External Appendix - Reassessing the Role of Labor Market Institutions for the Business Cycle

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1 Data

The following section describes in detail how the five labor market indicators from the original CEP-OECD institutions database by Nickell (2006), employed in this study, are extended beyond 2003, when the original database ends.

Data extension

The labor market indicators from the CEP-OECD institutions database are extended using the following adjustments for the respective series:

Union density (percent)

Union density (UDENS) is fully replaced by the ICTWSS source file data. The series covers all countries and extends until 2013. For some countries, where data is only available until 2012, values are held constant in 2013. The correlation between the CEP-OECD data and the updated data is 0.99 for 623 overlapping observations.

Benefit replacement rate (percent)

The measure for the unemployment benefit generosity (BRR) is fully replaced with the OECD source file. From 1970 to 2005 the gross replacement rate (GRR) of the average production worker (APW), which is also used in the CEP-OECD institutions database, is available. Thereafter, the available data relies on the new OECD measure for GRR, which is constructed in a similar way as the GRR (APW) series, but is calibrated to the average worker (AW). Differences for overlapping periods are very limited with the exception of Italy. The value for Italy after 2005 is, therefore, constructed by adding the change in the GRR (AW) to the lagged GRR (APW) in the previous period. The bi-annual data extends until 2011 (covering uneven years). Values after 2011 are kept constant until 2013. Even years are interpolated. The correlation between the CEP-OECD data and the updated OECD data is 0.99 for 680 overlapping observations.

Employment protection legislation (index)

The employment protection legislation index (EPL) is (recursively) extended using the following formula:

$$EPL_t = EPL_{t-1} + \Delta\widehat{EPL_t} \tag{1}$$

where Δ refers to the first difference operator and $\widehat{EPL}_t = c_1 + \beta_1 EPL_t^{OECD}$ corresponds to fitted values from an OLS regression of the CEP-OECD EPL indicator on the OECD EPL indicator for individual and collective dismissals and on a constant c_1. The OECD EPL indicator for individual and collective dismissals refers to regular contracts, version 1, and is available from 1985 to 2013. A higher value indicates stricter employment protection legislation. The correlation between the CEP-OECD EPL and the OECD EPL indicator is 0.86 for 280 overlapping observations.

Centralization of wage bargaining (index)

The index of wage bargaining centralization (CEW) is extended using a reclassified version of the ICTWSS indicator for the level at which bargaining takes place (LEVEL). The CEP-OECD data (based on Ochel 2000, 2001) classifies the bargaining level according to three levels:[1]

1 = Company/Plant level

2 = Sectoral level

3 = Central level

The ICTWSS instead uses five levels:

1 = bargaining predominantly takes place at the local or company level

2 = intermediate or alternating between sector and company bargaining

3 = bargaining predominantly takes place at the sector or industry level

4 = intermediate or alternating between central and industry bargaining

5 = bargaining predominantly takes place at central or cross-industry level

[1] The CEW(INT) series is the interpolated version of the CEW indicator in the original dataset. The latter is constant for 5-years, while the former models a smoother transition between changes to the wage bargaining set-up and takes on non-integer values between 1 and 3.

The reclassification is given by the following rules for converting the ICTWSS into the CEW(INT) scale:

$$\begin{array}{lll} 5 & -> & 3 \\ 4 & -> & 2.5 \\ 3 & -> & 2 \\ 2 & -> & 1.5 \\ 1 & -> & 1 \end{array}$$

The correlation between the CEP-OECD CEW(INT) and the ICTWSS rescaled LEVEL indicator is 0.77 for 605 overlapping observations. For the years that the original CEW(INT) is not available the reclassified ICTWSS is used. The resulting series is smoothed using a locally weighted regression with running-mean smoothing and a narrow bandwidth of 0.2. This leaves the period of the original dataset essentially unaltered (with a correlation of 0.997), but imposes the same interpolation pattern of the original CEW(INT) measure of the CEP-OECD database in the transition to and the period covered by the rescaled ICTWSS measure.

Tax wedge (percent)

The tax wedge (TW) is extended drawing on multiple sources, because no single source has data available for a large enough sample. The original CEP-OECD database comprises two TW measures: a tax wedge measure based on OECD data (TW) and a measure based on the Nicoletti institutions data (TW^{NICOL}). The CEP-OECD tax wedge measure TW defines the tax wedge as the sum of the employment tax rate, the direct tax rate and the indirect tax rate.[2] The TW^{NICOL} measure defines the tax wedge as the ratio of employers' and employees' social security contributions and income taxes over total labour costs (gross wage + employers' social security contributions).[3] The two series, which are highly correlated, are extended using data from the OECD National Accounts and Revenue Statistics databases.

The updating of the original CEP-OECD tax wedge proceeds in steps, exploiting first the most relevant information and then moving to the second most relevant information for the

[2]See, e.g., Nickell (2006) for details.
[3]See, e.g., Nicoletti et al. (2001).

remaining missing data, and then to the third and so on. The main steps are: First, the CEP-OECD indicator TW is extended using OECD source data. Second, the indicator TW^{NICOL} is extended drawing also on the relevant OECD source data. In a final step the two extended series are combined to derive the longest possible series for the tax wedge.

First step: TW is (recursively) extended using the following formula:

$$TW_t = TW_{t-1} + \Delta\widehat{TW}_t \tag{2}$$

where Δ refers to the first difference operator and $\widehat{TW}_t = c_2 + \beta_2 TW_t^{comp}$ corresponds to fitted values from an OLS regression of the original CEP-OECD indicator of TW on the updated computation using OECD source data in line with the description in the CEP-OECD database manual. The correlation between the CEP-OECD TW and the computed TW^{comp} based on OECD source data is 0.97 for 228 overlapping observations. The following countries can be extended by this approach (in line with data availability for the underlying OECD source data): Australia (1986-2012), Austria (2004-2013), Belgium (2004-2013), Canada (2001-2013), Denmark (2003-2013), Finland (2004-2013), France (2004-2013), Germany (2004-2013), Italy (2004-2013), Netherlands (2004-2012), Norway (2003-2013), Portugal (2003-2013), Spain (2004-2013), Sweden (2003-2013), United Kingdom (2001-2013), and United States (2004-2013).

Second step: TW^{NICOL} is (recursively) extended using the following formula:

$$TW_t^{NICOL} = TW_{t-1}^{NICOL} + \Delta\widehat{TW}_t^{NICOL} \tag{3}$$

where Δ refers to the first difference operator and $\widehat{TW}_t^{NICOL} = c_3 + \beta_3 TW_t^{NICOLcomp}$ corresponds to fitted values from an OLS regression of the original CEP-OECD indicator TW^{NICOL} on the updated computation using OECD source data in line with the description in Nicoletti et al. (2001). The correlation between the CEP-OECD TW^{NICOL} and the computed $TW^{NICOLcomp}$ based on OECD source data is 0.95 for 189 overlapping observations. The following remaining countries can be extended by this approach (in line with data availability for the underlying OECD source data): Ireland (1990-1998), Japan (2003-2012), New Zealand

(1999-2013), and Switzerland (1991-2013).[4]

Third step: Combine the information from the extended TW series and the extended TW^{NICOL} series using (recursively) the following formula:

$$TW_t = TW_{t-1} + \Delta\widehat{TW}_t^{NICOL} \text{ , if } TW_{t-1} \text{ is available and} \tag{4}$$

$$TW_t = c_4 + \beta_4 \widehat{TW}_t^{NICOL} \text{ otherwise.} \tag{5}$$

The latter case is only relevant for New Zealand (1972-2013), and Ireland (1999-2013). The correlation of the updated TW^{NICOL} indicator and the updated TW is 0.83 for 801 overlapping observations.[5] The charts below provide an overview by country.

[4]Because 2013 data is missing for three countries (Australia, Japan, and Netherlands), we also make use of the first principal component of the tax wedge data for all income levels and household compositions from the OECD taxing wages calculator, for these observations. This data is available starting in 2000. The correlation between the extended TW^{NICOL} and the principal component based on OECD source data is 0.84 for 277 overlapping observations.

[5]The results of the paper are unaffected when using the slightly shorter sample employing either the extended tax wedge measure based on OECD data (TW) or the extended tax wedge measure based on the Nicoletti institutions data (TW^{NICOL}), i.e. dropping step 3 and using the separate measures individually.

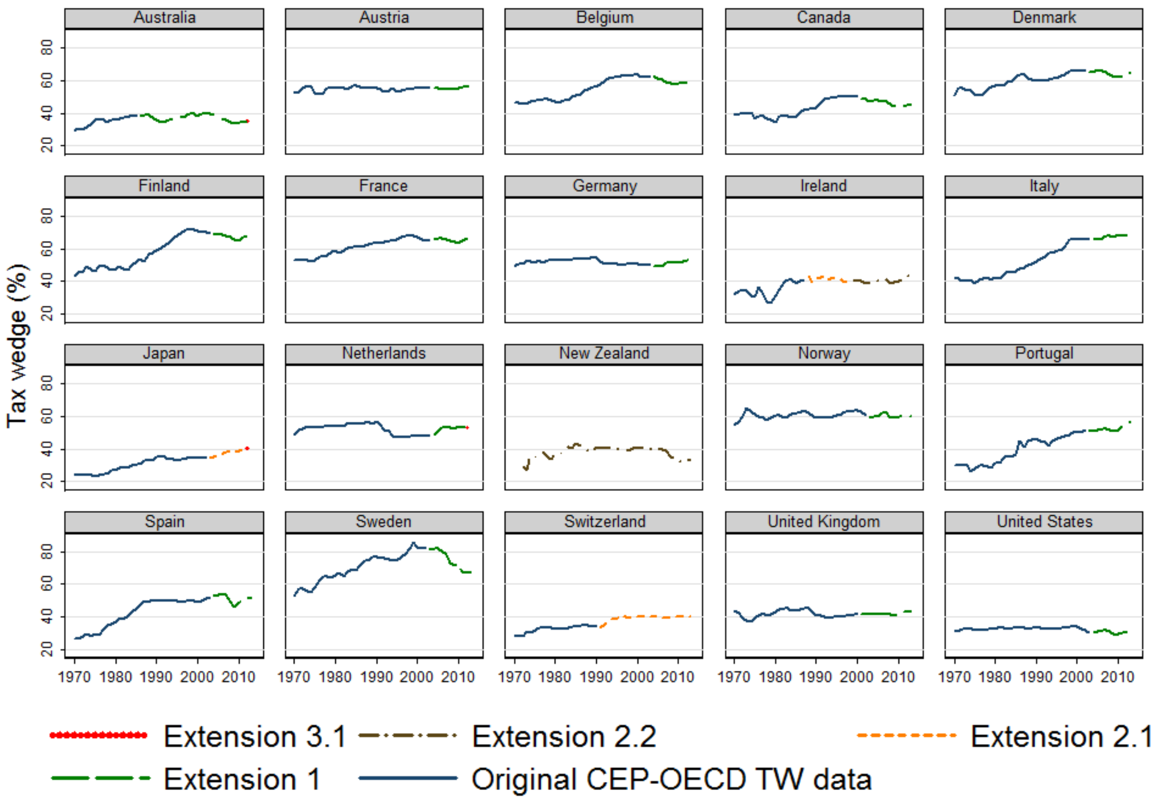

Figure 1: Tax wedge

Note: The respective extensions refer to: Extension 1: TW updated series based on OECD source data, Extension 2.1: based on original Nicoletti et al. (2001) data and recursive extension using OECD source data, Extension 2.2: based on non-recursive extension of Nicoletti et al. (2001) data using OECD source data, Extension 3.1: based on original Nicoletti et al. (2001) data and recursive extension using principal component of indicators from OECD.

2 Volatility Regression

In this section, we estimate directly the relationship between labor market institutions and the volatilities of inflation and the unemployment rate, similar to earlier approaches in the literature (see for instance Rumler and Scharler (2011), Merkl and Schmitz (2011)). We measure the volatility of a variable by the standard deviation of its HP filtered cyclical component. In line with much of the empirical literature on the macroeconomic effects of LMIs, the volatility measure is computed for 9 non-overlapping 5-year periods, roughly equivalent to the average length of the business cycle.[6] This procedure results in a panel with potentially 180 observations, but the effective sample is slightly shorter given missing LMIs and interest rate data for some countries in the earlier periods. Our baseline OLS regression is given by:

$$\ln \sigma_{i,t} = \beta \Lambda_{i,t} + \gamma X_{i,t} + e_{i,t} \tag{6}$$

where $\ln \sigma_{i,t}$ stands for the log of the standard deviation of the dependent variable (inflation or unemployment rate) for country i and period t and $\Lambda_{i,t}$ for the labor market indicators. $X_{i,t}$ is a vector of controls potentially including a constant, time fixed effects, country fixed effects, the (log) volatility of output (σ_Y) and the monetary policy stance proxied by the average real interest rate (R). Labor market variables are scaled such that coefficient estimates are interpretable as the percentage change in the standard deviation of the dependent variable as a response to a one unit change in the independent variable. The coefficient on the monetary policy stance is the semi-elasticity of the standard deviation of inflation and unemployment with respect to a 1 percentage point increase in the real interest rate. Standard errors are bootstrapped. Table 1 shows the results for the volatility of inflation and Table 2 for the volatility of the unemployment rate.

Based on the various regression results (A1-A8), we find no robust relationship between the labor market indicators and the volatility of inflation. While several indicators are significant at times (in particular unemployment benefits, the tax wedge, and the union density measures), coefficients change sign, are insignificant, or are not robust to the inclusion of country fixed

[6]Only the most recent period is limited to a shorter sample as data for 2014 and 2015 on LMIs are not yet available.

effects. Only union density appears to increase the volatility of inflation in almost all regressions (A1-A7), but turns insignificant when including all the controls. The only robust relationships that hold are that countries with higher output volatility tend to have higher inflation volatility and countries with tighter monetary policy lower inflation volatility.

A similar picture emerges for the effects of labor market indicators on the volatility of unemployment (Table 2). Throughout the regressions, the only variable that is always significant is output volatility. Employment protection legislation (EPL) is significant in two regressions (B3 and B6) notwithstanding the inclusion of time fixed effects and controlling for the overall output volatility and the monetary policy stance. However, the inclusion of country fixed effects generally implies that EPL is not significant anymore.[7] Similarly, unemployment benefits are significant in three regressions, but turn insignificant when including country fixed effects and the controls for monetary policy. The coefficients on the tax wedge and the degree of centralization are often insignificant and change sign with the specification.

Overall, these results point towards a rather weak effect of LMIs on macroeconomic fluctuations. This evidence contradicts economic theory and conventional wisdom, but is broadly consistent with many other studies that follow a similar approach and find a limited effect of most labor market institutions on unemployment and inflation dynamics.

[7] However, the Hausman test cannot reject that there is no systematic difference between random and fixed effect models.

References

[1] Nickell, W., (2006) ”The CEP-OECD Institutions Data Set (1960-2004)”, CEP Discussion Papers, Centre for Economic Performance, LSE.

[2] Nicoletti, G., A. Bassanini, S. Jean, E. Ernst, P. Santiago and P. Swaim, (2001) ”Product and labor Market Interactions in OECD Countries” (December 14, 2001). OECD Economics Department Working Papers No. 312.

[3] Ochel, W. (2000), ”Collective Bargaining (Centrilisation and Coordination)”, Ifo Institute, mimeo.

[4] Ochel, W. (2001), ”Collective Bargaining Coverage in the OECD from the 1960s to the 1990s”, CESifo Forum, Winter, 62-65.

[5] Visser, J. (2013), ”ICTWSS: Database on Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pacts in 34 countries between 1960 and 2012”, Amsterdam Institute for Advanced Labor Studies (AIAS), Version 4 - April 2013

	Dependent Variable: Ln(σ_π)							
	(A1)	(A2)	(A3)	(A4)	(A5)	(A6)	(A7)	(A8)
EPL	22.6	2.4	8.8	28.5	44.3	8.6	-1.0	3.0
	(21.2)	(32.7)	(7.9)	(17.6)	(33.4)	(8.9)	(42.0)	(38.4)
BRR	-0.7	-0.6	-0.5	-0.9*	-0.9	-0.6	-0.5	-0.8
	(0.5)	(0.8)	(0.4)	(0.5)	(0.7)	(0.4)	(0.7)	(0.6)
TW	-2.8***	-2.7***	-1.9***	-2.1***	-1.4	-1.3***	-0.4	0.1
	(0.7)	(0.9)	(0.3)	(0.6)	(1.0)	(0.3)	(1.0)	(0.9)
UDENS	1.6***	2.5***	1.1***	1.2***	2.0***	0.7***	1.4*	0.5
	(0.4)	(0.6)	(0.2)	(0.4)	(0.5)	(0.2)	(0.8)	(0.7)
CEW	9.4	4.0	7.0	3.5	-3.2	5.8	-1.4	-3.0
	(11.4)	(16.9)	(6.7)	(13.3)	(15.6)	(7.8)	(15.1)	(14.3)
R				-3.4***	-4.4***	-1.7		-6.3*
				(1.1)	(1.5)	(3.6)		(3.5)
σ_Y				52.8***	55.1***	42.1***		44.0***
				(9.6)	(7.7)	(8.0)		(12.1)
Constant	57.2**	40.1	41.4***	42.2*	-12.2	29.1*	-14.9	-9.4
	(23.2)	(71.9)	(14.7)	(25.4)	(66.2)	(15.1)	(69.0)	(62.1)
Observations	176	176	176	172	172	172	176	172
R^2 (within)		0.30	0.19		0.49	0.30	0.57	0.64
Countries	20	20	20	20	20	20	20	20
Periods	9	9	9	9	9	9	9	9
Time FE	No	No	Yes	No	No	Yes	Yes	Yes
Country FE	No	Yes	No	No	Yes	No	Yes	Yes
R^2 (overall)	0.32	0.28	0.32	0.45	0.38	0.45	0.46	0.55
Hausman		0.40	0.06		0.09	0.64		

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 1: Regression for Inflation

	Dependent Variable: Ln(σ_{UR})							
	(B1)	(B2)	(B3)	(B4)	(B5)	(B6)	(B7)	(B8)
EPL	-9.6	21.5	-39.1***	-8.6	21.5	-24.5**	-36.3	9.8
	(31.8)	(33.9)	(11.0)	(31.1)	(51.5)	(10.5)	(54.1)	(46.3)
BRR	1.7**	1.4	1.4***	1.2	1.0	1.3***	1.2	1.0
	(0.7)	(0.9)	(0.4)	(0.9)	(1.2)	(0.4)	(1.0)	(1.1)
TW	0.4	1.4	-0.5*	1.3	2.2**	0.1	0.6	1.1
	(0.9)	(0.9)	(0.3)	(0.9)	(1.0)	(0.4)	(1.4)	(1.5)
UDENS	0.2	0.5	0.2	-0.4	-0.2	-0.3*	0.1	0.2
	(0.5)	(0.7)	(0.2)	(0.5)	(0.6)	(0.2)	(1.1)	(1.1)
CEW	-8.2	-11.7	21.0***	-12.9	-18.8	11.3***	-4.4	-10.5
	(13.8)	(12.6)	(6.0)	(14.9)	(12.1)	(4.3)	(13.2)	(11.7)
R				4.1***	3.3**	3.2		1.7
				(1.4)	(1.6)	(3.8)		(2.5)
σ_Y				56.4***	57.2***	56.7***		56.7***
				(8.0)	(8.0)	(9.3)		(9.8)
Constant	-125.3***	-193.5***	-110.6***	-147.2***	-204.5***	-128.9***	-151.3**	-221.7***
	(41.9)	(59.1)	(12.2)	(39.6)	(79.3)	(16.0)	(75.1)	(76.5)
Observations	177	177	177	172	172	172	177	172
R^2 (within)		0.11	0.14		0.37	0.25	0.34	0.50
Countries	20	20	20	20	20	20	20	20
Periods	9	9	9	9	9	9	9	9
Time FE	No	No	Yes	No	No	Yes	Yes	Yes
Country FE	No	Yes	No	No	Yes	No	Yes	Yes
R^2 (overall)	0.09	0.04	0.10	0.28	0.19	0.29	0.26	0.35
Hausman		0.41	0.01		0.65	0.01		

Standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 2: Regression for Unemployment Rate

Inflation Volatility							
				(ln) difference	A1-A8		
	20^{th}	50^{th}	80^{th}	$80^{th} - 20^{th}$	Average	Min	Max
EPL	1.31	1.31	1.38	5%	9%	-0.6%	28%
BRR	1.53	1.31	1.19	-25%**	-11%	-14%	-8%
TW	1.52	1.31	1.25	-20%*	-35%	-64%	-2%
UDENS	1.2	1.31	1.56	26%**	40%	14%	73%
CEW	1.28	1.31	1.37	6%	3%	-3%	10%

Unemployment Volatility							
				(log) difference	B1-B8		
	20^{th}	50^{th}	80^{th}	$80^{th} - 20^{th}$	Average	Min	Max
EPL	1.63	1.03	0.96	-52%***	-5%	-25%	14%
BRR	0.77	1.03	1.39	59%***	21%	16%	27%
TW	0.99	1.03	1.18	18%**	19%	-11%	50%
UDENS	1.21	1.03	0.96	-23%*	1%	-12%	15%
CEW	0.88	1.03	1.16	28%**	-5%	-20%	22%

Using external shocks only

Table 3: Volatility as a function of LMIs