)	cor(w,y/n)	cor(y,y/n)	cor(n,y/n)	cor(LF,y)	cor(y,π)	
D_i	0.08 (0.49)	−0.07 (0.55)	0.15 (0.40)	0.26 (0.25)	(0.23) (0.11)	0.22 (0.22)	
$X_{i,pre}$	−0.73 (0.00)	−0.89 (0.00)	−0.32 (0.40)	−0.61 (0.06)	−1.04 (0.00)	−1.12 (0.01)	
Notice							
volatilities	vol(y)	vol(n)	vol(u)	vol(w)	vol(y/n)	vol(LF)	vol(π)
D_i	0.24 (0.37)	−0.20 (0.81)	0.00 (0.28)	−0.61 (0.34)	0.18 (0.23)	−0.46 (0.11)	−0.12 (0.03)
$X_{i,pre}$	−0.27 (0.17)	−0.22 (0.86)	−0.99 (0.00)	−1.34 (0.00)	−0.33 (0.00)	−0.89 (0.00)	−0.89 (0.00)
correlations	cor(y,n)	cor(w,y/n)	cor(y,y/n)	cor(n,y/n)	cor(LF,y)	cor(y,π)	
D_i	0.03 (0.81)	−0.56 (0.02)	0.02 (0.91)	0.09 (0.77)	0.03 (0.84)	0.10 (0.05)	
$X_{i,pre}$	−0.80 (0.00)	−0.75 (0.06)	−0.55 (0.33)	−0.91 (0.07)	−0.72 (0.00)	−1.92 (0.00)	

p-values are in parenthesis

Table A7: Effects of RR reforms on business cycles (HP filter)							
Eligibility							
volatilities	vol(y)	vol(n)	vol(u)	vol(w)	vol(y/n)	vol(LF)	vol(π)
D_i	0.04 (0.90)	−0.26 (0.79)	0.93 (0.09)	−0.02 (0.94)	0.09 (0.98)	0.08 (0.59)	−0.02 (0.62)
$X_{i,pre}$	0.09 (0.88)	−0.19 (0.81)	−0.28 (0.40)	−0.69 (0.00)	−0.48 (0.03)	−0.45 (0.37)	−0.95 (0.00)
correlations	cor(y,n)	cor(w,y/n)	cor(y,y/n)	cor(n,y/n)	cor(LF,y)	cor(y,π)	
D_i	0.15 (0.27)	0.24 (0.19)	0.25 (0.19)	0.22 (0.36)	−0.03 (0.86)	0.15 (0.48)	
$X_{i,pre}$	−0.84 (0.00)	−0.77 (0.12)	0.05 (0.84)	−0.35 (0.32)	−1.12 (0.00)	−0.63 (0.34)	
Benefits							
volatilities	vol(y)	vol(n)	vol(u)	vol(w)	vol(y/n)	vol(LF)	vol(π)
D_i	0.42 (0.39)	−0.44 (0.58)	0.18 (0.38)	−0.52 (0.12)	0.23 (0.65)	0.22 (0.44)	−0.01 (0.85)
$X_{i,pre}$	−0.73 (0.04)	0.32 (0.71)	−0.35 (0.00)	−0.83 (0.00)	−0.57 (0.03)	−0.88 (0.35)	−0.94 (0.00)
correlations	cor(y,n)	cor(w,y/n)	cor(y,y/n)	cor(n,y/n)	cor(LF,y)	cor(y,π)	
D_i	0.23 (0.12)	−0.11 (0.51)	0.03 (0.87)	0.41 (0.28)	−0.12 (0.59)	−0.09 (0.70)	
$X_{i,pre}$	−0.82 (0.00)	−1.18 (0.03)	0.05 (0.92)	−0.46 (0.39)	−1.32 (0.01)	−0.56 (0.40)	
Duty							
volatilities	vol(y)	vol(n)	vol(u)	vol(w)	vol(y/n)	vol(LF)	vol(π)
D_i	0.80 (0.08)	0.35 (0.63)	0.75 (0.35)	−0.60 (0.18)	0.40 (0.16)	0.44 (0.65)	−0.25 (0.75)
$X_{i,pre}$	−0.25 (0.43)	−0.32 (0.65)	−0.29 (0.59)	−0.68 (0.00)	−0.83 (0.00)	−0.10 (0.42)	−0.97 (0.00)
correlations	cor(y,n)	cor(w,y/n)	cor(y,y/n)	cor(n,y/n)	cor(LF,y)	cor(y,π)	
D_i	0.06 (0.66)	−0.09 (0.69)	0.44 (0.09)	−0.09 (0.71)	0.22 (0.19)	0.29 (0.14)	
$X_{i,pre}$	−0.98 (0.00)	−1.74 (0.05)	0.97 (0.06)	−0.60 (0.22)	−0.75 (0.06)	−0.24 (0.71)	

p-values are in parenthesis

Table A8: Effects of RR reforms on business cycles (BP filter)							
Eligibility							
volatilities	vol(y)	vol(n)	vol(u)	vol(w)	vol(y/n)	vol(LF)	vol(π)
D_i	0.41 (0.25)	−0.26 (0.79)	1.05 (0.10)	−0.02 (0.54)	0.05 (0.87)	0.35 (0.79)	−0.02 (0.62)
$X_{i,pre}$	0.80 (0.01)	−0.19 (0.81)	−0.44 (0.19)	−0.69 (0.00)	−0.58 (0.00)	−0.45 (0.37)	−0.95 (0.00)
correlations	cor(y,n)	cor(w,y/n)	cor(y,y/n)	cor(n,y/n)	cor(LF,y)	cor(y,π)	
D_i	−0.07 (0.75)	0.36 (0.06)	0.25 (0.10)	0.29 (0.26)	0.13 (0.20)	0.13 (0.38)	
$X_{i,pre}$	−0.71 (0.00)	−0.18 (0.49)	0.05 (0.84)	−0.56 (0.09)	−1.10 (0.06)	−0.93 (0.08)	
Benefits							
volatilities	vol(y)	vol(n)	vol(u)	vol(w)	vol(y/n)	vol(LF)	vol(π)
D_i	1.1 (0.04)	−0.71 (0.69)	0.69 (0.05)	−0.53 (0.08)	0.44 (0.27)	0.68 (0.68)	−0.01 (0.85)
$X_{i,pre}$	−0.11 (0.72)	0.10 (0.93)	−0.32 (0.03)	−0.82 (0.00)	−0.60 (0.00)	−0.98 (0.75)	−0.94 (0.00)
correlations	cor(y,n)	cor(w,y/n)	cor(y,y/n)	cor(n,y/n)	cor(LF,y)	cor(y,π)	
D_i	0.29 (0.19)	−0.13 (0.48)	0.22 (0.10)	0.59 (0.09)	−0.12 (0.59)	−0.08 (0.67)	
$X_{i,pre}$	−0.72 (0.00)	−0.68 (0.19)	−0.20 (0.60)	−0.40 (0.20)	−1.32 (0.01)	−0.87 (0.10)	
Duty							
volatilities	vol(y)	vol(n)	vol(u)	vol(w)	vol(y/n)	vol(LF)	vol(π)
D_i	1.29 (0.02)	0.35 (0.63)	1.22 (0.17)	−0.60 (0.08)	0.37 (0.32)	0.30 (0.74)	−0.02 (0.75)
$X_{i,pre}$	0.70 (0.12)	−0.32 (0.65)	−0.47 (0.49)	−0.69 (0.00)	−0.82 (0.00)	−0.35 (0.63)	−0.97 (0.00)
correlations	cor(y,n)	cor(w,y/n)	cor(y,y/n)	cor(n,y/n)	cor(LF,y)	cor(y,π)	
D_i	0.04 (0.72)	−0.23 (0.36)	0.10 (0.81)	−0.02 (0.83)	0.04 (0.85)	0.33 (0.07)	
$X_{i,pre}$	−1.02 (0.00)	−1.61 (0.03)	−0.25 (0.77)	−0.81 (0.05)	−0.84 (0.06)	−0.83 (0.21)	

p-values are in parenthesis